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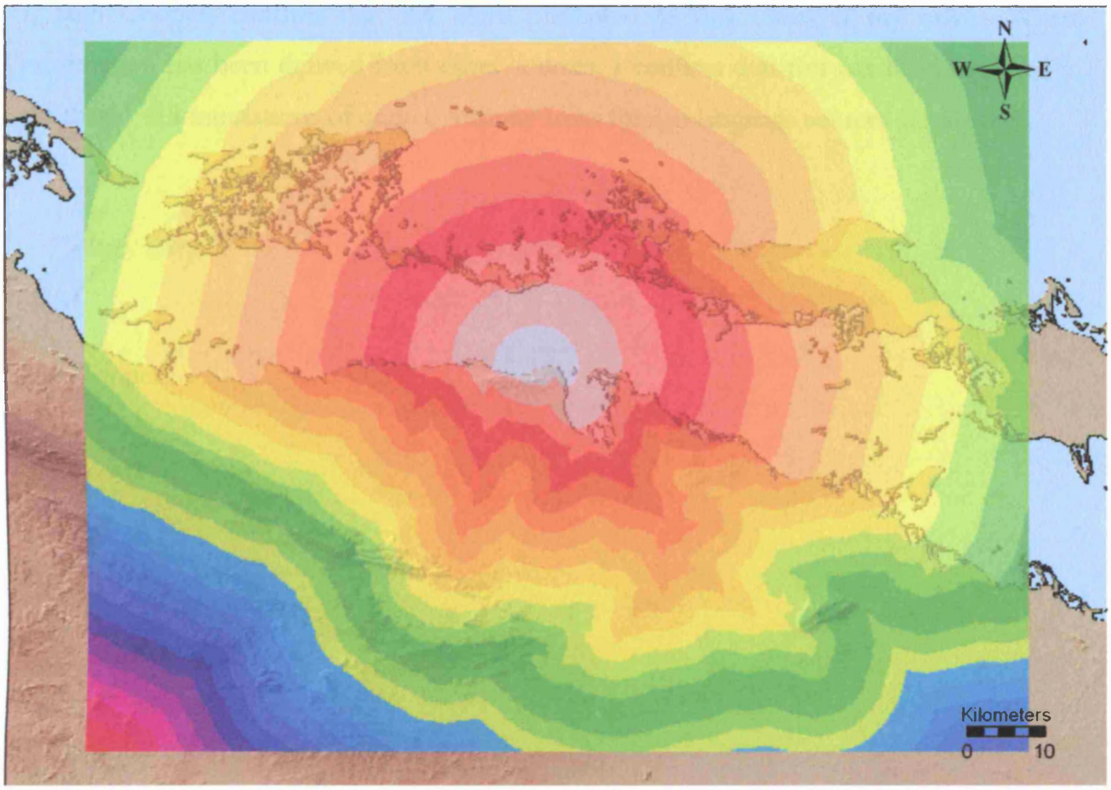
ISLAND INTERACTION IN THE PREHISTORIC CARIBBEAN: AN ARCHAEOLOGICAL CASE STUDY FROM NORTHERN CUBA

Volume I: Text and Bibliography

Jago Cooper



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Jago Cooper

ABSTRACT

A review of the socio-political history of the Caribbean and a discussion of the development of archaeology in the region provides the context for this research. The research focus is explored through the creation of a comprehensive database of Cuban archaeology. Analysis of this database reveals that of the 1061 previously excavated archaeological sites in Cuba, only 31 are located on offshore islands. Therefore, it became apparent that it was necessary to generate further archaeological data with which to study prehistoric island interaction.

Archaeological fieldwork was carried out in northern Cuba over four successive field seasons. An aim of this fieldwork was to expand the number of known archaeological sites on offshore islands in Cuba and generate a body of archaeological material with which to study prehistoric island interaction. Systematic archaeological survey was conducted in a 2000km^2 case study area that included 22 islands in the Jardines del Rey archipelago. Archaeological excavations were carried out on 7 islands and a large assemblage of archaeological material was recovered. Artefact analyses were carried out at laboratories in Cuba and additional material was exported for further scientific analyses in the laboratories of UCL Institute of Archaeology.

This research provides evidence of prehistoric island interaction in a case study area of northern Cuba. Excavations at the site of Los Buchillones on the Cuban mainland provide evidence of a settlement with stilted houses in a wetland environment with a maritime focused economy. Analysis of faunal assemblages from eight sites on offshore islands provides evidence of regular island interaction for the purposes of marine resource and subsistence exploitation. A radiocarbon dating project was conducted that collected 28 wood and marine shell samples from excavated archaeological contexts. These radiocarbon determinations provide evidence of long-term island interaction covering over 4000 years, as well as corroborative evidence of contemporaneous human activity at different sites in the case study area during later prehistoric times. This research uses GIS applications to map this evidence and to compare archaeology from the case study area with the newly created database of Cuban archaeology. Spatial analysis of the archaeological and environmental evidence for inter-site movement allows different interpretive models for prehistoric island interaction in the Caribbean to be evaluated.

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INTRODUCTION

The research herein employs archaeological methods and techniques to investigate prehistoric island interaction in the Caribbean by focusing on a case study in north central Cuba. In this introduction, the basis for the research is described. The island is discussed in detail in Chapter 3 with reference to developments in landscape and island theory and their implications for island archaeology. In the context of the title, 'island' is taken to refer to a marine island of land surrounded by sea; this includes both the terrestrial space of different islands in the Caribbean as well as the marine environments that constitute the sea that surrounds them. 'Interaction' has been tailored by different academic disciplines to suit distinct and varied meanings. In my research, the term is used in its broadest sense to mean human movement, communication and exchange. It is important to note that, in this thesis, island interaction includes movement and exchange between the terrestrial and marine environments of a single island as well as interaction within the terrestrial space of different islands. The use of terms and their application in the context of this thesis is discussed throughout the paper and considered in light of new interpretations that emerge.

'Prehistoric' is one of a number of terms that have been used to specify the period of archaeological study of peoples living in the Caribbean before the arrival of documentary sources of evidence. The terms 'pre-Columbian' and 'indigenous' are also used in this thesis. 'Pre-Columbian' is used to define the period before AD 1492 and the arrival of Columbus. The term 'indigenous' is used broadly to refer to all people living in the Caribbean before the arrival of Europeans to the New World. The term 'prehistoric' is chosen over 'pre-Columbian' in the title because many indigenous peoples in the Caribbean survived after the calendar date of the arrival of Columbus in AD 1492. There are a number of important historical texts that inform archaeologists about the people living in the Caribbean during this period. However, this thesis focuses on archaeological approaches to studying island interaction and potentially includes the study of peoples that may have survived after the arrival of Columbus AD 1492, but for which historical sources do not exist. Therefore 'prehistoric' in the title is used to highlight that this thesis will focus on the people living in the Caribbean before the arrival of European cultural influence and whose island interactions were not recorded in historical literature.

The Caribbean as an entity is notoriously hard to delineate owing to a lack of a clearly defined and universally accepted geographical, ethnic or cultural boundary. I use a geographical frame of reference that distinguishes between the pan-Caribbean region and the Caribbean islands. The pan-Caribbean region is a flexible boundary that adjusts to suit the context of its use, and can include the Caribbean coasts and adjacent interiors of South America, Central America, Mesoamerica and North America. The Caribbean islands are more rigidly defined and include all the islands in the Caribbean Sea bounded by the continental land masses listed above and the Atlantic Ocean. Therefore I use the term 'Caribbean' to refer to the Caribbean islands.

The thesis is organized into nine chapters:

Chapter 1 Context of Research

Chapter 1 provides a review of the context for archaeological research. The section on Caribbean Archaeology provides an overview of the development of archaeology in the Caribbean and how this has affected the generation of material evidence and interpretation of material culture. Attention is paid to how the socio-political history of the colonial and modern Caribbean has affected the ability of archaeologists to study island interaction. The section on Cuban Archaeology provides an overview of the development of archaeology in Cuba with particular attention paid to how the country's rich history has influenced the research focus of archaeology in the country.

Chapter 2 Research Focus

This chapter details attempts to create an archaeology database for prehistoric sites in Cuba with site locations projected using GIS. Existing archaeological evidence for island interaction in Cuba is described and some of the perceived gaps in the data that require further investigation are highlighted. This chapter discusses the focus of research and establishes the background to the research questions addressed within this thesis.

Chapter 3 Theory

Chapter 3 provides an overview of the theoretical framework for this research. I discuss how recent developments in landscape theory have influenced the study of island archaeology. Spatial analysis techniques and their application are discussed as important tools for aiding the study of interaction in the past. Theoretical frameworks for archaeological approaches to identifying island interaction are then evaluated.

Chapter 4 Methodology

Chapter 4 details how the research design for fieldwork in northern Cuba was planned in order to generate the necessary archaeological and environmental data for computer based analysis of island interaction. The methods employed for archaeological surveys, excavations and artefact analyses are discussed, and the reasons for their selection are explained.

Chapter 5 Survey Data Collection and Analysis

Chapter 5 reviews the collection, analysis and interpretation of data from the archaeological surveys conducted in the case study area

Chapter 6 Excavation Data Collection and Analysis

In Chapter 6, the collection, analysis and interpretation of data from the archaeological excavations are discussed.

Chapter 7 Site Chronology and Interpretation

Here, the strategy for determining the chronology of archaeological sites identified during the fieldwork is considered. A radiocarbon dating program is discussed with a focus on the processes of sample selection, calibration and interpretation of the relative and absolute chronologies for different archaeological contexts.

Chapter 8 Conclusions

The archaeological evidence for prehistoric island interaction in the case study area is synthesized and summarised here.

Chapter 9 Comparative Interpretation and Spatial Analysis

In this chapter, spatial analysis techniques (ArgGIS and GRASS software) are employed to model data from the case study area. Discussion shows how the evidence for interaction might help generate hypotheses about possible pathways and journeys between sites in the interior of the Cuban mainland, sites on the coast, and sites on the offshore islands. These analyses provide models that aid interpretation of prehistoric island interaction in northern Cuba.

Volume II: Figures

All figures have been collated sequentially into Volume II to facilitate their access whilst reading the text in Volume I.

Volume II: Appendices

The appendices can be found embedded on the DVD in Volume II. These appendices include two Access databases, two ArcGIS projects, one GRASS project and two OxCal calibration datasets. Details of software requirements can be found in the text files provided on the DVD.

Chapter 1

CONTEXT OF RESEARCH

1.I Caribbean Archaeology: A Regional Context for Research

Introduction

Since the arrival of Columbus in AD 1492, the Caribbean has been consistently and methodically transformed resulting in large population movement, loss of indigenous cultural practices and large scale exploitation of the natural environment (Melville 1997; Mintz 1996:294). The inheritance of this period for the Caribbean has been the development of complex and potentially divisive political, linguistic and cultural barriers that impact modern Caribbean communities. Modern day Cuba illustrates the extent to which these potential barriers can restrict interaction between islands in the Caribbean. Cuba has become politically and economically separated from many of its neighbours since the revolution of 1959 (Grant 2005). An interest in the history and prehistory of the region is one issue that unifies the peoples of the Caribbean. Therefore studying island interaction in the past has the potential to develop and encourage island interaction in the present.

Modern socio-political context continues to have an important influence on the ability of archaeologists to study island interaction in the region. Therefore a review of the socio-political context of research is necessary before the development of archaeology in Cuba and the Caribbean is discussed in more detail. Such a review is necessary not only to understand and learn from past attempts to identify island interaction in the Caribbean, but also to help contextualise existing archaeological data that can be used retrospectively to study island interaction. Therefore, this chapter will review theoretical frameworks that have influenced archaeological research in the past in order to contextualise how extant archaeological data generated under the influence of different theoretical traditions can be analysed in order to contribute to interpretations of indigenous interaction in Cuba and the wider Caribbean.

1.1.1 Origins of Caribbean Archaeology

Columbus arrived in the Caribbean on 12th October 1492 (Dunn and Kelley Jr. 1989:65). His arrival marked the beginning of a new chapter for peoples living in the Americas. The cultural confrontation that followed reflected the coming together of peoples from continents with distinctly different pasts, and there quickly arose a mutual need for knowledge and understanding. There is documentary evidence from the colonists of Europe, who were eager to explain this 'New World', that led to a great deal of speculation, interpretation, and conjecture; the legacy of which, the "*West Indies*" (Colon B. W. Ife 1493 (1992):25), still lives with today. The ethnohistorical records give us a great deal of information relating to the contact period from a European perspective (Hulme 1995). The thoughts and commentary of people like Las Casas (De Las Casas A. Hurley and F. W. Knight 1578 (2003)), Oviedo (Oviedo S. A. Stoudemire 1526 (1959)) and Ramon Pané, (Pané J. J. Arrom 1498 (1990); Pané S. C. Griswold 1498 (1999); Pedroso 1944) are easily accessible in local bookshops in the Caribbean today. However, an indigenous perspective of this meeting of cultures is less accessible from the historical record, and the discipline of archaeology has proved one of the few ways to study the emergence, development, and eventual destruction of an indigenous way of life in the Caribbean (Alegria 1997:19; Guerrero 1999; Martinón-Torres, *et al.* 2007).

Archaeological and ethnohistorical evidence for indigenous ideology suggests that the past played a very important part in indigenous society (Curet and Oliver 1998). The role of ancestors and creation mythology is manifested in the artistic media of expression found extensively throughout the Greater Antilles (Oliver 2000). The part the past played among the Taíno is best documented in Ramon Pané's ethnohistorical research, which focused on the identification of specific characters and individuals who played particular roles in the development of Taíno society (Arrom 1997). However, the material expression of an interest in the past is not the same as a study of the past, and if archaeology as a research discipline is defined as a study of past peoples through their material remains (Renfrew and Bahn 1996:485) then the origins of archaeology in the Caribbean can only be argued for convincingly with the emergence of antiquarian interest in the 19th century Caribbean. These origins arise from a population culturally removed from their subjects of study. The socio-political context of the development of archaeology is therefore particularly relevant for the Caribbean.

1.I.2 Social and Political Context of the Caribbean

The social and political make up of the Caribbean is a living testament to its role as a battleground in the conquest and colonisation of the 'New World' (Nuñez Jiménez 1992). A map of the Caribbean reveals how different interests have colonised, annexed, leased, and generally held influence in different territories since 1492 leaving us today with a complex patchwork of social and political boundaries. A map of the Caribbean showing some of the major national languages on different islands illustrates some the present boundaries hampering better regional communication (Figure 1.01).

The study of Caribbean archaeology by Caribbean peoples, or Caribbean Caribbeanists, to use a phrase coined by Watters (Watters and Murphy 2006) has been a feature of Caribbean archaeology since its inception in the 19^{th} century. Archaeologists and amateur enthusiasts have been researching and excavating in the Caribbean for over 200 years and new generations of Caribbean archaeologists are emerging from academic institutions in the region. Archaeology and its potential to provide an indigenous perspective for the Caribbean region is an attractive prospect to people living in the region. This is exemplified by the neo-Taíno movement based in Puerto Rico (Jatibonicu Taíno Tribal Nation of Boriken (Puerto Rico) 2003). The idea of pan-Caribbean identity is strongly linked to a shared past (Haviser 1995; Ucko 2000) and this has encouraged the study and interpretation of the prehistoric past. However, the sharing of a pan-Caribbean identity has not always resulted in the free-flow of information. This is because the Caribbean lacks a common language and publications tend to be in the language of the country of origin (Figure 1.01). Publication in more than one language is rare and tends to be the specific result of efforts to improve international communication by the archaeologists involved (Veloz Maggiolo 1977). It is not only the language barrier that limits the study of island interaction but also the availability of the literature itself. There are a limited number of libraries that include regionally representative archaeological collections. Libraries that do contain substantial Caribbean archaeology collections, such as Gainesville (USA), Leiden (Netherlands), London (U.K.), are located outside the Caribbean. This in itself is a clear example of how the social and political context of the Caribbean has affected the ability of archaeologists to study different islands in the Caribbean. The emergence of more Caribbean archaeologists from within the Caribbean is also limited by the small number of archaeology departments in higher education facilities in the region. Many archaeologists working in the region have received their training outside the region. Inevitably this has led to different schools of archaeology from different countries affecting the development of archaeology in different ways. Therefore the socio-political history of the Caribbean has had a direct effect on the development of archaeological theory, methods and practice.

1.I.2.i European Influence

The ethnohistorical records of the Caribbean were written by European colonists, and their accounts strongly reflect their Eurocentric standpoints. European involvement in the Caribbean was at its peak during the 15th to 19th centuries when there was little archaeological work conducted. Columbus claimed the islands of the Caribbean in the name of King Ferdinand and Queen Isabella and the Royal court of Spain. Direct Spanish influence was at its strongest between AD 1492 and AD 1898. At the close of this period, Spain was defeated in the Spanish-American wars and lost Puerto Rico and Cuba. Spain controlled Hispaniola from 1492-1697 until ceding control of the western part of Hispaniola (Haiti) to France in 1697, and the rest of the island (Dominican Republic) to France in 1795. The main legacy of the Spanish involvement in these countries for archaeology has been the Spanish language that links the islands of Cuba, Dominican Republic, Puerto Rico and the Venezuelan and Columbian Territorial islands. Articles in the journals *Caribe Arqueologico, Catauro* and *Boletin del Museo del Hombre Dominicana* reflect the fact that archaeological links between these islands are stronger compared to the rest of the Caribbean.

United Kingdom

During the 19th century antiquarian interests in the Caribbean were common. Antiquarians collected artefacts from Jamaica and Barbados. The specific details of this antiquarian period are scarce, but the extent of collecting is best evidenced by the large collection of Caribbean artefacts in the stores of the British Museum some of which have been displayed in a recent exhibition (The British Museum 2007 (May-August)). Unfortunately, very little of the Caribbean material has related documentation and the collection requires further cataloguing and analysis before the material can be used to study island interaction. United Kingdom involvement in the socio-political development of the Caribbean emerged during the 17th century. The United Kingdom still maintains close relationships with many islands in the Caribbean, including the independent nations of Jamaica, Bahamas, Barbados, Grenada, St Kitts, St Nevis, St Lucia, St Vincent, Grenadines, Antigua and Barbuda, Trinidad and Tobago and the overseas territories of the United Kingdom including the Turks and Caicos Islands, Cayman Islands, Montserrat, Anguilla and the British Virgin Islands. The historical links between Britain and the Caribbean have perhaps influenced the geographical location of British archaeological research in the Caribbean (Drewett 2000, 2003; Haag 1965; Hill-Harris and Drewett 1995; Kaye 2003; Kaye, *et al.* 2004).

Netherlands

The Netherlands has been actively involved in the Caribbean since the arrival of the Dutch West Indies Company in 1621. The Leeward Netherlands Antilles include Bonaire, Curacao, Kralendijk and Aruba, which were claimed by the Dutch West Indies Company in the 17th century. These islands were formally made part of the Kingdom of the Netherlands in 1954. Aruba was granted special status as a separate part of the Kingdom in 1986. The Windward Netherlands Antilles include Saba, Sint Eustatius and Sint Maarten (the southern half of the island). They were also claimed by the Dutch West Indies Company in the 17th Century and were formally made part of the Kingdom of the Netherlands in 1954. Archaeologists with Dutch connections have been very active in the Caribbean for many years and the University of Leiden currently has one of the most active Caribbean archaeology departments (Bartone and Versteeg 1997; Boomert 1995; Delpuech, *et al.* 1999; Hoff 1995; Hofman, *et al.* 2005; Hoogland and Hofman 1993; Hoogland and Hofman 1999; Knippenberg and Gijn 1998; Van Gijn 1993).

France

France has long been an active force in the socio-political history of the Caribbean; Guadeloupe is still an overseas *département* of France that forms one of the twenty six *régions* of the French Republic. Marie Galante, Desirade, Saint-Martin (the northern half of the island only) are all French overseas territories and administratively part of the Guadeloupe overseas *département.* Martinique is also an overseas *département* of France. Haiti, a base for French and British pirates during the mid 17th century, was formally ceded to France by Spain in 1697. In 1804 there was a Haitian Revolution, inspired by recent events in France, and it became only the second country in the Americas (after the United States) to gain sovereign independence. Spain also ceded the Dominican Republic to France in 1795, before a war for independence broke out in 1821, France then formally accepted the independence of the Dominican Republic in 1845. Archaeologists with French connections have been influential in the development of Caribbean archaeology from very early on. Petitjean-Roget (Petitjean-Roget 1961) was instrumental in the setting up of the First International Convention for the Study of pre-Columbian Cultures in the Lesser Antilles and there have been numerous French language archaeological publications (Bérard 2006; Desrayaud and Berthé 1999; Gervais 1992; Petitjean Roget 1975).

1.I.2.ii Continental American Influence

A number of islands in the Caribbean are federated states of Venezuela; these include Los Aves islands, Blanquilla Island, the Frailes archipelago, the Hermanos archipelago, the Monjes archipelago, Orchilla Island, Los Testigos Islands, Margarita Island, Tortuga Island, and the Roques archipelago (Antczak 1995). Archaeologists with Venezuelan connections have long been involved with the development of Caribbean archaeology. Sanoja (Sanoja 1965) and Vargas (Vargas Arenas 1996, 1997; Vargas Arenas and Vivas 2000) have been integral to the development of a 'social archaeology' framework that has been particularly influential in the Dominican Republic (Veloz Maggiolo 1972, 1997, 1999) and Cuba (Ulloa Hung 2003).

North America

Puerto Rico and Vieques were ceded to the United States by Spain following the American-Spanish War in 1898. The country became a self-appointed commonwealth in 1952 but is referred to by the United States as an unincorporated territory. Discussions of the island's future sovereignty are ongoing. The United States government owns 60% of Vieques territory. St Croix, St John, St Thomas and Water Island, make up the U.S. Virgin Islands that remain under the U.S. flag, but the islands are an unincorporated territory with non-voting representatives in the United States House of Representatives. These islands were previously the Danish West Indian Islands (1754-1917) before being sold to the United States in 1917 for $25 Million.

Both the United States of America and Canada have had a close association with the Caribbean and there is no doubt that archaeologists trained in North America have had a durable and long lasting effect on Caribbean Archaeology. In many ways this is due to the timing of North American involvement in the Caribbean that has developed strongly between the mid 19th century and the present day. North American archaeologists such as Bullen, Harrington and Irving Rouse, worked in Caribbean countries that were developing relations with the U.S.A. during the first half of the 20th century. North American archaeologists brought with them established archaeological theories and methods during a time when archaeology as a discipline was in its formative stages in the Caribbean. Rouse used information retrieved from his excavations in Haiti, Cuba, Puerto Rico and Venezuela, and his research visits to a number of other Caribbean islands, to develop a regional perspective on Caribbean prehistory. His conclusions were based on evidence for a series of migrations of people into the Caribbean from South America. A brief look at some of

Rouse's publications, such as *Migrations in Prehistory: Inferring Population Movement from Cultural Remain* (Rouse 1986), reveal the culture historical influence of the interpretative frameworks within which he worked. Perhaps Rouse's greatest achievement was to bring the regional perspective to the Caribbean. During the 1930s, 1940s and 1950s he had the political and logistical means to work and visit a great number of islands in the Caribbean and this allowed him to conduct island comparisons across broad spatial and temporal dimensions. More recently, archaeologists with North American connections have continued to be very active in the Caribbean. A number of universities in the United States of America and Canada have strong Caribbean archaeology departments. The proximity of North America to the Caribbean and the abundance of educational facilities has meant that a number of Caribbean archaeologists continue to travel to the United States and Canada for both training and jobs and therefore the influence of North America in the development of Caribbean Archaeology continues (Carlson and Keegan 2004; Curet 2005; Keegan 1992; Newsom and Wing 2004; Rouse 1992; Sandweiss and Watters 1996; Siegel, *et al.* 2005; Wilson 1999).

1.I.3 History of Archaeological Development

Understanding the social and political context of past archaeological research is useful in order to review the influences on archaeological development in the Caribbean. However, in order to understand the relevance of this influence on studies of island interaction in the prehistoric Caribbean, it is necessary to review how theoretical and methodological frameworks have emerged during different periods in Caribbean archaeology. This historical perspective provides an understanding of how archaeological frameworks for studying prehistory have developed in the Caribbean.

1.I.3.i Antiquarianism in the Caribbean

Antiquarian interest in the past gathered momentum during the middle of the 19th Century with populist science acting as a driving force in European society. High profile publications such as Darwin's *Origin of Species* in 1859 stimulated public debate as "Charles Darwin's fundamental idea inspired intense reactions ranging from ferocious condemnation to ecstatic allegiance, sometimes tantamount to religious zeal" (Dennett 1995:17) and this motivated often well moneyed individuals to dabble in the study of the past and the evolution of 'primitive man'. The influence spread to the British, Spanish, French and Dutch colonies that made up the majority of the Caribbean at the time. Antiquarianism became a common, albeit often poorly documented, phenomenon in the region during this period. At the beginning of the 20th century the introduction of professional archaeology radically altered the biography of researcher and the methods, theory and practice employed. As Jesse Fewkes acknowledged during his work in Puerto Rico in 1907, "by far the most important means now available for the interpretation of the culture of the prehistoric Porto Ricans is a study of archaeological objects that are being brought to light by chance discovery or scientific exploration" (Fewkes 1907:89). A body of archaeological information founded on the study of excavated artefacts began to emerge as professional archaeologists started working in the Caribbean.

1.I.3.ii The Emergence of Professional Archaeology

The previous discussion of socio-political context in the Caribbean has revealed the influence of North American and European involvement in the emergence of Caribbean Archaeology. Even though many archaeologists working in the Caribbean may have been native to their areas of study, there has been external influence on the direction and selection of their archaeological theories and methods. For the purposes of this overview the review has been broken down into three broad sections loosely based on the chronological development of North American and western European archaeology: Culture History, Processual or New Archaeology and Post Processual archaeology. These are clearly loaded terms about which much has been written and critiqued but they provide relevant and broadly understood terms for sequential periods of intellectual development in archaeology.

1.I.3.iii Culture History

Although early 19th century antiquarians used material remains as the basis for inference about past cultures, it was Vere Gordon Childe who was one of the first archaeologists to lay down clearly a theoretical foundation from which material remains could be viewed as material culture leading to the interpretation of culture history (Childe 1925:343; Harris 1994). Childe's efforts to interpret the dynamics of European prehistory using a detailed analysis of material culture were the subject of intense debate within the archaeological community both during his lifetime and after his premature death in 1957. Many of his conclusions, based on large scale migrations within a broader teleological approach to 'explaining' European civilisation, have since been challenged (Renfrew 1973:42), but what has continued is his theoretical legacy. To this day his "theoretical work continues to inspire and to resonate with the perspectives of successive generations of archaeologists and with new fashions of archaeological interpretations" (Harris 1994:1). As first laid out in *The Dawn* *of European Civilisation,* the foundations of Childe's approach was using artefact types to define archaeological cultures; he worked with "assemblages of archaeological phenomena that should reflect the distinctive behaviour patterns of human societies" (Childe 1925:341). Childe understood the complexities of this approach and he attempted to divide material culture so as to represent ethnic identifiers and functional adaptations. He argued that ethnic indicators were durable long-term indicators of culture whereas technological attributes were transitory and likely to change (Childe 1944; Trigger 1994:11). Childe was influenced by Marxist theory, reflected in his penchant for using the revolution as he described the Neolithic and Urban Revolutions, and this Marxist influence was emphasised by later generations of Cuban archaeologists, who credited Childe with the first practical introduction of dialectical materialism in archaeology (Davis 1996:168). However, Childe himself argued that much of his theoretical framework was 'common sense', an argument that was to be criticised for its failure to stand up to the objective 'scientific' rigours popular a few years later. Childe's eurocentric focus contrasted with his internationalist approach in which he used his language skills to read more than just the English literature (McGuire 2002). However, his failure to take on a world perspective allowed North American archaeologists to use non-European examples to argue against his culturally universal interpretations (Parsons 1937). The criticisms against the cultural historical approach will be discussed below but it is interesting that some of the latest 21st century theoretical debates are revisiting culture history and recognising the lasting importance of the movement (Shennan 2002:268).

Culture History in the Caribbean

The 1930s and 1940s saw a surge in the number of researchers working in the Caribbean. Their approaches and interpretations strongly reflect the cultural historical trends of the time (Hatt 1935; Rainey 1940; Rouse 1941, 1942). They focused on linking archaeological material remains with past cultural groups, defining cultures and looking at cultural development almost exclusively through the construction of pottery typologies. These approaches have had far reaching consequences for Caribbean archaeology. Rouse's original explanation of advanced cultural expansion into the Caribbean through mass migrations based on his study of spatial patterning of ceramics is still taught in Caribbean schools today (Parry, *et al.* 1987). The continued dependence on ceramic typologies as indicators of migration and colonization are highlighted in discussions about Bahaman colonization; "the empirical foundation for migration and colonization of the Bahaman archipelago was based on surface remains and limited excavation, dependence on ceramic cross-dating and reliance on ceramic style" (Berman 1994:424).

This framework influenced the study of island interaction in the prehistoric Caribbean with popular concepts of migration affecting the way in which the Caribbean has been perceived both geographically and culturally. Geographically, it has been said that "the windward and leeward island groups that extend from Trinidad northward to the Virgin Islands seem to be natural stepping stones for the migration of peoples from northern South America into the Greater Antilles" (Haag 1965:242); and culturally that "the expansion of the Island Arawaks through the Antilles can be viewed as a series of waves whose rate of advance increased every time a frontier was breached" (Keegan 1992:16).

Another key influence of the culture historical approach on Caribbean archaeology is the evolutionary or progressivist paradigm within which these approaches were first developed. Just as Childe explained European prehistory as a progression towards the great civilisations of the 20th century, so too did Caribbean archaeologists try to work towards explaining a progressive development to the level of civilisation encountered by Columbus and the European colonists. This means that interpretations were often inherently teleological with prehistory providing a retrospective rationale used to explain the historical present (Smith 1994:375). Initially, the clearest way to explain a perceived progressivist cultural development in the Caribbean was by arguing for a series of migrations of more advanced cultures from South America that swept up into this geographical and cultural backwater, seemingly wiping out successive generations of culturally stagnating societies. The peoples who first populated the Caribbean, obviously had the technological skill to cross some substantial bodies of water particularly if "the first colonisers of the Greater Antilles came from western Yucatan" (Wilson 1995:391). However, these first colonists are classified as 'simple' archaic hunter gatherers who were swept aside by later more culturally 'advanced' ceramic populations (Rouse 1992:82). This framework has the potential to give much less weight to the possibility of regular and small-scale island interaction throughout prehistory by focusing on large-scale movements of people and material.

As more work was carried out in the Caribbean, attention focused on how people living in the Caribbean might have experienced more independent cultural development. New scientific techniques were introduced and the potential for internal cultural change was used to challenge the predominance of early cultural historical theoretical frameworks.

1.I.3.iv Processual or New Archaeology

One of the clearest ways to see how important Childe's work was in laying the foundations for the material culture debate is the ferocity and diversity of the reaction to his work in later years (Trigger 1994:13). Processual archaeology wasn't just a reaction against the cultural historical approach, it was an attempt to introduce a series of robust theoretical frameworks that could 'scientifically' make the link between material remains, material culture and past cultural practices. This was seen by the new movement as the move away from an age of myths to an era of understanding, putting an end to "a doomed race of disciplinary dinosaurs" (Clarke 1973:8). Binford stands out as a leading protagonist in the ensuing debate, and his work was a catalyst in the introduction of "new methods, new observations, new paradigms, new philosophies and new ideologies within a new environment" (Clarke 1973:12). Binford, in pursuing his actualistic studies, was very interested in archaeological metaphysics, as he called it, and he tried to analyse with minute detail the artefact as a representation of past human action (Binford 1978:331). An example of how he employed increasingly complex classification techniques for interpreting material culture is found in his attempts to divide artefacts into socio-technic and ideo-technic categories (Binford 1968; Binford 1971:252; Johnson 1999:58). He argued "that a science that lacks a robust methodology cannot operate as a science" (Binford 1981:289). Using his middle range theory to act as the bridge, he took the static artefact and used it as a piece of the material culture jigsaw with which he could recreate the past dynamic culture. However by undertaking the process of distinguishing between the inanimate 'material' world and the animate 'cultural' world, Binford was unable to avoid some level of subjective decision-making, which undermined his idealised objective approach (Binford 1981; Binford 1971:250; Jones 2002:65). Many others have attempted to make this universal link between material remains and material culture with Mertion, Raab and Goodyear all immersed in what Schott calls the semantic confusion around formation theory (Schott 1998:301). However, they all struggled to produce workable methods that could match their lofty theoretical aspirations. The dissemination of this critique of cultural historical processes, conducted primarily by North American and European archaeologists, has been variable in the Caribbean, reflected in the different archaeological approaches employed on different islands.

New technology played an important role in the development of processual archaeology by offering a 'scientific' solution to the problems of studying material culture. Not only did radiocarbon dating techniques allow new chronological systems to be constructed but also computers permitted analytical approaches to large groups of data in a scientific manner (Clarke 1973:12; Gillespie 1989). One of the main criticisms of these times highlights the way in which 'science' was used as a smokescreen for quantitatively and qualitatively dubious interpretations (Hegmon 1992:527; Jones 2002:65; Shennan 1997, 2002). The introduction of new data management techniques and statistical analyses allowed an increase in level of detail with which archaeological sites and material remains could be studied. By adopting quantitative approaches to material culture, people using these new techniques increased the scale and detail of analysis and increased the levels of data, potentially allowing a wider scope for interpreting past cultural practices through material remains (Price 1973:211). Schiffer worked at developing a quantitative approach by building a bridge between processual archaeology and mathematical structuration leading to the development of statistical spatial patterning of material culture and more complex mathematical models that were not easily transferable to practical use (Schiffer 1972:158). Hodder and Orton, working within this mathematical paradigm, provided a strong critique of Schiffer's approach showing how "a given set of data will always support more than one interpretation" (Hodder and Orton 1976; Shennan 1989:2) and that in reality, nothing was a provable certainty. However, during this period the scale and level of detail employed in studying material culture increased the potential scope for archaeological research.

Processual or New Archaeology in the Caribbean

The influence of the processual movement led to the development of more scientific methods in the Caribbean. The development of a quantitative approach to material culture was hailed as a breakthrough in interpretative reliability. However, quantitative techniques rely on representative data sets and in the Caribbean a reliance on ceramics continued with excavations often only looking for and recording ceramic collections. Non-representative data sets reflect the treatment in the Caribbean of material culture as a record of aggregate symbolism and meaning (Mendez 1972) and then negated the validity of much of the quantitative analysis of the period. For example, in the case of Rouse and colleagues' excavation of Ronquin, the excavators specifically stated in their aims and objectives that they were trying to find earlier ceramics in order to support their out-of-Orinoco hypothesis (Rouse, *et al.* 1975:117). Their approach is fraught with bias that casts doubt on the justification of the excavation findings and later interpretations. Harris' discussion of the various ways of classifying pottery and the different sorts of classification techniques employed highlights the development of a material specific approach to archaeology in the Caribbean (Harris 1995). These techniques became increasingly focused on universal ways of classifying ceramics either through the Rouse method (Rouse 1983), Yeloz-Yargas-Sanoja method, or the Pinchon-Petitjean Roget method (Harris 1995:348). But just as the wider processual debate underwent statistical critique (Hodder and Orton 1976; Orton 1980) so too did these attempts at universals that required essentialist statements such as "each vessel type is designed and manufactured for one specific function and these functions are indicated by clearly visible codes or signs" (Harris 1995:348). These attempts at scientific modelling of pottery typologies affected sampling strategies introduced during this time. There were biases in sampling strategies, with high-yield sites in easily accessible areas being given more attention (Righter 1995:58). More recently, marginal areas have yielded information that has totally altered past concepts of settlement patterns (Pendergast, *et al.* 1999:79; Purdy 1988:328) and are indicative of the need for a reassessment of sampling strategy and material focus in the Caribbean.

Meggers (Meggers 1954) and Lathrap (Lathrap 1970), reflecting the influence of Leslie White (Sanderson 1990) and Julian Steward (Steward 1972) focused on the impact of environmental pressures on cultural development within a cultural ecology framework. This environmental model for cultural expansion and resource adaptation, as part of a biogeographical approach, was adopted by Carneiro as the foundation of his 'Environmental Circumscription Theory' (Carneiro 1973; Carneiro 1988; Sanderson 1990). The focus is on how material culture reflects human adaptations to different ecosystems (Wagner 1978). Biogeographical approaches to the Caribbean reflect the influence of early island biogeographers like Vayda and Rappaport who argued that "an island population with simple horticultural techniques may double its numbers in each generation as long as additional land and resources continue to be readily available" (Vayda and Rappaport 1965:137). The influence of Carneiro and the culture environment models popular during the 1970s (Carneiro 1988) can still be seen in Caribbean archaeology. Keegan and others continue to focus on the relationship between past peoples and the environment (Keegan 1995; Petersen 1997). Keegan builds on a biogeographical approach to Caribbean prehistory using population growth and density models to explain population expansion, migration and dispersal (Keegan 1994).

1.I.3.v Post Processual Archaeology

A body of opposition to processual approaches gained momentum during the 1970s, and there were questions asked about the lack of representation for non-material communication amongst past cultures (Goody 1977:12). A solely material culture approach was recognised as being biased against societies with strong oral traditions that leave few material remains. The approach was also reflective of the Eurocentric colonial origins of this strand of theoretical development (Fletcher 1989; Hodder 1984; Shanks and Tilley 1987; Tilley 1999:262). Critiques also focused on the lack of representation of material remains in relation to past material cultures and the validity of a universal interpretative link between material remains and culture. Once it began in the late 1970s, the deconstruction of processual archaeology grew quickly and suddenly all ideas and approaches of the past 30 years were under scrutiny, tarred with a brush of doubt and coated with a layer of post-modernistic cynicism. Semiotics and the reading of symbolic meaning in the archaeological record were examples of how the whole process of interpreting archaeological material was overhauled (Patrik 1985:49). New interpretative approaches re-ignited discussion of the active and passive record of past cultures and underlined the problems of attempting to recreate a past in the present because the "past, present and future meet in complex forms, such that the present is only given meaning through retaining elements of the past and anticipating the future" (Gosden 1994:2; Hodder 1999:86). The development of Public Archaeology has increased this debate over whether there really is a past or whether it is just a creation of the present motivated by social and political pressure, because "any reconstruction of the past is a social statement in the present" (Hodder 1984:18). These new developments have led to different pressures being placed upon archaeologists and their ability to interpret material culture in the past. A consequence is an increasing awareness of the politicisation of the past and the importance of satisfying increasing demand for interpretations of material culture whilst maintaining a valid methodological approach.

The essentialist approaches of the past and the tendency to look towards metanarratives were criticised (Lyotard 1984) and a much smaller scale of interpretation adopted. Hermeneutics and the location of meaning in material culture was questioned and the use of analogy (Wylie 1985) and metaphor in archaeology were critically assessed to reveal the inherent subjective biases in interpreting material culture (Hodder 1984; Preucel and Hodder 1996:3; Shanks 1987; Shennan 1989:1; Shennan 1993; Tilley 1994; Wiessner 1989:57).

Cognitive archaeology and the study of past ways of thought became prominent, and reflected the way in which the individual was playing a more important role. Tilley exemplified this emphasis on the individual through his phenomenological approach to interpreting archaeological remains in the landscape (Hodder 1984; Tilley 1995:52). The raising of the profile of the individual in past cultures opened up the potential for finding the individual in material culture but practical attempts at obtaining data on the individual highlighted the impracticalities of such an approach (Shanks and Tilley 1987:25). The interest in human intention and the examination of social consciousness polarised the archaeological community as very different interpretations and hermeneutic approaches arose, which increased the disparity between scales of interpretation (Hegmon 1992:518; Hodder 1984; Shanks and Tilley 1987; Shanks 1987). Divisions over the scale at which data and interpretation can be correlated have arisen. Doubts emerged over the use of micro-scale analysis of material culture with macro-scale cultural interpretation at a society or individual level (Jones 2002:65; Shennan 2002:232). The European and American focus of past theoretical discussion was recognised as lacking subjective transparency and past protagonists were criticised for their naivety in attempting the impossible when striving for interpretative objectivity and claiming scientific sterility (Leone 1987; Schott 1998:302). Past theoretical developments were accused of ignoring worldwide indigenous cultures and maltreating indigenous archaeology and this in turn re-ignited the debate over using ethnographic analogy for interpreting material culture (Ucko 1969, 1989).

Post Processual Archaeology in the Caribbean

Research in the Caribbean during the past 20 years has reflected some of the ideas and themes of post processual archaeology. Non-verbal communication through material culture has been an interesting avenue of research in recent studies of pre-Colombian art and design (Gutiérrez Calvache 2002; Velandia Jagua 2002). Oliver's work (Oliver 1997:145), influenced by Dolmatoff (Dolmatoff 1995) and recent archaeological theory (Wiessner 1989:57), attempts to question the cognitive element to archaeology in the Caribbean. Oliver focuses on the cosmological beliefs of the Taíno and the level to which material culture is influenced by individual and group belief systems (Oliver 1997:145). Petitjean Roget has also cited the importance of cosmology amongst indigenous groups of the Greater Antilles; "the Taíno referred constantly to myth and its non-linear conception of time" (Petitjean Roget 1997). This case-by-case approach undermines the functionalist approaches discussed earlier in this chapter and introduces the complexity of working with different scales of meaning.

Developments of landscape studies and the influence this has had on island archaeology has had an effect on the Caribbean. New directions in Island Archaeology have suggested that "island material culture assumes a more active, constitutive role in island life than has generally been realised" (Broodbank 2000:1). Also, Broodbank has criticised the stepping-stone approach to island migrations. Taking on a more multi-directive approach to interaction, he argues that "islands are potential stepping-stones from everywhere to everywhere else" (Ibid.:41). These ideas have been picked up in the Caribbean and developed by Curet *Island Archaeology and Units of Analysis in the Study of Ancient Caribbean Societies* (Curet 2004). Curet discusses the importance of using social units of analysis rather than relying on physical boundaries and uses this social focus in his recent publication (Curet 2005). Other post processual movements such as agency and phenomenology are yet to have a large scale impact on the Caribbean with Keegan stating that 'human agency can only account for a relatively small subset of human behaviour' (Keegan 1999:256).

Ethnographic analogy, particularly popular during the 1970s, was very influential for Caribbean archaeology. Ethnographic analogies were used to connect the peoples of lowland South America and the peoples of the pre-Hispanic Caribbean. Another inheritance of Rouse's (Rouse 1992) out-of-Orinoco migration theory was that modern South American indigenous groups were, and continue to be, perceived as analogous to past indigenous groups of the Caribbean (Heckenberger and J Petersen 1995:379). This approach to cultural similarity reflects the influences of social evolution and ideas that have resurfaced throughout the 20th century (Levi-Strauss 1955).

Ethnography has provided some interesting lessons for Caribbean archaeology, particularly in showing the importance of organic material culture and cosmology in the creation of iconography and style in material culture. Siegel (Siegel 1996; Siegel, *et al.* 2001) has also drawn comparisons in ideology and spatial patterning between South America and the Caribbean. Siegel argues that "archaeological residues of Saladoid sites are similar in overall structure to extant villages of lowland Native American Communities in South America, also constructed as physical models of the universe" (Siegel 1996:319). Therefore ethnographic analogy has provided a very useful way of interpreting material culture, but problems can arise from stretching links across large temporal and spatial distances.

1.I.4 Theoretical Frameworks in Caribbean Archaeology

This chapter has highlighted how the history of archaeological development in the Caribbean has influenced the theoretical context of previous studies. As noted above, theoretical frameworks have the potential to change the way in which the space of the Caribbean is perceived both geographically and culturally. Therefore different theories need to be considered briefly to contextualise my research. The socio-political history of the Caribbean has had a far-reaching impact on the nature and development of archaeology in the Caribbean. These influences have affected not only the theoretical frameworks and methodological techniques developed in the Caribbean but also the topics of research conducted. This has led to divergent traditions in archaeological approaches in different parts of the Caribbean.

The development of archaeology in the Caribbean has been shown to mirror aspects of wider theoretical debates in the discipline. The culture history foundations of archaeology in the Caribbean have left an influential legacy and these origins continue to influence attitudes towards research in the Caribbean today. The use of ethnohistorical, ethnographic, environmental, biogeographical, and linguistic approaches have provided useful interpretative frameworks, but the use of archaeology to support pre-existing hypotheses created from these alternative sources of data has produced some speculative and perhaps untenable archaeological interpretations. Archaeology needs to be more intensively focused locally, on specific areas, to enable new hypotheses and research questions to be developed independently, and only then can interpretations be compared with alternative sources of data. My response has been to develop an island archaeological framework to begin addressing the question of island interaction in Cuba.

1.II Cuban Archaeology: A National Context for Research

Introduction

The research questions posed in this thesis emerge from a review of Cuban archaeology in the following chapter and the identification of areas where additional work could contribute to a better understanding of island interaction. In order for island interaction studies in Cuba to be well founded, the context of past research needs to be understood. It is only through a review of the development of Cuban archaeology that it is possible to contextualise past studies of island interaction and understand why North American and Cuban archaeologists would need in 2005 to discuss their attempts to "help thaw the state of communication between scholars from both countries, which in many ways has remained frozen in the political climate of the early 1960s" (Dawdy, *et al.* 2005:1). This review builds on previous reviews of Cuban archaeology (Dacal Moure and Watters 2005; Davis 1996; Dawdy, *et al.* 2005; Hernández Godoy 2003; Hernández Oliva and Arrazcaeta Delgado 2004;

Marichal García 1995; Moreira de Lima 1999; Oliver 2004; Rangel Rivero 2003) and is divided into four sections broadly based chronologically around the political events in the island's history. These sections are significant because the political events that mark the transitions, namely Cuban Independence in 1898, the Cuban revolution in 1959 and the break down of the Soviet Union in 1989, were to mark noticeable changes of course in the development of Cuban archaeology.

1.II.1 Antiquarianism pre-1898

This period of Antiquarianism in Cuba mirrors similar trends discussed earlier with regard to the wider Caribbean. Nelsa Trincado refers to the origins of antiquarianism in Cuba gathering momentum around 1830 as "the reformist movement in Cuba began an intense rescue effort of Cuban History" (Trincado Fontán 2000:102). This movement during the first half of the 19th century saw a rise of public interest into the past, reflected in the poetry and oral histories of Juan Cristobal Napoles Fajardo (Dacal Moure and Watters 2005:29) and the popular literature of Gertrudis Gómez de Avellaneda, who described the Indian petroglyphs in the Cueva de Santa María in the Sierra de Cubitas in Camaguey in her book *Sab,* published in 1941.

The majority of antiquarian interest was the simple collection of artefacts of curiosity, often restricted to a local area and followed by the discussion of the objects among friends. Consequently there is little documentary evidence related to the discoveries made during this period, but some information survives. Miguel Rodríguez Ferrer was trained in law and theology in Spain before being sent to Cuba with a broad remit to study the island's past. Guarch, in his detailed study *El Taíno de Cuba* cites Miguel Rodriguez Ferrer, "the indefatigable Spanish explorer" (Guarch Delmonte 1978:39) as visiting the site of Pueblo Viejo in Baracoa in 1847 where he discovered seven skulls, six with cranial deformation, in the Cueva del Indio (ibid.). Ferrer also mentioned finding petaloid axes around the area of Mayari during his explorations in the area (Tabio and Guarch 1966:13). It is likely that some form of excavation was employed during these explorations and consequent discoveries but scant detail of the methods are known, as the focus of his interest and his subsequent publications only describe the artefacts themselves. There is evidence that research interests during this time were focused on the bigger picture of the relationship between Cuba and the rest of the New World. Ferrer's findings were published in his seminal work *Naturaleza y Civilización de la Grandiosa Isla de Cuba* in 1876 (Rodríguez Ferrer 1876), the main treatise of this work being that his findings supported his hypothesis that Cuba was originally attached to the continent of North America. The archaeological text is descriptive and, typical of this antiquarian period, grapples with broad inter-disciplinary issues, uses archaeological artefacts as contributory pieces of evidence without recourse to any defined cultural or chronological context.

E.G. Squier visited Cuba in 1860 and is credited with influencing the development of stratigraphy in archaeology (Dacal Moure and Watters 2005). On July 26th 1877, the Sociedad Arqueológica de la isla de Cuba was founded and became a focal point for the collection and dissemination of information relating to prehistoric occupation in Cuba (Hernández Godoy 2003:10). This generated a national forum for researchers, namely Eusebio Jiménez, Luis Montané and Carlos de la Torre who were all to have a long-lasting effect on Cuban archaeology. Jiménez was a collector in the classic sense, valuing objects for their aesthetic beauty (Tabio and Rey 1979). Luis Montané Dardé, influenced by his time spent at the University of Paris in France, published prolifically between 1885-1916 and became a leading figure in Cuban archaeology, Montané collected artefact assemblages from Cuba and the wider world and created the collection that would lead to the foundation of the Montané Museum (Rangel Rivero 2003). Following independence in 1898 he became the first director of anthropology at the University of Havana. Carlos de la Torre worked with Montané and carried out excavations in the Cueva de Ovando close to Maísi; he found the first recorded evidence of shell *gubias* or gouges. Carlos de la Torres' interest in archaeology persisted during his time as the Rector of the University of Havana and he influenced the academic direction and development of Fernando Ortiz (Ortiz 1922).

Tabio and Rey, in their book *Prehistoria de Cuba* (Tabio and Rey 1979), provide a comprehensive list of some of the more anecdotal evidence for antiquarian work during this period, including excavations by Don Andres Perdigo in 1888. Unfortunately, the majority of actual material recovered during this pre-Independence period has been lost or remains uncatalogued in private collections. It was a period when private collections were popular and socially acceptable. Indeed Fewkes in his book *The Aborigines of Porto Rico and Neighboring Islands* describes his work touring and purchasing objects from private collections in Puerto Rico, Cuba, Grenada, Haiti, St. Vincent and Trinidad (Fewkes 1907:18). Some artefacts from this period, including those uncovered by Rodriguez Ferrer, are known to have survived and some are now in the Museo de Antropología de la Universidad Nacional (Guarch Delmonte 1978:40).

The relationship between archaeological research during this period and the emergence of a Cuban nationalism or even a Cuban identity appears strong and is embodied by the literature of populist Cuban icon, José Martí, who described the importance of national heritage as paramount for the survival of the nation: "The history of the Americas, from the Inca to the present has to be taught comprehensively, even if the history of the great judges of Greece is not. Our Greece is preferable to the Greece that is not ours" (Martí 1963:18, cited in (Trincado Fontán 2000:103)). This antiquarian period saw the emergence of a close association between identity, nationhood and archaeology (Robaina Jaramillo, *et al.* 2003:59). This inevitably affected the direction of research, and interest in island interaction became connected with issues of Cuban independence both physically, with discussion of ancient land connections to Florida, and culturally, with discussion of cultural associations with peoples of continental North America. These issues in archaeology were influenced by the political context of the Spanish-American wars followed by the independence of Cuba in 1898 (Thomas 2001).

1.II.2 Cuban Independence 1898-1959

Cuban archaeologists worked intensively during the beginning of the 20th century (Dacal Moure 2006). Archaeological research by the likes of Jiménez, Montané, Gómez Planos, Cosculluela, Grave de Peralta is not widely disseminated outside Cuba and was overshadowed by English language publications. North American archaeologists such as Powell, Holmes, Culin, Fewkes, De Booy and Harrington travelled to Cuba from the United States and worked on archaeological projects with Cuban colleagues, assimilating knowledge before publishing their work in English ensuring a wider international recognition. North American researchers were also in the position to draw on wider inter-island comparisons, exploiting their access to archaeological data from other islands such as Puerto Rico and Haiti (Fewkes 1907). As discussed previously, the socio-political context of North American involvement in Cuban independence, has been interpreted by some authors as influencing the research topics and interpretative frameworks for archaeological research during this period. Cuban archaeologists have been seen as working within a national interpretative framework whilst North Americans were more interested in drawing on comparative international connections and wider island interactions. Indeed some authors have interpreted contemporary research by North American palaeontologists during this period as being overtly motivated by a wider political agenda:

> "These scientific works of the 20th century put in manifesto the importance that paleontologic data had to emphasize the ownership of Cuba to the American geo-historic and ethnologic area. In any case, it must be indicated that the previous and subsequent years to 1898, the year of the Cuban independence, the problem of the geological past of Cuba had a repercussion that transcended the paleontological range, because the land connection to the American continent permitted use as a scientific factor to prove the American identity of Cuba" (Sic.) (Pelayo López 1995:11).

In 1902, the same year the Platt amendment legislated diplomatic relations between the United States and Cuba, Jesse Walter Fewkes was commissioned by the Director of the Bureau of American Ethnography in the United State's to study the prehistory of the islands of the Caribbean that had recently come under the United States sphere of influence. Fewkes focused his work on Puerto Rico, but he played an important part in summarising archaeological research in the Caribbean up to 1907, and he provided a framework for Cuban archaeology based on the two cultures Taíno and Ciboney. Fewkes perhaps reflected the wider socio-political context of his work because he focused on links between the islands where the American government held influence: "the prehistoric Porto Rican aborigines may be said to have been a mixed Taínan race, closely related to the people of Haiti and Cuba, but considerably modified by Carib influences in the eastern sections of the island" (Fewkes 1907:26). However, the relationship between North American and Cuban archaeologists was symbiotic, and Fernando Ortiz picked up on the North American research interest in island interactions. He cited how "the renowned archaeologist (Fewkes) showed the similarities between the Indian cultures in the Florida Keys and those in Cuba and the neighbouring islands, he mentions the existence of Indians living in lacustrine stilted houses and interpreted that there was past contact , exchange or migrations between one country and the other" (Ortiz 1922:29).

In 1915, direct North American involvement in Cuban archaeology increased as the Museum of the American Indian in New York began a four year archaeological project, funded by the Heye Foundation, with the primary aim of collecting artefacts for the museum and studying the lives of the 'American Indian' in Cuba. This project, directed by Harrington, began with the assumption, based on previous archaeological work by Cuban archaeologists and reiterated by Fewkes, that there were two different ethnic groups in Cuba before the arrival of Columbus: the Taíno and the Ciboney. Harrington's important text *Cuba before Columbus,* published in 1921, was a comprehensive view of Cuban prehistory that provided a turning point in archaeological approach because he focused on the lives of the past people rather than just their artefacts. It was clear that Harrington used the previous works of Cuban archaeologists such as Montané and Cosculluela because he described their findings and used their terminologies. The book was published in New York in English and reflected the way in which both material and information were taken out of the country by North American researchers during this period.

Fortunately, Fernando Ortiz had access to this "most important contribution to Cuban archaeology" (Ortiz 1922:10) and disseminated much of the information to a Spanish audience in his *Historia de Arqueologia Indocubana,* published in Havana in 1922 (Ortiz 1922). The intepretation of Ortiz in his book is cited by Cuban archaeologists today as a crucial turning point in Cuban archaeology. He brought an independent Cuban critique to the work of international archaeologists and "the *Historia de la Arqueología Indocubana* was without doubt the most important text written between 1847 and 1922" (Hernández Godoy 2003:15). Ortiz identified the complicated relationship that Cuba, and by association Cuban archaeology, had with the United States of America during this period. Ortiz was a great patriot and to this day remains perhaps the most universally recognised Cuban researcher of the country's past. He is credited with identifying the past as a crucial building block for the construction of a Cuban identity in the present. Ortiz developed his theory of transculturation, which he adapted from the culture historical ideas of the time. Transculturation was the study of how similarities in material remains between different geographical areas could be used to study cultural relations or more specifically the adoption and flow of cultural traits. Ortiz discussed the validity of North American investigations of long distance cultural links, he reviewed the work of Holmes, who argued for links with Georgia based on ceramic designs, and of Harrington, who built upon Fewkes's previous interpretations and worked on establishing links with Florida based on his own analysis of shell tools of the Ciboney of Cuba. But the main interest of Ortiz was the emergence of the Cuban nation itself. The focus of his eloquent research into Cuba's past allowed him to construct the foundations upon which his Cuban 'Patria' could be built. Ortiz has remained a key Cuban academic inspiration for archaeologists and is commonly cited in the revolutionary literature (Pichardo Moya 1990).

The next large scale North American archaeological project emerged from the Yale University Caribbean Archaeology program in 1933. Osgood and Rouse from Yale brought new methodological and theoretical ideas and traditions to Cuba and left a long lasting legacy. They are credited with introducing the first systematically recorded stratigraphic excavation methods (Tabio and Rey 1979:122). Osgood's excavations at Cayo Redondo led to his publication of *The Ciboney Culture of Cayo Redondo* (Osgood 1942) and provided the type site for later cultural divisions of the preceramic period. Rouse established a cultural framework for archaeology based on ceramic typologies established during previous work in Haíti during 1933-4. Rouse worked within a typological framework that relied on identifying ceramic series, subseries and styles (Rouse 1952; Rouse 1992). This ceramic framework based on Meillac and Chican ceramics was taken from work in Hispaniola and has had an important impact on Cuba. His ceramic typologies underpin the cultural classification of ceramic period sites in Cuba (Rouse 1992; Trincado Fontán and Ulloa Hung 1996). Cuban archaeologists, such as Carlos García Robiou and Rene Herrera Fritot, were influenced by North American techniques during educational visits to the United States (Dacal Moure and Watters 2005:32; García Robiou 2003), and García Robiou then worked with Rouse in the excavation of Aguas Gordas in Holguín. These Cuban archaeologists began the tradition of placing archaeological evidence within a pre-existing cultural framework based on artefact typologies (Hernández Oliva and Arrazcaeta Delgado 2004; Rouse 1942).

An example of the Cuba centric research during this period is the work conducted by Felipe Pichardo Moya, which led to his comprehensive book *Cavena, Costa y Meseta,* published in 1934 (Domínguez 1990; Pichardo Moya 1990). The book focuses on settlement patterns through prehistory and argues for a cultural move away from the coast and into the interior, initiated by the development of agriculture. Pichardo Moya highlights an emerging Cuban nationalism with his praise of "el maestro" Fernando Ortiz and a criticism of Rouse's cultural framework. Cuban archaeologists now cite Pichardo Moya as the first in the new generation of Cuban archaeologists, highlighting his functionalist techniques based on the "trilogy; man-space-environment" (Domínguez 1990:xiv).

This role of Cuban archaeology in the emergence of Cuban nationalism was recognised at a government level and led to legislative steps by the Cuban Government which culminated in the establishment of the Junta de Arqueología in 1937 and the regulation of archaeological work in Cuba by the Comisión Nacional de Arqueología (Dacal Moure and Watters 2005:33; Davis 1996:163).

This brief review has focused on some of the more important figures and events during this period but many other Cuban archaeologists were at work. The important Grupo Guama was established in 1956 and began a series of excavations around the country. The work of archaeologists such as Orencio Miguel Alonso, Oswaldo Morales Patino, Dulce Baisi-Facci, José Riverón, José Garcia Castañeda, Pedro Gracia, Bernado Utset, Antionio Gonzalez Muñoz, José Sanjurjo, Felipe Martínez Arango and Antonio Navarrete Sierra has perhaps not received that much attention due to the lack of publications or the lack of access to the reports and publications from the period. Despite the disproportionate recognition of North American archaeologists working in Cuba, it is clear that the "bulk of substantive research in Cuban prehistory had in fact been carried out by Cubans" (Davis 1996:164), even during this pre-revolutionary period.

1.II.3 Revolutionary Archaeology 1959-1989

The revolution in 1959 marked the greatest point of transition in the development of the Cuban nation and the consequences for archaeology have been profound:

> "The triumphant revolution of 1959 and the beginning of deep rooted social transformations in the island permitted the rescue of our historical cultures as a profound expression of national unity... during these years the development of archaeological studies in Cuba allowed a better understanding of our aboriginal peoples" (Trincado Fontán 2000:105).

The following review of the development of Cuban archaeology focuses on the changing methods, theoretical frameworks and practice of archaeology after the revolution of 1959. Fidel Castro proclaimed the Cuban revolution as a socialist revolution in 1961. Following this date, strong political, economic and cultural links were forged with countries sympathetic to the new socialist government. This led to the development of a new socio-political context for archaeology in Cuba. Cuba became the first Marxist regime in Latin America and has consequently acted as a regional centre for socialist theory and thought for almost half a century (McGuire 2002). A Cuban-Marxist framework has grown to dominate Cuban archaeological approaches during the years since the revolution in 1959. It is important to note that 1959 is not seen in Cuba as the date of the Cuban revolution, but merely as the start of an ongoing revolution constantly invigorated by the socialist principles of the Cuban people. Revolution is seen as a constant process of renewal, and socialist thinking continues to pervade all elements of the administrative infrastructure. The importance of Marxist ideology in Cuba has inevitably influenced the development of archaeology and this revolutionary period of political and theoretical change can be seen as effectively moving archaeological research away from ideas of culture history/diffusion and more towards the development of a socio-economic approach that focused on material remains as indicators of human advancement within a rigid economic model.

1.II.3.i Administration

In 1962, the Departamento de Antropología was established as part of the Academia de Ciencias de Cuba. This administrative structure was seen as highlighting the importance of archaeology as part of "the progressive development of the sciences that form an essential condition for laying the material and technical base for a socialist society, and indeed enables the creation of cultural well-being in the community (Tabio and Rey 1979:13). P.13. Four archaeologists, already well established in their fields of expertise, were drafted in to run the new archaeological section. Two renowned figures in archaeology, Antonio Nuñez Jimenez, a speleological expert, and René Herrera Fritot, from the Montané museum, were joined by two younger archaeologists, Ernesto Tabío and Estrella Rey. Shortly afterwards the department also welcomed José Guarch Delmonte, Ramón Dacal Moure, Milton Pino and Rodolfo Payarés. This department quickly developed into the national centre for archaeology and formed an important collaboration with the Miklujo Maclay Institute of Ethnography in the Soviet Union. Several Cuban archaeologists travelled to the Soviet Union for training, and Ernesto Tabio, Estrella Rey, José Guarch and Jorge Febles all gained their doctorates from the Miklujo Maclay Institute of Ethnography in the Soviet Union. This administrative system has remained despite modification in the 1980s, when a wider government policy of decentralisation led to the establishment of regional offices for archaeology as part of the Ministry of Science, Technology and Environment.

Archaeological work was conducted within an archaeological framework influenced by these Marxist traditions until the collapse of Soviet Union affected the socio-political context of archaeological research in Cuba.

1.II.3.ii Theoretical Development

Following their training in the Soviet Union and their work within the newly established Departamento de Antropología, Tabio and Rey wrote a seminal text, *Prehistoria de Cuba* (Tabio and Rey 1966). This book laid out the Cuban-Marxist framework for revolutionary archaeology in Cuba and their interpretation of the role of archaeology within the emerging revolutionary country was clear;

> "the result of this action was to put in place the concept of archaeology as one of the investigative disciplines of history (past), developing the study of primitive communities, and in particular the study of Cuban and Caribbean aborigines, with the light of dialectic materialism and history, always holding economic conditions of primary importance, the social forces of production and the study of the factors for transformation during the first stages of society" (Tabio and Rey 1979:13)

Tabio and Rey established a rigid interpretative framework based on Marxist theoretical traditions. The most important element of their Cuban-Marxist theories was the movement away from the 'culture' as defined by spatial or temporal boundaries. They focused instead on economic production as a means of classifying and defining past peoples: "our aborigines, like all primitive communities, continued along a process of development in the stages shown and explained in *The Primitive Society* (Morgan 1877) *and Origin of the Family, of Private Property and of the State* (Engels 1884)" (Tabio and Rey 1979:150). At the core of their framework was the premise that Cuban prehistory only had one mode of production or socio-economic classification, namely primitive communism. This was defined by collective 'ownership' of the primary means of production and the absence of any social divisions based on class structure, leading to the view of Tabio and Rey that all pre-Columbian societies in Cuba conformed to the general laws of primitive communism (Oliver 2004).

Using this Cuban-Marxist model, their categories of analysis could remain uniform for any site being excavated or any body of evidence being studied. These rigid and uniform categories of study, such as forces of production, instruments of production, economic activities, relations of production (Tabio and Rey 1979), created circular arguments with every piece of evidence placed within a category then used to strengthen the category and its role within the overall Cuban-Marxist framework. This Cuban-Marxist synthesis was distributed throughout the Spanish-speaking Caribbean and is cited by some as having had an influence on regional archaeology: "This soviet-style archaeological study of Cuba had a profound effect on a generation of Latin American archaeologists, who saw it as a way to link their revolutionary politics with archaeological practice" (McGuire 2002:87). However, possibly reflecting the realities of the socio-political isolation of Cuba from her regional neighbours, it has been pointed out that references by the likes of Tabio and Rey and Guarch that embody Cuban-Marxist theoretical approaches rarely appear in the bibliographies of archaeological books from elsewhere in the region and "Marxist-oriented archaeology was then, and still is at present, a largely 'alien' theory in Caribbean pre-Columbian archaeology" (Oliver 2004:13).

1.II.3.iii Theoretical Critique

The lack of international relations with countries outside of the Warsaw Pact reduced the potential for Cuban archaeologists to experience any critique of their Cuban-Marxist framework. However, in the mid 1970s the social archaeology movement, initiated by

Sanoja and Vargas in Venezuela, inspired Marcio Veloz Maggiolo in the Dominican Republic to criticise orthodox Marxist approaches for failing to accommodate social variability. This social archaeology also argued against neopositivst approaches of new archaeology and called for strengthening ties with a new interpretation of historical materialism. Veloz Maggiolo suggested that different modes of production could be used to explain social variability in communities. Tabio responded with a staunch defence of their interpretive framework in *La Comunidad Primitiva* published in 1974 (Tabio 1974). Tabio's defence was based on Veloz Maggiolo's misuse of the term 'mode of production' and argued that none of "the aboriginal groups had exceeded, socio-economically and structurally, the essence of the mode of production of the primitive community" (Tabio 1974). Veloz Maggiolo countered Tabio's defence. He discussed the terminology of production and referred to *moda de vida* / mode of life as a necessary addition to the Marxist framework as part of a wider social archaeology (Veloz Maggiolo and Pantel 1989). This small critique of the Cuban-Marxist framework had little lasting affect on Cuban archaeology and it was only in the 1980s, when Tabio himself made some adjustments (Tabio 1984) to his orthodox Marxist framework, that changes in the theoretical framework for Cuban archaeology took place.

By 1987, the sheer amount of archaeological data that had been accumulated meant that there was a need for a more refined form of site classification. The development of comparative studies of mortuary practices (Guarch Delmonte, *et al.* 1987; G. La Rosa Corzo 2003) and artistic expression (Dacal Moure and Calle 1996; Godo 2005; Linville 2005) led to pressure to include elements of cultural expression and cultural variation within the original Cuban-Marxist framework. The potential for hierarchical societies was discussed but the role of the *cacique* or chief was originally interpreted more as an organiser of collective action rather than as a member of a controlling elite. Incipient social stratification was explained by citing variable rates of economic adaptation by different communities whilst always staying within the universal mode of production of primitive communism. These variations were often interpreted as local environmental variation and therefore cultural idiosyncrasies that did not require a modification of the overall classification system.

Guarch continued a staunch defence of orthodox Marxism in archaeology despite his work on Taíno hierarchical societies in eastern Cuba. In his own thesis he outlined his personal theoretical beliefs, "as a conceptual philosophical base, the dialectic and historical materialism as applied by Marxism-Leninism in an orthodox form and without the pretence of introducing other elements" (cited: Oliver 2004:33). Therefore Marxist influence on Cuban archaeology since 1959 has been profound. Since the revolution, research has often focused on the detailed excavation of a limited number of archaeological sites using the material remains to categorise the sites into pre-determined categories of perceived economic development (Valcárcel Rojas 2002a:24).

1.II.3.iv Methodological Framework

Once the Cuban-Marxist framework was established in Cuban archaeology, shortly after the revolution, the practice of archaeology continued with a methodological focus on gathering new archaeological data and placing it within the pre-determined interpretative categories. Archaeological work often focused on detailed material specific studies and specialists in the study of lithics, ceramics and faunal remains emerged (Gabino La Rosa Corzo 2003:39). Excavation methods were often based upon regimented 30cm or 10cm layers with artefacts divided into material based categories before being removed for specialist off-site examination. Artefact analysis was based on the premise that categorisation of means of production would allow a site to be placed within the economic framework for Cuban archaeology established by Tabio and Rey. This economic focus was quite different to the cultural studies being conducted elsewhere in the Caribbean region (Davis 1996:170). A consequence was the specialisation of archaeologists in material specific categories rather than in cultural, chronological or geographical areas. Febles reflected this artefact approach, developing a detailed lithic typology that used lithics as indicators of the progressive development of production. Ramon Dacal Moure became a specialist in shell artefacts, writing *Artefactos de Concha en Las Communidades Aborigenes Cubanas* in 1978. This detailed typology of shell artefacts examined associations between shell artefacts and stages of economic production (Dacal Moure 1978). Cuban archaeologists capitalised on access to radiocarbon dating facilities in the Soviet Union in order to date samples, predominantly charcoal. The bureaucratically lengthy and financially expensive process of sending samples to laboratories in the Soviet Union meant that less than 100 radiocarbon dates were produced between 1959 and 1989. The dated samples helped create the chronology for the stages of economic development discussed in Chapter 2.

Archaeological work was conducted by Nuñez Jiménez, Enrique Calera, Calvera Roses, Febles, Kozlowski, Pino, Guarch Delmonte, Herrera Fritot, Dacal Moure, Jouravleva, Rankin Santander, Rivero de la Calle and others between 1959 and 1989. Much of this research was only written up in the form of fieldwork reports and is not widely distributed outside Cuba. The majority of publications that are widely available from this period reflect the focus on descriptive analysis of sites and their artefact assemblages with the research aim of building a record of sites in Cuba and identifying their position within the socio-economic framework as determined by Tabio and Rey (Febles Duenas and Martínez 1995; Martinez Arango 1982; Tabio and Rey 1966).

1.II.4 Periodo Especial 1990-2007

In 1990 the international trade frameworks upon which the Cuban economy depended collapsed, and this quickly led to a catastrophic national economic meltdown. Archaeology, like all areas of Cuban life, has suffered. The scarcity of basic necessities such as paper, ink, plastic and fuel make archaeological work very difficult. "During the few years since the disintegration of the USSR, the Cuban Academy of Sciences, and its archaeologists in particular, have been increasingly open to, and indeed solicitous of, interaction with archaeologists in North America and western Europe." (Davis 1996:183).

Recently the generation of Soviet trained archaeologists has, sadly, not been able to continue the implementation of long standing archaeological research (Valcárcel Rojas 2002b). The increase in international collaboration has led to an influx of new literature and new ideas into Cuban archaeology. One such collaboration led to the establishment of *El Caribe Arqueologico* in 1996. This is the first widely distributed international archaeological journal to be published in Cuba for many years and has already contained contributions from archaeologists working throughout the region. The *periodo especial* is seen by La Rosa as "without doubt the most fruitful from the scientific point of view, and accompanied with many new investigations. These years also saw the collapse of the Socialist camp" (Gabino La Rosa Corzo 2003:39)

1.II.5 Theoretical Frameworks in Cuban Archaeology

Pre- revolutionary Cuban Archaeology closely reflects wider Caribbean approaches used by North American archaeologists working in Cuba during the 1940s and 1950s (Rouse 1942). Interestingly Childe, an important influence on the culture history development of Caribbean archaeology, was also an important reference point for the development of a Cuban-Marxist approach. Much of Childe's Soviet-focused archaeological research was carefully examined during the 1960s by Cuban archaeologists (Harris 1994). Ironically Childe, whilst being attacked in England for his involvement with Soviet archaeology, was also being criticised in the Soviet Union for failing to accept the Soviet state ideology of Marxism without refinement (McGuire 2002).

The importance of Marxist ideology in Cuba has inevitably influenced the development of archaeology in the country. This is exemplified by Guarch Delmonte, a leading Cuban Archaeologist of his generation, who described indigenous communities in his doctoral thesis in 1987 as having "relations of production founded upon common property of the means of production; the exploitation of Man by Man does not exist and there are neither social classes nor state. . . . . we have, as a conceptual philosophical base, the dialectical and historical materialism as applied by Marxism-Leninism as an orthodox form and without the pretence of introducing other elements" (Oliver 2004). More recently, Cuban archaeology has begun to develop closer links with the international archaeological community both regionally and internationally. However, considering that Cuba is such a large island in the Caribbean, archaeological data from this country is greatly underrepresented at a regional level, and much more work is required to fill this void of knowledge about the past.

Out of this review of Cuban archaeology some potential limitations in the development of archaeological research have been highlighted. The majority of studies into island interaction between Cuba and the wider Caribbean were conducted before 1959 and often in association with North American archaeologists who had access to the collections of neighbouring islands. Following the revolution, archaeology emerged as a research tradition focused on the study of past peoples living on the island of mainland Cuba, consequently restricting the potential for studies of prehistoric island interaction. Some archaeologists have gone so far as to say that "Cuban archaeologists have also displayed virtually no interest in pre-Columbian exchange of raw materials or artefacts, either locally or regionally" (Davis 1996:173) that could help indicate interactions. The Marxist economic focus has led to detailed site-specific investigations. Comparative studies of inter-site relationships and spatial analyses have been limited but the need for spatial studies has been acknowledged in recent years (Godo 2003). The development of an archaeological census in the 1980s and 1990s (Febles Duenas, *et al.* 1987), in tandem with the advent of new computer software for spatial analysis, has led to the potential for inter-site comparisons between different geographical locations in Cuba as reflected in recent studies (Jardines Macias and Guarch Rodríguez 1996; Ulloa Hung and Valcárcel Rojas 2002; Valcárcel Rojas 2002a; Valcárcel Rojas, *et al.* 1996). During this time of change, topics of research that have previously been under represented in Cuban archaeology, such as historical ecology and landscape archaeology, can now be investigated.

Chapter 2

RESEARCH FOCUS

2.I Archaeology in Cuba

Introduction

Geographically, the nation of Cuba is an archipelago of over 1000 islands and constitutes more than 47% of the land area of the Caribbean. Archaeologically, Cuba has some of the earliest evidence of human occupation in the Caribbean. Sites such as Levisa and Canimar Abajo have been identified as providing some of the earliest evidence, primarily from lithic artefacts, for human settlement (Martínez Fuentes, *et al.* 2003:64; Wilson, *et al.* 1998). A wealth of archaeological information has been generated by over 100 years of research in Cuba (Dacal Moure 2006; Marichal García 1995; Nuñez Jiménez 1992:16); however, much of this information is not always easily accessible within Cuba or well disseminated internationally. This chapter reviews my attempts to collate existing archaeological data into a comprehensive database of Cuban archaeology. The term 'national' is used to define the scale of study that includes all of the available information available from the country of Cuba. Methodological issues of dealing with this macro-scale of archaeological data are also assessed in light of the sample of archaeological site information available. The result is a national archaeology database that provides:

1. The names and locations of all known prehistoric archaeological sites in Cuba

2. Details of the artefact assemblages recovered from each site

3. Current site classifications based on existing archaeological frameworks

4. Radiocarbon determinations from archaeological sites that could be used to construct site chronologies

The database is then used to examine existing archaeological evidence for prehistoric island interaction in Cuba. In creating the database, archaeological sites were located and projected to facilitate spatial analysis. Existing radiocarbon determinations were collated and calibrated to enable discussion of site chronologies and the potential for studying interaction.

2.I.1 Creating a Cuban Archaeology Database

There have been a number of previous attempts by archaeologists to collate archaeological data from the country into a centralised computer based system. In the Cuban journal *Catauro* the Department of Archaeology in the Centre of Anthropology in Havana (Departamento de Arqueología de Centro de Antropología 2003:199), part of the Cuban Ministry of Science, Technology and Environment, discuss a current project to create a national sites and monuments atlas. At the time of writing, the results of this project have not been published or disseminated. The most recent published version of a national database was in 1995 (Febles Dueñas and Martínez 1995). A CD Rom was produced of archaeological census data from 975 archaeological sites. It built upon earlier attempts by Febles and colleagues (Febles Duenas, *et al.* 1987) and Rives and Colleagues (Rives Pantoja, *et al.* 1991) to computerise archaeological data in Cuba.

Although the 1995 census is now over ten years old, it still provides the most complete summary of archaeological site data in Cuba. The census data includes categories of site information recorded on predefined document templates. This census can be searched for information about individual sites, but there is no means of analysing the data through relational queries. The majority of the sites have map co-ordinates but the maps to which they refer are not easily available and therefore the actual locations of many of the sites are not widely known. Establishing the locations of archaeological sites within a national framework is necessary before it is possible to identify sites on different islands in the Cuban archipelago and study site distribution patterns.

In addition to the 1995 census, there is also a substantial body of data in the archaeological literature (Dacal Moure 2006). This includes information on new archaeological sites, excavated since 1995, as well as supplementary information on existing sites. By extracting the data from the 1995 census and adding to it data from the available literature, a relational database of 1061 archaeological sites in Cuba has been created and the results are described herein.

2.I.1.i Database Design and Data Organisation

The relational database was designed with 41 related tables for data entry of available archaeological, geographic and environmental evidence. The categories of information for each site are, to a large extent, reliant on the nature of the existing data. This is a limitation of the database in that the level of detail of available information for each site varies and the basis on which previous conclusions have been made by archaeologists is not always clear or well referenced. Therefore a number of the categories of information used are based on the pre-existing categories recorded during the 1995 census in order to provide a standardised framework that enables inter-site comparisons. The primary site table (Figure 2.01) includes an individual site reference numbers, site name, projected site co-ordinates, elevation above sea level, province, municipality, topography, soil, paleogeology, general artefact categories of material recovered, detailed individual artefact classification, faunal evidence of site subsistence practices and the classifications of sites, site economy, site phase, and site chronology. Each of these categories of data includes a separate related table that is linked through the relationships established in the database (Figure 2.02).

2.I.1.ii Site Location

A map of Cuba was generated using the global shoreline data available from the National Geophysical Data Centre of the National Oceanic and Atmospheric Administration. These data were projected in the co-ordinate system of Universal Transverse Mercator (UTM) World Geodetic System (WGS) 84 17N. This projection system was selected based on its worldwide popularity and compatibility with existing Global Positioning Systems (GPS). It provides a template for mapping locations of archaeological sites in Cuba. There is a minor, but consistent, distortion in the projection of the eastern (18N) and western (16N) parts of Cuba, but this distortion does not affect the relative patterns of site distribution. Two methods were used to identify and project the archaeological site locations. These two methods were geographic co-ordinate reprojection and site point digitisation.

For sites with existing co-ordinates, either map co-ordinates or latitude and longitude co-ordinates, it was possible to reproject them into UTM WGS 84 17N. Experimental reprojections were tested using sites with both recorded map co-ordinates and known locations in UTM WGS 84 17N that were recorded during recent archaeological fieldwork (Cooper, *et al.* 2006; Valcárcel Rojas, *et al.* 2006). My study revealed that the different maps were projected using either North American Datum (NAD) 1927 CUBA Norte or NAD 1927 Cuba Sur. By cross referencing the site location with the known province and municipality of each site in the database, it was possible to identify which projection system was used for each site and to re-project all of the sites in UTM WGS 84 17N using an ArcToolbox co-ordinate re-projection wizard.

The second method used to identify site location was to produce high resolution scanned images of existing maps with archaeological site locations. These scanned images were then georeferenced to the existing map of Cuba in ArcGIS. The archaeological sites could then be manually digitised to provide point data with x-y coordinates in UTM WGS 84 17N. The accuracy of these site locations is dependent on the quality of the original site maps and confidence levels in the accuracy of site locations were recorded in the database. The methods described allowed the locations of 998 archaeological sites in Cuba to be identified and reprojected in order to study site distribution patterns. An example of the reprojected x-y co-ordinates for the sites from the site co-ordinates table is illustrated in Figure 2.03 and Figure 2.04 shows the site distribution of these 998 archaeological sites in Cuba.

2.I.1.iii Spatial Analysis

Spatial analysis using GIS software provides a useful means of identifying patterns in site distribution at a national scale. By analysing the distance between site point data and the Cuba shoreline line data it was possible to identify the distances from the shoreline. The 1995 census included 108 sites that were within 1km of the coast. Using the ArcGIS maps it was possible to identify 224 sites within 1km of the current Cuban coastline. The definition of a coastal site is based on location in proximity to the coastline and the nature of the archaeological assemblage (Davis and Oldfield 2003; Keegan 1991; Trincado Fontán and Ulloa Hung 1996). Potentially, 1 km is too large a distance from the shoreline to categorise the site as coastal and therefore futher analyses were done to identify sites within different distances of the coast. Within a distance of 200m, 100m and 50m there were 96, 48 and 23, sites respectively. An additional factor that also needs to be taken into consideration before inferring coastal interaction from proximity to the shoreline is sea level change and coastal accretion. There are data on sea level change available for Cuba but site chronologies for individual sites need to be established before site locations can be correlated with paleocoastlines.

However, identifying distances from the shoreline alone is not satisfactory for identifying coastal sites. The term 'coastal site' implies active engagement with the coastal environment most easily identifiable by marine resource exploitation. Therefore analysis of sites with evidence of marine resource exploitation is also a useful means of helping to identify coastal sites. Cross referencing the 96 sites with actual archaeological evidence of marine resource activity reveals 82 sites within 200m of the shoreline with evidence of marine resource exploitation. Thus, both distance from the shore and the evidence for marine exploitation provide an indication of the minimum number of known archaeological sites in Cuba that can potentially be defined as coastal sites.

2.I.1.iv Sites on Offshore Islands

Having plotted the location of known archaeological sites in Cuba it was then possible to identify and investigate which archaeological sites are located on offshore islands. My study showed that only 31 sites are located on offshore islands in the Cuban archipelago whilst there are 967 sites located on the Cuban mainland. Eight sites are located on Isla de la Juventud (known as Isla de Pinos pre-1959). This large island of 3056 sq. km is located 11 km off the south west coast of the Cuban mainland. Extensive work has been carried out at the sites on this island by rock art specialists and archaeologists (Kozlowski 1974; Linville 2005). Twenty-three sites on offshore islands are found in the Sabana-Camaguey archipelago in north central Cuba. These sites are all clustered in a central portion off the archipelago of the coasts of Villa Clara and Ciego de Avila provinces in a group of islands known as the Jardines del Rey archipelago. These islands were surveyed in the mid-1940s by the Grupo Guama (Morales Patino 1946, 1947, 1948), a group of archaeological enthusiasts whose background and work is discussed further in Chapter 4. These same islands were also visited and briefly investigated by Antonio Nuñez Jimenez in 1984 (Morales Patino 1946, 1947, 1948; Nuñez Jiménez, *et al.* 1985) and by Jorge Calvera Roses and colleagues in the 1990s (Calvera Rosés and García Lebroc 1994). The exact nature of the archaeological evidence recovered from these sites is not clear because the published articles by Morales Patino and Nunez Jimenez are only brief fieldwork reports.

2.I.1.v Site Classification

Frameworks for the classification of archaeological sites in Cuba reflect the influence of theoretical and methodological approaches that have emerged in Cuban archaeology over the years. It is necessary to use existing classificatory frameworks for sites in order to investigate existing archaeological data at a national scale. There has been much debate about the suitability of different systems of site classification within Cuban archaeology (Godo 1997; La Rosa Corzo 2003; Torres Etayo 2004). Discussion of these frameworks and the context of their development within the history of archaeological research in Cuba was discussed in Chapter 1. There are two systems of site classification that have been used extensively in Cuba since the 1960s; These provide a standard framework for a large number of sites. The first classification framework promoted by Tabio and Rey (Tabio 1974, 1984; Tabio and Rey 1979; Tabio 1995; Tabio and Guarch 1966) is, in its simplest form, based on the presence or absence of archaeological evidence for ceramic production and agriculture . This classification has three categories: 1) *preagroalfarero* or pre-agroceramic, 2) *protoagricola* or proto-agricultural, and 3) *agroalfarero* or agroceramic. The Spanish terms are part of a theoretical framework that is particular to Cuban archaeology and to avoid confusion the Spanish terms are used in this thesis (Tabio 1984). The second classification framework promoted by Guarch Delmonte adopts a more focused, economic approach based on artefact assemblages from each site (Guarch Delmonte 1990; Guarch Delmonte, *et al.* 1995). Artefacts were classified using an economic framework as evidence of subsistence appropriation, or production. Guarch then subdivided these two classifications of site economy into phases, namely Phase 1: hunting, Phase 2: fishing and collecting, Phase 3: incipient agriculture, all associated with appropriative economies, and Phase 4: agriculture for productive economies. These economic phases were then further categorised into cultural variants based on site and regional variations in material culture with Phase 1 comprising the Seboruco culture, Phase 2 comprising the Guanahacabibes and Guacanayabo cultures, Phase 3 comprising Canimar and Arroyo del Palo cultural variations and Phase 4 comprising the Damajayabo, Bayamo, Cunagua, Baní and Maisí cultural variations. Currently, these two existing classification systems are the only frameworks that provide a nationwide perspective on the nature and dating of Cuban sites.

2.I.1.vi Implications for Study of Site Distribution Patterns

The spatial projection of sites based on the two site classification systems are illustrated in Figure 2.05 and Figure 2.06. Figure 2.05 includes site classifications for 983 sites and indicates the absence of *agroalfarero* sites in the west of Cuba. It also reveals a widespread distribution of *preagroalfarero* sites throughout the country with a concentration of sites in the western province of Pinar del Rio. Discussion of this preceramic concentration in the west of Cuba and the association with ethnohistorical references to the Guanahatabey or Guanahacabibes has sparked debate over recent years (Keegan 1994:271; Keegan 1989). Another popular hypothesis in Cuban archaeology is that intensive agricultural societies with elaborate artistic traditions spread from the east of Cuba westward (Guarch Delmonte 1978; Valcárcel Rojas 2002), influenced by their interaction with the societies on Hispaniola. The distribution of *agroalfarero* sites appears to support this hypothesis with a predominance of *agroalfarero* sites in the east and central areas of Cuba. It is possible that the ethnohistorical evidence known to 19th century antiquarians and 20th century archaeologists has influenced the hypothesis of developed agricultural societies in the east and *preagroalfarero* societies in the west. It is important to consider the potential for the influence of preconceived ideas to manifest themselves archaeologically by attracting targeted archaeological surveys with inherent research agendas to particular geographical locations. A possible example of archaeological survey creating a biased sample of sites is found in the western Sandino municipality of Pinar del Rio in the westernmost part of Cuba. Is the fact that 90 of the 103 archaeological sites in this municipality are cave or rock shelter sites a reflection of targeted use of caves by past peoples in this region, or the result of targeted archaeological survey that focused on investigating caves? Furthermore, does the fact that the sites are all in caves then influence the classification of sites as *preagroalfarero*? In order to examine these questions it is advisable to look at the spatial distribution of sites and archaeological material rather than rely on existing site classifications.

2.I.1.vii Site Assemblages

Sites in Cuba rarely have published artefact catalogues available for study (Febles 1982; Godo Torres 1994). For sites where evidence of individual artefacts existed, these were linked to tables of material specific artefact analyses in access (Figure 2.07).

Therefore only broad categories of artefacts are available from most sites in Cuba. In order to provide the basis for inter-site comparison I created a standardised list of artefact categories for each site that was based on those used in the Febles census (Febles Duenas and Martínez 1995). The categories of artefact descriptions include: ceramics (with sub-categories of vessels, *burens*-griddles, incised decoration, appliqué decoration, painted decoration, decorated handles, European influenced indigenous ceramics and European Ceramics); shell (with sub-categories of faunal remains, artefacts modified for ornamentation, artefacts modified by scraping, artefacts modified by cutting, artefacts modified through intensive and high-energy percussion and artefacts modified through sustained and medium-energy percussion); burials (with sub-categories of primary burials, secondary burials and burials with grave goods); bone (with sub-categories of faunal remains, bone modified by cutting, bone modified for ornamentation and worked bone); wood (worked modified for ornamentation, worked wood and unworked wood); paints and dye materials; metals (colonial and non-local metal, European metal and non-ferrous metal); stone (stone modified for ornamentation, stone modified by hammering, stone modified by polishing, lithics modified by knapping and unmodified); and textiles.

The spatial distribution of the sites with each of these categories of artefact was then projected. Patterns in the distribution of European-influenced material culture at indigenous sites provide an interesting topic of research, but this is not discussed in this thesis. Human remains have been found at 176 archaeological sites in Cuba (Figure 2.08).

There is a widespread distribution of burials with associated grave goods that includes sites classified as *preagroalfarero* in the west and *agroalfarero* in the east. Human remains have been found on 5 offshore islands. Shell and stone artefacts are the most common artefact categories found at over 90% of archaeological sites in Cuba. Both stone and shell artefacts are found at Cave 1 and Cave 3. In addition, there are only a limited number of sites where wood and textiles have been recovered and spatial patterns in distribution appear to reflect local environmental conditions rather than any archaeologically significant pattern. The spatial distribution of sites with indigenous ceramics is illustrated in Figure 2.09.

This map appears to reflect a broad pattern of ceramic distribution similar to sites classified as *agroalfarero* but it also shows a subtler pattern in ceramic style distribution. There appears to be a concentration of elaborate decoration styles in central and eastern Cuba. There is evidence of *buren* fragments found in the western province of Pinar del Rio at the rock shelter site of Solapa de Nora and four cave sites including Cueva del Chino, Cueva de Evaristo, Cueva de la Bibijagua and Cueva de la Pintura. There are also vessel fragments found in seven sites in the most western municipality of Sandino in Pinar del Rio including Cueva de Paulino, Cueva de Bolondron, Cueva de la Viuda, Cueva del Resguardo, Cueva del Negro, Cueva de la Pintura and Cueva del Agua. These sites are all classified as *preagroalfarero* or appropriative fisher-collectors associated with the Guanahatabey. This highlights how artefact distribution patterns can complement the existing site classifications and provide a more detailed framework for interpreting prehistoric settlement in Cuba.

2.I.1.viii Archaeological Evidence on offshore islands

As described above, archaeological research has been conducted on Isla de la Juventud and 11 islands in the Jardines del Rey archipelago. The whereabouts of the artefact assemblages from the excavations on these islands is not known. As a result, it is only possible to rely on the broad categories of artefacts recorded for each site. The information from many sites appears to indicate the focus of the archaeologists working at the sites rather than necessarily providing a complete picture of the nature of past human activity.

The archaeological evidence from the sites on Isla de la Juventud perhaps reflects the nature of the archaeological fieldwork conducted on the island. Pictographs are recorded for all eight cave and rockshelter sites on the island. In fact rock art is the only recorded evidence for prehistoric activity at the four sites of Cueva de los Alemanes, Cueva Finlay, Solapa 2/3 and Solapa de Puerto Frances in the west of the island. The dominance of cave and rock shelter sites on the island suggests the influence of targeted archaeological survey. The influence of speleology on Cuban archaeology may well have affected the high proportion of archaeological sites found in caves (Iturralde-Vinent 1983; Linville 2005:72).

Human remains were found at Cueva 1 and Cueva 4 on Punta del Este. There is no evidence in the database that ceramics were found at archaeological sites on Isla de la Juventud. This dearth of ceramics in association with the evidence for pictographs at the cave sites might explain the classification of all archaeological sites on the island as *preagroalfarero*. Shell artefacts were found in Cuevas 1, 2, 3 and 4 at Punta del Este. These assemblages included shell artefacts modified by scraping, cutting and percussion. No ornamental shell artefacts or faunal remains are recorded as being recovered from these sites. Stone artefacts, predominantly worked lithics, are reported from Cuevas 1, 2, 3 and 4 at Punta del Este. Therefore the existing archaeological evidence from Isla de la Juventud provides evidence of prehistoric human activity on the island but there is limited existing data on which to infer island interaction.

The offshore islands in the Jardines del Rey archipelago off the north central coast of the Cuban mainland provide a larger sample of sites with a wider distribution of recorded artefact categories.

Painted materials, in the form of petroglyphs, have been recorded at seven sites on five islands (Kozlowski 1974; Linville 2005); Cayo Aguada I (Cayo Aguada), Cueva del Chino and Cueva Plaza de Toros (Cayo Lucas), Cueva de los Ninos and Cueva de los Cuchillos (Cayo Salinas), Cueva de Cayo Fabrica (Cayo Fabrica) and Cueva el Muneco (Cayo Maja). Human remains were also found in each of these caves. Burials in a primary context were found at the sites of Cayo Aguada I and Cueva de Rudbeckia (Cayo Aguada I), Cueva del Chino (Cayo Lucas), Cueva de los Niños (Cayo Salinas) and Cueva de Cayo Fabrica (Cayo Fabrica). In addition, burials with grave goods were also found at Cueva de los Ninos and secondary burials were found at Cueva de los Cuchillos on the same island. No *buren* or ceramics with any evidence of decoration are recorded as having been found on the islands. Simple ceramic vessel sherds were recovered from six island sites including, Cueva 8 Las Conchas (Cayo Lucas), Cueva de los Cuchillos (Cayo Salinas), Playa Ginebra (Cayo Aguada I), El Megano (Cayo Maja), Cayo Santa Maria III (Cayo Santa Maria) and Cayo Guillermo

(Cayo Guillermo). Cueva de los Cuchillos was the only site where burials and ceramics were recovered together and this is the only site on the islands with secondary burials. Cueva de los Cuchillos is also the only island site where textiles were recovered. This may indicate why this site is one of only two sites in the Jardines del Rey classified as *agroalfarero*. The other site that is classified as *agroalfarero* is Cueva de Rudbeckia (Cayo Aguâda), but the reasoning behind this classification is not clear.

No animal bone is recorded from any of the sites. Shell was found at all the sites except Cueva del Isognomon and Cueva Plaza de Toros on Cayo Lucas and Cayo Guillermo on the island of the same name. Shell tools for cutting, percussion and scraping dominated the shell assemblages at all of the other sites. No ornamental shell artefacts were found on the offshore islands. This indicates that shell was used extensively as a raw material for tool production and use on the islands. Unfortunately, there is no evidence on the species of shell being exploited, which would help to identify interaction with different island and marine environments.

Stone artefacts were found at all of the sites except Cueva del Isognomon (Cayo Lucas), Cayo Los Baujas II (Cayo Baujas) and El Megano and Cayo Maja 1 (Cayo Maja). Stone artefacts for hammering are only found at the three sites of Playa Ginebra (Cayo Aguada I), Cueva del Chino (Cayo Lucas) and Cueva de los Ninos (Cayo Salinas). Polished stone artefacts are only recorded from Cueva de los Ninos (Cayo Salinas). These three islands are all within 8km of the current coastline of the Cuban mainland and are among the islands with evidence of past human activity that are closest to the coast. Worked lithics are also found at these sites as well as at sites further offshore including Solapa de los Chivos and Cueva el Muneco (Cayo Maja), Cayo Santa Maria III and Cayo Santa Maria IV and Cayo Guillermo. No ornamental or figurative stone artefacts are recorded from sites on these islands. The different stone used to make these artefacts is not recorded. Knowledge of the geology of the region could indicate potential sources; This, in addition to identifying the material used to manufacture stone artefacts is one way of establishing movement of raw materials, which would contribute to understanding island interactions in the local area (Knippenberg and Gijn 1998). The current data available from past archaeological work does not allow this analysis at present.

A review of existing artefact assemblage data from archaeological sites on offshore islands around Cuba reflects prehistoric activity and island interaction. However, the resolution of this data and the reliance on broad categories of artefact type do not provide a sufficient basis on which to base a study of island interaction. Revisiting the assemblages from these sites and studying the artefacts in more detail would be one option for future investigation. Initial efforts to identify the whereabouts of the collections included a review of existing literature and communication with Cuban archaeological colleagues, who indicated that this approach was not viable. The extended time periods of over 50 years since the majority of archaeological fieldwork was conducted on these islands has contributed to difficulty in finding the artefact assemblages in museum stores and identifying their archaeological context or which island they are from. Consequently, existing information provides evidence of prehistoric island interaction but if further details of the nature and extent of this interaction are to be investigated, new archaeological data need to be generated.

2.I.1.ix Evidence of Marine Interaction

In addition to the sites on offshore islands discussed above, there is also evidence of marine interaction at a number of sites on the Cuban mainland. The distribution of sites where marine shell has been found is illustrated in Figure 2.10. This shows that over 800 sites have marine shell represented in their artefact assemblage. Not only does this indicate a high degree of marine interaction at sites in Cuba; it also provides evidence of long distance interaction between the interior and marine environments. Many of these sites are in the interior of the Cuban mainland over 50 km from the coast. The large number of sites with marine-sourced material indicates intensive interaction with marine environments among indigenous populations in prehistoric Cuba

More recently, a number of sites on the Cuban mainland have been the subject of more focused faunal studies that reveal detailed evidence of marine interaction. Analyses identify the percentages of marine sourced fauna include 31% at El Birama in Sancti Spritius (Angelbello Izquierdo, *et al.* 2002), 1.2% from Solapa del Silex (Córdova Medina, *et al.* 1997:80; Crespo Díaz and Jiménez Vázquez 2004) and 2.4% from San Fernando del Pozo (Trapero Pastor 1999). Species are recorded from Bacunayagua I and II (Martínez Gabino 1989:20); Cacoyuguín I (Pérez Iglesias 1999); Cueva del Muerto (Pino Rodríguez and Córdova Medina 2000); Los Buchillones (Rosario Pérez Iglesias, *et al.* 2003); Cabagan (Rankin Santander 1994) and Caimanes III (Navarrete Pujol 1990). Bacunayagua I and II also provide evidence of fishing technology in the form of harpoon points, net weights and fishhooks (Martínez Gabino 1989:21). The importance of marine mammals, reptiles and fish for indigenous resource and subsistence, at sites such as Victoria I and Caimanes III have also been discussed (Godo 1985; Godo Torres 1994; Navarrete Pujol 1990; Reyes Cardero 1997, 2004). Coastal sites, unsurprisingly, appear to have larger assemblages of marine fauna; however the presence of marine fauna at sites in the Cuban interior highlights the importance of marine interaction. Whether this island interaction is direct or indirect is a difficult question to address with the limited archaeological data available. Therefore an aim of my research is to understand the nature of this interaction through the study of a case study area in northern Cuba.

2.I.1.x Site Chronology

Spatial studies of material culture need to be complemented by a secure temporal context for past human activity. This temporal context can be provided through a better understanding of site chronology. In Cuba, artefact typologies only provide broad, long term relative chronological ranges. Consequently sites and archaeological contexts are normally allocated broad dates based on the presence or absence of diagnostic artefacts such as worked lithics, ground stone tools, shell artefacts and ceramics. Guarch allocated chronological ranges to site phases based on the presence or absence of these artefacts and the existing radiocarbon laboratory dates for certain type sites (Guarch Delmonte, *et al.* 1995). These chronological ranges include hunters 6000-2500 BC, fisher-collectors 2500 BC-AD 1500, incipient agriculturalists 400 BC-AD 1500 and agriculturalists AD 600-1500. Such broad periods reflect a lack of well defined and securely dated artefact typologies in Cuban archaeology.

2.I.2 Radiocarbon Chronologies

Collating existing radiocarbon determinations from archaeological sites is a useful basis on which to begin framing a temporal context for prehistoric archaeology in Cuba. Radiocarbon determinations can provide a useful method for establishing relative and absolute site chronologies. However, comparisons of radiocarbon determinations are fraught with methodological issues that can limit the usefulness of direct association between radiocarbon dates and archaeological context, as well as comparison of radiocarbon dates. Radiocarbon determinations from the site of Vega de Palmar in Cuba are listed in the first volume of the journal *Radiocarbon* in 1959 (Deevey, *et al.* 1959), showing that radiocarbon dating has been used for over 45 years in Cuban archaeology. During this period, few radiocarbon determinations appear to have been calibrated (Ulloa Hung and Valcárcel Rojas 2002; Wilson, *et al.* 1998) and often laboratory dates are misrepresented as being calendrically significant, having been cited from secondary literary sources. This repetition of laboratory dates is not always explicit and the chronological significance of a given date is not always clear. In addition many of the radiocarbon dates in the literature are listed without the necessary information required to interpret the archaeological significance of the date, such as archaeological provenance; what material was dated; where and when it was dated; what, if any, calibration methods were used; and what error margins are involved. Without this important information, many of these dates cannot be used to provide a reliable indication of site chronology. Attempts have been made recently to establish standards for the use of radiocarbon dating in Caribbean archaeology (Fitzpatrick 2006). However, before this can be done, all of the available information on radiocarbon determinations in Cuba needs to be collated. Therefore, an important part of my research was to review extant literature for details of radiocarbon determinations from Cuba. Alternative sources of data were cross-referenced to create a list of 140 radiocarbon determinations from archaeological sites in Cuba (Table 2.01) (Deevey, *et al.* 1959; Godo Torres 1994; Jardines Macias and Calvera Roses 1999; Jouravleva and González 2000; Kozlowski 1974; Martínez Fuentes, *et al.* 2003; Mielke and Long 1969; Navarrete Pujol 1990; Pazdur, *et al.* 1982; Pendergast, *et al.* 1999, 2002; Pino 1995; Rankin Santander 1994; Steadman, *et al.* 2005; Stuckenrath and Mielke 1973; Trincado Fontán and Ulloa Hung 1996; Ulloa Hung and Valcárcel Rojas 2002; Vinogradov, *et al.* 1968; Wilson, *et al.* 1998)

All radiocarbon dates represent a statistical calculation with inherent margins of error. Archaeologists are charged with assessing how the potential errors for each radiocarbon date affects its application in archaeological interpretation. Therefore a summary of radiocarbon determinations from archaeological sites in Cuba provides useful information with which to evaluate potential margins of error for each radiocarbon determination and assess its usefulness for studying interaction between contemporaneous sites in prehistoric Cuba.

Table 2.01 List of existing radiocarbon laboratory dates of samples taken from prehistoric archaeological sites in Cuba that includes relevant information necessary for their appraisal

Site Name	Lab. No.	Lab. Date BP	+/-	Stratigrapic context
Abra Del Cacoyuguin I	BETA-133948	1640	130	Excavation 1, enlargement 1, level 30-40 cm
Abra Del Cacoyuguin I	BETA-133947	1210	60	Excavation 1, enlargement 1, level 10-20 cm
Abra Rio Cacoyuguin II	BETA-133950	2780	40	Excavation 2, grid square 1, level 40-50 cm
Abra Rio Cacoyuguin II	BETA-133951	3720	70	Excavation 2, grid square 1, level 50-60 cm
Abra Rio Cacoyuguin IV	BETA-140079	4180	80	Cut 1, level 30-40 cm
Aguas Gordas	GD-1054	485	50	Mound 2, pit 1, level 75-100 cm
Aguas Gordas	GD-621	705	65	Midden 2, pit 1, level 1.25-1.5 m. Assoc. with ceramics, shell and stone artefacts
Aguas Gordas	GD-620	165	60	Midden 2, pit 1, level 50-75 cm. Assoc. with ceramics and some shell and stone artefacts
Aguas Gordas	GD-1055	575	60	Midden 2, pit 1, level 1-1.25 m

Aguas Gordas	MO-399	1000	105	Midden 1, sample depth 1.75 m
Arroyo Del Palo (Mayarí)	Y-1556	970	80	Cave 1, sample depth 25 cm
Arroyo Del Palo (Mayarí)	Y-1555	760	60	Trench 2b, level 75-100 cm, sample depth 75 Cm
Belleza	UNKNOWN-4	1120	60	Trench 1, level 40 cm
Birama	UNKNOWN-5	820	40	No information
Cabagan	UNKNOWN-6	1080	20	No information
Caimanes III	UM-1953	1745	175	Test pit 4, sample depth 38 cm
Canimar 1	GD-203	1010	110	Sample depth 70-80 cm. Unsecure stratigraphy
Canimar Abajo	UBAR-170	4270	70	Sample depth between 30 and 60 cm
Canimar Abajo	UBAR-171	4700	70	Sample depth 1.65 m
Catunda	BETA-93862	1890	60	Trench 2, level 40 cm
Catunda	BETA-93866	1850	50	Trench 1, level 30 cm
Catunda	BETA-140078	1280	60	Trench 5, level 20-30 cm
Chorro De Maita	BETA-148955	360	80	Skeleton 39, depth 79 cm
Chorro De Maita	BETA-148957	730	60	Unit 5, grid square 2, natural layer 1, spit depth 30-50 cm
Chorro De Maita	BETA-148956	870	70	Skeleton 25, depth 88 cm
Corinthia III	BETA-133953	2220	70	Excavation 3, encaque 3, level 10-20 cm
Corinthia III	BETA-133952	2300	60	Excavation 4, encaque 2, layer 1
Corinthia III	BETA-140080	1700	70	Unit III, level 0-10 cm
Cueva 4 Punta Del Este	LC-H 1106	1100	130	Test Pit, 1x.5 M, Sample Depth 38 Cm
Cueva De La Lechuza	LE-4281	2610	120	Test pit 1, block 1, level 2.15 m
Cueva De La Lechuza	LE-4290	2610	120	Test pit 1, block 1, level 2.05 m
Cueva De La Lechuza	LE-4283	5270	120	Test pit 1, block 1, level 1.95 m
Cueva De La Lechuza	LE-4269	1470	110	Test pit 1, block 1, level 25 cm
Cueva De La Lechuza	LE-4287	3030	180	Test pit 1, block 1, level 1.65 m
Cueva De La Lechuza	LE-4275	2580	90	Test pit 1, block 1, level 2.35 m
Cueva De La Lechuza	LE-4288	3030	180	Test pit 1, block 1, level 1.55 m
Cueva De La Lechuza	LE-4271	2380	80	Test pit 1, block 1, level 75 cm
Cueva De La Lechuza	LE-4272	2750	160	Test pit 1, block 1, level 65 cm
Cueva De La Lechuza	LE-4267	2220	160	Test pit 1, block 1, level 35 cm
Cueva De La Lechuza	LE-4274	2030	160	Test pit 1, block 1, level 45 cm
Cueva De La Lechuza	LE-4282	2930	300	Test pit 1, block 1, level 1.25 m
Cueva De La Lechuza	LE-4276	2250	150	Test pit 1, block 1, level 55 cm
Cueva De La Lechuza	LE-4270	3110	180	Test pit 1, block 1, level 1.05 m
Cueva De La Lechuza	LE-4273	2420	100	Test pit 1, block 1, level 95 cm
Cueva De La Lechuza	LE-4279	2390	170	Test pit 1, block 1, level 85 cm
Cueva De La Pintura	GD-1046	2840	60	Excavation unit 2, block 5, sec. D, level 1.25-1.5 m. Assoc. with shell and stone artefacts
Cueva De La Pintura	GD-613	2880	70	Excavation unit 2, block 5, sec. D, level 1.5-1.75 m. Assoc. with shell and stone artefacts
Cueva De La Pintura	GD-591	2930	80	Excavation unit 1, block 1-i, sec. D, level 1.5-1.8 m. Assoc. with shell and stone artefacts
Cueva De La Pintura	GD-1039	2160	55	Excavation unit 1, block 1-i, sec. A, level 50-75 cm. Assoc. with shell and stone artefacts
Cueva De La Pintura	GD-614	2720	65	Excavation unit 2, block 5, sec. D, level 1-1.25 m. Assoc. with shell and stone artefacts
Cueva De La Pintura	GD-601	2805	60	Excavation unit 1, block 1-i, sec. D, level 1-1.25 m. Assoc. with shell and stone artefacts
Cueva Del Perico I	GD-616	1350	70	Trench 2, sec. 2, level 1.5-1.75 m. Assoc. with human burials and shell and stone artefacts
Cueva Del Perico I	GD-1051	1990	80	Trench 1, sec. 1, level 1.3-1.4 m
Cueva Del Perico I	GD-617	1495	60	Trench 1, sec. 1, level 1-1.2 m. Assoc with human burials and shell and stone artefacts
Cueva Funche	SI-426	2070	150	Block II, sec. A. Sample depth 50 cm
Cueva Funche	SI-429	4000	150	Block III, sec. A. Sample depth 1.72 m

Cueva Funche	SI-428	3110	200	Block III, sec. A. Sample depth 1.40 m
Cueva Funche	SI-427	2510	200	Block II, sec. D. Sample depth 55 cm
Cueva No.1 De Punta Del Este	GD-618	910	85	Block I, sec. A, level 50-75 cm. Sample depth 57 cm. Assoc. with shell and stone artefacts
Damayajabo	Y-1764	3250	100	Trench 51, level 134 cm
Damayajabo	Y-1994	1120	160	Sample found in association with ceramics
El Boniato (El Palmar)	BETA-148958	670	70	Unit 2, grid square 9, natural layer 2, spit depth 40-50 cm
El Convento	GD-1053	665	50	Pit 2, level 25-50 cm. Sample depth 45 cm.
El Convento	UNKNOWN-7	400	20	No information
El Guafe I	FS AC 2419	690	50	Block 2, natural layer 2, sample depth 30 cm
El Guafe I	FS AC 2420	450	35	Block 1, sec. 2 & 4, layer 3, sample depth 50 cm
El Morrillo	SI-353	590	90	Block 9-q, sec. B, sample 45 cm. Assoc. with ceramics, shell and stone artefacts
El Paraiso	UNKNOWN-8	1130	150	Test Pit 1, 1x1 m. Level 20-30 Cm
El Porvenir	BETA-148960	500	50	Unit 5, grid square b, natural layer 1, spit depth 40-50 cm
El Purial	UBAR-169	3060	180	Level 40 cm (approx.)
Esterito	SI-350	500	100	Midden 1, trench 1, sec. D, sample depth 1.15 m. Assoc. with ceramics, shell and stone artefacts
Esterito	SI-349	550	150	Midden 1, trench 1, sec. C, sample depth 45 cm. Assoc. with ceramics, shell and stone artefacts
Herradura 1	BETA-140075	2050	70	Cut 5, level 0-10 cm
Jorajuria	LE-1783	4110	50	Pit 1, 1x1m, Nivel 80-90 Cm
Jorajuria	LE-1784	3870	40	Pit 1, 1x1m, Level 40-50 Cm
Jorajuria	LE-1782	3760	40	Pit 1, 1x1m, Nivel 60-70 Cm
Jucaro	BETA-148949	690	60	Cut A, natural layer 1, spit depth 20-40 cm
La Escondida De Bucuey	UNKNOWN-9	1060	150	Test pits 3 & 4, 1x1 m. Level 2-3 m
La Guira	BETA-140077	1390	70	Trench 1, level 19 cm
La Guira De Barajagua	SI-351	590	100	Midden 1, trench 1, sec. B, sample depth 90 cm. Assoc. with ceramics, shell and stone artefacts
La Luz	BETA-93863	1350	50	Test excavation 3, level 1.20 m
Laguna De Limones	SI-348	640	120	Midden 2, trench 2, sec. D. Sample depth 40 cm
Levisa 1 (Far. De Lev.)	MC-860	4420	100	Sec.i-i, level 55-60 cm, layer 6
Levisa 1 (Far. De Lev.)	GD-250	5140	170	Sec i-i, 85-90 cm
Levisa 1 (Far. De Lev.)	MC-859	4240	100	Sec.i-i, level 55-60 cm, layer 6
Levisa 1 (Far. De Lev.)	GD-204	3460	160	Sec.i-i, layer v, 50-55 cm
Levisa 8 (Cueva S.Rita)	LE-2720	2680	40	Unit 3, sec 23 a, 40-50 cm, layer 1
Levisa 8 (Cueva S.Rita)	LE-2718	2610	40	Unit 3, sec 45, 20-22 cm, layer 1
Levisa 8 (Cueva S.Rita)	LE-2719	2160	40	Unit 2, sec 25, 20-40 cm, layer 3
Levisa 8 (Cueva S.Rita)	LE-2717	2010	40	Unit 3, sec 35 a, 20-30 cm, layer2/3
Loma De La Campana	GD-1057	490	45	Midden 2, block i, sec. C, level 50-75 cm. Assoc. with ceramics, shell and stone artefacts
Loma De La Campana	GD-624	505	40	Midden 2, block ii, sec. D, level 75-100 cm. Assoc. with ceramics, shell and stone artefacts
Loma De La Campana	GD-1056	600	55	Midden 2, block ii, sec. D, level 1-1.50 m. Assoc. with ceramics, shell and stone artefacts
Loma De La Forestal	SI-352	970	100	Midden 9, trench 1, sec. A, sample depth 70 cm. Assoc. with ceramics, shell and stone artefacts
Loma De Ochile	FS AC 2414	770	35	Block 2, sec. 3, natural layer 1, sample depth 10-30 cm
Loma De Ochile	FS AC 2415	690	50	Block 2, sec. 1,2 & 3, natural layer 2, sample depth 30-40 cm
Loma De Ochile	FS AC 2416	660	35	Block 1, sec. 1-2, natural layer 2, sample depth 30-60 cm
Loma De Ochile	FS AC 2417	620	30	Block 1, sec. 2, natural layer 3, sample depth 60-80 cm
Loma De Ochile	FS AC 2418	880	40	Block 1, sec. 2, natural layer 4, sample depth 80-90 cm
Los Buchillones	TO-8070	280	60	Post 4, structure f1-1
Los Buchillones	TO-7627	460	50	King post 1, structure d2-1,
Los Buchillones	TO-7628	560	50	King post 2, structure d2-1,

Los Buchillones	TO-8067	240	60	Post 1, structure f1-1
Los Buchillones	TO-7624	1320	60	Rafter 3, structure d2-1,
Los Buchillones	TO-7623	390	50	Rafter 2, structure d2-1,
Los Buchillones	TO-7622	320	40	Post 13, structure d2-1,
Los Buchillones	TO-7621	1404	60	Post 12, structure d2-1,
Los Buchillones	TO-7620	430	50	Post 7 sub, structure d2-1,
Los Buchillones	TO-7619	300	50	Post 7, structure d2-1,
Los Buchillones	TO-7618	510	50	Post 2, structure d2-1,
Los Buchillones	TO-8069	230	70	Post 3, structure f1-1
Los Buchillones	TO-8071	250	60	Post 5, structure f1-1
Los Buchillones	TO-8072	430	60	Post 6, structure f1-1
Los Buchillones	TO-7626	540	50	Rafter 5, structure d2-1,
Los Buchillones	TO-8068	480	60	Post 2, structure f1-1
Los Buchillones	TO-7617	330	50	Post 1, structure d2-1,
Los Buchillones	TO-7625	340	50	Rafter 4, structure d2-1,
Los Chivos	BETA-140074	1150	60	Trench 1, level 10-20 cm
Los Chivos	BETA-140076	2710	80	Trench 1, level 45 cm
Los Pedregales	GD-619	1170	90	Trench 2, sec. B. Level 2-2.25 m. Sample depth 2 m. Assoc. with shell and stone artefacts
Marien 2	LV-2063	2020	80	Excavation square m-07, level 20-30 cm
Marien 2	LV-2062	780	100	Excavation square ll-10, level 10-20 cm
Mejias	SI-347	1020	100	Trench 1, sec. B, sample depth 45 cm
Mogote De La Cueva	UNKNOWN-3	960	50	No information
Mogote De La Cueva	SI-424	1620	150	Trench 1, sample depth 35 cm. Unsecure stratigraphy
Mogote De La Cueva	SI-425	650	200	Trench 1, level 1. Sample depth 1.25 m
Playita (Villa Clara)	UNKNOWN-2	1280	20	No information
Potrero Del Mango	Y-206	810	80	Midden 1, sec, y-5, level 75-100 cm
Potrero Del Mango	BETA-148961	880	80	Unit 1, grid square a, spit depth 80-90 cm
Potrero Del Mango	BETA-148962	620	60	Unit 2, grid square a, spit depth 1-1.1 m
Punta De Peque	BETA-93860	1400	60	Trench 1, level 50 cm
San Benito	BETA-93851	2020	60	Trench 2, level 40-50 cm
Vega Del Palmar	Y-465	960	60	Midden 150 cm deep, sample depth 105-120 cm. Ceramics only found in the top two 15-cm spits.
Ventas De Casanova	FS AC 2421	375	25	Test trench, sec. 4, layer 1 & 2, sample depth 0-23 cm
Ventas De Casanova	FS AC 2424	475	35	Block 1, sec. 1, layer 4, sample depth 60-80 cm
Ventas De Casanova	FS AC 2422	420	45	Block 1, sec. 1 & 2, layer 3, sample depth 30-50 cm
Ventas De Casanova	FS AC 2423	315	45	Block 1, sec. 1 & 2, layer 4, sample depth 50-60 cm
Victoria I	LC-H 565	960	50	Block, sec. B, level 2-2.25 m
Victoria I	LC-H 1034	2070	110	Block 1, sec b, level 6.25-6.50 m
Victoria I	LC-H 1035	1450	70	Block 1, sec b, level 2-2.25 m

2.I.2.i Radiocarbon Chronologies Discussion

Table 2.01 shows that 135 of the 140 known radiocarbon determinations from Cuba have the necessary contextual information to facilitate their use in establishing site chronologies. A number of the radiocarbon dating laboratories used to date archaeological samples from Cuba, such as Gliwice (GD-624), Leningrad (LE-4290) and Vernadsky (MO-399), were in the former Soviet Union. The history and methods of these laboratories is not widely known in Europe and North America (Taylor 1987:168). Publications on radiocarbon determinations from these laboratories appear to indicate that reliable methods were used and that the laboratories were part of the inter-laboratory cross-checks carried out between radiocarbon laboratories to verify international standards that started in the 1960s (Pazdur, *et al.* 1982; Vinogradov, *et al.* 1968).

The use of radiocarbon determinations from early periods in the development of the technique raises some methodological considerations. Sample Y-465, from Vega del Palmar, was collected in 1956 and dated before 1959. This comparatively early use of radiocarbon dating could indicate that it was determined using the Libby half-life rather than the Cambridge half-life. This potential error can be accounted for by increasing the laboratory error for the laboratory date by 3%, based on the difference between the two half-life calculations (Higham 2005). By 1970, the effects of isotopic fractionation on radiocarbon determinations were well known among the radiocarbon community, but they were considered to have been quite minor, and laboratories accounted for them by increasing the error margin by ± 80 years (Barker 1970:39). By 1977, procedures for accounting for isotopic fractionation, based on the $\delta^{13}C$ of individual samples, were well established (Stuiver and Polach 1977:356). However, it must be assumed that the radiocarbon determinations from before this year did not account for isotopic fractionation but merely increased the margins of laboratory error by an additional ± 80 years. Studies have shown that isotopic fractionation can in fact lead to larger errors than originally anticipated when dating charcoal samples (Taylor 1987:122). This must be taken into account when considering the use of pre-1977 radiocarbon determinations.

The archaeological contexts of the samples taken for radiocarbon dating, detailed in Table 2.01, provide useful information for their interpretation. For example, the early laboratory date of sample LE-4283 from Cueva de la Lechuza does not appear to be corroborated by further dates taken from deeper stratigraphic levels at the site.

As discussed above, there remain a number of potential issues that may affect the direct comparison of radiocarbon dates; however, it is necessary to calibrate the laboratory dates in order to provide a meaningful basis for discussion of site chronologies. Calibrated dates provide a more valid means of comparing radiocarbon determinations taken from marine and terrestrial samples and also provide a more relevant chronology for comparisons with historical dates such as AD 1492.

2.I.2.ii Calibrated Radiocarbon Determinations

The laboratory dates were calibrated using OxCal 3.8 software from the Oxford Radiocarbon Accelerator Unit. Samples from terrestrial sources were calibrated using IntCal04 (Reimer, *et al.* 2004). Isotopic data for the bone samples were not available and the potential for a marine diet of the inhabitants of El Chorro de Maíta must be considered when assessing the reliability of dates from samples Beta-148955 and Beta-148956 (Bayliss, *et al.* 2004). The samples from marine sources were calibrated using Marine04 (Hughen, *et al.* 2004). Local marine reservoir offsets are not available for Cuba and regional marine reservoir offsets were investigated but not applied in this study (Reimer 2005; Reimer, *et al.* 2002). Further methodological issues surrounding the use of marine shell should also be considered before using marine shell samples as direct evidence of site chronology (Ascough, Cook and Dugmore 2005; Ascough, Cook, Dugmore, *et al.* 2005; Rick, *et al.* 2005; Stuiver and Braziunas 1993). These issues are discussed in detail in Chapter 7, Site Chronology and Interpretation. Calibrated dates for the samples were all calculated to 2 Sigma and are listed in Table 2.02.

Table 2.02 List of calibrations of radiocarbon dates using different calibration methods dependent on the type of material originally dated

Site Name	Lab. No.	Material	cal BP lower range	cal BP upper range	Pre-1977
Abra Del Cacoyuguin I	BETA-133948	Charcoal	1866	1296	
Abra Del Cacoyuguin I	BETA-133947	Charcoal	1283	974	
Abra Rio Cacoyuguin II	BETA-133950	Charcoal	2964	2779	
Abra Rio Cacoyuguin II	BETA-133951	Charcoal	4256	3873	
Abra Rio Cacoyuguin IV	BETA-140079	Charcoal	4867	4446	
Aguas Gordas	GD-1054	Charcoal	624	480	1971
Aguas Gordas	GD-621	Charcoal	734	550	1971
Aguas Gordas	GD-620	Charcoal	307	1	1971
Aguas Gordas	GD-1055	Charcoal	666	508	1971
Aguas Gordas	MO-399	Charcoal	1149	692	1963
Arroyo Del Palo (Mayari)	Y-1556	Charcoal	1055	727	1965
Arroyo Del Palo (Mayari)	Y-1555	Charcoal	787	568	1965
Belleza	UNKNOWN-4	Charcoal	1176	927	
Birama	UNKNOWN-5	Charcoal?	793	674	
Cabagan	UNKNOWN-6	Bone	1054	934	
Caimanes III	UM-1953	Charcoal	2060	1300	
Canimar 1	GD-203	Charcoal	1174	692	1973
Canimar Abajo	UBAR-170	Charcoal	5030	4622	
Canimar Abajo	UBAR-171	Charcoal	5590	5300	
Catunda	BETA-93862	Charcoal	1950	1700	
Catunda	BETA-93866	Charcoal	1894	1631	
Catunda	BETA-140078	Charcoal	1302	1062	
Chorro De Maita	BETA-148955	Human Bone	533	154	
Chorro De Maita	BETA-148957	Charcoal	740	561	
Chorro De Maita	BETA-148956	Human Bone	930	673	

Corinthia III	BETA-133953	Marine Shell	1986	1650	
Corinthia III	BETA-133952	Marine Shell	2078	1770	
Corinthia III	BETA-140080	Marine Shell	1380	1114	
Cueva 4 Punta Del Este	LC-H 1106	Charcoal	1292	735	
Cueva De La Lechuza	LE-4281	Charcoal	2958	2352	
Cueva De La Lechuza	LE-4290	Charcoal	2958	2352	
Cueva De La Lechuza	LE-4283	Charcoal	6298	5746	
Cueva De La Lechuza	LE-4269	Charcoal	1568	1178	
Cueva De La Lechuza	LE-4287	Charcoal	3638	2762	
Cueva De La Lechuza	LE-4275	Charcoal	2856	2358	
Cueva De La Lechuza	LE-4288	Charcoal	3638	2762	
Cueva De La Lechuza	LE-4271	Charcoal	2720	2181	
Cueva De La Lechuza	LE-4272	Charcoal	3328	2460	
Cueva De La Lechuza	LE-4267	Charcoal	2719	1864	
Cueva De La Lechuza	LE-4274	Charcoal	2349	1610	
Cueva De La Lechuza	LE-4282	Charcoal	3834	2346	
Cueva De La Lechuza	LE-4276	Charcoal	2724	1890	
Cueva De La Lechuza	LE-4270	Charcoal	3718	2850	
Cueva De La Lechuza	LE-4273	Charcoal	2749	2181	
Cueva De La Lechuza	LE-4279	Charcoal	2796	1996	
Cueva De La Pintura	GD-1046	Charcoal	3158	2789	1973
Cueva De La Pintura	GD-613	Charcoal	3242	2845	1973
Cueva De La Pintura	GD-591	Charcoal	3341	2858	1973
Cueva De La Pintura	GD-1039	Charcoal	2332	1996	1973
Cueva De La Pintura	GD-614	Charcoal	2959	2742	1973
Cueva De La Pintura	GD-601	Charcoal	3075	2770	1973
Cueva Del Perico I	GD-616	Charcoal	1376	1146	1972
Cueva Del Perico I	GD-1051	Charcoal	2146	1734	1972
Cueva Del Perico I	GD-617	Charcoal	1526	1294	1972
Cueva Funche	SI-426	Charcoal	2352	1702	1966
Cueva Funche	SI-429	Charcoal	4854	3994	1966
Cueva Funche	SI-428	Charcoal	3828	2785	1966
Cueva Funche	SI-427	Charcoal	3066	2112	1966
Cueva No.1 De Punta Del Este	GD-618	Charcoal	969	675	1967
Damayajabo	Y-1764	Charcoal	3697	3262	
Damayajabo	Y-1994	Charcoal	1332	697	
El Boniato (El Palmar)	BETA-148958	Charcoal	728	536	
El Convento	GD-1053	Charcoal	686	546	1974
El Convento	UNKNOWN-7	Charcoal	507	338	
El Guafe I	FS AC 2419	Charcoal	693	556	
El Guafe I	FS AC 2420	Charcoal	534	476	
El Morrillo	SI-353	Charcoal	686	498	1966
El Paraiso	UNKNOWN-8	Charcoal	1312	732	
El Porvenir	BETA-148960	Charcoal	630	495	
El Purial	UBAR-169	Charcoal	3644	2780	
Esterito	SI-350	Charcoal	667	310	1965
Esterito	SI-349	Charcoal	739	299	1965
Herradura 1	BETA-140075	Marine Shell	1808	1438	
Jorajuria	LE-1783	Charcoal	4827	4442	
Jorajuria	LE-1784	Charcoal	4419	4152	
Jorajuria	LE-1782	Charcoal	4241	3984	
Jucaro	BETA-148949	Charcoal	728	548	
La Escondida De Bucuey	UNKNOWN-9	Charcoal	1292	682	
La Guira	BETA-140077	Terrestrial Shell	1407	1178	
La Guira De Barajagua	SI-351	Charcoal	692	484	1965

La Luz	BETA-93863	Charcoal	1342	1178	
Laguna De Limones	SI-348	Charcoal	786	495	1964
Levisa 1 (Far. De Lev.)	MC-860	Charcoal	5318	4828	
Levisa 1 (Far. De Lev.)	GD-250	Charcoal	6288	5584	1973
Levisa 1 (Far. De Lev.)	MC-859	Charcoal	5041	4520	
Levisa 1 (Far. De Lev.)	GD-204	Charcoal	4150	3367	
Levisa 8 (Cueva S.Rita)	LE-2720	Charcoal	2858	2744	
Levisa 8 (Cueva S.Rita)	LE-2718	Charcoal	2778	2623	
Levisa 8 (Cueva S.Rita)	LE-2719	Charcoal	2313	2007	
Levisa 8 (Cueva S.Rita)	LE-2717	Charcoal	2059	1876	
Loma De La Campana	GD-1057	Charcoal	622	494	1972
Loma De La Campana	GD-624	Charcoal	624	502	1972
Loma De La Campana	GD-1056	Charcoal	670	518	1972
Loma De La Forestal	SI-352	Charcoal	1066	686	1965
Loma De Ochile	FS AC 2414	Charcoal	736	666	
Loma De Ochile	FS AC 2415	Charcoal	693	556	
Loma De Ochile	FS AC 2416	Charcoal	674	556	
Loma De Ochile	FS AC 2417	Charcoal	663	544	
Loma De Ochile	FS AC 2418	Charcoal	917	694	
Los Buchillones	TO-8070	Wood	496	1	
Los Buchillones	TO-7627	Wood	546	340	
Los Buchillones	TO-7628	Wood	656	510	
Los Buchillones	TO-8067	Wood	462	1	
Los Buchillones	TO-7624	Wood	1334	1091	
Los Buchillones	TO-7623	Wood	520	308	
Los Buchillones	TO-7622	Wood	496	294	
Los Buchillones	TO-7621	Wood	1404	1188	
Los Buchillones	TO-7620	Wood	536	320	
Los Buchillones	TO-7619	Wood	496	154	
Los Buchillones	TO-7618	Wood	635	498	
Los Buchillones	TO-8069	Wood	471	1	
Los Buchillones	TO-8071	Wood	472	1	
Los Buchillones	TO-8072	Wood	542	316	
Los Buchillones	TO-7626	Wood	650	504	
Los Buchillones	TO-8068	Wood	631	349	
Los Buchillones	TO-7617	Wood	504	288	
Los Buchillones	TO-7625	Wood	506	294	
Los Chivos	BETA-140074	Terrestrial Shell	1242	933	
Los Chivos	BETA-140076	Terrestrial Shell	2988	2722	
Los Pedregales	GD-619	Charcoal	1286	927	1976
Marien 2	LV-2063	Charcoal	2293	1819	
Marien 2	LV-2062	Charcoal	924	553	
Mejias	SI-347	Charcoal	1172	730	1965
Mogote De La Cueva	UNKNOWN-3	Charcoal?	961	742	
Mogote De La Cueva	SI-424	Charcoal	1874	1278	1966
Mogote De La Cueva	SI-425	Charcoal	957	299	1966
Playita (Villa Clara)	UNKNOWN-2	Charcoal	1282	1174	
Potrero Del Mango	Y-206	Wood	920	652	
Potrero Del Mango	BETA-148961	Charcoal	936	670	
Potrero Del Mango	BETA-148962	Charcoal	676	522	
Punta De Peque	BETA-93860	Terrestrial Shell	1402	1187	
San Benito	BETA-93851	Terrestrial Shell	2140	1830	
Vega Del Palmar	Y-465	Charcoal	970	734	Pre-1959
Ventas De Casanova	FS AC 2421	Charcoal	503	310	
Ventas De Casanova	FS AC 2424	Charcoal	542	496	

Ventas De Casanova	FS AC 2422	Charcoal	530	321	
Ventas De Casanova	FS AC 2423	Charcoal	498	288	
Victoria I	LC-H 565	Charcoal	961	742	
Victoria I	LC-H 1034	Charcoal	2338	1816	
Victoria I	LC-H 1035	Charcoal	1518	1272	

This table of the plotted radiocarbon dates shows the chronological breadth of prehistoric indigenous activity in Cuba. The table also reflects the small sample of only 37 radiocarbon dates between 6298-5746 BP and 2313-2007 BP, which reduces the potential for studying interaction between sites during this period. There is a larger sample of 102 calibrated radiocarbon dates between 2796-1996 BP and AD 1492. This indicates that it is easier to identify contemporaneous indigenous activity at archaeological sites during the more recent prehistoric period.

2.I.3 Summary

This chapter provides a summary of archaeological information collected from 1080 archaeological sites in Cuba. The creation of a database of archaeological sites, spatially projected using GIS, provides a useful framework for reviewing the archaeological evidence for island interaction in prehistoric Cuba.

Spatial mapping of archaeological material and site locations have revealed that the majority of sites are on the Cuban mainland and only 31 sites occur on offshore islands. There is evidence that survey strategies have impacted on spatial patterns in the location of existing archaeological sites. Therefore knowledge of island interaction is dependent on further archaeological surveys that are explicit about strategies and approaches, and that identify a representative sample of archaeological sites on offshore islands. There is currently limited information with which to identify island interaction that is based on broad similarities in material culture between sites. In addition, artefact assemblages from sites with potential evidence of island interaction are not easily accessible for study. Stores in the Montané Museum have artefact collections but the sample size and limited contextual information is unlikely to provide the data resolution required for a study of island interaction. Therefore new data are required.

A review of radiocarbon determinations from Cuba reveals a relatively small sample of dates and there are only two radiocarbon dates from archaeological sites on offshore islands in the Cuban archipelago. It is proposed that further radiocarbon determinations are essential to build a robust framework for site chronologies and to enable inter-site comparisons in Cuba. This national scale of analysis discussed in this chapter enables the observation of macro-scale patterns in site distribution and site chronology. In order to generate higher-resolution data a delimited case study area is required, where targeted research questions can be addressed in greater detail.

This chapter has revealed initial evidence of island interaction and has highlighted some potential areas where studies of island interaction require further data collection and analysis. The collation and study of extant archaeological data from Cuba has revealed a small number of poorly recorded archaeological sites on offshore islands and demonstrated the lack of detailed archaeological or chronological evidence with which to identify island interaction. The database also provides indirect evidence of sites in the interior of the Cuban mainland having interacted with the coast and marine environments beyond. Further investigations are necessary in order to:

1. Identify whether the lack of archaeological sites on offshore islands is a result of a lack of archaeological research or a lack of indigenous activity

2. Generate archaeological data suited to the study of island interaction, including interaction between and among humans and interaction between humans and their environment

3. Establish the relative chronologies of a group of sites in order to generate a more robust temporal framework for studying interaction

4. Investigate the interaction between coastal settlements and offshore islands

5. Investigate patterns of interaction between coastal and interior sites

Chapter 3

THEORY

3.I Theoretical Frameworks for this Research

Introduction

Chapter 1 and Chapter 2 gave a review of past theoretical frameworks that have structured archaeological research previously carried out in Cuba and the Caribbean. These reviews highlighted how socio-political context has influenced the ability of archaeologists to study island interaction. A conclusion that was drawn was that past studies have tended to produce categories that were either grand stages of development, or grouped artefacts into classes too broad for detailed analysis. Thus, both extant theory and data do not lend themselves to a study of island interaction in the prehistoric Caribbean. In the previous chapters it was stressed that, in addition to the collection and contextualisation of existing data, it is essential that further research generate new data that can contribute to our knowledge of prehistoric island interaction. The primary aim of this chapter is to establish a well-grounded theoretical framework that provides the context for my research. It is necessary to establish this theoretical framework for research from the outset in order to identify what data are required, how they should be collected and in what ways they can be analysed in order to provide the basis for meaningful interpretation of island interaction.

This chapter discusses theoretical approaches to the study of island interaction through four subsections. **Landscape Theory** discusses recent developments in landscape studies and examinines how inter-disciplinary debate has influenced archaeological approaches. **Island Archaeology** examines how key themes from landscape studies have contributed to the study of the island as a conceptual space and consequently led to the development of new approaches to the study of island archaeology. **Modelling Island Interaction** examines how new spatial applications can be used to model island interaction. **Identifying Island Interaction** will review how approaches to studying island interaction outlined in this chapter will have implications for data retrieval methods. The fieldwork methods are then discussed in Chapter 4.

3.I.1 Landscape Theory and Archaeology

Landscape studies have been an interesting area for theoretical discussion for many years (Cherry 1987; Clarke 1977). Recently new theories and approaches have emerged that have had far-reaching impacts on archaeology (Bender 1992; Ingold 1993; Thomas 1995a). Spatial applications, including GIS, have developed that have enriched the study of landscape archaeology (Conolly and Lake 2006; Lloyd 2007; Worboys 1995). One of the main results of these recent developments has come from inter-disciplinary discussion that has conceptually broadened the horizons of the landscape in archaeology. Recent developments in landscape studies have expanded the potential for research in island archaeology, partly as the result of new investigative techniques, which are employed as part of this research project.

Landscape studies directly affect the study of islands because islands are primarily perceived as landscape phenomena. The first definition of an island in the Oxford English Dictionary: "A piece of land surrounded by water" leads to a second definition: "Something resembling this because it is detached or isolated" (Hawkins 1979:429). Therefore the island can be defined as a bounded entity and such a definition can allow for many different types of island to be envisioned. Islands can be represented in numerous different shapes and forms depending on the choice of boundary selected. This is exemplified by political or cultural islands, such as the state of Israel bounded by surrounding Arab states, or habitat islands bounded by desert or mountains, such as the Himalayan kingdom of Bhutan. These examples of different 'islands' highlight the importance of the conceptualisation of islands and their landscapes and being explicit about the approach to the island concept in this thesis. The context of this research is the Caribbean, and the focus is on marine islands, defined as bodies of land surrounded by sea. However, in light of the fact that there are so many different types of island, the sea as the boundary for marine islands can also be taken as a metaphor for other types of culturally imposed boundaries. My research is concerned with bringing a focus on the populations of islands and their relationship with the terrestrial landscape and marine seascape around them; however, it is argued that islands and insularity as concepts encompass much more than the geographical images often associated with islands. The very basis of cultural identity can be perceived as a concept of insularity and the transmission of knowledge through interaction between peoples helps to form cultural identities. So if steps can be taken to develop a framework for studying interaction among marine islands, perhaps lessons can be transferred to the study of cultural islands.

3.I.1.i Development of Landscape Archaeology

New Geography was a catalyst for the development of New Archaeology in the 1960s and 1970s and works such as Clarke's *Models in Archaeology* and *Spatial Archaeology* (Clarke 1972, 1977) introduced a geographical paradigm to archaeology. More recently, Human Geography has taken centre stage and this has led to a critique of past use of landscape by examining the material and symbolic interpretation of landscapes through their social relationships (McDowell 1997). This social element of the landscape contrasted with the quantitative landscape studies of New Archaeology in which the planet was sometimes perceived as an economic resource for human exploitation and landscape simply described as the interface between nature and culture (Witcher 1998). The advantages of an approach in which the landscape was simplified and examined at a universal analytical level is clear. Hypotheses such as central place theory were established in which geometric shapes could be superimposed on this universal landscape (Rossignol 1992). This perspective that "market centres will be determined by the competitive features of the market economy" (Smith 1976:10) failed to account for the complexity and idiosyncrasies of past societies by relying on the assumption that all land use was determined by the aim to maximise its economic potential. This kind of critique of the processual approach was extended and expanded during the 1980s and 1990s and was reflected in landscape archaeology as the humanist element of the landscape was developed (Thomas 1995a:32).

Landscape studies have undergone a revolution in recent years and have acted as an inter-disciplinary magnet that has drawn together the intellectual resources of geography, archaeology, ecology, history, and anthropology (Cherry 1987). There has also been a greater acceptance of alternative perspectives and the integration of viewpoints and opinions that were previously under-represented in the discipline. The landscape approach of the processual period is well illustrated by the landscape picture, the freeze-frame vista, portrayed as a universal record of what is 'there'. It is almost as if the landscape could be used as a fixed canvas upon which interpretation of past human activity could be painted. Ingold's deconstruction of the painting 'The Harvesters' illustrates criticisms of such a simplistic approach (Ingold 1993:161). By exploring the dualist humanistic experience of time and space, Ingold shows how the landscape is not static but dynamic, perpetually under construction and culturally interpreted. The addition of multi-scaled time depth to the landscape has important implications for archaeology and highlights the importance of chronological frameworks for understanding human interaction with landscape.

Different researchers understand the concept of landscape differently, often influenced by the geographical area and chronological period of their study (Blanton 2004). The landscape can be interpreted as the surface of the land within view, or it can be all encompassing term for human interaction with all aspects of the earth both above and below ground (Wandsnider 1992:287). Alternative views of land were used to show the dangers of 'universal' and 'scientific' viewpoints. Barbara Bender has been a strong influence in promoting this alternative "ego-centred landscape, a perspectival landscape, a landscape of views and vistas" (Bender 1995a:1) as important for archaeology. By highlighting how there has never really been a universal way of viewing landscape, she reveals how the empowerment of one particular view had been allowed to dominate and claim an objective higher moral ground. Ingold too has argued that 'every landscape is a particular cognitive or symbolic ordering of space' (Ingold 1993:152) and different spatial and temporal interpretations of the landscape can arise. These differences can become polarised as high-profile cases in Australia have shown. The perspective of Aboriginal groups is that landscape is whole and temporally unified, because dreamtime and human time run concurrently. Aboriginal views stand in contrast to Euro-centric legislation, upon which Australian law is based, that empowers international mining corporations to exploit the land underneath Aboriginal reserves. Such conflicts in landscape perception illustrate how important it is to identify 'landscape' before it is possible to analyse a past human interaction with it. The question of how alternative perceptions of the landscape impact upon the archaeological record, and whether it is possible for archaeologists to identify them is of course a question that remains hotly debated (Thomas 1995c).

Tilley has become a leading proponent of applying the experience or phenomenology of landscape as an interpretative tool in archaeology (Tilley 1994, 1995; Tilley 1999; Tilley 2004). Influenced heavily by philosophers such as Heidegger and Merleau-Ponty (Karlsson 1998), Tilley uses the concept of dwelling in the landscape, as if vision and perspective are not sufficient for an empathic interpretation . He argues that 'the body provides the fundamental mediation point between thought and the world' (Tilley 1994:14) and it is movement through landscape and the feeling or atmosphere received from it that creates human experience and memory. Phenomenology is not new to archaeology and although perhaps framed within a different theoretical context, the experimental archaeology approaches popular since the 1960s have close parallels to this somatic approach. Tilley's direction of thought ties in with Ingold's concept of 'taskscapes', because both Ingold and Tilley take the important step of introducing the dimension of time into the landscape.

Time depth is of course key to any archaeological investigation, but this use of temporality by Tilley and Ingold is an attempt to isolate and focus on a humanist time that views "society itself as a kind of clock, whose moving parts are individual human beings" (Ingold 1993:159). Temporal definition allows for a dynamic landscape that is constantly in flux and accommodates the human experience of cyclical change due to elements such as the weather and seasonality as well as linear change (Thomas 1995a:27). A theoretical framework that provides the possibility to study time depth at different scales of resolution in archaeology would be useful. Therefore in recent years landscape studies have empowered past societies by valuing the variability of perspective and put the focus on those people who actually lived in the landscape.

New approaches in landscape studies have led to interesting developments in cognitive archaeology and a sense of urgency to not only "study past ways of thought as inferred from material remains" (Renfrew 1994:3) but also to see if it is possible to recreate a past experience of human/landscape interaction by evaluating how the landscape creates society and how society creates the landscape. There is a danger that the resolution of data required for such approaches undermines the legitimacy of archaeological research into the past. Certainly a hermeneutic phenomenological approach recognizes the levels of complexity in a landscape that unites nature and culture, and many academics, including Tilley himself, accept that such an approach cannot easily be used for empirical research (Layton and Ucko 1999:12; Tilley 1994:11). But one element that is key to an experiential approach to landscape is that of memory. All human experiences create memory and consequently the landscape will influence the consciousness of the individual and the society within it (Samuel 1994:49). An area for investigation includes how interaction with the landscape could affect the lifeways of past peoples and if this is interpretable through the archaeological record. One way such interaction can be revealed archaeologically is through the identification of pathways through the landscape that reflect human interactions. Potential ways of studying landscape interaction through spatial analysis, archaeological material and settlement patterns are explored in Chapter 9.

Island archaeology has been closely associated with developments in landscape studies. By focusing on marine islands in this study, one of my research aims is to evaluate how these new landscape approaches can contribute to an understanding of how island societies experienced their landscapes and how this is visible in the archaeological record.

3.I.2 Island Archaeology

Recent developments in landscape studies have revealed the "potential challenge and rewards of different ways of understanding islands and island people" (Broodbank 2000:362). Acknowledgement of the subjective in the landscape in recent years has revealed that islands can be as varied as the minds that create them. By introducing a human subjective element into landscape, islands can potentially lose their shackles of isolation and uniformity as people begin to "note that no feature of landscape is, of itself, a boundary" (Ingold 1993:156). Marine islands are defined as land bounded by a seascape barrier, but this raises the important question of whether the sea really is a boundary or if this is just a common ethnocentric misconception by landlubber archaeologists (Gosden and Pavlides 1994:162; Rainbird 2004). Seascape studies represent an area in which recent developments in spatial, temporal and humanistic debates of landscape studies allow a radically altered perception of the sea (Anderson 2004; Horden and Purcell 2000; Rainbird 2004). A seascape is constantly changing and fluctuating; it is a dynamic medium open to human experience (Rainbird 1999). The sea can be one person's mortal fear, another person's happy childhood memory, a balmy afternoon in the Mediterranean, or a stormy night in the Pacific. It is clear that the relationship between a people and their seascape needs to be re-evaluated at a local level (Gosden and Pavlides 1994:163; Watters 1983).

Island peoples often live on the border between land and sea; this intra-spectra domain has recently been phrased as an islandscape, "a more flexible approach to insularity, and one that incorporates the sea and maritime culture as components of its definition, it also prompts reconsideration of the best way to approach island landscapes and seascapes, or in effect islandscapes" (Broodbank 2000:21). My research adopts such an approach to the island and includes a study of interaction between different marine islands as well as interaction with the sea that surrounds them. Numerous ethnographic and ethnohistorical examples indicate that the sea is not always regarded as a barrier or as negative space, but is often seen as positive space by different societies (Lathrap and Oliver 1984:3). This has been highlighted by the large scale cultural models established by Rouse in the Caribbean that centre on the bodies of water between islands (Rouse 1992). There is evidence that some prehistoric communities in the Caribbean lived on houses built over the sea, purposefully locating themselves 'at home' in the seascape (Pendergast, *et al.* 1999). Archaeologists could potentially view such lives as marginal, living on the edge of the landscape (Calvera Rosés and García Lebroc 1994), but perhaps this island society felt that they were located at the centre of their islandscape. This view of the sea as positive space contradicts and perhaps solves the riddle of the remote Pacific islands populated by thriving marine-focused island societies (Rainbird 2004), yet often explained as the isolated remnants of some Crusoesque maritime catastrophe (Graves and Addison 1994). This interpretation of the sea casts shadows of doubt upon interpretations of island societies that are based on isolationist theoretical frameworks. Therefore adopting a wider islandscape approach provides a framework to investigate island interaction in the prehistoric Caribbean in different ways. Whether archaeological investigation reveals isolated island societies with mainland-adapted subsistence patterns, populated by peoples who lacked ships, sails and the ability to navigate, or whether there is evidence for thriving maritime-focused communities with regular island interaction, or somewhere in-between is a question addressed in my research project. The enormous diversity of islands, small to large, isolated to clustered, offshore to oceanic creates very different islandscapes that would in turn have created different experiences of life for different island societies. Therefore the scale of investigation needs to be carefully balanced. The area of study has to be large enough to provide a body of archaeological evidence of island interaction if it exists whilst providing a detailed resolution of spatial and chronological data upon which to base valid interpretation of the nature of this interaction.

The link between the island, past people and the way in which people organised and interact with the space around them has been investigated in different ways around the world (Cherry 1987:149; Moss 2004; Takamiya 2004; Terrell 2004). Bradley (Bradley 2000) developed his theoretical approaches by looking at the interface between land and sea and concluded that many megalithic monuments in the Orkney Islands were clearly designed and located to be seen from the sea, which reflects a communication and close relationship of Orkney island society with their islandscape. Sources of archaeological evidence clearly suggest that for many island societies around the world, the islandscape is an experience in which the sea is neither barrier nor bridge but simply a part of life (Bailey and Parkington 1988; Broodbank 2000; Gosden and Pavlides 1994).

Focusing on the islandscape rather than just the landscape of marine islands completely changes the way in which island resource and subsistence practices have been investigated (Fitzhugh and Hunt 1997). A biogeographical perspective was popular in island archaeology during the 1960s and 1970s, possibly because the island was seen as providing a defined unit of analysis helping to order the ever-increasing amounts of empirical information (Terrell 1976; Vayda and Rappaport 1965). Biogeographical approaches to island colonisation often focus on migration driven by environmental adaptation (Allen and Gosden 1996:183;

Keegan 1992:46; Keegan and Diamond 1987). Some environmental approaches relied on a theoretical framework based upon certain universal constants in the human/environment relationship that occasionally did not account for the dynamic and variable relationship of societies and their islandscape. MacArthur and Wilson's (1967) seminal work *The Theory of Island Biogeography* reflected an original biological approach to island biogeography.

Biogeographical approaches to studying island societies have sometimes resulted in a cognitive link between islands, insularity and isolation (Lape 2004). Philosophers have often used island metaphors for theoretical discussion of concepts in isolation. Imaginary habitats have been used to create 'guinea pig' human populations, such as Voltaire's island of Utopia in *Candíde* (Voltaire J. Pearson 1759 (1994):41). The use of the island as a microcosm in which hypotheses can be tested in 'isolation' reflects the dangers of ethnocentrism in island study. It has invariably been philosophers living in European metropolitan environments that have misrepresented the lives of island societies and imposed upon them their own cultural values. This use of the island society as a virgin case study has been heavily criticised in recent years but insularity as a concept has the potential to influence archaeological interpretations of island interaction. This is the case in the Caribbean where island studies are often bounded by socio-political context as outlined in Chapter 1 (Curet 2004; Rouse 1992). It was developments in landscape studies by Bender (Bender 1992; Bender 1995a, 1995b), Thomas (Thomas 1995a, 1995b, 1995c), Tilley (Tilley 1994, 1995; Tilley 1999; Tilley 2004) and others that highlighted the human as an individual in the landscape and this in turn has been reflected by a more multi-perspective view of the human-environment relationship (Simmons 1996) that has influenced the development of island archaeology (Broodbank 2000; Horden and Purcell 2000; Keswani 1994; Terrell 2004). Island biogeography reflects these changes and not only have biological approaches to island studies moved on from a framework of island insularity but in fact the data from such studies have become a key factor in identifying prehistoric island interaction (White 2004). The potential for studies of human-environment relations on islands to contribute to data on island interaction will be explored in this thesis.

3.I.3 Modelling Island Interaction

Geographic Information Systems (GIS) provides a potential means of dealing with the methodological problems of a landscape approach to island interaction because it allows a multi-angled and multi-layered vision of the islandscape (Orejas Saco del Valle, *et al.* 2002).

GIS can combine the capture, modelling, manipulation, retrieval, analysis, presentation and interpretation of geo-spatial data (Worboys 1995). However, the empirical and quantitative approach of GIS has been heavily criticised in recent years for being incapable of generating a more qualitative interpretation, because "meaning is a multi-faceted qualitative measure that cannot be reached with purely quantitative tools such as GIS" (Gillings and Wise 1990:8). The dangers of subjectivity in data inputting and of false pattern interpretation are acknowledged in spatial analysis (Broodbank 1999:194; Lock and Harris 1992:91; Orton 2000). The result of this acknowledgement is a higher level of methodological transparency in recent GIS studies (Fotherington, *et al.* 2000:10). The GIS community has worked hard at developing and integrating quantitative and qualitative approaches and "new research is beginning to humanise GIS" (Witcher 1998:13). GIS can now allow the manipulation of space by inputting divergent valuations and alternative perceptions whilst maintaining a form in which data can be effectively displayed and interpreted. As the technology available to the archaeologist improves, so too does the potential for an improved landscape approach (Wandsnider 1992:287). Islandscapes can now be humanised by creating interactive GIS, with phenomenological data placed within 3-dimensional recreated landscapes in order to combine an objective recording of the natural with a subjective experience of the cultural. This interactive research technique will hopefully allow a third way between the two extremes of empiricist objectivism and cognitive idealism, thus appeasing the critics from either end of the theoretical spectrum and, in the current context, provide a methodological framework for archaeological research of island interaction in the Caribbean.

Areas for research with spatial analysis and GIS modelling include inter and intra-island visibility, distances, surface cost maps and pathways, sea levels, environment zones, shoreline types, site location and settlement patterns. By creating a better understanding of 'distance' within a case study area it is possible to model the archaeological evidence for island interaction more effectively. GIS models can help to show visual links in the islandscape, identify travellable distances and evaluate the impact of potential barriers such as elevation, wind and currents as "the direction and speed of the sea currents and the winds were an important factors in deciding what routes it was possible for indigenous peoples to take when travelling between island territories" (Dacal Moure and Rivero de la Calle 1984:42). It is hoped that this spatial framework and GIS methodology will enable the spatial analysis of the archaeological evidence and enhance interpretation of island interaction.

3.I.4 Identifying Island Interaction

Discussion of island archaeology has shown the intricate relationship between people, land and sea. The levels of complexity of this relationship are differentially reflected in the spatial scale at which island interaction can be studied. For archaeologists, the level of available data determines the different scales at which archaeologists can interpret island interaction (Rouse 1977:2). This raises the question of how island interaction can be identified archaeologically.

3.I.4.i Maritime Technology

The study of maritime technology can be used indirectly to indicate island interaction and such data can come from a number of sources. There is the potential for direct evidence of transport technology with studies of past seafaring craft and navigation systems (Johnstone 2001; Robiou Lamarche 1992; Veloz Maggiolo 1974). This can provide an indication of the potential distance and conditions past societies were able to travel. Ethnohistorically, the dugout canoe of the Caribbean is well recorded and studied (Glazier 1991; Morales Patino 1950:89; Veloz Maggiolo 1974). This provides evidence of large ocean-going canoes that were able to carry large numbers of people. Archaeologically, the wood used to manufacture these crafts does not usually preserve well in archaeological contexts (Olazagasti 1997:134). Canoe fragments have been found in the archaeological record as have canoe paddles (Conrad, *et al.* 2001) but the details of their sea going potential is not always clear. As well as evidence for maritime transport there is also the potential for evidence of marine exploitation through paraphernalia such as net weights (Córdova Armenteros 1995) and fishhooks (Rodriguez 1981). Such data can provide evidence of marine interaction and potentially indicate the nature of marine resource exploitation. Therefore understanding the nature of prehistoric marine transport technology is potentially useful for studying island interaction but difficult to identify archaeologically. Furthermore, this evidence is circumstantial and can not be subjected to quantitative analysis to interpret the importance of marine interaction at a site.

3.I.4.ii Archaeological Sites

The identification of site location and site activities provide the most accessible evidence of island interaction to archaeologists. Identifying the location of each site in the islandscape establishes the building block for spatial analysis and the modelling of island interaction discussed above (Bailey and Parkington 1988:3). The first discovery of archaeological evidence for human activity on an island provides the earliest evidence for island interaction

(Keegan and Diamond 1987). Therefore finding sites on different islands and identifying the nature of the activities being conducted is the starting point for archaeologists wanting to study island interaction (Kirch 1986). The activities at each site can indicate the nature of island interaction. Material remains provide the basis for studying the relationship between human activities at different sites. There are examples of production sites of diagnostic artefacts on one island that can be linked with the distribution of finished artefacts on another island and this can form a strong basis for reconstructing networks of interaction (Fitzpatrick and Diveley 2004).

3.I.4.iii Sourcing Materials

Sourceable materials can be used to indicate interaction at both local and regional scales. Evidence of local island interaction networks have been identified in the Caribbean through geological studies of stone artefacts in the Lesser Antilles (Knippenberg and Gijn 1998). Regional island interaction has been suggested by the movement of metals (Vega 1979) and semi-precious stones (Oliver pers. com.). Guanin pendants originating in Colombia are found in Cuban assemblages (Valcárcel Rojas and Rodríguez Arce 2003), and arguments have been made for large scale trade networks (Petitjean Roget 1975; Rodríguez Ramos 2002; Szaszdi Nagy 1984). However, this only provides broad indications of island interaction without well defined spatial or chronological context.

3.I.4.iv Resource Exploitation and Subsistence

Biological studies of resource and subsistence practices can aid the study of sourceable materials from archaeological sites (Erlandson, *et al.* 2004:73). Studies of faunal assemblages from archaeological sites in the Caribbean that include marine molluscs (Rodriguez Matamoros 1994), marine reptiles (Godo 1985), marine mammals (Antczak 1995; Sutty 1995) and marine fish (Rodriguez 1981; Wing and Scudder 1983) reveal evidence for past marine interaction. A number of site-specific studies (Martínez Gabino 1987) have provided large enough assemblages to provide quantified analysis of resource and subsistence habits (Newsom and Wing 2004) and the relative dietary importance of marine and terrestrial fauna (Reitz and Wing 1999). The study of faunal remains offers a useful method for studying human environment interaction (Gumerman IV 1997:112). Spatially, archaeologists have identified the exploitation of different marine environments from littoral (Davis 2000:15) to pelagic (Harris and Drewett 1995:302; McKillop 1985; Olazagasti 1997:138). Temporally, archaeologists have identified changes in resource and subsistence practices through time (Carlson and Keegan 2004). If the environmental zones for different exploited faunal species can be identified, then this provides evidence upon which to base interpretation of island interaction in the past (Graham 2004). However, it is important to consider the spatial scale at which such studies can be conducted. The area for which data on local marine environmental zones are available defines the scale of the study. Information that is required includes bathymetric data, seabed types and sea level change. Therefore if biological approaches to studies of island interaction are to be employed, it is necessary to focus on a case study area where the retrieval of archaeological and environmental information can be gathered at a sufficient resolution.

3.I.5 Summary

Archaeological studies of island interaction are entirely reliant on the body of archaeological evidence available from the islands under investigation. Chapter 2 has highlighted how little archaeological data exists for studying the different islands in the Cuban archipelago. Therefore if island interaction is to be further investigated, archaeological fieldwork is essential to identify if there is evidence of prehistoric human activity on a selected sample of islands. The next step would then be evaluating the interaction represented.

Recent developments in landscape studies have enabled new approaches to archaeological studies of landscape. Islands, as an area of study, have benefited from developments in landscape studies despite the fact that approaches can often become polarised between hermeneutic phenomenologists and deterministic functionalists. Islands and island societies have been shown to reflect different patterns of interaction and archaeology provides an opportunity to study interaction through time. In this chapter it is argued that there are clear interpretative benefits in adopting a methodology that builds on these theoretical developments. Such a methodology will require the detailed recording of archaeological and environmental data. Archaeological evidence can be used to help reconstruct past patterns of interaction within a case study area and GIS led spatial applications can help to facilitate interpretation of the nature of this interaction.

Chapter 4

METHODOLOGY

4.I Research Methods and Execution

Introduction

In this Chapter, different archaeological research methods are evaluated, the reasons for the selection of particular methods are explained and a critical assessment is made of attempts to employ them. As discussed in the preceding chapters, my research entailed the generation of new archaeological and environmental data that could be analysed in a relational database and modelled using GIS applications. Therefore this chapter has the primary aim of outlining the research methods for data collection through archaeological survey, excavation and post-excavation analysis.

4.I.1 Research Design

When conducting primary archaeological fieldwork, it is necessary to create a research design that aims to produce carefully planned, efficiently executed and widely disseminated archaeological research. It can be argued that archaeological fieldwork is not theoretical but merely good archaeological practice that should be maintained no matter what the research framework employed (Praetzellis 2003:x). However, it is important to acknowledge a potential theoretical dichotomy between research archaeology, which employs methods to answer specific research questions (Roskams 2001:32) and professional or contract archaeology, which aims to produce a well recorded body of archaeological data in a format that is available for future interpretation by interested parties (Lucas 2001:200). Therefore in order to be explicitly clear on the framework for fieldwork conducted as part of my research, the research design will be briefly reviewed (Shafer 1997:21).

The majority of archaeological fieldwork conducted as part of this research will be carried out in areas where little or no previous archaeological research has been done before. The impact of fieldwork will be destructive, as archaeological material is studied and removed during survey and excavation. Therefore there is a responsibility to record the archaeological evidence in a methodical and detailed manner so that any future stakeholder can access a well-ordered body of data. The constraints of time, resources and personnel influence all archaeological fieldwork. Therefore acknowledging these constraints whilst bearing in mind the destructive nature of archaeology highlights the need for a fieldwork strategy that steers a course between providing a body of data to address predefined research questions as well as recording important archaeological information that could be useful for future archaeologists. Contract archaeology provides an influential model for the research design of this research with a structure well suited to fast and efficient survey, excavation and post excavation analysis and interpretation.

The collected data need to be compatible with extant data from Cuba to allow comparative analysis. Contract archaeology focuses on the methodical retrieval of archaeological data from which post fieldwork analyses and interpretations can be made (Museum of London Archaeology Service 1994; Museum of London Department of Urban Archaeology 1980). This requires a context sheet recording system that provides standardised archaeological and environmental data. This is in contrast to the fieldbook recording strategies that have traditionally been common in Cuban archaeology in the past and have restricted access to archaeological data from previous excavations.

4.I.1.i Conducting Fieldwork in Cuba

Planning archaeological fieldwork anywhere in the world poses its own unique issues that affect the planning and execution of the proposed project, and this is no different for archaeological research in Cuba. Therefore discussion of the research methods requires a brief summary of some of the political, economic and ethical issues that affect the logistics of archaeological fieldwork and influence the selection of fieldwork methods. The dependency on grant funded fieldwork places financial limitations on the scale and available time for research. The nature of current sanctions against Cuba restrict the importation of important materials for fieldwork that have to be brought in at relatively high expense and these sanctions also increase the costs of essential commodities such as paper and diesel. Between the start of fieldwork in 2003 and its completion in 2007, Cuban government taxation on all foreign currency transactions increased to 15% for dollars and credit card withdrawals and 8% for euro and sterling cash transactions. The nature of the fieldwork environment in the Jardines del Rey required the use of a diesel-fuelled boat to travel between the islands; however, due to Cuban navy regulations on boat use in Cuba, the boat had to be returned to the marina before dark each evening. When travel times to and from each island are considered, fieldwork time on each island was limited. Doctoral research, in particular full-time research funded by the research councils, is currently limited to four years in the United Kingdom. Therefore it is important that data collection strategies generate a body of relevant data that can be feasibly analysed and interpreted within this time period. Such factors are not uncommon when planning fieldwork, however, they need to be cited as a means of explaining the selection of certain research methods and focused data collection strategies. All archaeological fieldwork was conducted within the framework of the UCL code of ethics and in accordance with the Cuban Ministry of Science, Technology and Environment (CITMA) ethical policies.

4.I.1.ii Archaeological History of the Case Study Area

One of the few areas where previous archaeological research has been conducted on offshore islands in Cuba is in parts of the Sabana-Camaguey archipelago. This archipelago stretches along the north coast of Cuba from the province of Matanzas in the west to the province of Camaguey in the east (Figure 4.01). A central portion of this archipelago is known as the Jardines del Rey archipelago that includes islands in the province of Villa Clara in the west to Ciego de Avila in the east. Publications on previous work in the Jardines del Rey, by the Grupo Guama, are limited to three brief fieldwork reports published in the 1940s (Morales Patino 1946, 1947, 1948). These archaeological explorations identified evidence of indigenous activity in these islands; however, there are few details of the exact nature of these excavations or the current location of the material excavated. Further archaeological research on these islands is reported in a one page summary from the XLV Symposium of the Speleological Society of Cuba. Antonio Nuñez Jiménez led a team of archaeologists on a visit to this area to study some of the caves on the offshore islands for evidence of indigenous activity (Nuñez Jiménez, *et al.* 1985). Therefore there is limited existing archaeological evidence that can be used to study island interaction.

Thirty-five km to the east of the area where the Grupo Guama surveyed archaeological sites on offshore islands is the archaeological site of Los Buchillones. Los Buchillones is situated between the modern villages of Punta Alegre and Maximo Gomez in the province of Ciego de Avila on the north coast of central Cuba (Figure 4.02). The site appears to be a large indigenous settlement site stretching along the coast (Pendergast, *et al.* 1999). The site is first referred to by a group of archaeological enthusiasts from Moron in 1940, who collected indigenous artefacts in the area (Calvera Roses, *et al.* 2001). Wooden artefacts from the site were first recovered by Nelson Torna and Pedro Guerra during the 1980s and were brought to the attention of archaeologists working for CITMA.

Jorge Calvera and Juan Jardines directed initial excavations of the site in 1983 and 1989. These excavations uncovered evidence of ceramic and stone artefacts that indicated indigenous occupation in the area (Calvera Roses and Febles 1984). From 1990 to 1994 the site was protected by CITMA and more wooden objects washed up along the shore were collected by Nelson Rodriguez Torna and Pedro Guerra and handed over to the museum authorities in Chambas. In 1994 a multi-disciplinary scientific delegation from Canada visited the area and David Pendergast from the Royal Ontario Museum in Toronto agreed to assist in future archaeological research. Radiocarbon dates taken from some of the wooden artefacts during this visit revealed dates between the 13th and 16th centuries AD (Calvera Rosés, *et al.* 1996:66).

The Royal Ontario Museum and CITMA then carried out three separate excavations in 1997, 1998 and 1999 focusing on the wetland areas adjacent to the lagoon (Figure 4.03). These excavations uncovered the remains of household structures with evidence of thatched roofs overlaying wooden ceilings with a number of wooden artefacts in association. Excavation of deeper deposits was restricted by water seepage under the constructed dykes (Pendergast, *et al.* 2003; Pendergast, *et al.* 2002).

There is also a history of further archaeological research in the interior of the Cuban mainland within a 50km radius of Los Buchillones. Eusebio Jimenez excavated around Moron during the middle of the 19th century (Calvera Rosés, *et al.* 1996:60) and Andres Poey studied the artefacts from these excavations before presenting his findings to the American Ethnological society in New York (Hernández Godoy 2003:11). Calvera and Leloc, and members of the Grupo Caonao, have also conducted further work around Cunagua, 30km to the east of Los Buchillones. A number of these sites in the interior of the Cuban mainland indicate extensive evidence of marine resource exploitation. Calvera was aware that these marine resources came from marine environments and he conducted some research in the eastern islands of the Jardines del Rey archipelago. Calvera (Calvera Rosés 1982) identified one archaeological site on the offshore island of Cayo Guillermo. This site contained a small collection of indigenous ceramic sherds in a rockshelter on the north coast of the island. This evidence again raised the possibility of indigenous activity on the offshore islands of the Jardines del Rey but did not provide a substantive body of data with which to study such activity further.

There was no evidence of any previous archaeological research on the offshore islands directly opposite Los Buchillones between Cayo Santa Maria and in the west and Cayo Guillermo in the East and this was the area selected for focused archaeological investigation through systematic survey and excavation (Figure 4.04).

Environmental Conditions

The site of Los Buchillones is both adjacent to and partially within a large lagoon approximately 1.6km in length and 300m in width covering 26 hectares with an average depth of 50cm below msl. This lagoon is contained by a seaward spit of land of between 2 and 20m in width. There is evidence that there has been coastal erosion and environmental change in the area during the past 50 years (Peros 2000). Aerial photographs from the 1950s indicate that the coast has receded by as much as 20 metres (Pendergast pers. com.) possibly due to the construction of a causeway 16km east of Los Buchillones that connects Cayo Coco to the mainland. This rapid erosion has led to the uncovering of the archaeological remains at Los Buchillones and the continued erosion threatens their rapid destruction.

The coastal flora consists mainly of thick mangrove scrub, dominated by black mangrove (*Avicennia germinans*), with smaller amounts of red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia racemosa*), buttonwood mangrove (*Conocarpus erectus*) and sea grass (*Thalassia testudinum*). Along the coastline there is usually a small beach of between 1 and 10 meters where material eroded from the coastline is revealed. The marine and terrestrial environments of the islands in the Jardines del Rey archipelago between the site of Los Buchillones and the Bahama Channel are not well documented. There have been environmental impact assessments for hotel developments to the east of the case study area (Pascual Fraga, *et al.* 1990a), on Cayo Coco, and to the west (Pascual Fraga, *et al.* 1990b), on Cayo Santa Maria, and these provide an broad indication of the likely island environments. However, environmental data need to be collected during any archaeological survey of the islands.

Maps, as well as aerial photographs, of the case study area are politically and militarily sensitive and consequently difficult to procure. One navigational map of the case study area was given to the team by a local fisherman and this map (Instituto Cubano de Hidrografía 1996) provides the location and occasional name of some of the offshore islands as well as detailed information of the nature of the different bodies of water including bathymetric data at 25m intervals. In order to generate a better cartographic template, SRTM elevation data was downloaded from NASA and overlain on global shoreline data to produce a map of the case study area. This map did not include many of the islands and these needed to be mapped by hand during the fieldwork in order to provide their location. This map provided a template upon which archaeological and environmental data recorded during the fieldwork could then be projected.

4.I.1.iii Study Area Selection

When considering the selection of a case study area for archaeological survey, there are a number of considerations including "the information desired, the distribution of that information in space, the cost of obtaining samples and the degree of precision needed" (Read 1979:60). Therefore the size of area selected was large enough to include a representative sample of islands from the north coast of Cuba as well as a representative sample of different terrestrial and marine environments. The area selected was 200 sq. km stretching from the populated island of Cayo Santa Maria in the West to the populated island of Cayo Coco in the east, to the uninhabited island of Cayo Caiman Mata de Coco in the north to the known archaeological site of Los Buchillones on the Cuban Mainland in the south. When dealing with an area of this size, sampling is essential but the percentage of land within the case study area that is surveyed has to be sufficient to be confident that spatial patterns in the archaeological data are significant (Terrenato 2000:60). Therefore a comprehensive survey strategy is required to provide a sufficient sample of archaeological evidence should it exist.

4.I.1.iv Ethnographic Survey

Based on the adage that the best way to find archaeological sites is to ask the people who know where they are, a series of interviews were conducted with the populations of Punta Alegre and Maximo Gomez on the Cuban mainland as well as with Calvera and Leloc, the two living archaeologists with experience of working in this area. The interviews focused on discussing any known areas with archaeological evidence in the case study area. A map was used to mark any areas where interviewees had seen or knew of ceramics, wood, stone or shell artefacts had been identified.

Interviews Summary

The interviews provided circumstantial information about the location of possible evidence of past human activity in the case study area. A number of sources confirmed that ceramics and wooden artefacts had been found eroding from the shoreline between Punta Alegre and

Maximo Gomez around the known site of Los Buchillones. By contrast there was no recorded evidence for archaeological remains to the east of Maximo Gomez and only one interviewee raised the possibility of ceramics to the west of Punta Alegre. The fishermen from the Punta Alegre marina also discussed the presence of archaeological evidence on islands in the Jardines del Rey archipelago. Specific islands were referred to by a number of sources including Cayo Tomate, Cayo Guillermo, Cayo Hijo de Guillermo Este and Cayo Hijo de Guillermo Oeste. The nature of this evidence was predominantly ceramics. Calvera related his discovery of a small collection of indigenous ceramics recovered from a rock shelter on the north coast of Cayo Guillermo. This site is was recorded in the database of Cuban archaeology discussed in Chapter 2 (Febles Duenas and Martínez 1995). Although all of this evidence is based on personal experiences of often technically untrained local enthusiasts, these interviews provided anecdotal evidence of possible archaeological evidence on the coast and in the islands within the case study area.

4.I.2 Coastal Survey Pilot Study

Aims and Objectives

The three aims of the coastal survey were

1. To identify the extent of archaeological evidence for prehistoric occupation along the coastline of the Cuban mainland in the case study area, and identify the size and extent of the Los Buchillones settlement site

2. To evaluate survey methods as a pilot study for a larger survey of the Jardines del Rey island archipelago

3. To collect an assemblage of archaeological material that could be used for comparative analysis with material recovered from the survey of the Jardines del Rey archipelago

4.I.2.i Coastal Survey Methods

Different survey strategies were evaluated (Chapa Brunet, *et al.* 2003; Drewett 1999; Fink 1995; Lucas 2001; Read 1979:60), but the mangrove swamp environment restricted the survey techniques that could be employed. The survey strategy was based on identifying areas where archaeological remains were most visible. Along the shoreline, above the high tide mark, archaeological deposits are visible on the surface around the site of Los

Buchillones and this area also provided a relatively homogeneous survey tract along the length of the coast. It was decided to use the current excavation at Los Buchillones as a provisional centre point of the 'known' archaeological zone; the survey could then be conducted both east and west from this centre point. The survey area was bounded geographically by the Rio Perros delta, 4.3km to the west, and the Chicola Canal, 8.7km to the east.

Trial fieldwalking along the coast revealed that the density of visible archaeological material required some sort of sampling strategy for artefact collection. Survey squares were located at 100m intervals along the coast and all material was collected from these squares. Survey tracts between these survey squares were fieldwalked and artefacts were identified, counted and recorded but not collected. Environmental data and surface visibility within each survey square was recorded to allow statistical comparisons between squares with varying visibility. In addition, details of the weather, sea level, wind direction, coastal type, were recorded as other potential causes of statistical variation. A handheld GPS was used to record the location of each individual survey square, the GPS was always placed in the centre of the sample square to reduce error margins. Evidence of modern refuse was recorded but not collected. The survey squares were given individual unit numbers and all artefacts were double bagged with two finds labels one with the artefacts and one between the double bags. All the finds bags were stored in the Chambas Museum stores where they underwent initial processing. This initial processing included a preliminary examination of the artefact collections with Roberto Valcarcel, an authority on indigenous ceramics and with Gabino de la Rosa, an expert on colonial period ceramics. Every sample bag with indigenous artefacts was separated and an application was made to export these artefacts to the Institute of Archaeology in London for secondary processing. All of the indigenous ceramics recovered from the coastal survey were small sherds <5 cm in diameter and were heavily eroded. Each sherd was classified into rim, body and base and then inspected for any evidence of vessel shape or surface decoration. Only one sherd, from unit 3210, provided a diagnostic vessel and this was a flat griddle fragment. At the Institute of Archaeology in London the ceramics were subjected to further examination and macroscopic evidence for firing temperatures, temper and fabric were recorded. This initial study revealed that the indigenous ceramics identified were similar to indigenous ceramics described from past excavations at Los Buchillones (Mesa González, *et al.* 1994).

4.I.2.ii Coastal Survey Summary

This pilot study established a method to survey a coastline that included areas with dense mangrove vegetation. This was done by entering the mangrove at 100m intervals and surveying squares above the high tide mark. It was necessary to use intensively surveyed squares at specific distances so that vegetation cover could be cleared to provide visibility of the ground surface. Travel between these 100m survey squares often required wading around the edge of the dense mangrove vegetation and therefore it was not always possible to survey the transects between the squares. A boat was necessary to survey further along the coasts in both directions because the water levels around the mangrove were above shoulder height.

Results from the survey are discussed in Chapter 5: Survey Data and Analysis. However, there is no doubt that although environmental conditions greatly affect the visibility of the archaeological evidence, it is possible to conduct a methodical archaeological survey on islands with dense mangrove vegetation. This pilot coastal survey also permitted the further development of techniques and methodologies for subsequent surveys that included mangrove-covered islands in the Jardines del Rey archipelago.

4.I.3 Island Survey

The aims of the island survey were to:

1. Survey islands from the case study area systematically and comprehensively so that spatial patterns in the distribution of archaeological material could be studied

2. Identify and record the different environmental zones within the case study area

3. Recover a body of archaeological data with which to interpret the nature and extent of past human activity on the offshore islands

One aspect of archaeological surveys in the Caribbean is the distinctive difference in material culture between indigenous and colonial or modern deposits (Domínguez 1995). The presence of iron, glass, glazed pottery and transformation in the use of shell tools, all help to identify colonial or modern material evidence. During our survey all the recovered material was evaluated on site for diagnostic evidence of modern, colonial or indigenous association.

Evidence of modern activity was recorded but modern artefacts were not collected. All material evidence of colonial and indigenous activity was recorded and collected.

4.I.3.i Island Survey Methods

There was little or no prior environmental or geographic data for the islands in the case study area. Therefore the survey methodology required the recording of this information in parallel with the search for archaeological evidence. The survey was designed specifically to provide quantifiably comparable datasets from islands in each of the different environmental zones.

It was considered important that the survey was conducted with as much empirical control as possible in order to validate any post-survey interpretations. Control was complicated by the differing environmental conditions of the islands ranging from thick, mangrove-covered islands closer to the coast to barren, exposed limestone rock islands out in the Bahama Channel. Survey time was allocated evenly to each of the different island environments irrespective of pre-conceived ideas of where archaeological sites were most likely to be found.

Based on the need for strict empirical control and the collection of basic geographic and environmental data as well as archaeological data, it was decided to employ a systematic survey methodology that allowed for the more dynamic recording of archaeological evidence with comparable but separable datasets. The method for recording each survey square remained constant but there were three different places that the squares could be located. There were perimeter survey squares, interior survey squares and dynamic survey squares. The survey square type was recorded on the context sheet under 'type of survey square'. The need for these three different types of survey square became apparent during the pilot coastal survey and was primarily due to the different vegetation cover and resultant variation in accessibility (Cooper and Valcárcel Rojas 2004).

Therefore the survey methods involved a systematic grid of survey squares at 100m intervals over the island. The lines between each grid survey square were field walked with members of the team separating at 2m intervals where possible and surveying the ground surface. The start of the survey for each island was the perimeter of the island. A survey square was placed above the high tide mark and above any area deemed to be part of the storm wash zone. The perimeter of the island was then surveyed with squares located in the same topographic location above the high tide mark at 100m intervals around each island. A handheld GPS was used to locate each square with the distance from the high tide mark recorded on the context sheet. This survey method meant that the perimeter survey square point data could be buffered in ArcGIS in order to map the shorelines of the surveyed islands in the case study area (Figure 4.05).

Once the survey of the island perimeter had been conducted, the perimeter survey square GPS co-ordinates could be used as reference points to form a grid that enabled the systematic survey the interior of the islands. By using the 'goto' function on the GPS it was possible to fieldwalk transects between opposing perimeter survey squares at 100m intervals. Interior survey squares were placed at 100m intervals within the interior and recorded in exactly the same way as the perimeter squares (Figure 4.06).

This rigorously controlled systematic survey involved both line fieldwalking and intensively searched survey squares at 100m intervals, creating a surveyed grid of each island. However, archaeological evidence is far from predictable and additional survey squares were also used to record and map evidence of past human activity. These dynamic survey squares have exactly the same 4 square metre surface area and the same recording system. Whenever any archaeological evidence was identified during fieldwalking, dynamic survey squares were used to record and collect the archaeological evidence. In addition, these dynamic survey squares were used to map the extent of archaeological evidence. This was done by continually recording successive dynamic survey squares until the full extent of archaeological material had been recorded (Figure 4.07).

4.I.3.ii Recording Methods

Survey recording was designed around the use of a context sheet system (Museum of London Archaeology Service 1994). The same pre-printed context sheet was used for each survey square allowing for direct comparison between the different survey datasets. The term 'unit' is used in this research to describe an artificially defined area of archaeological study. Therefore each survey square represents a single unit. If evidence of past human activity was found during the survey, this would represent an archaeological context and could be spatially defined by the distribution of archaeological evidence (Museum of London Department of Urban Archaeology 1980:3). The context sheet was designed in Spanish and included categories of name of location, date, context no, site name (where relevant), type of survey square, GPS co-ordinates and metadata, vegetation, soil, geology, visibility of ground surface, weather conditions, discussion and interpretation, topography of survey square, views from survey square, similarity with other contexts, drawn record including plan no, section no, photograph no, finds recording including presence of ceramic, bone, stone, shell, wood, colonial/modern artefacts, environmental sample, whether these materials were collected and if so, how many bags, members of the survey team, checked by and date entered into computerised database (Figure 4.08).

Every survey unit was 4 sq. m and marked out using two 5m hand tapes. However, the shape of the survey unit could vary as long as the surface area remained constant, i.e. 2m x 2m or 1m x 4m. This variation in shape was necessary to adapt to the variations in island environment and local topography. Two people would closely inspect each survey square for approximately four minutes using hand-held picks to move vegetation and examine the ground surface as closely as possible without excavation. The survey square was photographed including a photo board with the island name, survey square unit number and scale. All potential material evidence for past colonial or indigenous activity was collected. In survey squares with very large accumulations of faunal remains that were identified as natural accumulations with no modified artefacts, the faunal species were identified, counted, catalogued and then left in situ. Any unidentified faunal remains would be recorded, bagged and removed for more detailed post-survey analysis in the laboratories.

The survey method was influenced by the fact that context sheet data were to be inputted into a pre-designed relational access database. Database tables for each material were also linked with each context sheet providing directly comparable data frames for relational querying. This facilitated the analysis of large amounts of data and selected queries could be projected and spatially analysed in ArcGIS. Therefore this survey methodology has been specifically designed to record a wide range of inter-disciplinary data within a robust framework that can allow for interpretation of archaeological and environmental data with spatial analysis of the results.

4.I.3.iii Survey Execution

The research team was based at the CITMA coastal ecosystem research centre or Centro de Investigaciones Ecosistemas Costeros (C.I.E.C.), on Cayo Coco. This facility provided the laboratory, library and reference collections necessary for the identification and classification of the collected flora and fauna. The CIEC speedboat was initially based at Marina Aguas Tranquilas on Cayo Coco but it was moved to Marina Darcena on Cayo Guillermo in order to facilitate quicker access to the islands within our case study area.

The team carried out four months of archaeological survey during three fieldwork seasons. Everyday the speedboat was used to transport the team as close to an unsurveyed island as possible and then the team would either walk or swim to shore with our equipment. The inaccessibility of some of the islands did not prevent any islands from being surveyed. This proved to be time consuming and dry bags were essential for transporting paper and electrical equipment to the islands. A canoe was borrowed from Marina Darcena and this was used to facilitate the survey of islands with dense mangrove vegetation where mud sediments and deep water prevented fieldwalking.

The survey team quickly increased the speed and efficiency of the survey as each member of the team became used to the new survey methods. Some of the mangrove-covered islands were impenetrable and interior survey was not possible. However, the separation of perimeter survey data-sets meant that these datasets could be directly compared. Despite the difficulty of surveying the mangrove islands, archaeological material was recovered during the survey of islands with dense mangrove vegetation indicating the survey methods were potentially effective.

A significant issue that emerged during the survey was the time wasted in travelling to and from the targeted island each day; it took on average 45mins to travel to the marina by van, 25mins to prepare the boat and secure our permission to leave from the Cuban navy, then an average of 1hr 20mins to our designated island. With the same time for the return journey, it was not unusual to spend 5 hours a day travelling to and from our designated survey area. It was not possible to secure permission from the Cuban Navy for overnight stays on the uninhabited offshore islands. Therefore it was important to carefully allocate survey time to islands in different environmental zones to provide a representative sample of islands. In total, 22 offshore islands were surveyed.

4.I.4 Excavation Methods

Aims and Objectives

The aims of the excavations carried out as part of this research were:

1) To provide a substantive body of artefacts from well defined archaeological contexts in order to interpret human activities at sites found during the survey and provide archaeological data for inter-site comparison

2) To identify and record stratigraphy that will help to identify the archaeological contexts

3) To recover contextually secure samples for radiocarbon determinations

Introduction

Guidance on excavation methods were taken from a number of key texts including (Drewett 1999; Museum of London Archaeology Service 1994; Museum of London Department of Urban Archaeology 1980; Roskams 2001) and different methods were evaluated on the basis of their effectiveness in achieving the aims outlined above. Methods were selected to maximise the retrieval of the required archaeological evidence whilst bearing in mind the time, budget and personnel available. Excavations were carefully planned in collaboration with CITMA. Different excavation strategies were employed depending on the nature of the sites found during the survey in the case study area (Downum and Burrell Brown 1998).

4.I.4.i Island Site Excavations

Sites on the offshore islands were excavated by natural stratigraphic layers where possible (Drewett 1999:93). Definition of archaeological contexts in sandy soils is often challenging because variations in soil colour, texture and consistency can be difficult to distinguish. Therefore interfaces between archaeological contexts were often distinguished based on the nature of inclusions and archaeological material. Excavations were also conducted in a two caves on the offshore islands. These caves, found during the survey, provided large quantities of well-preserved archaeological evidence within a well defined space. Open-area excavations were conducted at each cave with a $1m^2$ grid used to provide a spatial framework for recording the horizontal distribution of archaeological material in the cave. Following the open area excavation of the top stratigraphic layer of archaeological material a $1m^2$ test pit was excavated to identify further vertical sequences of archaeological contexts down to the limestone cave floor.

4.I.4.ii Los Buchillones Excavations

A wetland area at the site of Los Buchillones was excavated. A 4 sq. m grid was used to excavate this 192 sq. m excavation area, called D2-6. An important consideration that affected the methods of excavation at Los Buchillones was the difficulties of wood conservation following excavation (Grattan 1988; Van der Heide 1979). This consideration was the primary reason for focusing archaeological excavations, conducted as part of my research, offshore where it was though that fewer portable wooden artefacts would be recovered. The excavation was planned to investigate the nature of the structural wooden elements that would be uncovered, analysed on site, and then reburied in the same environment to ensure their continued preservation (Moore and Gasco 1990). The waterlogged nature of the site provided a challenging context for excavation. An area of open sea was dyked using sandbags and plastic sheeting. Each morning before dawn, the water from inside the dyke was pumped out, taking approximately 2 hours. All excavations of the sediments were conducted below the bottom of the dyke and consequently the excavated areas would fill with water overnight. Wooden posts, embedded in the seabed sediments, dominated the archaeological assemblage recovered during this excavation. The top stratigraphic layer of the deposits also contained small amounts of wood, shell and ceramic artefacts. The excavation methods employed were adapted during the excavation to focus on the recovery of archaeological material from the top stratigraphic layer and the full excavation of the wooden posts. Each $4m^2$ grid square was excavated on plan recovering archaeological material from the top stratigraphic layer and revealing the tops of wooden posts. A half-section around each post was excavated to below the base of the post following natural stratigraphic layers where identified. No post pits were identified in section. Section drawings and further photographs were taken before fully excavating and extracting the post.

The analysis of the wooden artefacts involved detailed on site recording that included an artefact reference number linked to context, location within excavation, detailed measurement of element size, study of any tool marks, discussion and interpretation, drawing and photographic record. In addition a wood sample was taken from the heartwood to help species identification and selected samples were taken from the sapwood, which included a segment of bark, for potential radiocarbon determinations.

4.1.4.iii Artefact Recovery

Wherever possible, methods for artefact recovery were consistent during all excavations in order to prevent variations in sampling bias that could undermine archaeological interpretation. All sites were hand trowelled using 3-5 inch pointing trowels with brushes used where necessary. All spoil was collected and sieved using 5mm mesh to increase small artefact retrieval. Dry sites were excavated using dry sieving and the wetland excavations used wet sieving. Soil samples were taken from excavations for the study of soils, land snails and archaeobotanic remains. As with the survey all artefacts were divided into categories of ceramic, bone, shell and stone before being bagged, labelled and taken to the CIEC laboratories for the post-fieldwork artefact analysis processes discussed above. Archaeological wood was only found during excavations at Los Buchillones. The spatial location of special finds and samples taken for radiocarbon determinations were recorded in situ before being recorded and bagged individually.

4.1.4.iv Excavation Recording

A single context sheet recording system was used during the excavation. The categories of recorded data for each archaeological context included location, date, context number, site name, context location, context type, GPS co-ordinates, context size, soil colour, soil texture, soil inclusions, method of excavation, excavation description and interpretation, plan, section and photograph reference no., archaeological materials, collected, bag no, excavation team, checked, entered into database (Figure 4.09). Levels were recorded for each context on the back of the context sheet along with a sketch plan and section showing the location of the level locations (Figure 4.10). A schematic diagram was maintained that recorded the stratigraphic sequence of the archaeological contexts during all excavations (Harris 1992).

4.1.4.v Methods for Archaeological Interpretation

Archaeological contexts were identified and recorded through archaeological survey and excavation. Archaeological materials from these contexts were studied to interpret the nature of past activity. The sequences of archaeological contexts were established and the interfaces between contexts were studied to reveal the nature of the archaeological and environmental processes involved in the creation of the stratigraphic layers. Phases of activity were interpreted from the sequence of stratigraphic layers to provide relative chronological relationships between the archaeological contexts. Samples were taken for radiocarbon dating to evaluate the validity of these relative chronological relationships and to establish relative and absolute chronologies for the activities represented in each archaeological context.

4.1.5 Methods for Identification, Classification and Analysis of Archaeological Material

Introduction

Archaeological material identified during the survey was separated into material categories and placed into labelled bags and transferred to the laboratories at CIEC. All material was then inspected for evidence of surface residues or fragility before being cleaned using a soft-brushed toothbrush. Each individual object was then photographed and analysed individually and data inputted into material specific database tables following the analysis methods outlined below.

4.I.5.i Ceramics

All ceramics found during the survey were initially analysed on site and categorised, based on visual inspection of fabric and form, into categories of modern, colonial or indigenous. The modern ceramics were recorded on site but not collected. All indigenous and colonial ceramics were recorded, collected and transported to the CIEC laboratories. Following inspection for potential painted decoration or food residues, the ceramics were cleaned shortly after recovery using a soft-brushed toothbrush.

All of the ceramic sherds were given individual artefact numbers linked to the unit from which they came. Each sherd was then analysed for details of fabric, form, decoration and surface condition. The fabric of each sherd was studied for evidence of colour, hardness, firing temperature and inclusions. The sherds were then categorised into rim, body and base to facilitate the possibility of vessel identification and reconstruction. Where there were large enough ceramic assemblages to require quantification, sherds were counted and weighed to provide numbers of individual elements (NIE) and weights (Orton, *et al.* 1993:171).

All of the ceramics found during the survey were compared with indigenous ceramics found at other archaeological sites in the wider region, based on the criteria discussed above. The majority of sherds recovered during the survey and subsequent excavations were small eroded sherds measuring less than 10cm in diameter and provided little evidence of vessel form or decoration that could facilitate inter-site comparisons.

4.I.5.ii Stone

Part of the survey methodology included recording the visible geology from each survey square. The geology was recorded in order to indicate what stone was locally available in the case study area. This data provided evidence that all of the offshore islands were universally limestone. Portable stone objects found during the survey were visually studied for geological classification and for evidence of past use by humans. The presence of rocks other than limestone indicated their transport into the case study area and therefore these were collected as potential evidence of island interaction. Stones that reflected evidence of human activity were classified based upon established Cuban stone classification methods

(Febles 1988). Traditionally in Cuba, stone artefacts are divided between *piedra tallada*, lithics, and *piedra volumen*, ground or polished stone artefacts. Three categories of archaeological evidence were identified including: A) Imported stones with no direct evidence of human modification; B) waste cores and waste flakes that reflected the process of stone artefact manufacture; C) stone artefacts with direct evidence of use by humans.

4.I.5.iii Bone

The exposed nature of many of the island environments is not conducive to the preservation of bone. Therefore the bone assemblage was limited to less than 500 number of individual elements (NIE). The bone that was recovered during survey and excavation was initially analysed on site for evidence of human modification and then collected for post-survey analysis at CIEC. The bone was carefully dry brushed in the laboratories to prevent fragmentation. Initial faunal analysis involved allocating individual reference numbers, identification of skeletal element (Crania were used to count minimum number of individuals MNI) and categorisation of the bone into categories of terrestrial mammal, marine mammal, fish, bird and reptile. The fish and bird bone were carefully bagged up separately and sent to specialist faunal analysts in La Habana. The remaining bones were further analysed for species identification.

4.I.5.iv Shell

Shell formed the largest category of material evidence used to identify past human activity on the offshore islands. Large assemblages of shell were found on a number of islands. This created the research issue of trying to identify, which accumulations of shell were formed by environmental processes such as wave action, and described in this section as natural and which accumulations of shell reflect past human activity. Three factors were used to help identify humanly created accumulations of shell: their topographic location away from high-energy seas or blow-holes, species demography that reflects human selection, and the presence of humanly modified shell or archaeological artefacts.

If any of these factors were identified following initial examination of an assemblage, then all of the shell was subjected to the same methods of analysis. During this analysis each shell was allocated an artefact number and analysed individually. Categories of data recorded for each shell included archaeological context, shell species, shell age, MNI signifier, shell part, evidence of human modification, artefact classification, artefact condition including process of manufacture, evidence of use-wear and evidence of breakage, description, interpretation and photograph (Figure 4.11).

Species Identification

All shells were identified to species and recorded. Any shells that were not clearly identifiable were compared with the reference collection at CIEC. Shells from natural deposits of accumulated shell along the coast were also identified, helping to establish a sample of known shellfish living in the case study area and a broad indication of the location of their habitats. In total 131 marine shellfish genus and species were identified during the survey providing a reference collection of known species in the case study area.

Shell Age Classification Methods

Where possible, shells were defined using one of four age categories. These determinations were based on the size of the shell and defining characteristics specific to individual species such as the presence or absence of a flaring lip for the *Strombus gigas*. The basis for these age categories were species specific and based on measurements of shell size and thickness (Claassen 1998:25). The four age categories are younger juvenile (juvenile 1), older juvenile (juvenile 2), mature adult (adult 1) and senile adult (adult 2).

Shell Counting

In order to compare shell data between different archaeological assemblages, a systematic method of counting and quantifying the shells is required. Each collected shell, or shell fragment, represented an individual shell element that could be used to count the number of individual elements (NIE). A problem that can arise from comparisons between NIE counts is that fractured shells can distort the faunal analysis. Therefore a count of the minimum number of individuals (MNI) is useful to identify this potential bias. A number of methods for counting the minimum number of individuals were evaluated including only counting shells with greater than 50% body size and reconstructing fractured shells to do this. However, it was decided to count the MNI by identifying a single shell element that would be counted to represent the MNI. Gastropods with a complete apex were used to represent one individual. Valves with intact umbos were recorded and two valves of the same species with intact umbos were counted as one individual. This provided a method to quantify shell assemblages by using either NIE or MNI.

Shell Artefacts

Shell artefacts are defined in this research as shells with diagnostic physical evidence of human modification. Faunal remains that reflect human exploitation and food processing are sometimes termed 'ecofacts', this is a useful term that can be used to help classify the archaeological assemblage on sites with large quantities of faunal evidence. However, the term has not been used during this project because faunal exploitation is an important focus of the research and does not require separation to aid site interpretation, and it is also a term not readily used in Cuban archaeology. The most common shell artefact found during the survey were shells with butchery marks made during the process of animal extraction. The most common of these butchery marks is a perforation in the spire that enables the extraction of the shellfish animal from gastropods such as *Strombus gigas* and *Cittarium pica.* The spire perforation is a well known diagnostic mark identified at a number of archaeological sites throughout the Caribbean, including by Watters (Watters, *et al.* 1991) who noted "the punched-hole technique left a very distinctive hole in the apex of the *Strombus gigas* shell as clear evidence of human exploitation. The hole facilitated extraction of the animal from its shell" (Ibid: 33). Some archaeologists have raised the possibility that occasionally perforations in shells are naturally created through taphonomic processes such as wave action. Examples of shells with perforations that might have been created by natural processes are illustrated in Figure 4.12.

Detailed studies of the different types of spire perforation in shells found during the survey suggested that it was possible to differentiate between cultural and natural perforations. One type of perforation dominated the shell assemblages. This perforation type was a single circular hole between 15-25 mm located in the spire of gastropods between two axial ribs (Claassen 1998:19). Typologically similar perforations were found in 184 gastropods during the survey. Although this butchery technique indicates human activity it is not necessarily possible to conclude that this is evidence of indigenous activity as opposed to colonial or modern shell animal exploitation. In the absence of alternative artefactual evidence, diagnostic differences in butchery marks between indigenous and modern or colonial shells were studied. The indigenous technique appears to be typologically consistent with using a sharp point to create a circular perforation (Figure 4.13). Modern and colonial artefacts appear to have a different technique that uses a linear tool such as a machete or cutlass in order to make a linear incision. This linear cut for modern *Strombus gigas* exploitation has also been noted elsewhere in the Caribbean such as the Caicos by Doran (Doran 1958:395). A modern *Strombus gigas* with a linear cut is illustrated in Figure 4.14.

The majority of shells with circular spire perforations were found in archaeological contexts with other artefacts that indicated indigenous activity. No shells with linear cut perforations were found in association with archaeological evidence of indigenous activity. However, the use of shells with circular spire perforations as an indication of indigenous human activity was a hypothesis that arose during the development of the research methods. This hypothesis was tested through the radiocarbon dating of shells with circular spire perforations taken from shell assemblages on the islands sites and is discussed in Chapter 7.

Shell Artefact Typologies and Classification Methods

There have been a number of detailed studies of shell artefacts in Cuba (Dacal Moure 1978; Izquierdo Diaz and Rives Pantoja 1993; Izquierdo Diaz and Sampedro Hernández 2002; Rodriguez 1981). The identification and classification of shell artefacts in this study have been adapted from the shell artefact typologies used in these studies. An advantage of using a common shell artefact classification method, is that it facilitates the comparison between shell artefact assemblages found during this research with shell artefacts found in the wider region (Angelbello Izquierdo, *et al.* 2002; Febles Duenas 1994; Godo Torres 1994; Jardines Macias and Guarch Rodríguez 1996; Trapero Pastor 1999). As noted by Febles and Gonzalez during their study of shell artefacts from the site of Maruca in Puerto Rico (Febles and González 1999:54), relating Cuban shell tools typologies with wider international shell tool classifications and terminologies represents a further challenge that must be overcome before studies of wider international prehistoric island interaction can be identified (Florida Museum of Natural History 2005; Morales Patino 1950). The categories adopted for classifying the shells found during this research are listed in Table 4.01.

In addition to the artefact classification there were some artefacts that could be further sub-classified based on typological characteristics. To date there have been very few studies that have provided cultural or chronological classifications for different shell artefact typologies in Cuba. Many shell artefacts are considered to have been used without significant change in form or function from early archaic times associated with the type site of Guayabo Blanco up until the contact period, with sites such as Los Buchillones (Dacal Moure 1978; Izquierdo Diaz and Rives Pantoja 1993). However, some shell artefacts provide a more refined cultural and chronological association. It is considered that shell ornaments such as carved shell inlays for wooden figurines, elaborately carved shell pendants and *Guayzas* carved shell masks, are associated with agricultural societies dated to between AD 900 and 1500 based on the Guarch framework discussed in Chapter 2 (Guarch Delmonte, *et al.* 1995).

Table 4.01 Artefact classifications based on existing Cuban shell artefact typologies

Artefact Type	**Artefact Tipo**	**Artefact Type**	**Artefact Tipo**
Axe-head	*Hacha*	Pendant	*Colgante*
Bead	*Cuenta*	Perforator	*Perforador*
Bell/trumpet	*Botuto*	Plate	*Plato*
Carved eye	*Ojo de idolo*	Point	*Punta*
Carved fragment	*Caratona*	Scraper	*Raspador*
Carved teeth	*Carved teeth*	Spatula	*Espatula*
Figurine	*Idolo*	Spoon	*Cuchara*
Net weight	*Peso de pescar*	Unidentifiable fragment	*Fragmento sin identificacion*
Fishhook	*Anzuelo*	Unidentified	*Sin identificacion*
Gouge	*Gubia*	Vessel	*Vasija*
Hammer	*Martillo*	Waste core	*Cuerpo de trabajo*
Hand pick	*Pico de mano*	Waste flake	*Fragmento de trabajo*
Knife	*Cuchillo*	Mallet	*Maza*

There has also been some discussion of changes in *gubia*-shell gouge typology through time with a predominance of simple *gubias* in early populations and *gubias* with polished sides more common in later periods as mentioned by Izquierdo Diaz and Sampedro Hernández:

> "in the preagricultural groups, the predominant gubia type that constitutes the material culture are the typical gubias..... These gubias are generally large with a large number of cracks and fractures on the cutting edge, these gubias have the apex intact and without doubt indicate a prolonged use" (Izquierdo Diaz and Sampedro Hernández 2002:75)

Therefore further typological classifications were made of shell artefacts with the potential for changes in form through time. These further classifications for shell points and *gubias* are detailed in Table 4.02.

Table 4.02 Refined artefact typologies for shell gouges and shell points

Nombre	**Name**	**Nombre**	**Name**
Gubia tipica	Typical gouge	*Punta de penetracion con parte del canal basal*	Penetration point with part of base
Gubia con paredes alisadas	Gouge with polished sides	*Punta de penetracion con parte de la sutura*	Penetration point with part of the suture
Gubia sin apice	Gouge without apex	*Punta de doble fractura*	Point with double fracture
Gubia modificada	Gouge with modification	*Punta intermedia*	Intermediate point
Gubia de dedo	Gouge finger thin	*Punta de impacto*	Impact point
Gubia en proceso de elaboracion	Gouge in process of manufacture	*Punta triangular de penetracion*	Triangular penetration point
		Punta de penetracion	Penetration point

4.1.6 Summary

This chapter has outlined the research design for archaeological fieldwork. The selection of methods has been governed by the primary aim of generating archaeological data with which to address the research questions outlined in Chapter 2. The survey data will be considered in detail in the next chapter.

Chapter 5

SURVEY DATA COLLECTION AND ANALYSIS

Introduction

Following the completion of the survey, the data were organised and transferred into a relational database. The structure of the database was based upon the context sheets, with separate tables created from each of the recorded data categories. The analysis of the survey data had two primary aims:

1. To characterise the nature and location of different environments within the case study area

2. To identify the range of archaeological evidence for past human activity within the case study area

5.I Environmental Data

Limited environmental data were available for the Cuban mainland, Cayo Santa Maria and Cayo Coco and no existing data was available for the offshore islands on which 85% of the survey was conducted. The surveyed islands varied in size and environment but they were all subjected to the same methods of recording categories of environmental data including soils/geology, topography, flora and fauna.

5.I.1 Soils and Geology

General soil maps for the Cuban mainland are available at 1:250000, based on the soil surveys conducted collaboratively between the Cuban Academy of Science and the Chinese Science Ministry (Chi Kuo, *et al.* 1990). This previous study identifies vertisols, or soils with clayey profiles capable of sustaining intensive agriculture in the area around Punta Alegre and Maximo Gomez. This map also helps to identify the soils of the wider Ciego de Avila province of the Cuban mainland, but there are no data for any of the offshore islands. During the archaeological survey, the ground surface of each survey square was examined for evidence of geology and soil types. This helped to build a detailed understanding of the geology and soil conditions on individual islands as well as to aid in identifying broader patterns within the case study area. The surveyed islands all have limestone parent material and there was no evidence of any other naturally occurring stone within the case study area. The limestone bedrock is overlain in places with a variety of soils forming different environmental zones.. The soils were classified using the United States soil taxonomy guide based on the soil surveys by the U.S. Department of Agriculture and detailed in their online soil classification database (US 2006). The soils on many of the offshore islands can be classified as entisols as "these soils can be penetrated by roots and show some mineral weathering and surface accumulation of organic matter, but the original crystalline, metamorphic, and sedimentary features of their parent materials remain little altered by soil formation" (Retallack 1990:107). This is certainly the case in the northerly islands where the soils and surveyed surfaces vary little owing to common parent materials of limestone, quartz sand and surface accumulations of organic matter. Histosols are also found in the case study area. Histosols are organic-rich soils with thick peaty horizons that have formed in the low-lying, permanently waterlogged parts of the southerly islands and Cuban mainland. In these areas, the underlying sediments or rock have not been affected by weathering and the histosols often maintain the structure of the parent materials with occasional leaching or formation of gley minerals such as pyrite or siderite (Retallack 1990:108). These soils are found in the wetland areas of Los Buchillones and are discussed in more detail in Chapter 6, following the account of the excavations at the site. The vertisol soils identified on the soil maps of the Cuban-Chinese survey were identified on the Cuban mainland in localities set back from the shoreline in the dry land areas of Los Buchillones. Following the survey of the case study area, categories of these surface geologies and soils were identified and summarised to facilitate the reconstruction of the environmental context within the case study area. These categories included: angular limestone, broken limestone, smooth limestone, quartz sandy limestone, sand, cave earths (entisols), peaty soils (histosols) and clayey soils (vertisols).

Angular Limestone

The limestone exposed to weathering on the islands becomes very angular and sharp, hence its local name of *diente del perro* or dog's teeth. This surface geology is most commonly found in the northerly windward islands of the case study area and this surface can be difficult to walk over without thick rubber-soled shoes (Figure 5.01).

Broken Limestone

This category comprises large areas of limestone that have cracked and broken up over time to form large boulders that are unstable and can vary in size up to 5m in diameter. This broken limestone surface is mainly found in the central areas of the windward islands that have higher limestone outcrops above 4m, such as Cayo Caiman de la Sardina, Cayo Caiman de la Bella and Cayo Hijo de Guillermo Este (Figure 5.02).

Smooth Limestone

Smooth, unbroken limestone bedrock is visible in areas that have been exposed to less erosion. It is characteristic of the southerly, leeward areas of the case study area where it is found in association with a variety of different environmental habitats (Figure 5.03).

Sand

Quartz sand dominates the sediments of the windward islands in the case study area. It often forms dunes and the sand dunes of northern Cayo Guillermo are renowned as among the largest in Cuba (Pascual Fraga, *et al.* 1990). The distribution of survey squares with quartz sand are illustrated in Figure 5.04.

Sandy Limestone

Survey squares where combinations of sand and exposed limestone are found were categorised as Sandy Limestone. Sandy limestone is common in transitional areas between environmental zones and is often associated with a change in vegetation (Figure 5.05).

Peaty Mangrove Soils

Mangrove environments dominate the leeward areas of the case study area. Mangrove is an environment in flux; it blurs the island boundary as the mangrove grows out into the water generating organic-rich soils. The location of peaty soils in the case study area is associated with mangrove environments. Peaty soils occur on the southern shores of the intermediate islands, such as Cayo Langosta and Cayo Flores, and are widely distributed on the leeward islands in the Bahia de Buena Vista such as Cayo Jutia and Cayo Pilon as well as along the coastline of the Cuban mainland (Figure 5.06).

Clay Soils

Clay soils were identified in one survey square 3089 adjacent to the dry land site of Los Buchillones. No clay soils were identified during the survey of the offshore islands. This indicates that closest source of clay for ceramic production is on the Cuban mainland (Chi Kuo, *et al.* 1990).

Cave Earths

The caves found during the survey have a calcareous soil that is the product of cave vegetation and fauna. These sandy grey brown loams were identified in three caves on Cayo Hijo de Guillermo Este (Figure 5.07).

Fresh Water

There are a number of fresh water sources on the Cuban mainland, with two springs close to the site of Los Buchillones. No springs, streams, lakes or *cacimbas* (brackish saltwater lagoons that can occasionally provide potable water) were found on any of the offshore islands in the case study area. The only exposed potential sources of drinking water came from rain-filled *pozos* or rock hollows that form in the weathered limestone. On Cayo Hijo de Guillermo Este, one large rock hollow was found measuring 78 cm by 52 cm and contained 38cm of rain water. There was evidence that this rock hollow had been covered with large flat stones over more than 70% of the natural aperture, possibly in order to prevent evaporation of the fresh water. However, no sustainable sources of water were found on the offshore islands during the survey that could have supported long-term human occupation.

5.I.1.i Summary

There are patterns in the distribution of soils and surface geology within the case study area. The windward islands closest to the Bahama Channel, including Cayo Caiman Mata de Coco, Cayo Caiman de la Bella, Cayo Caimancito, Cayo Caiman de la Sardina, Cayo Hijo de Guillermo Este and Oeste, Cayo Felipe Este and Oeste, Cayo Media Luna, Cayo la Jaula, and Cayo Los Peros, all have comparatively high angular, bouldered and smooth limestone outcrops rising to 5m in height with sand and sandy limestone soils. There is then a belt of intermediate islands that have exposed smooth limestone outcrops with sandy and sandy limestone soils in the northern and eastern areas of each island; but these islands also have sandy and peaty soils of the mangrove environments on the leeward southern and western areas of the island. These intermediate islands comprise Cayo Flores, Cayo Guillermo, Hijo de Guillermo Sur, Cayo Contrabando and Cayo Langosta. Then there are the leeward islands closer to the Bahia de Buena Vista, including Cayo Cubera, Cayo Latetona, Cayo Palomo, Cayo La Cascara, Cayo Mortero, Cayo Tomate, Cayo Pilon, Cayo Jutia, and Cayo

Bolo, that are predominantly peaty soils with the occasional sandy section or very small limestone outcrop. The Cuban mainland has developed soils and a more complex underlying geology than the islands. The area around Los Buchillones has sandy, peaty and clayey soils along the coastline.

5.I.2 Flora

The vegetation in each survey square was recorded and samples of unidentified species were taken for post-survey identification. These species were identified using the reference collection in the coastal ecology research centre on Cayo Coco (CIEC) with the assistance of Pedro González Gutiérrez. Patterns in the vegetation ecology were identified with particular species found growing together creating categories of different habitats (Bisse 1988:10; Del Risco Rodríguez 1999; Leiva Sánchez 1999). The vegetation was classified into six broad categories in order to facilitate interpretation and map the environment of the case study area. These categories were grass, grassy brush, brush, scrub, cave vegetation, and mangrove (Figure 5.08).

Grasses

A number of grassy areas are located in the case study area, dominated by *Pancratium arenicolum* with smaller amounts of *Manisuris loricata*, *Sporobolus* sp. and *Chamaesyce buxifolia.* These grasses provided dense coverage and limited the visibility of the ground surface. Survey squares with dense grass required longer periods of time to survey because the grass had to be pulled aside carefully to reveal the ground surface beneath.

Grassy Brush

Grassy brush vegetation is associated with mixed sandy deposits and smaller amounts of grass such as *Pancratium arenicolum*, *Manisuris loricata*, *Chamaesyce buxifolia*, *Sporobolus* sp. and *Sesuvium portacastrum* (sea purslane) interspersed with *Suriana maritime* (bay cedar), *Ximenia Americana* (beach plum), coastal searocket-*Cakile lanceolata*, saltwort-*Batis maritima* and railroad vine-*Ipomoea pes-caprae.* These areas of sparser vegetation were easier to survey as fieldwalking was possible and surface visibility was high.

Scrub

The rocky areas were unsurprisingly much sparser in vegetation; however the buttonwood mangrove-*Conocarpus erecta* and occasional *Nephrolepis* sp. (sword fern) are able to grow in these rocky conditions. The lack of nutrients and lack of protection from the elements affects the size and shape of much of this scrub vegetation.

Brush

The most common category of vegetation is in the transitional zone between the sand dunes and the exposed areas of barren limestone. In these sandy, rocky areas there is diverse vegetation with larger *Cornucarpus erectus* (buttonwood mangrove) as well as *Sesuvium portacastrum* (sea purslane), *Batis maritime* (saltwort), *Coccoloba uvifera* (sea grape) as well as the grasses *Manisuris loricata*, *Pancratium arenicolum*, *Chamaesyce buxifolia* and *Sporobolus* sp.

Mangrove

This mangrove category describes the wetland mangrove vegetation that dominates the coastline of the Cuban mainland. This vegetation is predominantly *Rhizophora mangle* (red mangrove) with smaller amounts of *Avicennia germinans* (black mangrove) , white mangrove-*Laguncularia racemosa* (white mangrove), *Cornucarpus erectus* (buttonwood mangrove) with *Thalassia testudinum* (turtle grass) woven within the mangrove root systems. The dense mangrove vegetation means it is not always easy to determine whether some of the mangrove-covered islands are formed around permanent limestone outcrops or around more transitory sediments formed in the shallow waters of the Bahia de Buena Vista.

Cave Vegetation

Vegetation found in the caves on Cayo Hijo de Guillermo Este included *Nephrolepis* sp. (Sword Fern).

5.I.3 Fauna

There are a number of important studies that provide regional data of terrestrial and marine fauna found in the Caribbean at different times in the region's past. (Carlson and Keegan 2004; Claro, *et al.* 2001; Lopez, *et al.* 1988; Newsom and Wing 2004). Existing studies of Cuban fauna provide details of the known fauna in Cuba, and the environmental impact assessment for the tourist development of the larger islands of Cayo Guillermo, Cayo Coco and Cayo Santa Maria provides some details of the fauna found on the larger islands (Pascual Fraga, *et al.* 1990). However there were no pre-existing data for the specific fauna of the case study area and in particular for the smaller islands and marine environments within the case study area. Establishing the known habitats of different species in the present can assist in establishing which environmental zones were being exploited in the past.

5.I.3.i Terrestrial mammals

Capromys pilorides (Jutias) are found throughout Cuba today and living examples were observed on Cayo Cubera and Cayo La Cascara during the survey. Jutia are hunted and eaten in the present day and therefore evidence for indigenous exploitation of jutia can only be drawn from the archaeological context in which the faunal remains are found. Other terrestrial animals that were observed in the case study area, but are associated with modern human activity, include *Bos taurus* (cow), *Equus caballus* (horse), *Ovis aries* (sheep), *Capra hircus* (goat), *Sus scrofa* (pig), *Felis catus* (cat), *Gallus domesticus* (chicken), *Rattus norvegicus* (rat). All of these are Old World species introduced into Cuba after 1492 (Cunningham 1997) and therefore are easy to distinguish from any potentially prehistoric faunal assemblages. *Canis familiaris* (dog) is known to have lived in the Americas for over 10,000 years (Baus de Czitrom 1988) and in the Caribbean before Columbus (Wilson 1997:17). Although this dog is taxonomically similar to its modern-day old world relatives, it is possible to identify pre-Columbian dogs through their diagnostic dentition and skeletal remains (Wing 1998).

Birds

The islands of the Jardines del Rey archipelago are renowned as a protected habitat for a diverse range of birds. Many of these birds, such as *Phoeniconais ruber ruber* (flamingo), are seasonal birds migrating to Cuba during the winter months. It is evident from past faunal studies (Córdova Medina, *et al.* 1997:80) and iconography (Guarch Delmonte and Querejeta Barceló 1993:14) that these birds were present in prehistoric times, although the existence of particular species within the case study area at any given time in the past would be dependent on whether climatic fluctuations were within the tolerance levels of these species (Garrido and Kirkconnell 2000). The remains of three *Limnothlypis swainsonii* (Swainson's Warblers) were found during the survey west of Punta Alegre. These birds had been recently shot and eaten by local residents.

Invertebrates

Cerion chrysalis (Peanut Shell) was identified during the survey of the islands. Living examples of this landsnail are found on all the islands with grassy and grassy-brush vegetation. *Coenobita clypeatus* (Caribbean hermit crab) occur throughout the sheltered coastal habitats of Cuba. Living examples were observed in Cave 1 and Cave 3 on Cayo Hijo de Guillermo

Este and remains of them were identified in survey square 4001 (2 NIE, 1MNI) outside Cave 3 on the same island. A brief discussion of the habits of the hermit crab is required as potentially they can disturb archaeological deposits and affect artefact distribution (Lundberg 1985:212). *Coenobita clypeatus* prefers to occupy empty gastropod shells with a circular aperture measuring from 1cm to 5cm in diameter. Apart from the shell that they inhabit, they are unlikely to move anything but the lightest objects, such as leaves and twigs, horizontally across an open surface. The crab changes shells as it grows in size and this can lead to the translocation of whole shells. Hermit crabs are known to avoid using shells with any perforations in the body or spire, reducing the chances of shells with circular spire perforations being moved. The Caribbean hermit crabs burrow up to 50cm into loose soil when they are ready to molt and they can remain underground for a month or more. They do not take their adopted shell with them during this period. This burrowing action can affect the vertical distribution of small artefacts, which fall into the holes created by the hermit crab (Serrand and Bonnissent 2005:30). Caribbean hermit crabs are, therefore, likely to redistribute whole shells with circular apertures less than 5cm horizontally across the ground surface and they can also affect the vertical location of small objects in the stratigraphy of loose soil deposits (Claassen 1998:79).

5.I.3.ii Coastal Environments as Animal Habitats

The coastal zone is the known habitat for a number of animal species found in archaeological contexts during the survey. Therefore identifying different coastal habitats in the case study area is an essential aid to identifying potential patterns in the past human exploitation of coastal zones. The nature of the different coastal environments within the case study area is provided by the paleopedological, geological, botanical, topographic and descriptive data recorded during the perimeter survey of the islands. Detailed environmental data for the shoreline of each individual island can be reproduced using these data (Figure 5.09). Therefore the coastal zones of each island can be categorised in more detail when specific habitat data for individual species are required.

Bathymetric data can be used to reveal marine topography and this is useful in understanding and mapping the different submarine environments in the case study area. The Bahia de Buena Vista is relatively shallow (<5m) with low to medium energy seas that allow muddy sea-bed sediments with dense sea grass beds to grow relatively undisturbed. The intermediate areas of the case study area have sea depths <8m, with medium energy seas. In this area sandy seabeds dominate with sea grass only growing in certain shallow areas close to the islands. The clearest topographic marine feature in the case study area is the submerged reef that runs east-west along the northern edge of the windward islands. The reef is marked by a dramatic change in sea depth from <8m to depths >50m. Beyond the reef, the Bahama Channel has a width of over 100km between northern Cuba and the Bahamas. The body of water that makes up the Bahama Channel descends to depths of over 500m and this body of open water is identified as pelagic. Therefore five broad categories of marine environment can be categorised in the case study area based on the survey and bathymetric data.

1. The coastal environment including all variations in shoreline type.

2. The soft-bottomed sea grass shallows of the Bahia de Buena Vista, <5m in depth.

3. The sandy-bottomed shallow waters of the intermediate islands between 3 and 8m in depth.

4. The sandy and rocky reef to the north of the windward islands between 8 and >50m in depth.

5. The pelagic waters of the Bahama Channel with depths up to 523m.

5.I.3.iii Marine Fauna

Dolphins, Manatee and Sharks

Tursiops truncatus (bottle nosed dolphins) and *Carcharhinus melanopterus* (reef sharks) were seen during the survey in the sea north of Cayo Guillermo and to the west of Cayo Media Luna. Both these species are found in the deeper waters around the reef and in the pelagic waters of the Bahama Channel. These animals are known to be seasonal in their frequency in the area (Sutty 1995:368). There was ethnographic evidence for *Trichechus manatus* (manatee) in the shallower waters of the Bahía de Buena Vista. Dolphin, shark and manatee faunal remains were found during the excavation of Los Buchillones (Rosario Pérez Iglesias, *et al.* 2003).

Turtles

Turtles that frequent the case study area, based on the ethnographic survey, include *Caretta caretta* (loggerhead turtle), *Chelonia mydas* (green turtle), *Eretmochelys imbricata* (hawksbill turtle), *Lepidochelys kempii* (Kemp's ridley turtle), *Lepidochelys olivacea* (olive Ridley turtle) and

Dermochelys coriacea (leatherback turtle) (Pascual Fraga, *et al.* 1990). A hawksbill turtle was seen during the survey in the water close to Cayo Langosta. Turtles are particularly common in the summer months between June and September when female turtles come on land to lay eggs. Turtles move through all of the marine environments in the case study area and also come up onto the sandy shores during their egg-laying season. Turtle bone was found in three survey squares on Cayo Hijo de Guillermo Este.

Fish

Interviews with fishermen conducted in Punta Alegre, in addition to the environmental impact assessment for Cayo Santa Maria (Pascual Fraga, *et al.* 1990), helped to establish a list of fish known to be found in the case study area. Each of the fish species has its known marine habitat preferences detailed so that patterns in selected species and their potential fishing locations might be identified from archaeological assemblages (Claro, *et al.* 2001; Delgado 2004; Randall 1983). These fish are listed in Table 5.01.

Table 5.01 List of fish species and the habitats they are known to inhabit in the case study area

Species	**Common name**	**Nombre vulgar**	**Known Habitats**
Albula vulpes	Bonefish	Macabi	Bahia de buena vista
Canthigaster rostratus	Sharpnose puffer	Botete dorado	Common reef fish that also migrates into seagrass beds for foraging
Caranx bartolomaei	Yellow jack	Cibí Amarillo	Pelagic waters and clear deeper waters but they may enter reef systems for foraging
Caranx latus	Horse-eye trevally	Gallego	Pelagic waters and clear deeper waters but they may enter reef systems for foraging
Caranx lugubris	Black jack	Tinosa	Pelagic waters and clear deeper waters but they may enter reef systems for foraging
Chilomycterus spp.	Porcupinefishes and burrfishes	Erizo	Reef-associated, depth range 20 – 100 m
Coryphaena hippurus	Dolphinfish	Dorado	Pelagic waters
Diodon spp.	Porcupinefishes and burrfishes	Puerco espina	Reef-associated, depth range 20 – 100 m
Halieutichthys aculeatus	Batfish	Diablo	Shallow waters
Jenkinsia lamprotenia	Dwarf herring	Marifria	Bahia de buena vista
Katsuwonus	Skipjack tuna	Bonito	Bahia de buena vista

pelamis			
Lagocephalus laevigatus	Puffer	Botete	Turbid brackish waters and even in fresh water at times
Lutjanus analis	Mutton snapper	Pargo criollo	Reef and pelagic waters.
Lutjanus cyanopterus	Cubera snapper	Cubera	Shallow waters, reefs and pelagic waters
Lutjanus jocú	Dog snapper	Jucu	Young found within in-shore and brackish waters, adults found close to reef environment
Lutjanus synagris	Lane snapper	Biajaiba	Bahia de Buena Vista, most prevalent May and June
Makaira nigricans	Blue marlin	Castero	Pelagic waters
Megalops atlanticus	Tarpon / king fish	Sábalo	Are primarily found in coastal waters, bays, estuaries, and mangrove-lined lagoons within tropical, subtropical, and temperate climates
Mugil liza	Mullet	Lisa	Inhabits coastal marine waters and brackish estuaries, also found in hyper-saline lagoons
Mugil trichodon	Mullet	Liseta	Inhabits coastal marine waters and brackish estuaries, also found in hyper-saline lagoons
Mycteroperca bonaci	Black grouper	Aguaji	Reef and pelagic waters
Mycteroperca interstitialis	Yellowmouth grouper	Ojanco	Reef-associated; marine; depth range 2 – 150 m
Mycteroperca rubra	Comb grouper	Bonaci cardenal	Reef and pelagic waters
Mycteroperca tigris	Tiger grouper	Bonaci gato	Reef and pelagic waters
Rypticus bistrispinus	Soapfish	Jabon	Reefs
Rypticus randalli	Soapfish	Soapfish	Reefs
Rypticus saponaceus	Soapfish	Jabon	Reefs
Rypticus subbifrenmatus	Soapfish	Jabon	Reefs
Seriola spp.	Jacks	Coronado	Reef-associated, depth range 1 – 360 m
Sphoeroides spp.	Pufferfish	Tamboril	Shallow waters and reefs
Sphyraena barracuda	Barracuda	Picua	Commonly occur in nearshore coral reefs, seagrasses, and mangroves. They may also

			reside in the open ocean, living predominantly at or near the surface, although they are at times found at depths to 325 feet
Tetrapturus albidus	White marlin	Aguja	Pelagic waters
Thunnini sp.	Tuna	Atun	Pelagic waters
Thunnus alalunga	Tuna	Albacora	Bahia de buena vista
Thunnus atlanticus	Blackfin tuna	Albacora	Bahia de buena vista
Xiphias gladius	Swordfish	Emperador	Pelagic waters

Marine invertebrates

Panuliris argus (Spiny Lobster) is found in the case study area. Walking along the seabed they are most vulnerable to fishing/capture in areas where the seabed is visible through clear relatively shallow waters. These lobsters are known to inhabit the reef and enter the Bahama Channel and can be found at depths of up to 90m (Claro, *et al.* 2001:350). However, fishermen currently focus their attention around the edges of the mangrove vegetation in the intermediate areas where the lobsters are visible and can be speared with a sharpened stick or harpoon. The shell of the lobster is perishable and does not preserve well in archaeological deposits (Colin 1988). Therefore the potential for identifying indigenous exploitation of *P. argus* through their remains is limited.

Coral

A submerged reef stretches along the edge of the Bahama Channel to the north of the windward islands in the case study area. This reef provides a rich and diverse habitat for a number of different coral species from the hexacorallia subclass. One coral species that was found during the survey was *Acropora cervicornis* (Staghorn Coral). *Acropora cervicornis* is found clustered in tight clumps most commonly between 12-22m below mean sea level (bmsl) (Colin 1988:223). This coral can grow in shallower conditions in protected areas without high wave energies but is more likely to grow at deeper depths in areas with high wave energies such as the reef on the edge of the Bahama Channel in the case study area. Dead *A. cervicornis* branches from the reef are washed up on the northerly shores of the windward islands. *A. cervicornis* was found in one survey square on Cayo Felipe Este.

Marine Molluscs

One hundred and twenty two species of marine shell, collected during the survey from the shorelines in the case study area, were identified using reference collections at CIEC and reference books (Claassen 1998; Humann 1994; Leal 2005a, 2005b; Tucker Abbott 1974) and the reference collections at the coastal ecology research centre on Cayo Coco. We also noted their habitat preferences so patterns in any past human exploitation of shellfish could be identified (Read 1964; Schmidt, *et al.* 2002; Tucker Abbott 1974). Listed in Table 5.02 are the shellfish species found during the survey that had direct evidence of human modification.

Table 5.02 Shell species found during the survey that had direct evidence of human modification and the marine habitats from where they came

Species	**Common Name**	**Nombre Vulgar**	**Habitat**
Cittarium pica	West Indian topshell	Sigua	Rock dwelling shell found in inter-tidal zones
Codakia orbicularis	Tiger lucine	Lucina tigre americana	Sandy bottoms offshore at subtidal depths.
Fasciolaria tulipa	True tulip	Tulipán verdadero	On seagrass bottoms and sandy flats between 0-15m.
Oliva reticularis	Netted olive	Oliva	Inhabits sandy areas near back reefs, found partially buried in sand 2-10m.
Strombus costatus	Milk conch	Cobo lechoso	In shallow subtidal water up to 2-8m in depth
Strombus gigas	Queen conch	Cobo rosado	Lives on sand near seagrass beds or back reefs, between depths of 3 and 15 m. Depth of habitat increases with age.
Tellina laevigata	Smooth telling	Telina lisa	Sandy bottoms, in shallow water 2-8m.
Xancus angulatus	West Indian chank	Chanque antillano.	In subtidal water between 3-18m in depth

It should be noted that there is one marine shell species, *Strombus pugilis*, which is not present in the case study area. The distribution of this shellfish appears to be limited to the provinces of La Habana, Matanzas, Villa Clara and Santiago de Cuba (Malacalog Website 2007). Marine shell forms the largest category of archaeological evidence for past human activity found during the survey.

5.II Archaeological Data

Introduction

Once all the archaeological data had been collated and inserted into a relational database it could be spatially projected in GIS. This enabled the spatial patterning of the archaeological evidence to be modelled and for areas of indigenous island activity to be identified and classified into sites based on the identified artefact distributions. In some cases the survey squares where archaeological material was found were not juxtaposed and therefore associations between artefact assemblages in close proximity were made based upon similarities in artefact typology and local topography.

The boundaries of each surveyed island were created in the GIS by digitising the perimeter survey squares and then buffering the boundary by the number of metres in from the high tide mark recorded in the topography section on each context sheet. It was then possible to calculate the surface area of each island using VBE coding in arcGIS (Conolly and Lake 2006). All of the survey squares could then be plotted on these island maps in arcGIS (Chapa Brunet, *et al.* 2003:11). The artefact assemblages could then be compared and related to their environmental contexts. Establishing site boundaries is an important basic requirement for inter-site comparisons, modelling and analysis within GIS. Initial boundaries were created for potential sites based upon the distribution of identified archaeological material. As more data were generated during the course of the research and following excavation then these site boundaries were open to modification.

5.II.1 Cuban Mainland

During the survey of 10km of coastline on the Cuban mainland, evidence of indigenous activity, based upon the criteria discussed in Chapter 4, was found in 31 survey squares (see Figure 5.10).

Flint fragments were found in 9 survey squares (3210, 3215, 3109, 3117, 3004, 3005, 3006, 3008, 3009). None of the flint fragments showed any signs of having been worked (Walker 1983) but, given the absence of flint in the geology of the study area, it is likely that this flint was imported, either intentionally or allochthonously by flotsam and jetsam (Keegan and Mitchell 1986:257) No shell artefacts were found during this survey and unmodified shells were not collected. Indigenous ceramics, identified through paste and fabric analysis, were found in 31 survey squares. The spatial patterning of archaeological evidence from survey squares around the known site of Los Buchillones provided initial evidence for the east-west artefact distribution from the site. The sherd count distribution of indigenous ceramics (Given 2004) reveals a concentration in the immediate vicinity of the known site of Los Buchillones extending beyond the previously established boundaries for the site (Figure 5.11).

The modern town of Punta Alegre appears to have truncated the distribution of archaeological material to the west of the site. In addition there is the potential that taphonomic processes such as coastal erosion, deposition and long shore drift might have affected the distribution of the archaeological deposits. Local residents have suggested in interviews that the building of a large causeway out to Cayo Coco 17km to the east of Punta Alegre has caused coastal erosion over the past 30 years, including long shore drift of sediments west to east across the bay around Punta Alegre. This could be one reason for the finding of indigenous ceramics to the west of Punta Alegre on the other side of the bay. There were a series of 21 consecutive survey squares with archaeological evidence around the known site of Los Buchillones. This evidence has been used to define preliminarily the potential east-west boundaries of the site, illustrated in Figure 5.12.

5.II.2 Cayo Caiman de la Sardina

This island has an area of 76,262 sq. m. Field walking, conducted by 5 people along an 8m wide tract, covered 1,667m around the island and included 25 survey squares. Archaeological evidence was found in one perimeter survey square (4398) and one juxtaposed dynamic survey square (4399) (Figure 5.13).

5.II.2.i Cayo Caiman de la Sardina, Surface Deposit 1

The archaeological evidence from 4398 included four whole *Strombus gigas* shells with circular spire perforations, identified using the shell artefact typology outlined in Chapter 4, and one whole adult *Strombus gigas* shell without modification. All these shells were lying on the surface, clustered on a low-lying sand dune <1m in height and covered with sparse grassy brush vegetation. Survey square 4399, located northwest of 4398, contained a further three whole *Strombus gigas* shells with circular spire perforations. There was no other archaeological evidence in the surrounding area. The artefacts from these survey squares are listed in Table 5.03.

Table 5.03 Shell assemblage from Surface Deposit 1, Cayo Caiman de la Sardina

Unit	Species	Age	Artefact type
4398	*Strombus gigas*	4 adult	Whole shell with spire perforation
4398	*Strombus gigas*	3 adult	Whole shell with spire perforation
4398	*Strombus gigas*	Unknown	Whole shell with spire perforation
4398	*Strombus gigas*	3 adult	Whole shell with spire perforation
4398	*Strombus gigas*	3 adult	Whole shell
4399	*Strombus gigas*	Unknown	Whole shell with spire perforation
4399	*Strombus gigas*	Unknown	Whole shell with spire perforation
4399	*Strombus gigas*	Unknown	Whole shell with spire perforation
4399	*Cittarium pica*	3 adult	Whole shell

The species and age structure of this small shell assemblage appear to indicate intentional selection and the presence of shells with spire perforations further indicates past human activity. The site was defined as a surface deposit with a boundary defined by the distribution of the material in 4398 and 4399 (Figure 5.14). This site is located on the southern side of the island behind a sheltered bay with low wave energy. The site is protected from strong winds and storm-wash from the north shore 83m away and by an elevated ridge running east-west across the centre of the island.

5.II.3 Cayo Caiman Mata del Coco

This island has an area of 128,908 sq. m. Field walking, conducted by 4 people along a 10m wide tract, covered 2026m around the island perimeter and 1564m through the interior of the island and included 41 survey squares. Archaeological evidence was found in four perimeter survey squares (4122, 4123, 4126, 4130) and two dynamic survey squares (4124, 4129) (Figure 5.15).

5.II.3.i Cayo Caiman Mata del Coco, Surface Deposit 1

This surface deposit included survey squares 4122, 4123 and 4124. Survey squares 4122 and 4123 contained a collection of fragmented and whole *Strombus* sp. shells. A dynamic survey square 4124, located 24m west of 4123, contained a whole *Strombus gigas* shell with a circular spire perforation and a small collection of *Strombus gigas* fragments and a single *Arca zebra*, detailed in Table 5.04.

Table 5.04 Shell assemblage from Surface Deposit 1, Cayo Caiman Mata de Coco

Unit	Species	Age	Condition	Part
4122	*Strombus* sp.	unknown	naturally eroded	body
4122	*Strombus* sp.	unknown	naturally eroded	body
4122	*Diplodonta notata*	unknown	whole shell	whole shell
4123	*Strombus gigas*	4 adult	naturally eroded	whole shell
4123	*Strombus gigas*	4 adult	unidentifiable fragment	outer lip
4123	*Strombus gigas*	4 adult	unidentifiable fragment	outer lip
4123	*Strombus* sp.	3 adult	unidentifiable fragment	columella
4123	unidentified	unknown	naturally eroded	whole shell
4124	*Strombus* sp.	3 adult	naturally eroded	columella
4124	*Strombus* sp.	3 adult	naturally eroded	columella
4124	*Strombus* sp.	3 adult	naturally eroded	columella
4124	*Strombus* sp.	3 adult	naturally eroded	outer lip
4124	*Strombus* sp.	3 adult	naturally eroded	nodules
4124	*Strombus gigas*	3 adult	whole shell with spire perforation	whole shell
4124	*Arca zebra*	3 adult	whole shell	whole shell

The species and age selection of the *Strombus* sp. shells, as well as the *Strombus gigas* with a circular spire perforation, provided potential evidence of human activity in this part of the island. This collection of shell was located on an exposed angular and smooth limestone plateau with sparse scrub vegetation. The shells were between 16 and 18m from the leeward southern shoreline of the island. It is possible that this assemblage could have been created by storm wash from the sea as the collection of shells is on a slight promontory exposed to medium to high-energy waves. A detailed examination of the perforation (shell 122) indicated that it was typologically similar to other shells with circular spire perforations, indicating indigenous activity. The nature of the location has exposed the shells to extensive weathering and this erosion lowered the potential for further interpretation of the nature and extent of human activity at this site. In addition there is no potential for excavation at this site. However, the selected species and age structure of the shell assemblage, in addition to the *Strombus gigas* shell with a circular spire perforation, means that this assemblage has been identified as Surface Deposit 1 (Figure 5.16).

5.II.3.ii Cayo Caiman Mata del Coco, Midden 1

Perimeter square 4126 contained six whole *Strombus gigas* shells, one of which had a circular spire perforation as well as four *Cittarium pica* shells and one whole *Xancus angulatus* shell.

This concentrated assemblage of potentially selected shells and the one shell with a circular spire perforation suggested human activity at this site. This survey square was on the southern edge of a mound, 5m high and covering an area of 84 sq. m. The mound was covered in dense grass that restricted visibility of the ground surface. A series of dynamic survey squares transecting the mound above 4126 did not reveal any evidence of further surface material. However, a dynamic survey square 4129, 14m west of 4126 and in a similar topographic location on the edge of the mound contained archaeological material. Survey square 4129 contained three large adult *Strombus gigas* with circular spire perforations that reflect human activity. Evidence from these two survey squares, located on the edge of the mound, suggests that there is more archaeological material buried beneath the mound's grassy vegetation and that material was only visible at this southern edge where the midden was eroding. The next perimeter survey square along the edge of this mound, 4130, contained two whole adult *Strombus gigas,* further possible evidence that this mound contained human-collected shell. A summary of the shell from these survey squares is given in Table 5.05

Table 5.05 Shell assemblage from Midden 1, Cayo Caiman Mata de Coco

Unit	Species	Age	Condition	Part
4126	*Strombus gigas*	2 juvenile	whole shell with spire perforation	whole shell
4126	*Cittarium pica*	3 adult	whole shell with spire perforation	whole shell
4126	*Xancus angulatus*	2 juvenile	whole shell	whole shell
4126	*Cittarium pica*	Unknown	unidentifiable fragment	body
4126	*Cittarium pica*	Unknown	unidentifiable fragment	body
4126	*Cittarium pica*	Unknown	unidentifiable fragment	body
4126	*Strombus gigas*	3 adult	whole shell	whole shell
4126	*Strombus gigas*	3 adult	whole shell	whole shell
4126	*Strombus gigas*	3 adult	whole shell	whole shell
4126	*Strombus gigas*	3 adult	whole shell	whole shell
4126	*Strombus gigas*	3 adult	whole shell	whole shell
4129	*Strombus gigas*	4 adult	whole shell with spire perforation	whole shell

4129	*Strombus gigas*	3 adult	whole shell with spire perforation	whole shell
4129	*Strombus gigas*	4 adult	whole shell with spire perforation	whole shell
4130	*Strombus gigas*	3 adult	whole shell	whole shell
4130	*Strombus gigas*	3 adult	whole shell	whole shell

These three survey squares are all located along the southern edge of the mound. The species selection and presence of a number of whole shells with circular spire perforations indicates probable indigenous activity. This raised the possibility of further archaeological material buried beneath the surface and therefore this mound was identified as a site that required further investigation through archaeological excavation, discussed in Chapter 5.

5.II.4 Cayo Contrabando

This island has an area of 7,133 sq. m. Fieldwalking, conducted by 5 people along a 10m wide tract, covered 307m around the perimeter of the island and 102m through the interior of the island. Archaeological evidence was found in two interior survey squares (4060, 4061) and one dynamic survey square (4062) (Figure 5.17).

5.II.4.i Cayo Contrabando, Surface Deposit 1

Survey square 4060 contained two ceramic fragments, which were both heavily eroded and measured a couple of centimetres in length. The sherds were studied in accordance with the methods outlined in Chapter 4. This square also contained three small *Strombus* sp. fragments but there was no evidence to suggest these were culturally modified. This survey square contained brush vegetation over sandy limestone and was located 2m south of the foundations of a 20th century concrete structure. Therefore the potential for this material being re-deposited by recent human activity is high. There was no further evidence for indigenous activity in the immediate area around 4060; therefore this survey square was identified as Surface Deposit 1 (Figure 5.18).

5.II.4.ii Cayo Contrabando, Surface Deposit 2

Survey square 4061 was an interior survey square with mangrove vegetation and peaty soils located below the southern edge of the limestone outcrop in the south of the island. This square contained a whole adult *Xancus angulatus,* a *Strombus* sp. fragment and two whole

Strombus gigas shells, one of which had a circular spire perforation. This assemblage indicated human activity in the area and the immediate area around 4061 was surveyed for further material. Survey square 4062 was juxtaposed to the north of 4061 and contained a whole *Cittarium pica* shell, a *Chondropoma jaulense* shell, a *Strombus* sp. fragment and three ceramic fragments. All three ceramic fragments were heavily eroded and there was no evidence of the vessel's shape or style. Macroscopic studies of the ceramic fabric indicated a possible quartz temper and a low -firing temperature that would be consistent with other indigenous ceramics found in the case study area. The GPS co-ordinates for 4062 were affected by the dense mangrove canopy and this survey square was in fact adjacent to 4061 in the border zone between the limestone rock and mangrove swamp. These two survey squares appeared to be directly associated and were therefore identified as Surface Deposit 2, illustrated in Figure 5.18.

5.II.5 Cayo Felipe Este

This island has an area of 55,264 sq. m. The survey, conducted by five people along a 10m wide tract, covered 1,338m around the island perimeter followed by 1150m gridding the interior of the island and included 32 survey squares. Archaeological evidence was found in 1 perimeter survey square and 12 dynamic survey squares (Figure 5.19).

5.II.5.i Surface Deposit 1

Survey square 5016 contained three whole *Strombus gigas* shells with circular spire perforations, two juveniles and one adult. There was also another whole juvenile *Strombus gigas* shell with a fractured base that appears to have been used as a hand pick. The size of the apertures in the three perforated *Strombus gigas* shells are compatible with being produced by the hand pick. These shells were clustered on a sand dune <2m in height with no vegetation. Two *Acropora cervicornis* (staghorn coral) branches were found in this square. These branches had no visible signs of use wear on the surface but were collected for microscopic analysis because similar coral branches have been used as scrapers at other indigenous sites in the Caribbean (Kelly and Van Gijn 2006:pers. com.). This small artefact assemblage provided evidence of a possible activity area, where shells had been brought for initial processing. The nature of the perforations appears to indicate that the flesh of the animals was the primary reason for collecting these shells. The *Strombus* hand pick used to open the shells appears to have been selected for its small size used expediently to open the three *Strombus gigas* shells and then discarded. There was no evidence of further archaeological evidence in the immediate area and therefore this material was identified as Surface Deposit 1 (Figure 5.20).

5.II.5.ii Midden 1

Survey square 5019, a perimeter survey square, contained two *Strombus gigas* shells with circular spire perforations and four *Strombus* sp. fragments. One of the *Strombus* sp. fragments was identified as a spoon, based on the shell artefact typology outlined in Chapter 4. There were also small fragments of *Cittarium pica* and *Xancus angulatus* shell in the survey square. This survey square was located on the northern edge of a sandy mound 2m above mean sea level (msl) covered with sparse grass vegetation. This mound rose to a height of 5m towards the interior of the southeast peninsular of the island. A line of dynamic squares was investigated transecting the mound and included survey squares 5020-5029 inclusively. This line of survey squares contained a collection of seventeen *Strombus* sp. fragments. One of these *Strombus* sp. fragments was identified as a point with a hafting phalange. This collection of shell debitage indicated the probability that this mound was anthropogenic in nature. However, the presence of an old oil drilling bore hole in the centre of the island in survey square 5044 raises the possibility that land moving equipment had been brought to the island and that this mound was either created during the levelling of the centre of the island or that a previously existing shell midden was truncated by the equipment. The mound was a well defined circular platform raised 5m above the natural limestone base of the island; however the top of the mound appeared unusually flat and possibly truncated. Therefore this assemblage of archaeological material was identified as Midden 1 (Figure 5.20) and identified for further investigation through archaeological excavation discussed in Chapter 6.

5.II.6 Cayo Felipe Oeste

This island has an area of 29,360 sq. m. The survey, conducted by five people along a 10m wide tract, covered 701m around the island followed by 284m through the interior of the island. This survey included 15 survey squares. Archaeological evidence was found in 1 dynamic survey square 4172 (Figure 5.21).

Survey square 4172 contained one large adult *Xancus angulatus* shell with a circular spire perforation and one large eroded adult *Strombus gigas* shell. This survey square was located on top of a limestone bluff raised 4m above a small beach in the northwest corner of the island. The bluff was a limestone outcrop 3m above the beach providing a small platform with a good panoramic view of the local area. A detailed search of the surrounding area produced no further archaeological material. This survey square was identified as Surface Deposit 1 and was identified for further investigation through archaeological excavation (Figure 5.22).

5.II.7 Cayo Flores

This island has an area of 78,597 sq. m. The survey, conducted by five people along a 10 m wide tract, covered 1068 m around the island perimeter. The thick mangrove vegetation prevented survey of the interior of the central and southern parts of the island. This survey included 17 survey squares. Archaeological evidence was found in two perimeter squares (5034, 5037), and in three dynamic squares (5035, 5036, 5041), (Figure 5.23). Survey square 5034 contained one whole adult *Strombus gigas* and four *Strombus gigas* fragments that raised the possibility of anthropogenic selection. The immediate area revealed further evidence listed in Table 5.06.

Table 5.06 Shell assemblage from Surface Deposit 1, Cayo Flores

Unit	Species	Part	Age	Condition
5034	*Strombus gigas*	Body	2 juvenile	Unidentifiable fragment
5034	*Strombus gigas*	Body	4 adult	Unidentifiable fragment
5034	*Strombus gigas*	Body	Unknown	Unidentifiable fragment
5034	*Strombus gigas*	Body whorl	3 adult	Unidentifiable fragment
5034	*Strombus gigas*	Outer lip	3 adult	Unidentifiable fragment
5034	*Strombus gigas*	Whole shell	3 adult	Whole shell
5035	*Codakia orbicularis*	Body	Unknown	Unidentifiable fragment
5035	*Strombus gigas*	Body	3 adult	Unidentifiable fragment
5035	*Strombus gigas*	Body whorl	3 adult	Unidentifiable fragment
5035	*Strombus gigas*	Body whorl	4 adult	Unidentifiable fragment
5035	*Strombus gigas*	Columella	3 adult	Unidentifiable fragment
5035	*Strombus gigas*	Outer lip	4 adult	Unidentifiable fragment
5035	*Strombus gigas*	Whole shell	3 adult	Whole shell
5035	*Strombus gigas*	Whole shell	3 adult	Whole shell with spire perforation
5035	*Strombus gigas*	Whole shell	4 adult	Whole shell
5036	*Strombus gigas*	Whole shell	3 adult	Whole shell with spire perforation
5041	*Strombus gigas*	Whole shell	3 adult	Naturally eroded

5041	*Strombus gigas*	Whole shell	4 adult	Naturally eroded

Survey square 5041, juxtaposed southwest of 5034, contained two eroded adult *Strombus gigas* shells. Survey square 5035, juxtaposed east of 5034, contained an adult *Strombus gigas* with a circular spire perforation. Survey square 5036, juxtaposed southeast of 5035, contained a single whole adult *Strombus gigas* shell with a circular spire perforation. The species and age selection of these shells, in addition to the two shells with circular spire perforations, indicates that this was an area of past human activity. Therefore this site was identified as Surface Deposit 1.

Survey square 5037 contained three *Strombus* sp. fragments and three *Codakia orbicularis* fragments. These were collected during the survey as two of the *Strombus* fragments were initially identified as possible points. However, following detailed analysis of the shells back at the CIEC laboratory, none of these fragments showed any signs of human modification. In addition, this survey square contained a plastic fork and a plastic bottle. These two items appear to have been blown off the beach, five metres beyond the visible high tide mark, indicating that the shells could also have been washed or blown up from the windward north shore. There was no further potential archaeological evidence in the immediate area and therefore this assemblage was not classified as an indigenous archaeological site.

5.II.8 Punta Morra Peninsula, Cayo Guillermo

This island peninsular has an area of 147,069 sq. m. The survey, conducted by five people along a 10 m wide tract, covered 1,679 m around the peninsula and 1952m through the interior of the peninsular. This survey included 46 survey squares. Archaeological evidence was found in 16 dynamic survey squares (Figure 5.24).

5.II.8.i Cayo Guillermo, Surface Deposit 1

Survey squares 4024 and 4025 are located to the east of a small road that connects Punta Morra with the rest of Cayo Guillermo and Cayo Coco. The surface of both areas had wind blown modern refuse including plastic bags and metal cans. The survey squares are both on a large exposed limestone plateau with no sediments. These survey squares contained four ceramic fragments, all smaller than 5 cm^2. The fragments were too small and eroded to allow any identification of vessel form or style. The fabric and paste showed a similar colour and consistency to other indigenous ceramics from the case study area. These survey squares also contained two whole adult *Strombus gigas* shells, one of which had a circular spire perforation, there were also two *Strombus* sp. fragments one of which was identified as a spoon, based on the shell artefact typology outlined in Chapter 4 (Dacal Moure 1978:73). Further investigation of the immediate area around these survey squares revealed three more survey squares (5061, 5062 and 5063) with archaeological evidence. These squares each contained unidentifiable *Strombus* sp. fragments that could have been the result of human activity, although the absence of any clearly diagnostic artefacts prevented conclusive identification. However, their proximity and distribution on the same flat limestone plateau led to their association as part of Surface Deposit 1 (Figure 5.25).

5.II.8.ii Suface Deposit 2 and Surface Deposit 4

In the interior transects, between perimeter survey squares 4013 and 4028, two further clusters of shell debitage were found. Survey square 5071 contained three whole juvenile *Strombus gigas* shells and one *Strombus* sp. shell with form and use wear that indicates use as a hand pick. Survey square 5073 was located fifty-nine meters northeast of survey square 5071 and contained two whole juvenile *Strombus gigas* shells and a number of *Strombus* sp. fragments. The topography of this area indicates landscape modification caused by the road being built between these two small shell assemblages and Midden 1. The potential for re-deposition of this material from Midden 1 appears likely but given their current location, these two survey squares were identified as Surface Deposit 2 and Surface Deposit 4 respectively until further corroborative evidence can be found for an association between these small sites, see Figure 5.25.

5.II.8.iii Surface Deposit 3

Survey square 5081 contained a cluster of four *Strombus* sp. fragments and two *Codakia orbicularis* fragments. One of the *Strombus gigas* fragments was identified as a *gubia* that had use wear on the cutting edge. The shells had all suffered extensive erosion and weathering whilst on an exposed limestone surface. No further archaeological evidence was found in the immediate area. However, the apparent selection of these shells, their location 105m from the sea, as well as the identification of the shell *gubia* indicates human activity at this site and therefore it was identified as Surface Deposit 3, see Figure 5.25.

5.II.8.iv Midden 1

Survey square 4030 contained a collection of ten *Strombus gigas* and *Strombus* spp. shells, of which six have been identified as worked shell tools including four hammers and two spoons made from adult *Strombus* sp. shells.

Table 5.07 Shell assemblage from Midden 1, Punta Morra, Cayo Guillermo

Unit	Species	Artefact	Age Stage	Part	Quantity
4030	*Strombus gigas*	Hammer	3 adult	Body	1
4030	*Strombus gigas*	Hammer	4 adult	Outer lip	1
4030	*Strombus gigas*	Naturally eroded	3 adult	Whole shell	2
4030	*Strombus* sp.	Hammer	4 adult	Outer lip	2
4030	*Strombus* sp.	Spoon	3 adult	Body whorl	2
4030	*Strombus* sp.	Unidentifiable fragment	Unknown	Base	1
4030	*Strombus* sp.	Unidentified	Unknown	Columella	1
5067	*Strombus gigas*	Unidentifiable fragment	3 adult	Body	2
5067	*Strombus gigas*	Whole shell	3 adult	Whole shell	2
5067	*Strombus gigas*	Whole shell	4 adult	Whole shell	1
5067	*Strombus* sp.	Unidentifiable fragment	3 adult	Body	1
5068	*Strombus gigas*	Unidentifiable fragment	3 adult	Body	1
5068	*Strombus gigas*	Whole shell	3 adult	Whole shell	1
5068	*Strombus* sp.	Unidentifiable fragment	3 adult	Body whorl	1
5068	*Strombus* sp.	Whole shell	2 juvenile	Whole shell	1
5069	*Strombus costatus*	Unidentifiable fragment	Unknown	Outer lip	1
5069	*Strombus gigas*	Whole shell with spire perforation	3 adult	Whole shell	1
5070	*Strombus gigas*	Unidentifiable fragment	3 adult	Body	2
5070	*Strombus gigas*	Whole shell with spire perforation	3 adult	Whole shell	2
5072	*Strombus gigas*	Whole shell	1 juvenile	Whole shell	2
5072	*Strombus gigas*	Whole shell	2 juvenile	Whole shell	4
5072	*Strombus gigas*	Whole shell	3 adult	Whole shell	2
5075	*Strombus gigas*	Whole shell	2 juvenile	Whole shell	4

5075	*Strombus gigas*	Whole shell	3 adult	Whole shell	4
5075	*Strombus gigas*	Whole shell with spire perforation	3 adult	Whole shell	2
5075	*Strombus* sp.	Gubia	Unknown	Base	1

A subsequent survey of the immediate area revealed extensive evidence of collected and modified shell. Adjacent survey squares 5067, 5066, 5068, 5069, 5070, 5072, and 5075 contained a large shell assemblage that was entirely of *Strombus* spp. (Table 5.07).

These survey squares were all on a raised sand dune up to 1.5m above msl with thick grass and grassy brush vegetation. The assemblage included 26 whole *Strombus gigas* shells of which five have circular spire perforations; 24 of the shells were mature adults. Therefore the species and age selection of these shells, along with the evidence of further shell working at this site indicated by the identified shell tools, suggests that this was an area of extensive past human activity. These shells were often embedded in the soil and indicated that further archaeological material could be buried beneath the surface within the mound. The topography of these survey squares on an undulating sand dune with evidence of human activity meant this site was identified as Midden 1 (Figure 5.25).

5.II.8.v Rock One, Cayo Guillermo

This rocky hill, surrounded by mangrove wetlands, is to the south of Cayo Guillermo and has an area of 1644 sq. m. The survey conducted by five people along a 5m wide tract, covered 185m around the island perimeter and 31m through the interior. This survey included 6 survey squares and possible archaeological evidence was found in two dynamic survey squares (Figure 5.26).

Survey squares 5087 and 5088 were located just outside the entrance to a small rock shelter on the southwest edge of this rocky hill. Eight fragments of *Cittarium pica* and *Strombus* sp. shell were collected from these survey squares. Analysis of these shells in the laboratory found no evidence of human modification, and this small sample of potentially selected shells did not provide conclusive evidence of human activity. Therefore this was not identified as an archaeological site.

5.II.9 Cayo Hijo de Guillermo Este

This island has an area of 16,186 sq. m. The survey, conducted by five people along a 10m wide tract, covered 590m around the island and 392m through the interior. This survey included 277 survey squares. Archaeological evidence was found in 3 perimeter survey squares, 3 interior survey squares, and 238 dynamic survey squares (Figure 5.27).

5.II.9.i Surface Deposit 1

Survey square 4001, a perimeter survey square, contained a single juvenile *Strombus gigas* with a circular spire perforation. An intensive search of the immediate area around 4001 resulted in 230 survey squares with archaeological material being identified. The archaeological material was spread over an exposed angular limestone plateau that restricted the potential for excavation. The distribution of the material covered an area of 4786 sq. m and was identified as Surface Deposit 1. The limestone topography included a number of caves and rock shelters in the north and west of the island. These rock shelters and caves provided contained areas of archaeological material that are discussed below individually and illustrated in Figure 5.28.

5.II.9.ii Rock Shelter 1

Survey square 4208, an interior survey square, contained eight whole *Strombus gigas* shells (six adults and two juveniles) of which four adults and both juveniles had circular spire perforations. The square also included two *Strombus* sp. fragments, three *Codakia orbicularis* valves and a single whole adult *Cittarium pica* shell. This assemblage indicated human activity and a survey of the immediate area produced 18 further dynamic survey squares with evidence of past human activity (4209, 4210, 4211, 4212, 4213, 4214, 4215, 4216, 4217, 4218, 4219, 4220, 4221, 4222, 4223, 4224, 4225, 4226). One turtle bone was found in 4214 inside the rock shelter. This bone showed no cut marks or scorching that might indicate human activity; however, its location in association with shell artefacts raises the possibility of potential turtle exploitation (Godo 1985:16), discussed further in Chapter 6. The shell assemblage included 73 whole *Strombus gigas* shells, 70 adults and 3 juveniles, of which 36 adult shells had circular spire perforations. There were also 12 whole but heavily eroded *Strombus* sp. shells, six adults and six juveniles, all with circular spire perforations. There were 9 heavily eroded *Strombus gigas* shell fragments and a further 22 *Strombus* sp. unidentifiable fragments. Two *Strombus* fragments were identified as possible *gubias* in the process of manufacture based on their form, yet there was no evidence of use wear or polishing. There were two whole adult *Xancus angulatus* shells with circular spire perforations and a further two eroded *Xancus angulatus* columellas. The assemblage also contained a single *Arca zebra* valve, a *Chama macerophylla* valve and three *Chama* sp. valves, a single *Chione cancellata* valve, a whole adult *Cittarium pica* and a *Cittarium pica* fragment. This assemblage indicates species selection, and the presence of circular spire perforations further indicates human activity. The spatial distribution of the shell material shows concentrations of shell within rock shelter 1 that diffuse outwards in a semicircular pattern. The spatial distribution of this evidence (Binford 1978) could indicate the use of the rock shelter as a refuge for initial shell processing, primarily for extraction of the animal from the shell. However, the spatial distribution could also be the result of taphonomic processes, with the archaeological material within the rock shelter being better protected from erosion than other remains on the exposed lower limestone areas. The rock shelter is located at the head of a promontory on Cayo Hijo de Guillermo Este, with the artefact distribution concentrated close to the protective cover that the rock shelter provides. Further evidence from this site and from comparable sites within the case study area are required before the significance of the spatial distribution of this evidence within the rock shelter can be assessed. The contours produced by a topographic survey of the island reveal the location of the rock shelter, and the artefact distribution within it (Figure 5.29).

5.II.9.iii Rock Shelter 2

This site was located next to Cave 3 on the southeast corner of Cayo Hijo de Guillermo Este. This rock shelter, measuring just 1.5 m^2, had suffered a partial collapse of the limestone roof. Survey square 4421 was located in the first chamber of this rock shelter on the west side of the roof collapse. This survey square contained 17 whole *Strombus gigas* shells, one *Xancus angulatus* columella that was identified as a hammer with use wear and an *Oliva reticularis* shell that had been worked into a bead. This assemblage indicated human activity and therefore this site was identified as Rock Shelter 2.

5.II.9.iv Rock Shelter 3

This rock shelter, measuring 2.5 m^2, was found whilst surveying the western edge of the central plateau of the island. Survey square 4446, located in the centre of this rock shelter, contained 25 whole *Strombus gigas* shells, all adults, of which 13 had circular spire perforations. There were also a number of *Strombus* sp. artefacts including two spoons, one plate and two points. In addition to *Strombus*, there were two whole adult *Cittarium pica* shells, two *Codakia orbicularis* valves and a *Xancus angulatus* columella fragment. This assemblage indicates human activity. This survey square was within an area protected by a naturally formed limestone rock shelter and therefore, whilst within a wider area of archaeological evidence, this bounded site was identified as Rock Shelter 3.

5.II.9.v Rock Shelter 4

Three metres north west of Rock Shelter 3 was another rock shelter that also contained a deposit of shell material. Survey square 4447, located within this rock shelter, contained 16 whole *Strombus gigas* shells, all adults, of which 13 had circular spire perforations, a further *Strombus* spire was found with a circular perforation. A further four *Strombus* tools were identified including a *gubia*, a hammer and two hand picks as well as four unidentifiable *Strombus* sp. fragments. This area, protected by the limestone canopy, was identified as Rock Shelter 4.

5.II.9.vi Cave 1

Survey square 4010 was located outside an entrance to a cave. This unit contained a juvenile *Strombus gigas* classified as a hammer, a *Strombus* sp. body fragment classified as a spoon, three *Strombus* sp. points, a *Codakia orbicularis* valve identified as a scraper, two *Oliva reticularis* shells, one of which was identified as a bead in process of manufacture, three *Strombus* waste flakes and 12 ceramic fragments. All the ceramic fragments measured less than 4cm in diameter and were too eroded to indicate vessel form and shape. A macroscopic study of the pastes and mineral inclusions suggested that these sherds were comparable to indigenous ceramics found elsewhere in the case study area. The sherds were similar to examples collected from survey square 4001, 10m southwest, of 4010, which were selected for thin section petrographic analysis. A search of the area immediately around 4010 included entering into the cave through a small circular aperture measuring 1.7m in diameter.

Once inside the cave it was clearly apparent that there was an extensive deposit of archaeological material on the surface of the cave floor. This cave had an area of 83 sq. m and contained large quantities of archaeological material. A number of objects were collected from within the cave before their provenance was recorded. This unprovenanced surface collection from Cave 1 was given an individual unit number of 4079. This assemblage contained 16 ceramic sherds with one identifiable rim sherd from a globular vessel. All of these sherds had a paste and fabric consistent with other indigenous ceramics found in the case study area. The bone assemblage from this context included turtle (6 Number of Individual Elements, NIE), jutia (12 NIE) and fish (5 NIE). One of the fish vertebrae was identified as *Sphyraena barracuda*. This fish has a broad marine habitat of shallow waters over seagrass beds, reefs and pelagic waters. Discussion of the significance of the faunal assemblage from Cave 1 continues in Chapter 6. The shell assemblage contained a number of modified shell artefacts listed in Table 5.08.

Table 5.08 Shell artefacts from unit 4079 in Cave 1, Cayo Hijo de Guillermo Este

Species	**Artefact Type**	**Unfinished**	**Use Wear**	**Broken**
Oliva reticularis	Bead	No	No	No
Oliva reticularis	Bead	No	No	No
Oliva reticularis	Bead	No	No	Yes
Oliva reticularis	Bead	Yes	No	Yes
Oliva reticularis	Pendant	Yes	No	Yes
Strombus gigas	Hammer	No	No	No
Strombus gigas	Whole shell with spire perforation	No	No	No
Strombus sp.	Gubia	No	Yes	Yes
Strombus sp.	Gubia	No	Yes	Yes
Strombus sp.	Hammer	No	No	No
Strombus sp.	Plate	No	No	Yes
Strombus sp.	Point	No	No	No
Strombus sp.	Point	Yes	No	No
Strombus sp.	Point	Yes	No	Yes
Strombus sp.	Point	Yes	No	No
Strombus sp.	Spoon	No	No	Yes
Strombus sp.	Spoon	Yes	No	Yes
Xancus angulatus	Hand pick	No	No	Yes
Xancus angulatus	Whole shell with spire perforation	No	No	No
Xancus angulatus	Whole shell with spire perforation	No	No	Yes

The species of shellfish used to make the shell artefacts reflects species-specific selection. The artefact assemblage is similar to shell artefact assemblages found in ceramic period indigenous sites elsewhere in Cuba and discussed in Chapter 6 (Calvera Roses and Febles 1984; Dacal Moure 1978; Izquierdo Diaz and Rives Pantoja 1993; Izquierdo Diaz and Sampedro Hernández 2002; Manuel Reyes 1997). Detailed interpretations of the activities within this cave were made following the open area excavation of the cave and the collection and recording of a large artefact assemblage (detailed in Chapter 6). This cave formed a clearly bounded distribution of material and was identified as Cave 1.

5.II.9.vii Cave 2

Survey square 4009 contained a single adult *Strombus gigas* with a circular spire perforation. A search of the immediate area led to the location of another cave 4m to the north. The cave aperture measured 2m by 1m but was partially blocked by a fallen boulder. Inside the cave, the surface of the cave floor comprised clean undisturbed cave earths and exposed limestone. A survey of the cave floor was made but the only finds were two jutia skulls in the centre of the main chamber. Given the known prevalence of jutias in the area, and a lack of evidence for human exploitation, these jutias were not interpreted as evidence of human activity. The cave was not mapped but it had an approximate size of 65 sq. m. This cave was named at the time of discovery as Cave 2 and identified for further investigation through archaeological excavation.

5.II.9.viii Cave 3

Survey square 4003 contained a *Strombus* sp. fragment and three ceramic fragments. All three ceramic fragments measured less than 3cm in diameter and were too eroded to indicate vessel form and shape. A macroscopic study of the pastes and mineral inclusions suggested that these sherds were comparable to indigenous ceramics found elsewhere in the case study area. The sherds were similar to sherds collected from survey square 4001, 49 m southeast of 4003. A search of the immediate area led to a Cave 14 m to the northeast of survey square 4003. The cave aperture measured 1.8 sq. m in diameter and was visible from the southeastern part of this island. This cave was filled with archaeological material that covered the cave floor. A survey square at the entrance of the cave 4420 was scanned for archaeological evidence and a number of shell artefacts were identified. All of these shells were left in situ awaiting an open plan excavation that is discussed in detail in Chapter 6. The Cave was identified as Cave 3 and its location along with all the other sites identified on Cayo Hijo de Guillermo Este are illustrated in Figure 5.28.

5.II.10 Cayo Hijo de Guillermo Oeste

This island has an area of 29,529 sq. m. The survey, conducted by five people along a 10m wide tract, covered 739m around the island perimeter and 425m through the interior. This survey included 31 survey squares. Archaeological evidence was found in 16 dynamic survey squares (Figure 5.30).

5.II.10.i Surface Deposit 1

Survey square 4043 contained a ceramic sherd 7.2cm x 5.1cm. The form of the sherd suggests that it came from a collared globular vessel similar to a number of vessels found at Los Buchillones. A macroscopic study of the ceramic paste found that it is similar to other indigenous pastes with a low to medium firing temperature and an unsorted matrix with large irregular quartz inclusions. A sample from this sherd was taken for thin section microscopic analysis and this is discussed in detail in Chapter 6. This survey square was located on an exposed angular limestone plateau. A collection of 25 unidentifiable and eroded shell fragments indicated high levels of erosion in this area. This survey square contained one identified but heavily eroded adult *Strombus gigas* shell, with a circular spire perforation, and single shells of *Codakia orbicularis, Arca zebra, Chama* sp. and a juvenile *Strombus gigas.* The immediate area included further unidentifiable shell debitage, and survey square 4044, juxtaposed to the east of 4043, contained another ceramic sherd. This sherd was too small and eroded to provide an indication of vessel form but a macroscopic analysis indicated a paste consistent with the ceramic sherd found in 4043. Survey square 4044 also included an adult *Strombus gigas* shell with a circular spire perforation alongside a single eroded *Strombus* sp. and an *Arca zebra* shell. It is possible that the large amounts of small unidentifiable shell fragments could be the result of storm wash from the shoreline with medium to high wave energies, located 14m to the south of this material. The two ceramic sherds and shells with circular spire perforations provided clear evidence of human activity, yet the nature of the context of this material on an exposed limestone plateau 2m above msl with evidence storm wash raised questions about the relationship of the assemblage and its contextual integrity. However, this spread of archaeological evidence was mapped and identified as Surface Deposit 1 (Figure 5.31).

5.II.10.ii Surface Deposit 2

Survey square 4427 contained a possible *Strombus* sp. shell point measuring 9.5 x 2.7 cm. An intensive survey of the immediate area revealed two further *Strombus* sp. shell points, measuring 5 x 2 cm and 4 x 1.5 cm respectively, found in survey square 4428 juxtaposed to the west of 4427. This indicated human activity in this area but no further archaeological evidence was found on this exposed limestone bluff in the northwest of the island. The material from these two survey squares was identified as Surface Deposit 2.

5.II.10.iii Surface Deposit 3

Survey square 4430 contained a collection of *Strombus* sp. fragments that appeared to reflect anthropogenic selection; however, in the absence of any diagnostic artefacts it was difficult to ascertain the nature of this shell material. The scrub vegetation only allowed 30% visibility of the area within this survey square. A survey of the surrounding area, under buttonwood mangrove, uncovered a distribution of shell material that indicated human activity. Survey squares 4430, 4431, 4432, 4434, 4435, 4436, 4437, 4438, 4439, 4440, 4441 and 4442 contained 25 whole adult *Strombus gigas* shells of which 13 had circular spire perforations. There were also three single *Arca zebra* and six single *Chama* sp. shells as well as a collection of small *Arca zebra, Chama* sp., *Cittarium pica, Strombus* sp. and *Xancus angulatus* shell fragments. In survey square 4441 a *Xancus angulatus* shell hammer was found. Therefore these survey squares were identified as Surface Deposit 3 and identified for further investigation through archaeological excavation.

5.II.11 Cayo Langosta

This island has an area of 13,886 sq. m. Fieldwalking, conducted by five people, covered 398m around the perimeter of the island. This island was covered with thick mangrove vegetation clinging to a thin limestone outcrop and the nature of the vegetation only allowed a 3m wide tract of the north side of island to be fieldwalked on dry land. An external perimeter survey around the rest of the island required wading through the wetland peaty soils. Archaeological evidence was found in two dynamic survey squares and one perimeter survey square (Figure 5.32).

5.II.11.i Surface Deposit 1

Survey square 4071 contained a collection of shells embedded in the peaty soils on the edge of the mangrove wetland in the north of the island. This assemblage included two *Strombus* sp. shell points, a whole adult *Strombus gigas* shell with a circular spire perforation and a single *Strombus gigas* handpick with evidence of use wear on the striking edge. There was no further archaeological evidence in the immediate area and therefore this survey square was identified as Surface Deposit 1 (Figure 5.33).

5.II.11.ii Surface Deposit 2

Survey square 4072 was a perimeter survey square 39m due east of 4071. It contained a *Xancus angulatus* fragment and a *Strombus* sp. *gubia*. The form of the *gubia* can be classified as a typical *gubia* type based on the shell tool typology outlined in Chapter 4. An intensive search in the immediate area did not reveal any further evidence of archaeological material so this survey square was identified as Surface Deposit 2.

5.II.11.iii Surface Deposit 3

Survey square 4067 contained a flint core measuring 3.8x2.7cm. This flint core showed evidence of being worked. A series of striking platforms indicate it that this core was used to produce small flint flakes to use as cutting tools. There was no other archaeological evidence in the immediate area. This single flint artefact indicates the potential for human activity but there is no corroborative evidence to indicate whether this activity is indigenous, colonial or modern.

5.II.12 Chapter Summary

No archaeological evidence of past human activity was found during the surveys on Cayo Caiman de la Bella, Cayo Caimancito, Cayo Media Luna, Cayo la Jaula, Cayo Los Perros, Hijo de Guillermo Sur, Cayo Latetona, Cayo Palomo, Cayo La Cascara, Cayo Mortero, Cayo Tomate, Cayo Pilon, Cayo Jutia, and Cayo Bolo. Evidence of colonial period activity was found on Cayo Cubera but is not discussed in the thesis. Archaeological evidence for prehistoric activity was found on 11 other islands, as detailed in this chapter, leading to the identification of 31 potential sites of prehistoric activity identified for further investigation. These are listed in Table 5.09 and illustrated in Figure 5.34.

Table 5.09 List of potential archaeological sites identified following the survey in the case study area

Site No.	Island	Site Name
1	Cayo Caiman de la Sardina	Surface Deposit 1
2	Cayo Caiman Mata de Coco	Midden 1
3	Cayo Caiman Mata de Coco	Surface Deposit 1
4	Cayo Contrabando	Surface Deposit 1
5	Cayo Contrabando	Surface Deposit 2
6	Cayo Felipe Este	Midden 1
7	Cayo Felipe Este	Surface Deposit 1
8	Cayo Felipe Oeste	Surface Deposit 1
9	Cayo Flores	Surface Deposit 1
10	Cayo Guillermo, Punta Morra	Midden 1
11	Cayo Guillermo, Punta Morra	Rock Shelter 1
12	Cayo Guillermo, Punta Morra	Surface Deposit 1
13	Cayo Guillermo, Punta Morra	Surface Deposit 2
14	Cayo Guillermo, Punta Morra	Surface Deposit 3
15	Cayo Guillermo, Punta Morra	Surface Deposit 4
16	Cayo Hijo de Guillermo Este	Cave 1
17	Cayo Hijo de Guillermo Este	Cave 2
18	Cayo Hijo de Guillermo Este	Cave 3
19	Cayo Hijo de Guillermo Este	Rock Shelter 1
20	Cayo Hijo de Guillermo Este	Rock Shelter 2
21	Cayo Hijo de Guillermo Este	Rock Shelter 3
22	Cayo Hijo de Guillermo Este	Rock Shelter 4
23	Cayo Hijo de Guillermo Este	Surface Deposit 1
24	Cayo Hijo de Guillermo Oeste	Surface Deposit 1
25	Cayo Hijo de Guillermo Oeste	Surface Deposit 2
26	Cayo Hijo de Guillermo Oeste	Surface Deposit 3
27	Cayo Langosta	Surface Deposit 1
28	Cayo Langosta	Surface Deposit 2
29	Cayo Langosta	Surface Deposit 3
30	Cuban Mainland	Los Buchillones
31	Cuban Mainland	Los Buchillones, Environs

Chapter 6

EXCAVATION DATA COLLECTION AND ANALYSIS

Introduction

Following the survey, sites were selected for further investigation through archaeological excavation. The primary aims of these excavations were to:

1. Define archaeological contexts and establish the stratigraphic relationships between them at each site

2. Select samples for radiocarbon dating in order to provide an absolute chronology for the sites within the case study area

3. Identify the prehistoric activities carried out at each site

4. Identify evidence of island interaction

Based on the criteria discussed in Chapter 5, eleven sites within the case study area were selected for investigation in this way, as follows:

Location	**Site Name**
Cayo Caiman de la Sardina	Surface Deposit 1
Cayo Caiman Mata del Coco	Midden 1
Cayo Felipe Este	Midden 1
Cayo Felipe Oeste	Surface Deposit 1
Cayo Guillermo, Punta Morra	Midden 1
Cayo Hijo de Guillermo Este	Cave 1
Cayo Hijo de Guillermo Este	Cave 3
Cayo Hijo de Guillermo Este	Rock Shelter 1
Cayo Hijo de Guillermo Este	Rock Shelter 2
Cayo Hijo de Guillermo Oeste	Surface Deposit 1
Cayo Hijo de Guillermo Oeste	Surface Deposit 3
Cuban Mainland	Los Buchillones D2-6

All of the excavations discussed in this chapter were conducted according to excavation methods outlined in Chapter 4.

6.I Cayo Hijo de Guillermo Este

6.I.1 Cave 1

This cave had the greatest concentration of archaeological material found during the survey. The cave walls de-limited a well-defined site area of 83 sq. m with approximately 12 sq. m of this space occupied by the bare, sloping walls of the limestone cave. The visible deposits within the cave occupied 73 sq. m. It was decided to focus initially on an open plan excavation of the whole cave to generate a body of data for inter-site comparison, and also to allow the study of any potential spatial dynamics of human activity within the cave. The cave environment did not prove conducive to the preservation of perishable materials, and artefacts recovered were limited to durable materials, namely fauna (bone, coral and shell) (1380 Number of Individual Elements), ceramics (21 NIE) and lithics (11 NIE).

6.I.1.i Excavation of Units 4510-4583

The cave was mapped. A base line datum was established, from which the cave was divided into 1m^2 grid squares. The cave contained extensive amounts of visible archaeological material on the surface or buried in a thin lens of sediments over the limestone bedrock. Each 1m^2 was given an individual unit number and then photographed, planned and excavated to the limestone bedrock or down onto the underlying natural stratigraphic layer of densely packed brown cave earth (Figure 6.01). This provided an open plan excavation of the top archaeological context that was defined as stratigraphic Layer 1. Material recovered from this top stratigraphic layer included faunal remains, ceramic sherds and stone artefacts.

6.I.1.i.a Fauna

The faunal assemblage was categorised into bone (229 NIE), shell (834 NIE) and coral (8 NIE). The bone assemblage was further divided into identifiable species and categories that comprised *Capromys pilorides* – jutia, (102 NIE); fish, (53 NIE); birds (19 NIE); *Coenobita clypeatus* – hermit crab (17 NIE); Chelonia – turtle (15 NIE); unidentified (13 NIE).

Jutia

Jutia are found in the case study area and therefore their presence in this assemblage alone cannot be taken as evidence of human exploitation. The bone was inspected for scorching or cut marks but no evidence was found for any human modification of the bone. Elemental analysis of the jutia assemblage was conducted to see if there were any identifiable patterns: Total 102 NIE: long bone 71, teeth 16 NIE, mandible 9, skulls 6 NIE. This elemental distribution shows no signs of human selection, with all of the most durable elements of the jutia skeleton represented in close proportion to their skeletal distribution. The distribution of jutia bone throughout this layer suggests an archaeological context for them. However, the small size of the jutia bones, less than 7cm, means that they could be susceptible to vertical redeposition as a result of hermit crab activity. Therefore it is not possible at this stage to determine whether these jutia bones are a result of human activity or are naturally intrusive into the archaeological deposit.

Fish

An initial study of the fish bone assemblage, including 53 NIE, identified 1 *Sphyraena barracuda* mandible, 3 *Chilomycterus* spp. vertebrae, 3 large fish vertebrae, 1 medium-sized fish mandible and 44 medium fish vertebrae. The two identified fish species inhabit the reef and intermediate areas close to Cayo Hijo de Guillermo Este. This assemblage was then was then sent to Havana for specialist faunal analysis, the results of which are not available at the time of writing.

Bird

The bird bone from this Layer included 19 elements: 17 long bones and two scapulas. There was no evidence of any scorching or cut marks on the bones. Fifteen NIE were found semi-articulated on the surface of unit 4525 in a small ante-chamber in the northwest corner of the cave (Figure 6.02). Articulation suggests that the bird was intact when it entered the antechamber, and could have flown in. A further 4 long bones were also found on the surface, three in 4522 and one in 4553, but without any further evidence of human modification, and given the presence of birds on the islands and in the cave, it is not possible to determine whether the presence of these bird bones is a result of past human activity.

Hermit Crabs

Living specimens of hermit crabs were found in Cave 1; 17 elements were found including 13 chelae and 4 body fragments. Hermit crab remains were found at all depths in this layer and provide evidence of burrowing, as discussed in Chapter 4.

Turtle

The presence of turtle bone in this layer reflects human activity; it would be difficult for any turtle to enter the elevated and rocky entrance to this cave of its own accord. There was no evidence of any scorching or cut marks on any of these bones. There were 21 long bones and 2 unidentified fragments. It is not possible to determine whether the prevalence of long bones is a result of human selection or relative durability of the densest bones against erosive taphonomic processes.

Coral

Eight coral fragments were found in six units. The presence of coral in the cave suggests translocation from the sea or coastline. Four of the coral fragments are branches. These were closely examined, but their surfaces show no macroscopic evidence of abrasion that would be compatible with their use as scrapers. Coral identified as scrapers has been found at other sites in the Caribbean, where microscopic analysis revealed some of the materials scraped (Kelly and Van Gijn 2006).

Shell Species

Shell constituted 77% (%NIE, rounded to nearest percentage) of the faunal assemblage from Layer 1 in the cave. Species represented in the assemblage are detailed in Table 6.01. The shell species appear to have been selected.

Table 6.01 Shell species excavated from units 4510-4583 of Layer 1 in Cave 1, Hijo de Guillermo Este

Shell Species	**Layer 1, Cave 1 NIE**	**Layer 1, Cave 1 %**
Strombus gigas	477	57
Strombus sp.	179	21
Cittarium pica	48	6
Xancus angulatus (*Turbinella angulata*)	32	4
Codakia orbicularis	25	3
Oliva reticularis	15	2
Murex brevifrons (*Chicoreus brevifrons*)	12	1
Fasciolaria tulipa	8	1
Pinctada radiata	5	<1
Nerita sp.	4	<1
Nerita peloronta	2	<1
Strombus costatus	2	<1
Arca zebra	1	<1
Tellina radiata	1	<1
Chiton sp.	1	<1
Diodora listeri	1	<1
Fissurella nimbosa	1	<1

Shell Age Structure

A table of the shell age structure from Layer 1 shows that *Strombus gigas, Strombus* sp., *Oliva reticularis, Murex brevifrons* and *Fasciolaria tulipa* appear to have a relatively evenly distributed selection of adult and juvenile shells. However, there is a pattern in the predominance of adult specimens in *Xancus angulatus, Cittarium pica* and *Codakia orbicularis* species listed in Table 6.02.

Table 6.02 Shell age structure from Layer 1 in Cave 1, Cayo Hijo de Guillermo Este

Cave 1 Shell Species	**Mature Adult**	**Young Adult**	**Adolescent**	**Juvenile**	**Unknown**
Strombus gigas	95	242	114	25	1
Strombus sp.	4	15	8	1	153
Cittarium pica	0	11	0	0	37
Xancus angulatus	8	17	4	0	3
Codakia orbicularis	0	12	0	0	13
Oliva reticularis	0	8	4	0	3
Murex brevifrons	0	3	4	1	5
Fasciolaria tulipa	0	5	1	0	2

This shell distribution indicates that adult *Xancus angulatus* and *Codakia orbicularis* shells might have been selected for a specific reason. The most common interpretation of targeted selection of adult shells is that it reflects optimal foraging subsistence practices that maximise biomass returns for foragers (Keegan 1992:122; Wing and Scudder 1983:199). Table 6.02 of shell ages for different shell species does not reveal the complete picture as individual shell species can be selected for multiple reasons. This can only be evaluated when shell species selection and age structure are compared against other data such as shell artefact typologies. Therefore these patterns in the shell age structure will be reviewed once shell use in the cave is better understood, see chapter 8.

Shell Artefact Types

All of the shells with evidence of human modification from Cave 1 were studied and categorized using the shell tool typology outlined in Chapter 4 (Dacal Moure 1978). The shell artefact assemblage from Layer 1 is listed in Table 6.03.

Table 6.03 Shell artefact types excavated from Cave 1, Hijo de Guillermo Este

Tool Type	Cave 1 Qty
Axe-head	1
Bead	5
Burnt fragments	4
Gubia	6
Hammer	11
Hand pick	39
Pendant	1
Perforator	3
Plate	6
Point	33
Scraper	7
Spoon	3
Unidentifiable fragment	179
Vessel	6
Waste core	9
Waste flake	12
Whole shell with spire perforation	111

A number of the shell artefacts from Cave 1 are very similar to examples found in the excavations at Los Buchillones. Along with the diagnostic shell artefacts, there was also evidence of shell working in Cave 1. In addition to the 9 waste cores and 12 identified waste flakes there were 179 shell fragments that appear to indicate shell working in the cave. As a result of this observation, analysis of evidence for shell working was conducted.

Table 6.04 Manufacturing process of unfinished shell tools excavated from Layer 1 in Cave 1, Hijo de Guillermo Este

Artefact Type	Use Wear	Broken	Unfinished	Qty
Gouge	No	Yes	Yes	1
Gouge	No	No	Yes	3
Point	No	Yes	Yes	20
Point	No	No	Yes	2
Hand pick	No	Yes	Yes	1
Pendant	No	Yes	Yes	2

This was done by inspecting each shell artefact for evidence of use wear, of being broken, or left unfinished in the process of manufacture. Analysis showed that a number of shell tools in Cave 1 were only partially worked or abandoned in an unfinished state: 29 of the identified shell artefacts are unfinished; of these, 24 were broken, suggesting they might have been discarded during the process of manufacture following breakage, see Table 6.04.

Shell Artefacts vs Species

Comparing shell species to shell tool type can help to indicate whether specific shells were being selected for specific artefacts (Table 6.05).

Table 6.05 Species selection of shell artefacts found in Layer 1 in Cave 1, Cayo Hijo de Guillermo Este

Tool type	**Shell species**	**Cave 1, Layer 1 Qty**
Axe-head	*Strombus* sp.	1
Bead	*Oliva reticularis*	4
Bead	*Strombus gigas*	1
Gubia	*Strombus* sp.	6
Hammer	*Strombus costatus*	2
	Strombus gigas	2
	Strombus sp.	3
	Xancus angulatus	4
Hand pick	*Strombus gigas*	29
	Strombus sp.	7
	Xancus angulatus	3
Pendant	*Oliva reticularis*	1
Perforator	*Strombus* sp.	3
Plate	*Strombus gigas*	1
	Strombus sp.	5
Point	*Strombus* sp.	33
Scraper	*Codakia orbicularis*	6
	Strombus sp.	1
Spoon	*Strombus* sp.	3
Vessel	*Strombus* sp.	6
Waste core	*Strombus* sp.	8
	Xancus angulatus	1
Waste flake	*Pinctada radiata*	1
	Strombus sp.	11
Whole shell with spire perforation	*Cittarium pica*	1
	Fasciolaria tulipa	3
	Strombus gigas	98
	Xancus angulatus	9

Table 6.05 reveals some interesting patterns of shell species selection for shell tools, although the sample sizes affects the level of confidence in the conclusions. Therefore, the single axe does not provide a sample sufficient to identify species specific selection. However, the 39 hand picks and 11 hammers are all made from *Strombus gigas*, *Strombus costatus*, *Strombus* sp. and *Xancus angulatus* shells, which are all gastropods with a robust shell structure well suited to withstanding percussive pressure. The hammers show a predominance of the larger, heavier *Xancus angulatus* and *Strombus costatus* shells. The *gubias*, perforators and points are all made from *Strombus* sp. shells. The plates, spoons and vessels are also all made from *Strombus gigas* and *Strombus* sp. shells. Of the five beads and pendants found in this layer, four were *Oliva reticularis* whilst six of the seven scrapers were made from *Codakia orbicularis*. Both these shell species have no other modified tools found in this layer, which indicates these tools could have been the reason for collecting these shells, or in the case of the *Codakia orbicularis,* the most common secondary use of the shell following consumption of the animal.

Shell Age Structure vs Shell Artefacts

It is useful to compare the shell age structure with each tool category in order to identify intra-species patterns in demographic selections, as shown in Table 6.06.

Table 6.06 Ages of shell artefacts from Layer 1 in Cave 1, Cayo Hijo de Guillermo Este

Tool Type	Mature Adult	Adult	Adolescent	Juvenile	Unknown
Bead		3			2
Hammer	3	5	3		
Hand pick		2	20	13	4
Pendant		1			
Plate	1	5			
Scraper		5			2
Spoon		3			
Vessel	2	3			1
Whole shell with spire perforation	75	25	10		2

All of the age determinable beads, pendants, plates, scrapers, spoons and vessels were made from adult shells as were eight of the eleven hammers. By contrast 33 of the 39 hand picks were made from adolescent and juvenile shells. This predominance of selected adolescent and juvenile shells for hand picks in contrast to the selection of adult shells for other tools illustrates the importance of identifying shell artefacts before interpreting the significance of age structure within the shell assemblage. In this case 95 of the 107 whole shells with spire perforations are adult shells. This suggests that either adult species were selectively collected for food or that the larger shells required circular spire perforations for animal extraction whereas the juvenile shells did not require this diagnostic butchery technique. Therefore the comparison of shell species and age structure with identified shell artefacts appears to indicate the selection of demographic subsets of shell species for different purposes.

Lithic Assemblage

Five lithic fragments were found during the excavation of Layer 1 listed in Table 6.07.

Table 6.07 Lithics excavated from Layer 1, Cave 1

Layer	Unit	Artefact	Material	Use	Broken	Unfinished
1	4560	Sharpener	Limestone	Yes	No	No
1	4571	Sharpener	Limestone	Yes	No	No
1	4578	Unidentifiable fragment	Flint	No	No	No
1	4578	Unidentifiable fragment	Flint	No	No	No
1	4581	Waste core	Flint	Yes	No	No

The two limestone objects found in units 4560 and 4571 are similar smooth flat limestone rocks with extensive use-wear on the surface. The use wear consists of a series of elongated grooves measuring between 8-16mm and are consistent with linear erosion caused by polishing, sharpening or filing (Figure 6.03). Figure 6.04 shows a close up of wear patterns on this stone artefact. One hypothesis is that these limestone artefacts were polishers for wooden hafts for the harpoons that were headed by the shell points found in this layer. Further microscopic analysis of microwear patterns is required to investigate the use of these artefacts. Two flint fragments found in unit 4578 did not have any evidence of modification or use-wear but, given the limestone geology of the island, it is likely that these objects reflect human activity. One flint fragment was found in 4581 that shows signs of use as a waste core. There are a number of striking platforms around the core that indicate that it was used to produce flint flakes. Given the limestone geology of the windward islands, it is likely that the presence of flint in the cave is the result of human activity. Flint flakes are known to have been used for cutting and processing meat and fish at other sites (Godo Torres and Sampedro Hernández 1994:83) and this might be one reason for their presence in this cave.

Ceramic Assemblage

The presence of ceramics in this layer clearly reflects human activity. Sixteen sherds were found in eleven units in this layer. All of the fragments were less than 5cm^2 with extensive surface erosion, limiting the potential for macroscopic analysis. One sherd (from 4567) is from a globular vessel with a collared rim and an incised line decoration 1cm below the rim. The rest of the sherds were too small and eroded to infer vessel shape but the rims, body and base sherds had the same fabric and general thickness as indigenous globular vessels found at Los Buchillones and a number of other sites in Cuba (Mesa González, et al. 1994).

6.I.1.i.b Excavation Summary

The archaeological material in these units forms a stratigraphic layer of artefacts spread throughout the cave that appears to represent the most recent archaeological context of evidence for past indigenous activity. Evidence of hermit crabs in the cave indicates the potential for bioturbation of the deposits and there is also the possibility that recent human activity has redeposited material. However, no evidence of colonial or modern activity was found in the cave during the survey or excavation. Whilst bearing in mind the potential for redeposition of material, it was considered useful to analyse artefact distribution within the cave.

6.I.1.i.c Spatial distribution of evidence

The spatial data contribute to the discussion of whether the jutia were collected and eaten by humans or are naturally intrusive into the assemblage. If jutias died naturally at random in the cave, their spatial distribution should also be random. However, jutia bone has a similar spatial distribution to the fish and turtle bone that are more likely to represent past human activity (Figure 6.05). Shell material was found in most of the cave and there is patterning in the distribution of shell artefacts (Figure 6.06). These appear to be concentrated in areas with higher ceiling space, such as the central chamber of the cave (Figure 6.07).

6.I.1.ii Excavation of Contexts 5500 – 5505

The open plan excavation of the upper stratigraphic layer of Cave 1, units 4510-4583, revealed that much of the cave floor had only a very thin layer of sediment overlaying the limestone bedrock. In the centre of the cave there was evidence of deeper sediments below unit 4553. Excavations were conducted below this unit to determine whether there were further archaeological contexts and stratigraphic layers of material.

The soil of context 5500 is a well-packed, sandy, grey-brown loam interspersed with black vegetation that appeared to be decomposing roots of sword ferns (*Nephrolepis* sp.). There were six limestone clasts that appeared to have collapsed from the roof. In addition to these limestone clasts there were smaller smooth limestone pebbles, with cracked white surfaces possibly indicating scorching. In addition there were some scorched turtle bone and charcoal flecks in the soil. A soil sample was taken but the charcoal flecks were not large or coherent enough for retrieval. This context, with an average depth of 8cm, overlay an orangey grey soil, was identified as a new context 5501. Details of the shell, ceramic, faunal and lithic evidence from contexts 5500-5506 are discussed below.

The soil of context 5501 is an orangey grey compacted sandy loam with a handful of small rounded limestone inclusions less than 5cm diameter. There was evidence of vertical holes in the stratigraphy associated with hermit crab remains. This context had an average thickness of 6cm. There was a change in context as the excavation came down onto a layer of compacted shell artefacts. This new context was designated 5502. The soil of context 5502 consisted of a dry and loose orangey brown sandy loam with a number of large limestone rocks that appear to be an earlier collapse from the cave ceiling. This context had an average thickness of 16cm. Below this layer of shell, there was another change in the soil matrix that was designated 5503. The sediment of context 5503 is compacted orange sand with no archaeological material. This context was approximately 4cm thick, and came down onto context 5504.

Context 5504 has a loose, orangey-brown sand matrix with densely packed shell. This context was approximately 14 in depth. It overlay a compacted brown soil, context 5505, only 2cm thick with no inclusions, which overlay the limestone bedrock, designated 5506.

6.I.1.ii.a Archaeological Evidence from Contexts 5500-5505

This excavation identified a number of stratigraphic layers of densely packed shell interspersed with layers of different soils with fewer shell artefacts. There is clear evidence of crab activity that raises questions over the stratigraphic integrity of the deposits. Material recovered during the excavation included ceramics, bone, lithics and shell.

Ceramics

Four heavily eroded body sherds were found in context 5500 and one in 5502. All were found during the sieving of the deposits and measured less than 2cm^2 in size. The fragments were too small and eroded to allow the identification of vessel form or style. A macroscopic examination of the fabrics showed a similar colour and consistency as other indigenous ceramics from the case study area.

Fauna

Turtle, jutia and fish bones were found in 5500, 5501, 5502, 5504 and 5505. Evidence of scorching was found on turtle bone from 5500 and 5501. The excavated bones from these contexts were very fragile and cleaning for initial identification and counting was deemed too destructive. Therefore all of the bone was packaged and sent for specialist analysis, the results of which are not available at the time of writing.

Lithics

Limestone fragments were found in contexts 5500, 5501, 5502, 5004. Given the limestone geology of the cave and the areas of roof collapse, it is likely that the limestone inclusions are natural accumulations. The only lithics with evidence of modification were three limestone pebbles from 5500 that showed evidence of burning. These burnt pebbles were found in association with burnt turtle bone.

Shell Species

The shell species (205 NIE) from contexts 5500-5505 are summarised in Table 6.08

Table 6.08 Shell Species from the stratified deposits in Cave 1

Shell Species	**5500 Qty (NIE)**	**5501 Qty (NIE)**	**5502 Qty (NIE)**	**5504 Qty (NIE)**	**5505 Qty (NIE)**
Cittarium pica	5	4	13	14	1
Codakia orbicularis	2	2			
Fasciolaria tulipa	1		1	1	
Murex brevifrons			1	1	
Nerita sp.	2	1		1	
Oliva reticularis	1		1	1	
Pinctada radiata	3				
Strombus gigas	1	3	10	3	
Strombus sp.	72	20	12	17	
Unidentified	4	1	1	2	3

These assemblages show a dominance of *Strombus gigas*, *Strombus* sp. and *Cittarium pica* species. Contexts 5500, 5502 and 5504, have larger quantities of shell, and greater species diversity. All the species found in these contexts were also found in Layer 1. The relative abundances of shell species are also comparable with Layer 1.

Shell age structure

The demographic patterns have been examined from the contexts with larger sample sizes (5500-5504). There are 10 juvenile and 8 adult *Cittarium pica* shells (18 NIE): 5502 (adult 2, juv. 6 NIE), 5504 (adult 6, juv. 3 NIE) 5505 (juv. 1 NIE). Juvenile *Strombus gigas* (15 NIE) dominate the assemblages of all four contexts: 5500 (1 juv. NIE), 5501 (1 juv. NIE), 5502 (1 adult, 9 juv. NIE) and 5504 (3 juv. NIE). These are small samples sizes of age-identified shells but the age distribution for *Strombus gigas* appears to in favour of juveniles. This is in contrast to the dominance of adult *Strombus gigas* in Layer 1 (4510-4583).

Shell Artefacts

Nineteen of the shells from these contexts showed signs of human modification. This includes five *Strombus* sp. from 5500 and four from 5504 that showed evidence of burning. The remaining ten artefacts are detailed in Table 6.09.

Table 6.09 Shell artefacts from the stratified deposits in Cave 1

Context	**Shell Species**	**Artefact**
5500	*Oliva reticularis*	Bead
5500	*Strombus* sp.	Knife
5500	*Cittarium pica*	whole shell with spire perforation
5501	*Strombus gigas*	Perforator
5501	*Strombus* sp.	Perforator
5501	*Strombus gigas*	point
5502	*Oliva reticularis*	bead
5502	*Strombus gigas*	whole shell with spire perforation
5504	*Oliva reticularis*	pendant
5504	*Cittarium pica*	whole shell with spire perforation

Context 5503 contained no shell artefacts. The knife, found in 5500, measures 8.5cm by 2cm and was made from the outer lip of an adult *Strombus* shell. The outer edge has been sharpened, through grinding, to provide a cutting edge (Godo Torres 1994:161). This is the only artefact of this type to be found in the case study area, flint being a more commonly found material for producing cutting implements at indigenous sites in Cuba. Perhaps the scarcity of available flint contributed to the production and use of this *Strombus* knife. The presence of a pendant and beads in three of the excavated contexts indicates shell ornament production. The pendant found in 5504 is broken and was in the process of being manufactured. It is not certain if the breakage occurred during manufacture but, given the similar state of other shell artefacts discarded during manufacture in Layer 1, this pendant is a further indication of shell working in this cave. The presence of whole shells with spire perforations indicates ongoing shellfish consumption throughout the occupation of the cave.

6.I.1.ii.b Excavation Summary

The excavation of these sequenced archaeological contexts revealed distinct stratigraphic layers. Four layers were identified below Layer 1 that contained archaeological material. These comprised layer 2 (5500), 3 (5501), 4 (5502), 5 (5504). If the cave was the location for long-term human activity, it is likely that the previous floor surfaces would have been cleared to provide space to work in this cave comfortably, given that the ceiling height ranges between 1-2m. However, the stratigraphy suggests that the cave floor has risen gradually over time by the deposition of thin layers of accumulated material from past human activity.

Interpretation of the relationships between these layers and establishing the chronological phases of activity require further relative and absolute chronological data, as discussed in Chapter 7. One initial observation is that ceramics were only found in 5500 and 5502, providing a broad chronological association with the top stratigraphic layer of Cave 1 and potentially distinguishing these contexts from the lower stratigraphic layers that lack ceramics.

There is evidence of human selection of shells by species, the patterns of species selection being similar to that found at other sites in the case study area. The shell age structure shows a bias in favour juvenile *Strombus gigas* shells. This pattern, of a bias in the favour of juveniles, is also seen in the lower stratigraphic layers at other sites, discussed in more detail below. The archaeological evidence indicates shellfish exploitation and shell artefact production in Cave 1.

6.I.2 Cave 2

No archaeological material was identified in Cave 2 during the survey. However, given the density of archaeological material at other sites on the same island, a test excavation was conducted in Cave 2. The $1m^2$ excavation in the centre of the cave revealed no archaeological evidence. Given the density of archaeological evidence elsewhere on the island, the lack of archaeological material in this cave is interesting. There are no shells anywhere on the cave floor surface or in the cave stratigraphy. This indicates that hermit crabs have not moved shell from the entrance of the cave, where there is an abundance of shell, into the cave. The main difference between Cave 2 and Caves 1 and 3 is the lack of natural light in Cave 2 that filters into the large chamber. The entrance to the cave provides enough light for the first 7m. Therefore lack of light does not seem a likely reason for its lack of use. The cave may not have been found by past peoples, but again, this seems unlikely given the evidence of long term human activity on the island. No archaeological evidence has been found to indicate human activity in Cave 2 and further investigation is required before a satisfactory explanation for this can be established.

6.I.3 Cave 3

6.I.3.i Excavation of Units 4620-4630

Concentrations of archaeological material were found in Cave 3 during the survey. This cave was considerably smaller than Cave 1 with an area of 16.4 sq. m. Approximately 5 sq. m of this area consisted of bare sloping limestone walls. The cave surface with visible material occupied 11 sq. m. As for Cave 1, it was decided to focus initially on an open plan excavation of the whole cave to generate a body of data for inter-site comparison and also to allow the study of any potential spatial dynamics of human activity within the cave. The cave was mapped and a base line established from which the cave was then gridded in $1m^2$ units (Figure 6.08). Archaeological material recovered during the excavation included faunal remains and a single ceramic sherd.

6.I.3.i.a Ceramics

One rim sherd was found at a depth of 3cm in unit 4629. Approximately $8cm^2$ and 3cm thick, this flat sherd had a raised double-lipped rim. It appears to be from a griddle or *buren*. *Burens* have been found in past excavations at Los Buchillones (Mesa González, *et al.* 1994; Pendergast, *et al.* 1999). The sherd had a compact brown grey paste with fine grain inclusions. I compared the fabric of this sherd with the *buren* from Los Buchillones and macroscopic inspection indicated that the sherd fabrics were very similar.

6.I.3.i.b Fauna

Faunal remains from Cave 3 included bone (10 NIE), shell (434 NIE) and coral (3 NIE). The bone assemblage was further divided into identified faunal species and categories that included jutia (*Capromys pilorides)*, (5 NIE), fish, (1 NIE), turtle (4 NIE). Evidence of hermit crabs was noted but hermit crab shell was not collected.

Jutia

The bones were inspected for any evidence of modification but no signs of scorching or cut marks were identified. The number of bone elements indicates 1 MNI. It is not possible from this assemblage to determine whether these bones represent human activity.

Fish

One medium-sized fish vertebra was found in unit 4627 and was sent to Havana for identification (not available at the time of writing).

Turtle

The bone showed no signs of scorching or cut marks. Elemental analysis identified three long bones and one metapodial indicating 1 MNI. With such a small sample there is little further that can be said but the presence of turtle suggests human activity.

Coral

Three coral fragments were found (in 4622, 4626 and 4628). These fragments were too small to identify the coral species and the surfaces showed no evidence of abrasion compatible with their use as scrapers. The presence of unmodified coral fragments in the cave raises the possibility of storm wash transporting the coral into the cave from the shoreline. However, the raised entrance to the cave was 2.7m above msl and its location on the leeward southeast corner of the island make this unlikely. These coral fragments are currently stored in Holguin and are awaiting microscopic analysis by coral microwear specialists (Kelly and Van Gijn 2006).

Shell

Shell constituted 97% (434 NIE) of the faunal assemblage from these units. The shell species from this assemblage are listed in Table 6.10.

Table 6.10 Shell species excavated from Layer 1 in Cave 3, Hijo de Guillermo Este

Cave 3, 4620-4630 Shell Species	**Qty NIE**
Strombus gigas	258
Codakia orbicularis	70
Strombus sp.	70
Xancus angulatus	14
Cittarium pica	9
Murex brevifrons	9
Fasciolaria tulipa	2
Chama sp.	1
Tellina laevigata	1

The species represented in these units in Cave 3 is similar to the species present in the top stratigraphic layer of Cave 1. However, *Oliva reticularis* shells are not found in Cave 3. This could be an indication that shell bead and pendent production was not an activity carried out in this cave. The relative representation of species also appears similar to Layer 1, Cave 1, see Table 6.11.

Table 6.11 Comparison between the shell species excavated from Layer 1 in Cave 1 and Layer 1 in Cave 3

Shell Species	**Cave 3**	**Cave 1**
Strombus gigas	59%	57%
Strombus sp.	16%	21%
Xancus angulatus	3%	4%
Cittarium pica	2%	6%
Codakia orbicularis	16%	3%
Fasciolaria tulipa	<1%	1%

One difference is the high number of *Codakia orbicularis* found in Cave 3. This shell is often used as a scraper and the high percentage of this shell in this cave could potentially indicate more intensive scraping activities in this cave. This possibility was investigated through the analysis of shell artefacts in the assemblage, discussed below.

Shell Age structure

Strombus gigas, Strombus sp., *Oliva reticularis, Murex brevifrons* and *Fasciolaria tulipa* reveals a relatively evenly distributed representation of adult and juvenile shells. While there is a predominance of adult specimens in *Xancus angulatus, Cittarium pica* and *Codakia orbicularis* species (Table 6.12). The age structure of the assemblage indicates that adult *Xancus angulatus* and *Codakia orbicularis* shells might have been deliberately selected.

Table 6.12 Age structure of shells excavated from Layer 1 in Cave 3

Cave 3 Shell Species	Mature Adult	Young Adult	Adolescent Juvenile	Juvenile	Unknown
Strombus gigas	14	95	108	1	1
Strombus sp.	0	8	2	1	55
Codakia orbicularis	0	55	2	0	14
Xancus angulatus / Turbinella angulata	4	10	2	0	1
Cittarium pica	0	3	0	0	7
Murex brevifrons (Chicoreus brevifrons)	0	2	5	0	2
Fasciolaria tulipa	0	0	2	0	0

Shell Artefacts

All of the shells from Cave 3 were categorized. This artefact list was compared with Cave 1 (Table 6.13). The hand picks and shells with circular spire perforations indicate shellfish exploitation. The shell points indicate the production of implements for harpoon fishing. There are more scrapers in Cave 3, all of which are *Codakia orbicularis* that show use wear on the ventral edge of the valve.

The axes, hammers, scrapers, spoons and points identified from Layer 1 in Cave 3 were similar to those found in Layer 1 in Cave 1. A further comparison of the assemblages illustrates a similar shell species selection for each shell artefact shown in Table 6.14.

Table 6.13 Shell artefact types excavated from Layer 1, Cave 3, Hijo de Guillermo Este

Tool type	**Cave 3 qty**	**Cave 1 qty**
Axe-head	2	1
Bead	0	5
Burnt fragments	0	4
Gubia	0	6
Hammer	1	11
Hand pick	10	39
Naturally eroded	6	51
Pendant	0	1
Perforator	0	3
Plate	0	6
Point	2	33
Scraper	14	7
Spoon	1	3
Unidentifiable fragment	110	179
Vessel	0	6
Waste core	0	9
Waste flake	0	12
Whole shell with spire perforation	8	111

Table 6.14 Comparison of shell species of artefacts found in Layer 1 in Cave 3 and Layer 1 in Cave 1

Tool type	**Shell species**	**Cave 3, Layer 1 Qty**	**Cave 1, Layer 1 Qty**
Axe-head	*Strombus sp.*	2	1
Hammer	*Xancus angulatus*	1	4
Hand pick	*Strombus gigas*	6	29
Hand pick	*Strombus sp.*	4	7
Point	*Strombus sp.*	2	33
Scraper	*Codakia orbicularis*	14	6
Spoon	*Strombus sp.*	1	3
Whole shell with spire perforation	*Strombus gigas*	6	98
Whole shell with spire perforation	*Xancus angulatus*	2	9

There is a more limited range of shell artefacts found in Cave 3 and no *gubias*, plates, perforators, vessels, beads or pendants were recovered. The sample size of the assemblage may be a contributing factor to this smaller array of artefact types. The species selection and artefacts are similar to those found in Layer 1 in Cave 1. The key differences are the higher percentage of scrapers and the absence of any beads or pendants.

6.I.3.ii Excavation of Contexts 5507-5513

A further 1m^2 excavation was located underneath unit 4627 in the centre of the largest cave chamber where the sediments were predicted to have the deepest stratigraphy (based on the angles of the sloping walls). The soil of context 5507 was a dark brown sandy loam with two large limestone angular rocks that appear to have fallen in from the cave walls. Shell, coral and a ceramic sherd were recovered. Context 5507 had an average thickness of 12cm and overlay context 5508.

The soil of context 5508 was a moist, light brown loam with root inclusions. There were a number of small, rounded limestone pebbles that appeared to be fragments from the cave walls. No bone and shell material were present. We excavated to a depth of 8cm before coming down onto context 5509. The soil of context 5509 was compacted, yellow brown sandy silt with numerous small limestone pebble inclusions. This context contained densely packed shell, and some bone; it extended to a depth of 25cm and overlay context 5512. The soil of context 5512 was damp brown silt with an abundant collection of large limestone rocks measuring between 20 and 47cm. This context was fully excavated; however, there were only six shells found between the rocks. Below these rocks was the limestone bedrock (Context 5513).

6.I.3.ii.a Ceramics

Only one small and heavily eroded ceramic sherd was found in context 5507. The paste of this sherd was consistent with other indigenous ceramics found in the case study area, although its eroded state prevented further classification.

6.I.3.ii.b Fauna

Coral

One *A. cervicornis* coral fragment was found in context 5507. This fragment shows no clear macroscopic evidence of being used as a scraper but its presence in the cave suggests it was introduced into the assemblage.

Shell

The shell species from the excavated contexts are listed in Table 6.15

Table 6.15 Shell species in the stratified deposits in Cave 3

Shell Species	5507 Qty NIE	5508 Qty	5509 Qty	5512 Qty
Arca zebra	1		1	
Charonia variegata			2	
Cittarium pica	2	2	4	
Codakia orbicularis	6	3	10	3
Fasciolaria tulipa		1		
Murex brevifrons	2		2	
Nerita peloronta			1	
Strombus gigas	9	2	18	2
Strombus sp.	23	17	49	19
Unidentified			3	
Xancus angulatus			3	

The excavations recovered a diverse collection of shell but there is a common dominance of *Codakia oribicularis*, *Strombus gigas* and *Strombus* sp. The ages of these three shell species are interesting. In all four contexts, all *Codakia orbicularis* are adult speciments (14 NIE) whilst all the *Strombus gigas* shells are juveniles (31 NIE) except for one adult that has a circular spire perforation. This predominant selection of juvenile *Strombus gigas* shells is distinctive and markedly different to the age structure found in the *Strombus gigas* shells in contexts 4620-4630 in this cave. Discussion of the significance of this follows the excavation of Midden 1, Cayo Guillermo, below.

Only nine shells from this assemblage showed evidence of human modification (Table 6.16). The shell scrapers and shell point found in contexts 5507, 5508 and 5509 were similar to examples found elsewhere in Cave 3. The *Strombus gigas* shell with a spire perforation (found in context 5509) is the only adult *Strombus gigas* shell from these excavated contexts. The forms of the perforators and the *gubia* found in context 5509 were unusual. The perforators were *Strombus gigas* fragments that had been shaped into boring implements that had wear evidence of being used as perforators.

These were different to the elongated and sharpened perforators found in 4527, 4571, 4581 and 5501 in Cave 1. The *gubia* was also distinctive and different from all the other *gubias* found during survey and excavation. Based on the shell artefact typologies discussed in Chapter 4, this *gubia* can be classified as preagroalfarero because " in the preagroalfarero groups, the gubias that predominate conform to the type known as 'typical' gubias... these gubias are generally large and a high level of evidence for percussion and fracturing of the striking edge that without doubt indicates long term use" (Izquierdo Diaz and Sampedro Hernández 2002:75). Such tools are distinctive and the presence of a specimen in context 5509 suggests distinctive activities or tool styles not previously found in the case study area.

Table 6.16 Shell artefacts from the stratified deposits in Cave 3

Context number	Shell species	Shell tool
5507	*Codakia orbicularis*	Scraper
5508	*Strombus* sp.	Point
5509	*Strombus* sp.	*Gubia*
5509	*Strombus* sp.	Perforator
5509	*Strombus* sp.	Perforator
5509	*Strombus* sp.	Perforator
5509	*Strombus* sp.	Perforator
5509	*Codakia orbicularis*	Scraper
5509	*Strombus gigas*	Whole shell with spire perforation

6.I.3.ii.c Excavation Summary

The ceramics, shell species selection and shell tools found in contexts 5507 and 5508 are similar to the assemblage from Layer 1 in Cave 3. The *Strombus gigas* age structure and the selection of juvenile shells that dominates all four contexts is in contrast to the more diverse selection of adult and juvenile shells found in the contexts above 5507. The species selection and shell artefacts found in context 5509 are different to those found in the overlying contexts in this cave and suggest that the stratigraphic location of this context might reflect an earlier activity or distinctive tool manufacturing style. Therefore these archaeological contexts were identified as Layer 1 (4583-4599), layer 2 (5507, 5508), layer 3 (5509) and layer 4 (5512).

6.I.4 Rock Shelter 1, Excavation of Context 5536

As discussed in Chapter 5, Rock Shelter 1 is an open hollow within the exposed limestone bedrock in the northwest part of the island. Surface material showed evidence of past human activity in and around the rock shelter. There was a small area with deposits at the back of the rock shelter. This was targeted for small-scale excavation with the aim of obtaining a humanly-modified shell for radiocarbon dating from a stratified context. The sediment of context 5536 was yellow sand with no inclusions. One adult *Strombus gigas* with a circular spire perforation was recovered from this context. This shell was semi-buried in 5cm of sand, and seated on the limestone bedrock at the back of the rock shelter. The shell was similar in species, age, artefact type and location to the other *Strombus gigas* shells with spire perforations found during the survey, and it was collected for radiocarbon dating (discussed in Chapter 7).

6.I.5 Rock Shelter 2, Excavation of 5510 and 5511

This small rock shelter measuring 1.5m^2 was excavated following the discovery of archaeological material in survey square 4421. A 1m^2 excavation was located in the centre of the first chamber of the rock shelter. The sediment of the first excavated context, 5510, was dark brown sand with root inclusions. At a depth of 15cm the sediment changed to lighter brown sand without vegetation inclusions and this was designated as context 5511. This context had a thickness of 5cm and overlay the limestone bedrock. Shell was the only archaeological material excavated from these contexts.

6.I.6.I Shell

The shell assemblage (16 NIE) from these two excavations contained *Cittarium pica*, *Codakia orbicularis*, *Fasciolaria tulipa*, *Strombus gigas*, *Strombus* sp. *Xancus angulatus*. There were two modified shell artefacts, a *Strombus gigas* hand pick from 5510 and a *gubia* from 5511. The *gubia* was similar to the *gubias* found in Layer 1 in Cave 1. The small sample size of the assemblage restricts detailed analysis.

6.II Cayo Guillermo, Punta Morra

6.II.1 Midden 1

6.II.1.i Excavation of Contexts 5530-5533

This excavation was located close to the centre of Midden 1 and 3m east of survey square 5070. The sediment of context 5530 was orangey yellow sand with dense root inclusions from grassy brush vegetation. Plastic was found in the top 2cm, probably blown in from a pathway, 35m to the north, which is still used by fishermen today. At a depth of 10cm the soil matrix changed, and this new deposit was given a new context number of 5531. Details of all excavated material are discussed below in the artefact summary.

The sediment of 5531 was damp, dark, loose brown sand with sporadic vertical root inclusions. A compact layer of mixed shell extended from 10cm-25cm. There was then a change in soil consistency and inclusions, and this new layer was designated context number 5532. The sediment of 5532 was wet brown sand with fewer and more dispersed shells. We excavated to a depth of 15cm before coming down onto a layer of tightly packed shell, context number 5533. The sediment of 5533 was wet orange sand with no inclusions. A densely packed layer of shell was uncovered that extended down 25cm before standing water (sea level) hindered further excavation. Shell was the only archaeological material excavated from these contexts.

6.I.6.i.a Shell

This assemblage indicates species selection with an 89% dominance of *Strombus*. All of the shells were examined for evidence of human modification, but only two whole shells with circular spire perforations and one hand pick were identified. These shell artefacts indicate flesh extraction at this site (Table 6.17). Context 5530 contained *Strombus gigas* and *Strombus* sp. shells, including one adult *Strombus gigas* with a circular spire perforation. Context 5531 contained a more diverse collection of shell species but *Strombus gigas* (78 NIE) and *Strombus* sp. (39 NIE) still dominate this assemblage. There is one *Fasciolaria tulipa* shell and four bivalve species: *Anadara* sp., *Arca zebra*, *Chama* sp., and *Diplodonta notata.*

Table 6.17 Shell species in the stratified deposits in Midden 1, Cayo Guillermo

Context No.	Species	Shell Description	Qty
5530	*Strombus gigas*	whole shell	6
5530	*Strombus gigas*	whole shell with spire perforation	1
5530	*Strombus* sp.	unidentifiable fragment	1
5531	*Anadara* sp.	whole shell	1
5531	*Arca zebra*	unidentifiable fragment	4
5531	*Arca zebra*	whole shell	1
5531	*Chama* sp.	whole shell	3
5531	*Diplodonta notata*	unidentifiable fragment	1
5531	*Fasciolaria tulipa*	whole shell	1
5531	*Strombus gigas*	Hand pick	1
5531	*Strombus gigas*	unidentifiable fragment	10
5531	*Strombus gigas*	whole shell	28
5531	*Strombus* sp.	unidentifiable fragment	39
5532	*Arca zebra*	whole shell	1
5532	*Chama* sp.	whole shell	1
5532	*Strombus gigas*	unidentifiable fragment	1
5532	*Strombus gigas*	whole shell	12
5532	*Strombus* sp.	unidentifiable fragment	1
5533	*Arca zebra*	whole shell	2
5533	*Chama* sp.	whole shell	2
5533	*Cittarium pica*	unidentifiable fragment	1
5533	*Diplodonta notata*	whole shell	1
5533	*Strombus gigas*	whole shell	33
5533	*Strombus gigas*	whole shell with spire perforation	1
5533	*Strombus* sp.	unidentifiable fragment	19
5533	*Strombus* sp.	whole shell	1

This species representation is similar to context 5532, with a dominance of *Strombus gigas* (14 NIE, 12 MNI), *Strombus* sp. (1 NIE) with additional *Arca zebra* (1 NIE) and *Chama* sp. (1 NIE) shells. Likewise for context 5533, with *Strombus gigas* (34 NIE, 34 MNI), *Strombus* sp. (20 NIE, 1 MNI), *Arca zebra* (2 NIE), *Chama* sp. (2 NIE), *Cittarium pica* (1 NIE) and *Diplodonta notata* (1 NIE). One of the *Strombus gigas* shells from this lowest stratigraphic layer has a circular spire perforation. Therefore all the contexts from this excavation have similar assemblages of shell species and shell artefact types that indicate these shells were selected and exploited for food.

Shell Age Structure

The age structure in *Strombus gigas* is dominated by juveniles (Table 6.18).

Table 6.18 Age structure of *Strombus gigas* from excavation of Midden 1, Cayo Guillermo

Species	Shell Age	Qty NIE	Qty MNI
Strombus gigas	Juvenile 1	52	48
Strombus gigas	Juvenile 2	35	32
Strombus gigas	Adult 3	5	5
Strombus gigas	Adult 4	0	0

The shells increase in size and maturity in the surface contexts of Midden 1. Similar selection of juvenile *Strombus* was also found in the lower stratigraphic layers of Cave 1 and Cave 3 on Cayo Hijo de Guillermo Este. This suggests an interesting pattern with a number of potential interpretations. Natural sorting of size by hermit crabs with larger shells being left on the surface is one possibility but the size of hermit crab burrows is smaller than the size of shells found in the stratified deposits, making this an unlikely explanation. Another possibility is that this pattern might reflect the exploitation by past peoples of the flat sea grass beds of the shallower waters in the intermediate islands. Sea grass beds are the known habitat of juvenile *Strombus gigas*. This focus could have been a selective choice, perhaps because the *Strombus gigas* shells were a secondary product of a marine exploitation with a primary focus on other species, such as *Panulirus argus* (lobster), that inhabit the same marine environment. The focus on a particular marine environment could also reflect a lack of ability, technology or desire to exploit the deeper marine environments of the reef and pelagic zones for more mature *Strombus gigas*. Alternatively, larger *Strombus gigas* specimens might not be represented in this assemblage because they were being processed differently and removed from the site. Further possibilities could be that this pattern reflects the lack of availability of mature *Strombus gigas* in the case study area during this period, possibly as a result of prior over exploitation of this resource. Establishing the chronology for the sites within the case study area may facilitate interpretation of this pattern. In short, more evidence is required before these hypotheses can be tested further.

There are a number of shell species poorly or not represented. There are no *Codakia orbicularis*, *Murex brevifrons*, *Oliva reticularis* or *Xancus angulatus* specimens in this assemblage, yet these shells are often a significant element of the assemblages at other sites (including Cave 1 and Cave 3 on Cayo Hijo de Guillermo Este). Only one small *Cittarium pica* fragment from this assemblage of 140 shells (NIE) was recovered, in contrast to the assemblage from Cayo Caiman Mata de Coco, where this species dominates.

The archaeological material from this excavation suggests that the midden reflects past human activity, primarily, targeted marine shellfish exploitation focused on juvenile *Strombus gigas*. The density of shell material in stratified deposits less than 65cm and the surveyed area of the midden 2104 sq. m, in addition to the consistency of the artefact assemblage throughout the different stratigraphic layers of the excavation suggests regular human activity at the site.

6.III Cayo Caiman de la Sardina

6.III.1 Surface Deposit 1

6.III.1.i Excavation of Contexts 5538 & 5539

Two excavations were conducted in survey squares 4398 and 4399, where *Strombus gigas* shells with circular spire perforations had been found during the survey. The sediment of context 5538 was yellow sand with intrusive roots from the grassy brush vegetation. Excavations continued to a depth 35cm before coming onto limestone bedrock. No archaeological material was recovered. The sediment of context 5539 was yellow sand with no inclusions. The excavation continued to a depth of 42cm before reaching the bedrock. Again, no archaeological material was recovered.

6.IV Cayo Caiman Mata de Coco

6.IV.1 Midden1

6.IV.1.i Excavation of Context 5540

Excavation of context 5540 was located 4m north of the survey square 4227 and in the eastern half of Midden 1. The sediment was of loose yellow sand with root inclusions from surface grass vegetation. A compacted layer of shell was concentrated in the top 25cm. No other material was uncovered. The excavation continued to a depth of 1m through 75cm of sterile sand, but no other artefacts were found. The shells (21NIE) revealed an interesting pattern in species selection with a high percentage of *Cittarium pica* shells (17NIE, 10MNI) in association with one juvenile *Strombus gigas* shell that had been used as a hand pick and one fractured *Strombus* sp. fragment. Three of the *Cittarium pica* shells had spire perforations consistent with being opened with the *Strombus gigas* hand pick found in the same context.

In addition, two juvenile *Xancus angulatus* shells were found with possible, but not conclusive, evidence of re-use as hand picks. The bottoms of both columellas indicated possible minor percussion fractures, but in accordance with the shell artefact typology, this is only inconclusive evidence and the shells have not been classified as hand picks. The assemblage indicates shell selection with concentrated exploitation of the *Cittarium pica* species. For details of the shell assemblage from context 5540, see Table 6.19.

Table 6.19 Shells and artefacts from context 5540 in Midden 1, Cayo Caiman Mata de Coco

Qty	Species	Artefact	Age	Part
2	*Xancus angulatus*	Whole shell	2 juvenile	Whole shell
1	*Strombus* sp.	Unidentifiable fragment	Unknown	Body
1	*Strombus gigas*	Hand pick	1 juvenile	Body
3	*Cittarium pica*	Whole shell with spire perforation	3 adult	Whole shell
1	*Cittarium pica*	Whole shell	3 adult	Whole shell
3	*Cittarium pica*	Whole shell	2 juvenile	Whole shell
10	*Cittarium pica*	Fragment	Unknown	Body

6.IV.1.ii Excavation of Context 5541

Excavation of Context 5541 was located on the bluff in the western portion of Midden 1, 4m northwest of survey square 4130. The soil was identical to context 5540, loose yellow sand with root inclusions from the grass vegetation. A layer of shell artefacts was uncovered 5cm below the surface, 56cm thick, below which was a layer of sterile sand that extended for a further 40cm. The shell assemblage (110 NIE) from this context mirrors the species selection of context 5540, 30m to the southeast, with a high percentage of *Cittarium pica* shell (87NIE, 53MNI). There were fourteen whole *Cittarium pica* shells with spire perforations consistent with being opened by the one *Strombus gigas* handpick also found in the assemblage. This *Strombus gigas* handpick was selected for radiocarbon dating. There were a further three whole *Strombus gigas* shells, one of which had a circular spire perforation. In addition, there was one juvenile *Fasciolaria tulipa* and another juvenile *Xancus angulatus* of a size similar to the two found in context 5540 (Table 6.20). This assemblage also indicates human shell collection with a focused exploitation of *Cittarium pica.*

Table 6.20 Shell species and artefact classifications of the shell assemblage from 5541 in Midden 1, Cayo Caiman Mata de Coco

Qty	Species	Artefact	Age	Part	MNI
1	*Cittarium pica*	Whole shell	2 juvenile	Whole shell	Spire
25	*Cittarium pica*	Whole shell	3 adult	Whole shell	Spire
3	*Cittarium pica*	Whole shell with spire perforation	2 juvenile	Whole shell	Spire
12	*Cittarium pica*	Whole shell with spire perforation	3 adult	Whole shell	Spire
3	*Cittarium pica*	Fragment	2 juvenile	Body	Spire
9	*Cittarium pica*	Fragment	Unknown	Body	Spire
34	*Cittarium pica*	Fragment	Unknown	Body	Fragment
1	*Fasciolaria tulipa*	Whole shell	2 juvenile	Whole shell	Spire
1	*Strombus gigas*	Hand pick	3 adult	Body	Spire
2	*Strombus gigas*	Whole shell	2 juvenile	Whole shell	Spire
1	*Strombus gigas*	Whole shell with spire perforation	3 adult	Body	Spire
2	*Strombus gigas*	Unidentifiable fragment	Unknown	Body	Fragment
14	*Strombus* sp.	Unidentifiable fragment	Unknown	Body whorl	Fragment
1	*Xancus angulatus*	Unidentifiable fragment	Unknown	Body whorl	Fragment
1	*Xancus angulatus*	Whole shell	2 juvenile	Whole shell	Spire

6.IV.1.iii Excavation Summary

There is evidence from both excavations of human activity at this midden site. There is an interesting pattern in the exploited shell species with over 79% (of NIE) of the assemblage being *Cittarium pica* shell, probably subsistence debris. *Cittarium pica* is a rocky shore species in the littoral zone. This habitat is found in the shallow southern leeward shoreline on Cayo Caiman Mata de Coco. There is also evidence that *Strombus gigas* shells was being exploited for both subsistence and for use of the shells as hand picks, to facilitate exploitation of the other gastropods. There were also *Xancus angulatus* and a single *Fasciolaria tulipa* shell, but these showed no clear signs of human modification. The selection of only four shell species, with a predominance of *Cittarium pica,* constitutes an assemblage quite distinct from those found at other sites in the case study area.

6.V Cayo Felipe Este

6.V.1 Midden 1

6.V.1.i Excavation of Context 5523

Context 5523, located 5m southeast of survey square 5521, has a sediment of yellow sand with root inclusions in the top 10cm. A large quantity of fractured shell was found in the top 15cm with *Cittarium pica* (83 NIE 1 MNI), *Strombus* sp. (39 NIE 3 MNI) and *Fasciolaria tulipa* (1NIE 1MNI). This assemblage of just three species reflects the selection found in the nearby survey squares 5019 – 5029. All the *Cittarium pica* and *Strombus gigas* fragments measured less than 10cm in size and the ratio between the 123 NIE and 5 MNI indicates the extent to which the assemblage is fragmented. Despite the extent of fractured shell, no shell artefacts were identified in this assemblage, or any other evidence of deliberate shell working. During the survey it was noted that the flattened topography and sharp sides of the midden site, in addition to its proximity to an oil drilling bore hole 63m to the west, could indicate recent large-scale machine-based earth moving. The shell assemblage and site topography indicates recent taphonomic processes have truncated and re-deposited the archaeological evidence. This limits the potential to interpret the nature and extent of past human activity at this site.

6.VI Cayo Felipe Oeste

6.VI.1 Surface Deposit 1

6.VI.1.i Excavation of Contexts 5220-5222

Context 5220 was located 1m south of survey square 4172, where previous evidence of human activity was found in the form of a whole adult *Xancus angulatus* shell with a circular spire perforation. The sediment of context 5520 was yellow sand with grass root inclusions in the top 5cm. One whole adult *Strombus gigas* shell was found 10cm below the surface. This shell had no evidence of human modification. The excavation continued to a depth of 1m through sterile sand, and no other evidence was recovered. Additional excavations were conducted in the immediate area. Context 5221 was situated 6m southeast of, and with sediment identical to, 5520. It was excavated to a depth of 50cm onto the limestone bedrock, but no archaeological material was recovered. A further excavation (context 5222), was located 6m south east of 5221 with soil identical to 5220 and 5221. This context was excavated to a depth of 50cm and again no archaeological material was recovered.

6.VII Cayo Hijo de Guillermo Oeste

6.VII.1 Surface Deposit 1

6.VII.1.i Excavation of Contexts 5518 and 5519

The exposed limestone bedrock limited excavation of Surface Deposit 1. However, because ceramics and other evidence of prehistoric human activity were found in the survey, attempts were made to identify any areas within the site where excavation might be possible. Context 5518 was located 5m north of survey square 4044 and context 5519 was located 21m northwest of survey square 4044. The locations were selected because they contained thin soil lenses below where ceramics had been visible on the surface. The ceramics comprised heavily eroded ($2cm^2$) body sherds. The fabric of the ceramic pastes indicating that these were probably indigenous ceramics. The excavations both revealed thin lenses of loose brown sand less than 5cm in depth, containing no further archaeological material. The only conclusion to be drawn from this excavation is that there are no discernable stratigraphic layers at this site and the archaeological context of the artefacts is not secure.

6.VII.2 Surface Deposit 3,

6.VII.2.i Excavation of Context 5516

The excavation of context 5516 was situated in the southwest quadrant of Surface Deposit 3, 4m southwest of survey square 4338. As discussed in Chapter 5, Surface Deposit 3 occurred relatively close to a windward shoreline and therefore the location of the excavation was chosen to maximise the distance from the seashore and minimise the influence of stormwash. The soil was yellow sand with large amounts of brush vegetation roots and decomposing vegetation in the top 30cm. All of the material evidence came from a densely packed concentration of shell in the top 30cm of the context. One shell from this assemblage showed evidence of human modification. This was an adult *Strombus gigas,* with a circular spire perforation, found 3cm below the surface. The rest of the assemblage consisted of a diverse range of shell species (Table 6.21). This diverse assemblage appears to be representative of shellfish species with small shell sizes that exist in the marine environment near this site today. Some of the species, such as *Thais* sp. and *Astraea* sp., have not previously been found associated with past human exploitation. Given the location of the context 57m to the north and 18m to the east of the windward shoreline, it is possible that this shell assemblage reflects storm wash. There is no further archaeological evidence from the excavated context. Therefore archaeological material found in survey squares 4330-4442 appears to overlay a layer of naturally accumulated shell.

Table 6.21 Species excavated from context 5516, Surface Deposit 3, Cayo Hjio de Guillermo Oeste

Context	Species	Qty
5516	*Acanthopleura granulata*	1
5516	*Anadara* sp.	2
5516	*Arca* sp.	2
5516	*Arca zebra*	23
5516	*Astraea* sp.	1
5516	*Chama macerophylla*	25
5516	*Chama sarda*	1
5516	*Chama* sp.	32
5516	*Chione cancellata*	1
5516	*Chione pygmaea*	1
5516	*Cittarium pica*	4
5516	*Diodora* sp.	1
5516	*Diplodonta notata*	7
5516	*Nerita* sp.	1
5516	*Spondylus* sp.	5
5516	*Strombus gigas*	10
5516	*Strombus* sp.	10
5516	*Thais* sp.	2
5516	Unidentified	14
5516	*Xancus angulatus*	1

6.IX Cuban Mainland, Los Buchillones

Introduction

In 2004, targeted excavations were conducted at Los Buchillones with the primary aims:

1. To better understand the design, location and function of structures within the settlement of Los Buchillones

2. To establish an absolute chronology for Los Buchillones by recovering contextually secure wood and shell samples for radiocarbon determinations

6.IX.1 Excavation of area D2-6 at Los Buchillones

Previous excavations by CITMA and the Royal Ontario Museum of areas F1_1 and E1_1 in the 1990s, previously discussed in Chapter 4, have established that the waterlogged remains of thatched structures were present around the lagoonal spit at Los Buchillones (Figure 4.03) (Calvera Roses, *et al.* 2001; Jardines Macias and Calvera Roses 1999; Pendergast, *et al.* 2003; Pendergast, *et al.* 1999, 2002). However, waterlogged conditions prevented the excavation of the structural posts. Therefore I located an excavation around some previously identified wooden posts emerging from the sea bed clustered 16m north of the shoreline in an area previously identified as D2-6 (Valcárcel-Rojas and Cooper et al. 2006). The excavation of D2-6 included an open plan excavation of an area 16.6m by 12m. The area was divided into a 4m2 grid.

The excavation followed the methods outlined in Chapter 4 and revealed two clear stratigraphic layers. The top stratigraphic layer of dark grey clay varied between 8-15cm in depth. This layer corresponds with the stratigraphic layer designated VI by Peros during his paleoenvironmental research at Los Buchillones (Calvera et al. 2001:76; Peros 2000). This layer contained a small number of shell, bone, lithic, wood and ceramic artefacts as well as the tops of a number of wooden posts. The horizontal and vertical location of the artefacts were recorded in situ and then removed for post excavation analysis. The radiocarbon dating project discussed in Chapter 9 uses samples for dating from this excavation. The second stratigraphic layer of light yellow grey clay, with occasional root inclusions, continued in depth to the limits of excavation. This layer corresponds with the stratigraphic layer designated V by Peros (Calvera et al. 2001:76; Peros 2000). This layer only contained wooden posts and no further archaeological material.

There were only a limited number of portable artefacts recovered 40 NIE. The small number of ceramic fragments 23 NIE were heavily eroded but analysis of vessel form and fabric identified these ceramic vessel and *buren* fragments as similar to those in the extant ceramic assemblage recovered from previous excavations at the site (Mesa González et al. 1994). The bone recovered from the excavation included 4 NIE *Quelonia* sp. long bones from the top stratigraphic layer of grid square 10. A single petaloid stone axe was found in association in the top stratigraphic layer of grid square 4. Shell artefacts excavated included 2 NIE *Oliva reticularis* shell pendants and 5 NIE valve scrapers. There were 5 NIE portable wooden artefacts recovered including 2 NIE fragments of wooden vessels and 3 NIE carved wooden objects. It appeared that the location of this excavation further offshore than previous excavations had revealed an area where there had been further erosion of the upper layers of cultural deposits. However, this erosion had revealed a large number of wooden posts and it was the excavation of these posts that became the focus of the excavation.

6.IX.1.i Posts recovered from Excavation of D2-6

The excavation of this site employed the methodology outlined in Chapter 4. Wooden posts were the most dominant archaeological feature of the excavation. The distribution of the posts recovered during the excavation (Figure 6.09) and the distribution of posts in each grid square is listed in Table 6.22.

Table 6.22 Distribution of posts excavated from grid squares during excavation of D2-6 at Los Buchillones

Grid Square	Number of Posts	Post Numbers
1	2	10 & 11
2	6	25, 26, 4, 5, 6 & 7
3	5	12, 13 1, 15 & 2
4	2	22 & 24
5	1	9
6	2	19 & 20
7	3	8, 21 & 14
8	1	23
9	0	0
10	1	3
11	2	16 & 18
12	0	0
13	1	17 (Grid Sq. 4 Baulk)

The posts were imbedded in the sediments and eroded above the level of the seabed sediments. The posts were all circular or oval in cross-section and slightly tapered towards the top indicating they were put in vertically. Analysis of form and tree rings suggested that all the posts came from the main tree trunk and only one post had signs of cut marks where a branch had been removed. Posts 7, 18, 20 & 23 had cut marks that suggested that the sides had been straightened to produce a regular diameter. The shape and form of the cut marks suggested the use of an adze. Posts 1 and 14 were more oval in nature but this appeared to be the natural form of the tree.

The posts varied in size from 33cm diameter by 168cm in length to 5cm diameter by 32cm in length. During the excavation of these large structural posts, small supporting posts were often found in association. Full details of the post sizes and angles of inclination are listed in Table 6.23.

Table 6.23 Sizes and angles of inclination of wooden posts excavated from D2-6, Los Buchillones

Post Number	Number of supporting posts	Length (cm)	Diameter (cm)	Angle of Inclination
1	2	80	33	40^0 North
2	5	142	30	Vertical
3	2	128	23	25^0 South
4	0	92	33	38^0 North
5	0	32	14	Vertical
6	0	44	7	Vertical
7	0	86	23	28^0 North
8	0	80	23	4^0 North
9	0	110	30	32^0 West
10	3	80	27	25^0 West
11	0	38	13	Vertical
12	6	147	28	Vertical
13	1	86	12	Vertical
14	0	79	23	15^0 South
15	0	65	24	18^0 North
16	4	135	33	30^0 South
17	0	65	5	Vertical
18	0	67	7	Vertical
19	0	86	18	29^0 West
20	0	76	23	42^0 South
21	2	156	27	30^0 East
22	1	132	23	Vertical
23	0	51	25	16^0 Northeast
24	0	168	23	5^0 East
25	3	123	23	5^0 East
26	0	95	27	5^0 South

The posts were categorised into 'small', 'medium' and 'large' to facilitate interpretation:

Length:

- Small (1 – 50 cm): 3 posts
- Medium (51 – 100 cm): 14 posts
- Large(101 – 168 cm): 9 posts.

Diameter:

- Small (1 – 7 cm): 3 posts
- Medium (8 – 18 cm): 4 posts
- Large (19 – 33 cm): 19 posts

These broad size categories highlight that the 'large' posts are found predominantly in the central area of the excavation, within grid squares 2, 3, 6 & 7 (Figure 6.09). The well-preserved bases of the posts had evidence of tool marks showing two different types of post-finishing technique. One end type was relatively flattened, though slightly convex towards the middle, with detailed adze marks uniformly distributed, as shown in Figure 6.10 This differed from another type of post-end that was cut with axes from two directions angled downwards, creating a small segment of uncut trunk that was then snapped off, leaving a fibrous finish (Figure 6.11). Large quantitites of petaloid axes, adzes and chisels have been found during excavations at Los Buchillones and are currently on display in the Chambas Museum.

These two types of post-end correspond with post size, as all of the 'large' posts, by length, had a flattened convex end, while the majority of the 'medium' posts and all of the 'small' posts had angular, roughly finished, post ends. A tentative explanation for the finishing technique associated with the larger posts could be that they give these larger structural elements greater stability.

6.IX.1.ii Spatial Relationships between the Posts

Spatial patterns emerged of two broadly concentric circles of vertical posts surrounding an open space between grid square 6 and 7. The inner circle includes posts 7, 15, 8, 14, 20 & 19. As well as being equidistant from the centre of the space, there is also a pattern in the distance between the posts, which ranges between 2.2m and 3.5m (Table 6.24).

Table 6.24 Spatial relationships of posts 7, 8, 14, 15, 19 and 20

Post	Post	Distance
7	15	2.6m
15	8	2.2m
8	14	2.2m
14	20	3.5m
20	19	2.3m
19	7	2.3m

The outer circle consists of posts 4, 1, 24, 21, 16, 3, 9, & 10 and the distances between these posts is 2.4m to 4.2m (Table 6.25).

Table 6.25 Spatial relationships between 1, 3, 4, 9, 10, 16, 21 and 24

Post	Post	Distance
4	1	4.2m
1	24	2.8m
24	21	3.1m
21	16	2.7m
16	3	4.2m
3	9	3m
9	10	3.3m
10	4	2.4m

By analysing these two groups of posts and drawing lines between them we are left with an internal hexagon surrounded by an octagon, as shown in Figure 6.12. The distances between all of the posts in the hexagon appear to be uniformly distributed. As for the octagon, the opposing pairs of posts have similar distributions (Table 6.26).

Table 6.26 Spatial relationships between opposing pairs of posts

Post	Post	Distance	Opposite Post	Opposite Post	Distance
4	1	4.2m	16	3	4.2m
1	24	2.8m	10	4	2.4m
24	21	3.1m	9	10	3.3m
21	16	2.7m	3	9	3m

Another pattern that suggests the validity of these spatial groupings is the different sizes of the posts. The dimensions of all the 'hexagon' posts range between 65-85cm in length and 18-24cm in diameter, see Table 6.27.

Table 6.27 Dimensions of posts within internal hexagon in D2-6

Post	Length (cm)	Diameter (cm)
7	86	23
15	65	24
8	80	23
14	79	23
20	76	23
19	86	18

However, the dimensions of the 'octagon' posts are distinctly different and range between 80-168 in length and 22-33cm in diameter, see Table 6.28.

Table 6.28 Dimensions of posts from the external octogon at D2-6

Post	Length (cm)	Diameter (cm)
4	92	33
1	80	33
24	168	23
21	156	27
16	135	33
3	128	23
9	110	30
10	80	27

This difference in size of post suggests an intentional selection and placement of each post, which could reflect the design of the structure for which they were used. A final piece of evidence that indicates these posts were in association, and part of a structure, comes from an analysis of their angles of inclination. The posts do not have a uniform direction of inclination, such as might arise if they were produced by, say, post-depositional wave action. Rather, the posts are all inclined away from the centre of the space between them. One interpretation of this is that the posts were held together in tension by a superstructure placed upon them. When this structure collapsed, and the tension released, the posts fell outwards (Figure 6.12). Samples of each post from D2-6 were taken for tree species identification and initial results suggest the presence of a number species at the site Mahogany (*Swietenia mahagoni*), Lignum Vitae (*Guiacum* sp.) Yaiti, (*Gymnanthes lucida*), Manglesillo (*Bonetia cubensis*) and Guaniquiqui (*Chamisoa altisima*) (Valcárcel Rojas, *et al.* 2006:83). However, Mahogany (*Swietenia mahagoni*) was the most common species used to make the large structural posts (Ibid).

6.IX.1.iii Carpentry Skills

The tool marks of petaloid axes and adzes on the posts clearly indicate indigenous manufacturing techniques, and this is supported by the presence of the ceramic, shell, bone and lithic artefacts at the site (Calvera Roses, *et al.* 2001; Valcárcel Rojas, *et al.* 2006). The tool marks exhibited on the posts excavated at D2-6 are similar to those exhibited on other wooden artefacts at the site including '*duho*' chairs and figurines found during previous excavations at the site. The size and shape of these cut-marks superficially correspond with the petaloid axes, adzes, chisels, perforators and files found at the site during previous excavations. There is no evidence of the use of fire in the felling of the trees, as is often mentioned in ethnohistorical accounts (Alegria 1997; Guarch Delmonte 1978; Valcárcel Rojas 1997). The good preservation of the cut marks on the post bases, together with the absence of many cracks and the presence of bark, indicates that the posts were used within a short space of time after the trees were felled. There is a clear selection process in choosing mature trees of a specific size with few branches on the trunk.

6.IX.1.iv Summary of Excavation of area D2-6, Los Buchillones

The structure appears to be circular, 8.7m in diameter, and, when interpreted in association with the artefacts found during previous excavations at the site (Calvera Roses, *et al.* 2001; Pendergast, *et al.* 2003; Pendergast, *et al.* 1999, 2002), probably represents a domestic structure. The posts in the external octagon were selected for their large diameters and were set deepest in the sediments, with flattened post ends probably used for stability. These were probably the main load-bearing structural posts. The posts in the internal hexagon appear to be very symmetrically placed and if they went up to support the roof or floor of the house, this would have left an open central house space, approximately 4.6m in diameter. This structure, in association with the other material remains from the site, indicates that the people of Los Buchillones lived in these stilted houses within a wetland environment (Peros 2005:175) on the shore of the Cuban mainland.

Chapter 7

SITE CHRONOLOGY AND INTERPRETATION

7.I Cuban Site Chronology

Summary

In Chapter 2, attempts were made to collate and calibrate all existing radiocarbon determinations from archaeological sites in Cuba. In addition, all available information on each sample taken for radiocarbon dating was recorded and this highlighted the methodological issues concerning the comparison between radiocarbon dates. Chapter 2 and Chapter 4 also summarised attempts to provide a spatial platform for projecting their locations in order to facilitate discussion of their relevance in studies of prehistoric island interaction in Cuba.

One hundred and forty radiocarbon dates for a country as big as Cuba and with such a long period of human occupation is a small sample. The small sample in addition to the methodological issues of date comparison limit the potential for studies of interaction in Cuba. This is because it is difficult to identify contemporaneous activity at different sites upon which interpretations of interaction can be identified. In order to identify the spatial distribution of sites with radiocarbon determinations, the location of each radiocarbon determination was mapped (Figure 7.01). There were only two existing radiocarbon dates from sites on offshore islands. Therefore it was clear that further radiocarbon dates were required from archaeological sites on offshore islands to provide evidence of the chronological range of prehistoric island interaction in Cuba. Archaeological research in the case study area, reviewed in the previous two chapters, provides an opportunity to achieve this. Therefore the site chronology of each archaeological site was reviewed and a strategy for a radiocarbon dating project was created.

7.II Site Chronology in the Case Study Area

7.II.1 Relative, Artefact-Based, Chronologies

The relative chronologies of the sites in the case study area were initially interpreted based upon the artefact assemblages. Sites were then given potential chronological ranges based on diagnostic artefacts with chronological ranges taken from the Guarch chronological framework outlined in Chapter 2 (Table 7.01).

Table 7.01 Site chronologies based on artefacts found at them

Island	Site Name	Layer	Artefact	Date Range
Cayo Caiman de la Sardina	Surface Deposit 1	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Caiman Mata de Coco	Midden 1	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Caiman Mata de Coco	Midden 1	2	Shell with spire perforation	6000 BC – AD 1500
Cayo Caiman Mata de Coco	Surface Deposit 1	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Contrabando	Surface Deposit 1	1	Indigenous Ceramic	AD 500 – AD 1500
Cayo Contrabando	Surface Deposit 2	1	Indigenous Ceramic	AD 500 – AD 1500
Cayo Felipe Este	Midden 1	1	Shell Point	2500 BC – AD 1500
Cayo Felipe Este	Surface Deposit 1	1	Shell handpick	2500 BC – AD 1500
Cayo Felipe Oeste	Surface Deposit 1	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Flores	Surface Deposit 1	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Midden 1	1	Shell spoons and hammer	2500 BC – AD 1500
Cayo Guillermo, Punta Morra	Midden 1	2	Shell with spire perforation	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Midden 1	3	Collected shell	6000 BC – AD 1500

Cayo Guillermo, Punta Morra	Midden 1	4	Collected shell	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Midden 1	5	Collected shell	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Rock Shelter 1	1	Collected shell	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Surface Deposit 1	1	Ceramic	AD 500 – AD 1500
Cayo Guillermo, Punta Morra	Surface Deposit 2	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Surface Deposit 3	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Guillermo, Punta Morra	Surface Deposit 4	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Hijo de Guillermo Este	Cave 1	1	Ceramic	AD 500 – AD 1500
Cayo Hijo de Guillermo Este	Cave 1	2	Ceramic	AD 500 – AD 1500
Cayo Hijo de Guillermo Este	Cave 1	3	Shell bead	2500 BC – AD 1500
Cayo Hijo de Guillermo Este	Cave 1	4	Shell bead	2500 BC – AD 1500
Cayo Hijo de Guillermo Este	Cave 3	1	Ceramic	AD 500 – AD 1500
Cayo Hijo de Guillermo Este	Cave 3	2	Ceramic	AD 500 – AD 1500
Cayo Hijo de Guillermo Este	Cave 3	3	Shell with spire perforation	6000 BC – AD 1500
Cayo Hijo de Guillermo Este	Cave 3	4	Shell with spire perforation	6000 BC – AD 1500
Cayo Hijo de Guillermo Este	Rock Shelter 1	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Hijo de Guillermo Este	Rock Shelter 2	1	Shell with spire perforation	6000 BC – AD 1500
Cayo Hijo de Guillermo Este	Rock Shelter 3	1	Shell bead	2500 BC – AD 1500
Cayo Hijo de Guillermo Este	Rock Shelter 4	1	Ceramic	AD 500 – AD 1500
Cayo Hijo de	Surface Deposit 1	1	Ceramic	AD 500 – AD

Guillermo Este				1500
Cayo Hijo de Guillermo Oeste	Surface Deposit 1	1	Ceramic	AD 500 – AD 1500
Cayo Hijo de Guillermo Oeste	Surface Deposit 2	1	Point	2500 BC – AD 1500
Cayo Hijo de Guillermo Oeste	Surface Deposit 3	1	Shell hammer	2500 BC – AD 1500
Cayo Langosta	Surface Deposit 1	1	Shell handpick	6000 BC – AD 1500
Cayo Langosta	Surface Deposit 2	1	Shell gubia	6000 BC – AD 1500
Cayo Langosta	Surface Deposit 3	1	Flint	6000 BC – AD 1500
Cuban Mainland	Los Buchillones	1	Ceramics	AD 600 - 1500
Cuban Mainland	Los Buchillones, Environs	1	Ceramics	AD 600 - 1500

These artefact chronologies only provide very broad chronological ranges for different phases of past human activity and cover hundreds and sometimes thousands of years. In the case of shell, the most common artefact found at these sites, the chronological frameworks for artefact typologies cover broad ranges of time. The majority of shell artefacts only provide the very broad chronological range of 6000 BC – AD 1500 or 2500 BC – AD 1500. Studies of shell tool typology and the potential for changes through time are ongoing in Cuba and, as yet, there are few distinctive and clear changes in tool form and shape that can be assigned spatial and temporal contexts. Izquierdo and Diaz (Izquierdo Diaz and Sampedro Hernández 2002) have argued that the *Gubia* has different styles through time. The ornately carved *Oliva reticularis* pendants and shell inlays for wooden effigies are associated with agriculturalist communities and therefore have a smaller prescribed chronological range of AD 600 – 1500 (Dacal Moure 1978). The possibility that early ceramic sites exist in Cuba, discussed in Chapter 2, has the potential to widen the existing chronological framework further. The poor temporal resolution for each site, based on these artefact typologies, restricts the potential for detailed inter-site comparative analysis. Therefore, it is clear that more precise relative and absolute chronologies are required in order to construct a more robust framework for studying interaction within the case study area.

7.II.2 Radiocarbon Chronology

In Cuba, no radiocarbon dating projects have been undertaken to investigate chronological relationships of Taíno sites. There are only five sites with radiocarbon laboratory dates within a 150 km radius of the case study area (Table 7.02).

Table 7.02 Radiocarbon laboratory dates from sites within a 150 kilometer radius of case study area

Site Name	Laboratory Code	Lab. Date BP	+/-	Stratigrapic context
El Convento	GD-1053	665	50	Pit 2, level 25-50 cm. Sample depth 45 cm.
El Purial	UBAR-169	3060·	180	Level 40 cm (approx.)
Jucaro	BETA-148949	690	60	Cut A, natural layer 1, spit depth 20-40 cm
Vega Del Palmar	Y-465	960	60	Midden 150 cm deep, sample depth 105-120 cm. Ceramics only found in the top two 15-cm spits.
Victoria I	LC-H 565	960	50	Block, sec. B, level 2-2.25 m
Victoria I	LC-H 1034	2070	110	Block 1, sec b, level 6.25-6.50 m
Victoria I	LC-H 1035	1450	70	Block 1, sec b, level 2-2.25 m

7.II.3 Absolute Chronology of Los Buchillones

During excavations at Los Buchillones by the Cuban Ministry of Science, Technology and Environment (CITMA) and the Royal Ontario Museum (ROM) during the 1990s, wood samples were taken from the house posts of two structures, D2-1 and F1-1, for radiocarbon dating by the Isotrace Laboratory (Pendergast, et al. 2002) (Table 7.03). Twelve wood samples taken from twelve different structural timbers of House 1, D2-1 were dated and produced a total calibrated date range of AD 540-690 to AD 1460-1665. Six wood samples taken from six different structural timbers of House 2, F1-1 were dated and they produced an overall calibrated date range of AD 1390-1490 to AD 1610-1690. These dates provide a chronological range for the wooden timbers used at Los Buchillones. As discussed in Chapter 2, there are two date ranges allocated to *agroalfarero* sites, AD 800-1500 and AD 1200-1500. Therefore the absolute chronological range of Los Buchillones broadly covers the later AD 1200-1500 period and closely matches the broad relative chronological range as suggested by the artefact typology at the site. There are a number of reasons why the range of dates may extend beyond the probable chronological range of Taíno occupation at Los

Buchillones. The heterogeneity of the radiocarbon determinations, detailed in Table 7.03 highlights potential problems with the use of house posts as a dating source and raises potential issues of tree longevity, re-use and use life that require consideration.

Table 7.03 Details of calibrated radiocarbon determinations (Pendergast, *et al.* 2002) of wood samples from two house structures at Los Buchillones by the ROM during the 1990s

Lab. No.	Material Dated	Cal. Age Range	Context
TO-7617	Wood, Post 1	AD 1440-1655	LBD2-1 (House 1)
TO-7618	Wood, Post 2	AD 1385-1450	LBD2-1 (House 1)
TO-7619	Wood, Post 7	AD 1460-1665	LBD2-1 (House 1)
TO-7620	Wood, Post 7 sub	AD 1410-1520	LBD2-1 (House 1)
TO-7621	Wood, Post 12	AD 540-690	LBD2-1 (House 1)
TO-7622	Wood, Post 13	AD 1455-1655	LBD2-1 (House 1)
TO-7623	Wood, Rafter 2	AD 1425-1640	LBD2-1 (House 1)
TO-7624	Wood, Rafter 3	AD 635-780	LBD2-1 (House 1)
TO-7625	Wood, Rafter 4	AD 1440-1655	LBD2-1 (House 1)
TO-7626	Wood, Rafter 5	AD 1380-1440	LBD2-1 (House 1)
TO-7627	Wood, K Post 1	AD 1400-1490	LBD2-1 (House 1)
TO-7624	Wood, K Post 2	AD 1295-1435	LBD2-1 (House 1)
TO-8067	Wood, Post 1	AD 1610-1690	LBF1-1 (House 2)
TO-8068	Wood, Post 2	AD 1390-1490	LBF1-1 (House 2)
TO-8069	Wood, Post 3	AD 1480-1890	LBF1-1 (House 2)
TO-8070	Wood, Post 4	AD 1450-1675	LBF1-1 (House 2)
TO-8071	Wood, Post 5	AD 1480-1685	LBF1-1 (House 2)
TO-8072	Wood, Post 6	AD 1400-1525	LBF1-1 (House 2)

7.II.3.i Tree Longevity

The wood species used for these larger structural elements was mahogany (*Swietenia mahagoni*); a mature tree stands between 15-20m, with a 50-90cm diameter and has an average longevity 70-100 years (Henderson 1964:56). The wood is hard, heavy and very dense, its specific gravity lies between 1.28 and 1.37 and so it will sink in water, making it particularly suitable for the construction of stilted houses in a waterlogged environment (Del Risco Rodríguez 1999:104). The wood is hard and there are ethno-historical and ethnographic sources from Cuba attesting to the use of the trunk for house construction and the leaves for thatched roofing (Del Risco Rodríguez 1999:89). Therefore the potential age range of the species of tree from which the samples come is likely to be between 40-100 years. In general, heartwood is denser and more durable than sapwood and so selective use of this could produce a bias towards the older ages of the tree. The effect of these potential problems could be minimised by extracting samples for radiocarbon determinations from the external sapwood of the trunk in areas where bark was still present. This would mean the dating sample came from the part of the tree grown most recently before death and its potential time of use in an archaeological context.

7.II.3.ii Re-Use

The excavations of structure D2-6 (discussed in Chapter 6) revealed some useful insights into the woodland practices of the people who constructed the houses at Los Buchillones. The availability and selection of straight trunk sections from mature hardwood trees could imply a locally accessible closed canopy forest. These trees were felled using petaloid axes and, depending on the structural role of the timber, the cut marks were sometimes left un-modified. In such examples, the exceptional preservation of the cut marks and tree fibres at the cutting point indicate that they were placed into an anoxic environment within days of being cut. The question of post or beam re-use also requires discussion as re-use is a common practice in house construction and can potentially provide a much older date for a structure than the period in which the structure was in use. During excavation of structure D2-6 some posts were found with bark still attached. The difficulty experienced during the excavation of the posts, including the need to dam off the area and fully excavate below the base of the post, provides circumstantial evidence that extraction and re-use of these posts would not have been a simple task. In addition, it appears unlikely that the bark, preserved on the posts in structure D2-6, would have survived the process of extraction from the mud and this suggests that these posts had not been removed and re-used before. Therefore the time between the last years of the trees' lives and their use in the construction of the house appears to have been minimal.

This evidence does not preclude re-use of wood in other elements of the structure, particularly in the superstructure. The very early dates for post 12 and rafter 3 from structure D2-1 could be explained by the re-use of old wood. It is possible that re-use was more likely for objects that did not have highly specific requirements of wood species, size or quality. Therefore samples for radiocarbon dating that are selected from artefacts that had highly specific requirements of wood species, size or quality might have a higher chance of having been selected from a living tree for the particular role required.

7.II.3.iii Use-life

There is little evidence to enable us to determine the use life of the different structural elements of the houses at Los Buchillones. However, the exceptional size, strength and durability of the house posts suggests that extended use is quite possible. Indeed the waterlogged posts excavated in 2004 are in pristine condition and have maintained their structural integrity and strength over 500 years after they were first used. This is particularly relevant if it was common practice to replace elements of the superstructure such as thatched roof, matted floor and rafters whilst keeping the main structural elements in place. Archaeological examples of Crannogs in Scotland and Ireland of similar stilted house constructions indicate the possibility of extended use-life of the main structural posts. Dating evidence for the wooden pile dwelling of Oakbank Crannog suggests an occupation span of over 200 years (Dixon 2000:11). At Los Buchillones, it is possible to hypothesise that some of the larger posts had longer use-lives than some of the less durable roof elements. This issue of extended and differential use-lives of the structural elements at Los Buchillones could have contributed to the broad temporal range of the dates for structures D2-1 and F1-1.

7.II.4 Radiocarbon Dating Project for Case Study Area

As discussed earlier, the Cuban chronological framework based on artefact typologies is too broad to allow the study of site interaction in the case study area because the temporal resolution is poor. Los Buchillones has the best cultural chronological framework based on its extensive artefact assemblage and absolute chronological framework based on radiocarbon dating of structural elements from D2-1 and F1-1. The radiocarbon dates from the site provide a broad temporal range that closely matches the known Taíno or *agroalfarero* period from AD 900 – 1500. Discussion of these radiocarbon dates has highlighted some of the reasons for the broad absolute chronology for Los Buchillones and what steps could be taken to improve the temporal resolution of the chronological range of occupation. An absolute chronological range for the island sites in the case study area of the current project, based on radiocarbon determinations would also be useful. Therefore a methodology for a new dating project was designed with the primary aim of providing a more refined relative and absolute chronology for the sites within the case study area that could then facilitate the detailed study of island interaction through time.

7.II.4.i Shell Sample Selection

The abundance of wood at Los Buchillones provides an ideal source for radiocarbon dating and the radiocarbon dates taken from structures in the mid 1990s provided the opportunity to compare relative and absolute chronologies for the site. However, there are no wooden artefacts or charcoal deposits from the island sites that could provide material for radiocarbon dating. The only archaeological material present in all of the sites on the islands is marine shell, and therefore this material was selected for radiocarbon dating. Selecting the same material for radiocarbon dating from all of the sites provides the possibility of relative comparative analysis, even if there are problems with the corrective calibration methods used for absolute dating of the marine samples. Shell as a material for radiocarbon dating is commonly used, although there are a number of factors that need to be taken into consideration in the development of a dating project methodology that is based on shell samples.

7.II.4.ii Animal Longevity

As discussed above, the life of the organism that is dated can affect the relevance of the radiocarbon date for archaeological interpretation. Therefore the selection of shells with known animal life spans can help address this potential problem. Generally the shells from the case study area have far shorter lives than the lives of trees used at Los Buchillones. This is a potential benefit of dating shell artefacts rather than wooden artefacts, in that the life of the organism being dated is shorter.

7.II.4.iii Re-Use of Shells

Re-use of shells can be a common problem because old shell is sometimes collected and re-used (Rick, et al. 2005:1641). Shell is a durable material that can be re-used many years after the animal has died. This is a particular problem in areas where there are large accumulations of old shell easily accessible or close to shell working communities in the form of paleoshorelines. In the Caribbean there has been much discussion of paleoshorelines that suggest old shell can survive on the surface for many years (Watters, et al. 1991). Therefore steps need to be taken to ensure that the shell samples selected reflect human activity close to the death of the animal and that the samples do not come from artefacts that have used old shell.

7.II.4.iv Use-Life of Shells

The durability of shell also creates the potential for extended use-lives. There are a number of archaeological examples of shell artefacts being used for extended periods of time (Rick, *et al.* 2005:1641), often passed down through generations. These potential issues need to be taken into account when selecting shell samples for radiocarbon dating and where possible, samples should be selected from artefacts with probable short use-lives.

7.II.5 Calibration

An additional factor that needs to be taken into account with marine shell dating are the issues that arise during calibration of laboratory radiocarbon dates. These include isotopic fractionation, re-crystallisation and marine reservoir offsets.

7.II.5.i Fractionation

Fractionation refers to the differential ratios in carbon isotopes, ^{14}C, ^{13}C or ^{12}C within any given sample. $\delta^{13}C$ values represent the parts per thousand (per mil) ratio of ^{13}C and ^{12}C content in any given sample. This can produce radiocarbon ages that are too young or too old as the ^{13}C /^{12}C against which the ^{14}C is calibrated is not always constant (Claassen 1998:93). Natural variations in carbon isotopic fractionation can be calibrated (or 'normalised') using the relative offsets against an established international PDB standard. PDB refers to the Cretaceous Peedee Belemnite deposits in South Carolina, U.S.A. upon which this standard carbon isotopic ratio is based. PDB nomenclature has recently been changed to VPDB (Petchey, et al. 2005). Therefore individual carbon isotope ratios need to be established for each shell sample and then corrected by using $\pm$ per mil relative to PDB or Vienna Peedee Belemnite Deposits (VPBD). In this way carbon isotope fractionation can be accounted for in the absolute chronologies for calibrated shell radiocarbon samples.

7.II.5.ii Recrystallisation

Mineral recrystallisation can affect radiocarbon dating of shell samples. The quantities and structural formation of aragonite and calcite mineralogy vary among different species and different locations. This is important for radiocarbon dating because recrystallization can occur in shell samples where the original mineralogy changes, during which exchange with exogenous sources of carbon can occur. This can produce an older or younger date for the shell dependent on taphonomic processes and the carbon environment in which the shell sample has been. There are examples of archaeological shell samples that have been affected by limestone environments which have produced older dates than known archaeological contexts (Claassen 1998). There are macroscopic and microscopic indicators of recrystallisation of marine shells, and these can be used to avoid the dating of recrystallised shells. In addition $\delta^{13}C$ values can highlight shell samples that might have been affected by recrystallisation.

7.II.5.iii Marine Reservoir Effect

An additional factor that affects radiocarbon dating of marine shell samples is the reservoir effect of old carbon that has been incorporated into the shells of animals living in the sea. This can produce radiocarbon dates that are too old; therefore the dates require correction. Marine reservoir effects for mixed-layer surface samples have been constructed using ^{14}C measurements on coral and foraminifera (Reimer, et al. 2004:1030). These dates are then compared to the terrestrial calibration curve in order to create a marine reservoir curve (Hughen, et al. 2004). Regional reservoir age variations Delta-R (Δ-R) are then calculated separately and are available for local corrections and calibrations. Therefore it is necessary to investigate the local Δ-R offset from the global ocean reservoir (Hughen, et al. 2004:1067). Unfortunately, there are no local Δ-R data from Cuba, but regional data are available from the Marine Reservoir Correction Database (Table 7.04) (Reimer 2005; Reimer and Reimer 2001) and currently "it is assumed that DeltaR, for any given marine location, remains constant to a first approximation" (Hughen, et al. 2004:1067).

Table 7.04 Existing Δ-R offset values nearest to case study area in the Caribbean

Reference	Location	Δ-R offset	Δ-R offset +/-	Sample
610	Golding Cay, Bahamas	146	66	*Acropora palmata*
609	Tortugas, Florida	114	51	*Acropora palmata*
304	Isla Tortugas	-70	40	*Montastrea annularis*
300	Jamaica	-44	41	*Liiona pica*
299	Jamaica	-30	42	*Liiona pica*
88	The Rocks, Florida	33	16	*Montastrea annularis*
86	Bahamas	56	59	*Strombus rninus*
85	Bahamas	-40	42	*Strombus rninus*

Different marine reservoir models can therefore be created using this Δ-R regional data. In order to evaluate the relative applicability of the different models in this project, it would be useful to have wood and shell dates from the same archaeological contexts at Los Buchillones in order to select the most appropriate marine calibration value.

7.II.6 Dating Project Methods

Los Buchillones

The excavation of Structure D2-6 at Los Buchillones, discussed in Chapter 4 and Chapter 6, provided shell and wooden artefacts for radiocarbon dating. Shell and wood samples were selected from the same excavated contexts in D2-6 and these samples are listed in Table 7.05.

The primary objectives of the sample selection were:

1. To obtain a chronological range for human occupation of D2-6
2. To obtain dates from short-life artefacts in both shell and wood that could aid in the calibration of the marine reservoir effect for the case study area
3. To obtain a sample of dated diagnostic shell artefacts that could be compared directly with similar shell artefacts from the island sites

Four samples were selected from shells that 1) were likely to have been used shortly after death, 2) had not been re-used, and 3) had probable short use-lives. Where possible, shells were selected that had their fragile lips intact and also had an animal-extraction perforation, assuming that these indicate that they were collected alive and consumed soon after. The fragility of the lips reduces the probability that the shells were re-used and increases the chance that they are in a primary context following collection and consumption (Tomé Pérez 1994). The most suitable shell artefact was selected and where possible similar species were collected for direct comparison between different sites; however there is evidence from previous studies that "differences in habitat and feeding behaviour between the species that were studied did not have a significant influence upon the ^{14}C activity of precipitated shell carbonate" (Ascough, et al. 2005:439).

Four samples were selected from diagnostic shell tools; these shell tools were selected so that their dates could be compared directly with similar artefacts from other sites in the case study area. Two *Oliva reticularis* shell pendants were selected and a *Codakia orbicularis* and *Phacoides pectinatus* shell scraper.

Table 7.05 Details of the twelve samples selected for radiocarbon dating during excavation of D2-6, Los Buchillones

Site	Sample No.	Sample Description	Dating Objective
Los Buchillones, D2-6	32	Wooden handle of large carved 'Bandeja', a delicately carved wooden platter.	Date of occupation from archaeological context 3549 and cross referencing of date with shell samples 37 and 38 from the same archaeological context
Los Buchillones, D2-6	37	Fragment of shell taken from a *Strombus gigas* with lip intact	Date of marine resource exploitation from context 3549 and cross referencing with samples 32 and 38 from the same archaeological context
Los Buchillones, D2-6	38	Shell scraper of *Phacoides pectinatus*	Date of shell tool use from context 3549 and cross referencing of date with samples 32 and 37
Los Buchillones, D2-6	33	Carved wooden object	Date of occupation from context 3502 and cross referencing of date with samples 41, 42, 43 and 44
Los Buchillones, D2-6	44	Fragment of shell taken from a *Strombus gigas*	Date of marine resource exploitation from context 3501 and cross referencing of date with samples 41, 42 and 43 from the same archaeological context.
Los Buchillones, D2-6	43	*Oliva reticularis* shell pendant in preparation.	Date of shell working from context 3501 and cross referencing of date with samples 41, 42 and 44
Los Buchillones, D2-6	34	Fragile wooden roof stringer	Date of occupation from context 3518 and cross referencing of date with samples 39 and 40
Los Buchillones, D2-6	39	*Fasciolaria tulipa* with lip intact	Date of marine resource exploitation from context 3511 and cross referencing of date with samples 34 and 40
Los Buchillones, D2-6	40	*Oliva reticularis* shell pendant in preparation.	Date of shell working from archaeological context 3516 and cross referencing of date samples 34 and 39
Los Buchillones, D2-6	36	Carved wooden object	Date of occupation from archaeological context 3505 and cross referencing of date with samples 33, 41, 42, 43 and 44
Los Buchillones, D2-6	41	*Fasciolaria tulipa* shell with lip intact	Date of marine resource exploitation from archaeological context 3501 and cross referencing of date with samples 42, 43 and 44
Los Buchillones, D2-6	42	Shell scraper of *Codakia orbicularis*	Date of shell tool use from archaeological context 3501 and cross referencing of date with samples 41, 43 and 44

Four samples were taken from wooden artefacts that were perceived to have had short-use-lives. These were fragile wooden objects: a carved wooden waterspout, two carved wooden vessel handles and a fragile roof stringer. These samples from fragile wooden objects were all taken from the same archaeological contexts as the shell artefacts, to provide a comparative dating source to enable a critical review of different marine reservoir effect values applied to the marine shell dates (Kennett, *et al.* 2002).

Offshore Islands Sites

The primary objectives of the sample selection were:

1. To obtain a chronological range for human activity on the islands.

2. To obtain dates with which to study possible changes in site type and artefact assemblages over time.

3. To obtain data for evaluating the relative chronological frameworks based upon established artefact classificatory typologies.

4. To obtain a series of dates for inter-site comparison.

Steps were taken to reduce the risk of selecting shell samples with mineral recrystallization that might affect the validity of the radiocarbon dates of the shell samples. Where possible, all shell samples were selected where there was no evidence of surface encrustation, powdery surfaces or bore holes of epibiotic organisms. Four of the twenty-four samples had evidence of surface deterioration: Samples 20, 23, 30, 44. Macroscopic examination of the surfaces of each sample indicated that this damage was caused mainly by a combination of natural weathering of wind and rain, and in the cases of 20, 30 and 44, there was evidence of surface scarring by root action. It was thought that these surface conditions were the result of taphonomic processes that had not affected the recrystallization of the original shell mineralogy. All the samples had cross-sections of freshly fractured edges studied macroscopically for evidence of subsurface damage, deterioration or any other potential evidence of recrystallization. These cross-sections were also compared with cross-sections of freshly fractured edges of modern specimens and were found to be identical in structural composition. Therefore there was no apparent evidence of recrystalization among the shell samples selected.

Table 7.06 Details of the sixteen shell samples selected for radiocarbon dating during survey and excavation of sites on offshore islands

Location	Site	Sample No.	Material	Dating Objective
Cayo Hijo de Guillermo Este	Cave 1	24	*Oliva reticularis* pendant in process	Date of shell working from context 4563
Cayo Hijo de Guillermo Este	Cave 1	26	Fragment of *Strombus gigas*	Date of marine resource exploitation from context 4561
Cayo Hijo de Guillermo Este	Cave 1	1	*Oliva reticularis* pendant in process	Date of shell working from context 5502, Layer 4 and chronological relationship of stratigraphic sequence
Cayo Hijo de Guillermo Este	Cave 1	2	Fragment of shell taken from a *Strombus gigas*.	Date of marine resource exploitation from context 5502, Layer 4 and chronological relationship of stratigraphic sequence
Cayo Hijo de Guillermo Este	Cave 1	6	*Oliva reticularis* pendant in process	Date of shell working from context 5504, Layer 5 and chronological relationship of stratigraphic sequence
Cayo Hijo de Guillermo Este	Cave 1	7	Fragment of shell taken from a *Strombus gigas* with lip intact	Date of marine resource exploitation from context 5504, Layer 5 and chronological relationship of stratigraphic sequence
Cayo Hijo de Guillermo Este	Cave 3	13	*Strombus* sp. *gubia*	Date of shell tool use in context 5509
Cayo Hijo de Guillermo Este	Cave 3	15	Fragment of shell taken from a *Xancus angulatus*	Date of marine resource exploitation in context 5509 and comparison with date of sample 13 from from the same context
Cayo Hijo de Guillermo Este	Rock Shelter 1	20	Fragment of shell taken from *Strombus gigas* with perforation.	Date of marine resource exploitation from context 5536
Punta Morro, Cayo Guillermo	Midden 1	19	Fragment of shell taken from a *Strombus gigas* with perforation.	Date of marine resource exploitation from context 5533
Cayo Felipe Este	Surface Deposit 1	21	Fragment of shell taken from *Strombus gigas* with	Date of marine resource exploitation from context 5016

			perforation.	
Cayo Caiman Mata del Coco	Midden 1	22	Fragment of shell taken from *Strombus gigas* with perforation.	Date of marine resource exploitation from context 5541
Cayo Flores.	Surface Deposit 1	23	Fragment of shell taken from *Strombus gigas* with perforation.	Date of marine resource exploitation from context 5036
Cayo Langosta	Surface Deposit 1	29	Fragment of shell taken from *Strombus gigas* with perforation.	Date of marine resource exploitation from context 4071
Cayo Contrabando	Surface Deposit 2	30	Fragment of shell taken from *Strombus gigas* with perforation.	Date of marine resource exploitation from context 4061
Cayo Hijo de Guillermo Oeste	Surface Deposit 1	31	Fragment of shell taken from *Strombus costatus* with perforation.	Date of marine resource exploitation from context 4043

Cave 1, Hijo de Guillermo Este was identified as the site with the artefact assemblage most similar to Los Buchillones. The relative typologies indicated a chronological range for the site of AD 900-1500. The fact that ceramics were only found in context 5500 linked this layer with the top stratigraphic layer of Cave 1 and distinguished it from the lower stratigraphic layers of 5501-5505 without ceramics. This site also had stratigraphic layers that suggested possible long term and phased occupation. Two samples for dating were taken from Layer 1 of Cave 1, (4561, 4563), two from Layer 4 (5502), and two from the lowest stratigraphic layer of Layer 5 (5504). Each pair of samples consisted of a *Strombus gigas* shell that was probably collected for food, and therefore 'used' soon after death, and an *Oliva reticularis* shell bead or pendant. The *Oliva reticularis* beads from 4563 and 5504 each had signs of having been broken during the process of manufacture, possibly indicating a short use-life for the objects. The *Oliva reticularis* bead Layer 4 was a finished shell bead that was selected in order to provide a comparable artefact from each of the stratigraphic layers, although this bead could have had a longer use life than the two broken shell pendants.

These *Oliva reticularis* shell pendants and beads were very similar to comparative artefacts selected for dating from Los Buchillones.

As discussed above, the top stratigraphic layer of Cave 3, Cayo Hijo de Guillermo Este had a similar artefact assemblage to the top stratigraphic layer of Cave 1 on the same island. However the deepest stratigraphic layer, 5509, had a distinctly different assemblage, which included a different type of *gubia* as well as a collection of whole shells that appeared to have been collected for subsistence. One *Xancus angulatus* shell was selected for dating that had a spire perforation that indicated the extraction of animal and therefore suggested a short use-life. The *Strombus* sp. *gubia* was also selected for dating to indicate whether the typological difference in *gubia* type could be diagnostic of a different chronological period.

Solapa 1, Cayo Hijo de Guillermo Este, had an artefact assemblage similar to the top stratigraphic layers of Cave 1 and Cave 3 on the same island; however the lack of stratigraphic contexts in the rock shelter did not enable the study of sequence. A single whole *Strombus gigas* shell with circular spire perforation was selected from the deposit. The shell surface and intact fragile lip suggested that the shell had not been re-used. It was hoped that this sample would indicate whether the shell assemblage at Rock Shelter 1 was contemporaneous with the similar assemblages in Cave 1 and Cave 3.

Midden 1 from Cayo Caiman Mata de Coco provided a number of well-stratified shell artefacts. A *Strombus gigas* shell with a circular spire perforation was selected from the lowest strata, 5541. This archaeological context contained a shell assemblage distinctive from sites on other islands. This chosen shell would show whether this distinctive shell assemblage indicated a different chronological range for the site.

Surface Deposit 2, Cayo Contrabando, provided the opportunity to date a shell with a circular spire perforation found in association with a ceramic fragment; this would tell us whether the shell was contemporaneous with ceramic use. The whole *Strombus gigas* shell had a circular spire perforation and its fragile lip was intact, indicating a short use life and no re-use.

Surface Deposit 1, Cayo Felipe Este, provided a collection of shells with circular spire perforations. A *Strombus gigas* shell with a circular spire perforation was selected to date human activity at this site.

Surface Deposit 1, Cayo Hijo de Guillermo Oeste, provided a mixed surface deposit of artefacts spread over exposed bedrock. A *Strombus costatus* shell with a circular spire perforation was selected to date human activity at this site.

Surface Deposit 1, Cayo Langosta, provided a collection of shells with evidence of human activity. A *Strombus gigas* shell with a circular spire perforation was selected to date human activity at this site.

Midden 1, Cayo Guillermo, provided a large assemblage of stratified archaeological material. A *Strombus gigas* shell was selected from the lowest stratigraphic layer to provide a date for the earliest evidence of human activity at the site. A *Strombus gigas* shell with a circular spire perforation was selected for radiocarbon dating.

Surface Deposit 1, Cayo Flores, provided a collection of shells with evidence of human activity. A *Strombus gigas* shell with a circular spire perforation was selected to date human activity at this site.

All of these shell samples were collected and stored in the laboratory facilities of the Cuban Ministry for Science Technology and Environment in Holguin. The specimens were all placed into clean and clearly labelled plastic bags (which were sealed in plastic boxes). Samples of these specimens necessary for radiocarbon dating were exported to the Institute of Archaeology, in the same packaging, where they were then inspected for evidence of recrystallization. The samples were then sent to the Oxford Radiocarbon Accelerator Unit (ORAU) for radiocarbon dating. For details of the chemical pre-treatment, target preparation and AMS measurement see (Hedges, *et al.* 1992). The laboratory dates for all of the samples sent for radiocarbon dating are listed in Table 7.07.

Table.7.07 Radiocarbon dates of samples selected from sites in the study area

Sample no.	Context	Lab. No.	Lab. Date BP	+/-	$\delta^{13}C$
36	3505	OxA-15123	710	27	-24.9
32	3549	OxA-15144	651	24	-25.7
37	3549	OxA-15145	879	26	2.2
38	3549	OxA-15146	1557	25	2.5
33	3502	OxA-15147	157	24	-27.2
44	3501	OxA-15148	891	23	3.4
43	3501	OxA-15149	874	25	1.6
34	3518	OxA-15150	531	23	-27.3
39	3511	OxA-15151	950	24	2.6
40	3516	OxA-15152	939	24	1.3
41	3501	OxA-15153	714	25	1.2
42	3501	OxA-15154	820	24	2.4
24	4563	OxA-15178	709	26	2.5
26	4561	OxA-15179	1112	26	3.3
23	5036	OxA-15180	3861	28	2.9
29	4071	OxA-15181	1561	24	3.1
30	4061	OxA-15182	857	24	3.5
31	4043	OxA-15183	1873	26	3
19	5533	OxA-15184	1686	26	3.1
1	5502	OxA-15259	827	36	-1.6
2	5502	OxA-15260	1617	29	3.8
6	5504	OxA-15261	782	26	2.1
7	5504	OxA-15262	2005	27	3.1
13	5509	OxA-15263	3271	29	3.7
15	5509	OxA-15264	3273	33	3.8
20	5536	OxA-15265	763	25	4.3
21	5016	OxA-15266	1978	33	3.9
22	5541	OxA-15267	4408	37	2.4

7.II.7 Analysis of Relative Chronologies

The uncalibrated AMS radiocarbon dates produced by the Oxford Radiocarbon Accelerator Unit (ORAU) provide an opportunity for comparative analysis of the relative chronologies of samples, calculated to one standard deviation (1σ) (Table 7.07). The process of calibration, calculated to two standard deviations (2σ) with increased $\pm$ error factors, produces an increased margin of error for the chronology of each sample. Therefore the direct comparison of uncalibrated laboratory dates for samples of the same material can be useful for the analysis of an intra-sample relative chronology. These relative chronological sequences can then be tested and cross-referenced with other chronological data when fully calibrated dates for the samples are established.

Of the twelve uncalibrated samples from Los Buchillones, the four youngest are from the four wood samples (157 ± 24 to 710 ± 27 BP) with all eight shell samples being relatively older (714 ± 25 to 1557 ± 25 BP). It is possible that the shell samples selected came from re-used 'old shell' or that the shell objects had much longer use-lives than the wooden objects. However, attempts to select comparably short use-life artefacts suggest that this disparity between the two materials is most likely to be due to the marine reservoir effect and that this needs to be corrected before inter-material analysis can be conducted. Based on the assumption that the samples come from the same archaeological context and phase of occupation, two dates stand out as being distinctly different from comparable dates of the same material. The uncalibrated date of wood sample 15147 is 157±24 BP, which is distinctly younger than the other three wood sample dates, which range between 531±23 and 710±27 BP. This might indicate that the sample was contaminated and not suitable for radiocarbon dating, or that this particular object is intrusive and not contextually secure. The uncalibrated shell date of 15146, a *Phacoides pectinatus* shell, is 1557±25 BP, which stands out for the range of dates given for the other seven shell dates that range between 714±25 and 950±24 BP. Again this might indicate that the sample was contaminated and not suitable for radiocarbon dating or that this particular object is intrusive and not contextually secure. Another consideration is that this is the only *Phacoides pectinatus* shell dated, and this particular shell species might not be suitable for dating because its usual habitat is mangrove mud, exposed to old carbon waters draining down off the limestone hills of Los Lomos de Punta Alegre, and possibly old carbon preserved in the mangrove muds at Los Buchillones (Read 1964:460).

The other three wood samples provide a date range of 531±23 to 710±27; this is a broad occupation span and indicates that either there was an occupation of structure D2-6 spanning 130 years, or that the tree life, re-use or differential use lives is affecting the chronological range of the samples.

The other seven shell samples have a date range of 714±25 to 950±24. This is a broad chronological range which indicates either that there was a long occupation of structure D2-

6 spanning 150 years, or that the animal life, re-use or differential use lives is affecting the chronological range of the sites. There is no great distinction between the shell artefacts with perceived short use-lives, 714±25 to 950±24, and those with potentially longer use-lives 820 ±24 to 939 ±24. Therefore the similar chronological range of both the wood and shell samples suggests that there was a long occupation of structure D2-6.

The three *Strombus gigas* shells excavated from sequential archaeological contexts 4561, 5502, 5504 in Cave 1 on Cayo Hijo de Guillermo Este, reflect a relative chronological sequence relating age with depth of archaeological context. However, the three *Oliva reticularis* beads and pendants from the same three archaeological contexts do not reflect the same sequence. A possible explanation could be that the stratigraphic matrix of Cave 1 is not secure. Perhaps the different size of the *Oliva reticularis* beads, all between 20-30mm length and 10-13mm diameter, and the *Strombus gigas* shells, all between 120-160mm length and 80-135mm diameter, means that the *Oliva reticularis* beads were more susceptible to post-depositional stratigraphic movement due to root, jutia or hermit crab activity than the larger *Strombus gigas* shells.

The date range for the *Oliva reticularis* beads and pendants from Cave 1 is 709±26 to 827±36. If the surface floor of Cave 1 represents the last activity phase of indigenous shell working on the island, it would be likely that these dates would be the most recent ones for indigenous activity on the island. These dates are younger than the date range for the *Oliva reticularis* pendants from Los Buchillones. However, their date range overlaps with the full date range for all the shell objects from Los Buchillones, 714±25 to 950±24 BP, and the relationship with the wood samples from Los Buchillones needs to be studied after calibration of the samples. The date range for the *Strombus gigas* shells from the different stratigraphic layers is considerably earlier than the chronological range for the shells from Los Buchillones. It is possible that the *Strombus gigas* shells are from earlier occupation phases in the cave and that the stratigraphic layers represent earlier activity phases at the cave that pre-date the occupation of Los Buchillones.

The two samples from Cave 3 were taken from the deepest archaeological context just above the natural limestone cave floor, and were selected because of their distinctive artefact form. The two shell samples from context 5509 in Cave 3 provide a tight chronological range of 3271±29 to 3273±33 BP. The very similar dates for the perceived short use-life *Xancus angulatus* shell and the potentially longer use-life *Strombus* sp. *gubia* makes it unlikely that these were 'old shells' that were re-used. Other date ranges are considerably earlier than the shell date range from Los Buchillones D2-6, and also earlier than the deepest stratum of Cave 1. This suggests there were human activity phases in Cave 3, 5509, considerably earlier than Los Buchillones and also earlier than the deepest stratigraphy in Cave 1. The remaining dates from the island sites were on single samples, intended to provide a chronology for past human activity.

Sample 15265 from Rock Shelter 1, Cayo Hijo de Guillermo Este gave a date of 763 ±25 BP. This date is in the middle of the date range for the three *Oliva reticularis* shells from Cave 1 and possibly reflects the most recent indigenous activity phase on the island.

Sample 15182 from Surface Deposit 1, Cayo Contrabando, gave a date of 857±24 BP, which is in the middle of the date range for the shell artefacts from Los Buchillones (714±25 to 950±24 BP). The archaeological site of Surface Deposit 1, Cayo Contrabando has ceramic fragments in association with the shell artefacts that were used to provide a relative chronological date for this site of AD 900-1500 and contemporaneous with Los Buchillones. This date suggests that indigenous activity at this site is contemporaneous with that at Los Buchillones.

Sample 15181 from Surface Deposit 2, Cayo Langosta, yielded a date of 1561±24 BP. Sample 15184 from Midden 1, Cayo Guillermo provided a laboratory date of 1686±26 BP. Sample 15183 from Surface Deposit 1, Cayo Hijo de Guillermo Oeste, gave a date of 1873±26 BP. Sample 15266 from Surface Deposit 1, Cayo Felipe Oeste, yielded a date of 1978±33 BP. These four dates are all on *Strombus* shells with extraction perforations and are contemporaneous with the *Strombus* samples from Cave 1 contexts 5502 and 5504, which yielded a chronological range of 500 years (between 1500-2000 BP).

Sample 15180 from Surface Deposit 1, Cayo Flores, gave a date of 3861±28 BP. This is earlier than the deepest stratigraphic layer of Cave 3. Sample 15267 from Midden 1, Cayo Caiman Mata del Coco, yielded a date of 4408±37 BP. This is the oldest uncorrected date from the case study area.

All of these shell dates provide evidence for a potential uncorrected chronological range of indigenous activity of 3699 years from 709±26 BP to 4408±37 BP. This is an extended period of indigenous activity in the case study area.

A K-means cluster analysis was conducted to see if there were any statistically significant groups that could be identified that might represent phases of activity. The analysis was conducted on the 23 shell samples (excluding sample 15146) and identified three cluster centres Cluster 1 855.15, Cluster 2 3703.25, Cluster 3 1786.67. The numbers of shell samples per cluster were 13, 4 and 6 respectively.

These clusters were then put into chronological order and termed groups. (Group 1 = Cluster 1, Group 2 = Cluster 3, Group 3 = Cluster 2) (Figure 7.02). A Mann-Whitney test indicated a statistically significant difference between Group 1 and 2 of Asymp. Sig. (2-tailed) P=0.01.; between Group 2 and 3 of Asymp. Sig. (2-tailed) P=0.011; and between Group 1 and 3 of Asymp. Sig. (2-tailed) P=0.03.

The question of whether these three chronological groups are archaeologically significant or instead a product of sampling bias can only be known when absolute chronologies are established. Therefore these relative chronologies need to be calibrated relative to an absolute chronological scale so that the archaeological data can be related to wider archaeological and chronological frameworks.

7.II.8 Date Calibration and Absolute Chronologies

7.II.8.i Calibration of Wood Dates

The four AMS ^{14}C laboratory dates on wood samples from Los Buchillones are in radiocarbon years BP using the half life of 5568 years. These laboratory dates were then calibrated against the IntCal 2004 atmospheric calibration curve (Reimer, et al. 2004). Sample 15147, as discussed earlier, appears to be contaminated or intrusive into the deposit and, when calibrated, the date range illustrates an inconclusive and potentially modern chronological date range (283 BP (0.17 2σ) 252 BP, 228 BP (0.42 2σ) 167 BP, 154BP (0.11 2σ) 133 BP, 117BP (0.12 2σ) 71BP, 34BP (0.19 2σ) 0 BP)(Figure 7.03).

The calibration plot illustrates the difficulty in identifying a useful date for this sample. The 14C date 157 BP hits a wide plateau on the calibration curve, with multiple cross-overs, hence multiple peaks (Blackwell, *et al.* 2006). None of the dates have a high enough confidence to be reliable. Therefore this date is not included in further analyses of the absolute chronologies within the case study area. The other three wood samples provide a potential chronological range, based on a 100% probability to two standard deviations, from 516 to 686 BP, see Figure 7.08.

Initial interpretation of this calibrated range of dates is that the trees grew within the pre-Colombian period, namely AD 1264-1434. The biological ages of the trees that produced these wood samples needs to be taken into account. The species used for carving these wooden artefacts are likely to be one of the species discussed above with a potential tree life of up to approximately 95 years. The artefacts have no identifiable sapwood or bark that could be used to identify the part of the tree the artefacts are made from, therefore there has to be a potential tree life offset of up to 95 years.

7.II.8.ii Fractionation

Each date provided by ORAU already had its isotopic fractionation calculated, and corrected, using $\delta^{13}C$ values in each specimen calculated relative to VPDB. The $\delta^{13}C$ values for the wood samples are within acceptable ranges of -25 ± 3 ‰. The $\delta^{13}C$ values for all the shell samples are within established ranges for marine shell values. The isotopic values fall within established ranges as "marine shells possess a $\delta^{13}C$ value of between -1 and +4 ‰, whereas river shells possess a value of between -8 and -12 ‰; therefore, in a case where the precise environment of the shell is not known, it is possible to determine the most likely by analysis of the $\delta^{13}C$ result" (Petchey, *et al.* 2005:1).

Sample 15259, an *Oliva reticularis* shell, is $\delta^{13}C$ –1.3 ‰ is the only shell with a negative $\delta^{13}C$ fractionation, but this is still within an acceptable $\delta^{13}C$ range for marine shell. The difference in $\delta^{13}C$ might be a reflection of different habitats, with sample 15259 coming from a more inter-tidal or littoral habitat. There appear to be patterns between the $\delta^{13}C$ values and shell species and this is probably reflective of different microhabitats and feeding patterns. *Strombus gigas* $\delta^{13}C$ values ‰ range from 2.2 to 4.3, in comparison to *Oliva reticularis* $\delta^{13}C$ values, which range from –1.6 to 2.5. There are no comparable local data from Cuba for relative $\delta^{13}C$ isotopic fractionation in marine shell, but comparisons with data from elsewhere in the Caribbean suggest that these $\delta^{13}C$ ranges are similar to other shells in the region (Table 7.07).

7.II.8.iii Marine Reservoir Effect

As discussed above, correction for marine reservoir effect is necessary when dating shell. This is done using marine reservoir calibration data (Reimer 2005; Stuiver and Braziunas 1993) within OXCal, based upon the 2004 marine calibration dataset (Hughen, et al. 2004). ΔR values used from this database have been corrected for isotopic fractionation and all came from the surface mixed layer (Reimer 2005). The first marine reservoir calibration was done using the global marine curve Marine 04 without any local reservoir offset (Hughen, et al. 2004). This produces a base line calibration from which local Delta offset values can be tested.

The local region has a wide variety of delta offset data with both positive and negative values. A simple average of the maximum and minimum ranges did not account for the disproportionate ranges created by individual samples or for rogue ranges produced by wiggles in the calibration curve. Therefore the comparisons were based on the chronological range created by the arithmetic mean of the maximum ranges and the arithmetic mean of the minimum ranges because "we cannot carry out a test for the difference between two means without also taking into account the degree of dispersion of the values in the two samples" (Shennan 1997:84). This method minimised the effect of potential rogue values created by distortions in the calibration curve.

The wood samples did not have normal distributions and so the constant was calculated using the arithmetic means of the maximum and minimum ranges based on the proportionate percentage probabilities of the date range distributions (Fletcher and Lock 2005). This produced an arithmetic mean maximum of 626 and an arithmetic mean minimum of 589. Therefore the two constants were formed by the absolute chronological range of 686 BP – 516 BP and an arithmetic mean range of 626 - 589 BP.

The variable was then the different absolute chronological ranges of the individual shell samples as produced by different local delta reservoir offsets. All the shell samples produced normal distributions that made it simple to calculate the arithmetic means. However, the wood samples did not produce normal distributions. For sampling disparity, the maximum and minimum date ranges at 2σ 100% of each individual date range were plotted against the variable of the different marine delta offsets for shell calibration. The global Marine 04 calibration curve produced a shell sample absolute chronological range of 616 – 283 BP and an arithmetic mean range of 538 – 439 BP.

Different delta offset values from the Bahamas, Florida, Jamaica and the Lesser Antilles were used to calibrate the shell laboratory dates and then compare with the calibrated wood dates from the same archaeological context. None of the absolute calibrated ranges or arithmetic means for the different delta offset calibrated shell dates provided an exact comparison with the wood dates. In every marine reservoir offset calibration model, the absolute chronological ranges of the shell sample and the arithmetic means remained younger than the wood sample absolute chronological ranges and arithmetic means. This could mean that the localised northern Cuba ΔR value is different from the rest of the Caribbean. However, when all the ΔR values from eastern North, Central and South America are analysed and the largest known negative marine offset from the Americas of – 70 ±34 was attempted, this was still not great enough to account for the age disparity between shell and wood dates from D2-6. Therefore whilst it is essential that a local reservoir ΔR value is calculated within the case study area, it appears likely that only a portion of the age disparity can be explained by the marine reservoir offset, and that there is an additional chronological disparity that needs to be considered. Such disparity is likely to have been caused by one or more of the factors discussed above, namely lengthy plant life, re-use of old-wood or extended use-lives of the wooden artefacts.

The reservoir offset values for the Caribbean are not large in comparison to other areas of the world such as the Pacific United States coastline or farther up the Atlantic seaboard (Reimer 2005). Indeed, the different regional delta offset values from the Caribbean rarely exceed the delta reservoir ± error factor, which means that the large increase in chronological ranges caused by the increased error margins masks the potential interpretative differences in the absolute chronological ranges. The geographically closest marine reservoir offset data comes from a site in the Bahamas where two gastropods from the same site had their marine reservoir offset values calculated (Broeker and Olson 1961). One gastropod was calculated as having a negative ΔR value of –40 with an error margin of ±42 and the other had a positive ΔR value of +56 with an error margin of ±59. Therefore both offsets had an error factor that was larger than the potential offset value. This same effect, offset within an error margin value, can be seen at a wider regional level with the regional mean of delta offset values for Jamaica, Florida and the Bahamas +10 ±11. In conclusion, there are regional offset data from elsewhere in the Caribbean, but they do not provide a clearly suitable offset to be used for the samples from the case study area. Therefore they cannot be used selectively in order to provide a local reservoir offset for the case study area and this needs to be calculated independently.

A local reservoir offset can be calculated by radiocarbon dating a shell with a known calendar age dated before 1950. There are shells available in the CIEC archive that could be used to do this in the future. Therefore, the absolute dates which are generated from the marine 04 calibration have the potential to be refined at a later date when a local marine reservoir offset has been determined for northern Cuba. Even given this potential for further refinement in the future, the accuracy and relevance of the absolute shell date ranges calibrated using the Marine 04 curve appear to be useful and fully within the calibrated ranges calculated using the regional offset data available from the wider region.

Calibrated Dates

Table 7.08 Calibrated dates of samples taken from sites in the study area

Laboratory No.	Material	Cal BP 2σ Lower Limit	Cal BP 2σ Upper Limit
OxA-15267	Marine Shell	4704	4428
OxA-15266	Marine Shell	1626	1420
OxA-15265	Marine Shell	475	312
OxA-15264	Marine Shell	3232	2980
OxA-15263	Marine Shell	3218	2986
OxA-15262	Marine Shell	1674	1492
OxA-15261	Marine Shell	486	330
OxA-15260	Marine Shell	1261	1088
OxA-15259	Marine Shell	514	408
OxA-15184	Marine Shell	1295	1174
OxA-15183	Marine Shell	1509	1330
OxA-15182	Marine Shell	521	444
OxA-15181	Marine Shell	1210	1043
OxA-15180	Marine Shell	3916	3709
OxA-15179	Marine Shell	718	627
OxA-15178	Marine Shell	434	280
OxA-15154	Marine Shell	502	416
OxA-15153	Marine Shell	438	283
OxA-15152	Marine Shell	608	494
OxA-15151	Marine Shell	616	498
OxA-15150	Wood	622	516
OxA-15149	Marine Shell	531	455
OxA-15148	Marine Shell	538	468
OxA-15147	Wood	283	0
OxA-15146	Marine Shell	1206	1040
OxA-15145	Marine Shell	534	457
OxA-15144	Wood	668	558
OxA-15123	Wood	686	574

7.II.8.iv Wood and Shell Calibrated Date Comparison

Once the calibration method for the shell dates was established, it was possible to begin a more detailed analysis of the absolute dates for the dating samples. The wood and shell dates from D2-6 were calibrated using the two separate curves and plotted together for direct comparison (Figure 7.05). These dates, listed in Table 7.09, can then be discussed in more detail.

Table 7.09 Calibrated radiocarbon dates of samples recovered during excavation of D2-6 at Los Buchillones

Lab. No.	Cal AD Date Range	Grid Sq.	Context	Sample
OxA-15123	1264 – 1376	7	3503	Wood
OxA-15148	1412 – 1482	7	3501	Shell
OxA-15149	1419 – 1495	7	3501	Shell
OxA-15153	1512 – 1667	7	3501	Shell
OxA-15154	1448 – 1534	7	3501	Shell
OxA-15150	1328 – 1434	10	3518	Wood
OxA-15151	1334 – 1452	10	3511	Shell
OxA-15152	1342 – 1456	10	3516	Shell
OxA-15144	1282 – 1392	11	3549	Wood
OxA-15145	1416 – 1493	11	3549	Shell

Each of the wood dates is older than the shell dates from the same context in D2-6. The closest correlation is in C10, where sample OxA-15154 (AD 1328-1434) closely overlaps with the ranges for OxA-15151 and OxA-15152 (AD 1334-1456). OxA-15154 is interpreted as a fragile roof rafter or stringer. The thin diameter and branching makes it likely that this is a branch with sapwood that represents the final years of the tree's life that is being dated. Excavation data from D2-6 suggests this element was used shortly after being cut down. Therefore, provided that the roof was standing when the shell objects were brought into the structure, it seems likely the wood sample would have a chronological age slightly older than the shell samples in the same context. These dates also strengthen my contention that the Marine 04 calibration curve provides dates for the shells comparable with the Intcal04 calibrated wood samples.

In contrast, the wood dates OxA-15144 and OxA-15123 provide chronological ranges that predate the shell sample from the same archaeological context by 36 and 24 years respectively. It was not possible to identify the part of the tree from which these two carved objects were made. It is possible that they could have come from the heart wood of a tree trunk, which would have provided an older date than the use of the objects in D2-6. Perhaps this disparate plant life age to the shorter animal life of the shell accounts for this chronological disparity between the dates of the two materials.

However, despite these methodological issues the absolute radiocarbon dates from structure D2-6 provide a chronological range of cal AD 1264-1667. This range provides an occupation period of D2-6, clearly within the Taíno period. This date range is also directly compatible with the date ranges proposed by Pendergast and colleagues (Pendergast, et al. 2002) for structure D2-1, "the period spanned by the samples, not including the dates that appear too early, is cal AD 1295-1655" (Pendergast, et al. 2002:69), and structure F1-1 of cal AD 1435 – 1655 (Pendergast, et al. 2002:73). Therefore the dates from D2-6 provide evidence of an extended indigenous occupation period that matches evidence for long periods of indigenous occupation at Structures D2-1 and F1-1. It also provides evidence that the calibration of the shell dates has provided useful absolute dates that can now be used for inter-site comparison.

7.II.8.v Absolute Chronologies for Islands Sites

The three *Strombus gigas* selected from the surface and two stratigraphic layers in Cave 1 provided a chronological sequence of cal AD 1232-1323, cal AD 689-862, cal AD 276-458. The sequential range of the dates appears to indicate that these larger *Strombus gigas* shells reflect an ordered stratigraphic deposition in the Cave. The surface layer is contemporaneous with occupation of structure D2-6 at Los Buchillones, although the full chronological range provides evidence of indigenous activity in the cave spanning 1000 years. The three *Oliva reticularis* beads taken from the same stratigraphic layers provide an overlapping chronology: cal AD 1436-1543, cal AD 1464-1620 and cal AD 1517-1671. Given the chronological range of these ornaments, it is likely that these small objects were subject to post-depositional movement through the stratigraphic matrix. The chronological range for these beads is contemporaneous with the latest phase of occupation of D2-6 at Los Buchillones. If the surface debris of Cave 1 represents the last indigenous activity in the cave, then it could be significant that they appear to correspond with the latest phase of indigenous occupation at Los Buchillones. Sample 15184 from Rock Shelter 1 on Cayo Hijo de Guillermo Este provided a date of cal AD 1475-1639. This date would support the hypothesis that this surface deposit represents the last activity phase of indigenous activity on the island and corresponds with the dates from Cave 1 and Los Buchillones.

Table 7.10 Calibrated radiocarbon dates of samples recovered during survey and excavation of sites on offshore islands

Lab. No.	Cal Date Range	Location	Site
OxA-15267	2754 - 2478 cal BC	Cayo Caiman Mata de Coco	Midden 1
OxA-15262	cal AD 276 - 458	Cayo Hijo de Guillermo Este	Cave 1
OxA-15260	cal AD 689 - 862	Cayo Hijo de Guillermo Este	Cave 1
OxA-15179	cal AD 1232 - 1323	Cayo Hijo de Guillermo Este	Cave 1
OxA-15259	cal AD 1436 - 1543	Cayo Hijo de Guillermo Este	Cave 1
OxA-15261	cal AD 1464 - 1620	Cayo Hijo de Guillermo Este	Cave 1
OxA-15178	cal AD 1517 - 1671	Cayo Hijo de Guillermo Este	Cave 1
OxA-15264	1282 - 1031 cal BC	Cayo Hijo de Guillermo Este	Cave 3
OxA-15263	1268 - 1036 cal BC	Cayo Hijo de Guillermo Este	Cave 3
OxA-15182	cal AD 1429 - 1506	Cayo Contrabando	Surface Deposit 2
OxA-15266	cal AD 324 - 531	Cayo Felipe Este	Surface Deposit 1
OxA-15180	1967 - 1759 cal BC	Cayo Flores	Surface Deposit 1
OxA-15265	cal AD 1475 - 1639	Cayo Hijo de Guillermo Este	Rock Shelter 1
OxA-15183	cal AD 441 - 620	Cayo Hijo de Guillermo Oeste	Surface Deposit 1
OxA-15181	cal AD 740 - 907	Cayo Langosta	Surface Deposit 1
OxA-15184	cal AD 655 - 777	Punta Morra, Cayo Guillermo	Midden 1

Sample 15263 and 15264 from Cave 3 provide dates of 1268 – 1036 cal BC and 1282 – 1031 cal BC respectively. Both samples come from the lowest stratigraphic context in Cave 3 and provide the earliest evidence of indigenous activity on Cayo Hijo de Guillermo Este. The distinctive *gubia* typology indicated the possibility of a different cultural affiliation for the tool, and this pre-Taíno date would support this hypothesis. This is an early date for marine activity on offshore islands in Cuba.

Sample 15182 from Cayo Contrabando provides a date of cal AD 1429 – 1506. There was a question if the ceramic artefact from this site could be used as a proxy indicator for a chronological range, and the radiocarbon date of the shell supports this. The chronological range is also contemporaneous with occupation of Los Buchillones and Cave 1 and Rock Shelter 1 on Cayo Hijo de Guillermo Este.

Sample 15181 from Surface Deposit 1, Cayo Langosta, provides a date range of cal AD 740 – 907. This date range is of particular interest because it was the youngest date of the previously discussed Group 2. Therefore the date range cal AD 740-907 represents a potential boundary in the archaeological evidence for island interaction in the case study area. This absolute date range corresponds with the period when established Cuban chronological frameworks place the transition towards *agroalfarero* societies. This relationship between date ranges, site activity and transitional periods of activity is further discussed in Chapter 6.

Sample 15184 from Midden 1, Cayo Guillermo, provides an absolute date range of cal AD 655–777. This date range suggests a pre-agriculturalist chronology for the site. This particular sample came from a lower stratigraphic layer and it would be interesting to define the chronological range of this site by dating samples from each of the different stratigraphic layers. However, no artefacts were found at this site that indicate ceramic period activity, and therefore there is no chronological or archaeological evidence that indigenous activity at this site was contemporaneous with Los Buchillones.

Sample 15183 from Surface Deposit 1, Cayo Hijo de Guillermo Oeste, provides an absolute date range of cal AD 441 – 620. This surface deposit was spread over an exposed weathered limestone plateau and included ceramic fragments. The preceramic date range therefore suggests that the archaeological artefacts in this surface deposit are not contemporaneous. This early date range for perforated shell and the presence of indigenous ceramics would suggest long-term indigenous activity in this location. However, there is no evidence to indicate the relationships between the different phases of indigenous activity and there is no potential for excavation of sequential stratigraphic layers at this site.

Sample 15266 from Surface Deposit 1, Cayo Felipe Oeste, provides an absolute date range of cal AD 324–531. This range suggests a pre-agriculturalist date for the site. This sample came from the top stratigraphic layer and no artefacts were found that indicated ceramic period activity. Therefore there is no chronological or archaeological evidence that indigenous activity at this site was contemporaneous with Los Buchillones.

Sample 15180 came from Surface Deposit 1, Cayo Flores, and provides an absolute date range of 1967–1759 cal BC. The nature of the sample suggests that it is from an artefact that was used shortly after death and was not subject to re-use. Therefore the sample provides an early date for evidence of indigenous activity in the case study area.

Sample 15267 came from Surface Deposit 1, Cayo Caiman Mata del Coco, and provides an absolute date range of 2754-2478 cal BC. This is the earliest date range for evidence of indigenous activity in the case study area. It appears from the circular spire perforation that the artefact was used shortly after the death of the animal.

7.II.9 Conclusions

The attempts to date comparatively short use-life shell and wood artefacts from D2-6, Los Buchillones, need to be reviewed. As discussed earlier, there is a disparity of a minimum of 34 years between the wood and shell samples from the same archaeological contexts. This could be accounted for by the comparatively longer-lived trees that provided wood samples, in contrast to the shorter animal lives of the shell samples. Therefore, future wood samples should be taken from parts of the tree with sapwood, as in the case of with OxA-15123. The absolute chronology for the wood and shell dates from D2-6 are directly comparable and contemporaneous with the absolute chronology for structures D2-1 and F1-1. It is now possible to reconstruct a chronological range for occupation of Los Buchillones, based on over 30 radiocarbon determinations, to between cal AD 1264-1667. The dating of wood and shell samples from the same archaeological contexts enabled the comparison of calibrated absolute chronologies of samples from Los Buchillones and shell samples in the island sites.

The nine dates from shells with perforations identified as produced by human activity provided a date range of 2754-2478 cal BC to cal AD 1475-1638. The use of shells with circular spire perforations was proposed in Chapter 4 as a possible indication of indigenous activity. This sample of shells with radiocarbon determinations supports this hypothesis. There are perforated shells found during each of the groups or activity phases within the case study area. There are no diagnostic variations in circular perforation type through this extended period. The full list of calibrated dates for indigenous perforated shells is given in Table 7.11. The nine shell beads and pendants from *Oliva reticularis* provide a date range of cal AD 1342-1456 to cal AD 1516-1670. This indicates that the species selection and manufacturing of these adornments in the case study area can be associated with the late prehistoric period of cal AD 1200-1500. OxA-15178 from the top stratigraphic layer of Cave 1, Cayo Hijo de Guillermo Este, provides the latest archaeological evidence for indigenous activity in the case study area. The full list of calibrated dates for shell beads and pendants made from *Oliva reticularis* is given in Table 7.12.

Table 7.11 Calibrated dates of shells with circular spire perforations

Lab. No	**Calibrated Date Range, 2σ**
OxA-15265	cal AD 1475 – 1638
OxA-15182	cal AD 1429 – 1506
OxA-15148	cal AD 1412 – 1482
OxA-15181	cal AD 740 – 907
OxA-15184	cal AD 655 – 776
OxA-15183	cal AD 441 – 620
OxA-15266	cal AD 324 – 530
OxA-15180	1966 – 1759 cal BC
OxA-15267	2754 – 2478 cal BC

Table 7.12 Calibrated radiocarbon dates of *Oliva reticularis* beads and pendants from Cave 1 on Cayo Hijo de Guillermo Este and D2-6 at Los Buchillones

Lab. no.	**Calibrated Date Range, 2σ**
OXA-15178	AD 1516 – 1670
OXA-15261	AD 1464 – 1620
OXA-15259	AD 1436 – 1542
OXA-15149	AD 1419 – 1495
OXA-15152	AD 1342 – 1456

Absolute chronologies can be also be assigned to the groups that were discussed earlier in the relative chronology analysis, illustrated in Figure 7.06. The fifteen samples in Group 1 are distributed between cal AD 1232-1323 and cal AD 1517-1671. This provides a maximum chronological range of 439 years. Four sites are included within this group, including D2-6 at Los Buchillones, Cave 1, Rock Shelter 1 at Cayo Hijo de Guillermo Este and Surface Deposit 1, Cayo Contrabando. These sites are within the chronological range of the late ceramicist agriculturalist period of AD 1200 onwards. The later dates suggest evidence of indigenous activity continuing potentially into the C16th and even C17th. This would be a late date for indigenous activity at a site that so far lacks any evidence of Old World contact. The ROM dates for D2-1 and F1-1 at Los Buchillones dated to AD 1295-1655 and AD 1435 – 1655 respectively match this chronological range. This raises the possibility of late indigenous occupation at Los Buchillones with indigenous island interaction continuing into the late 16th and possibly the beginning of the 17th centuries.

The sites within the case study area with artefacts that date to this later prehistoric period are located broadly on a north-south axis between Los Buchillones and Cayo Hijo de Guillermo Este. Further comparison of site location with paleo-environmental data might enable further interpretation of this site distribution. However, initially it appears that these sites could reflect a potential route or pathway of island interaction within the case study area by the inhabitants of Los Buchillones. The sites with artefacts dating to this period are illustrated in Figure 7.07.

The six samples from Group 2 create a potential chronological range of 629 years between cal AD 278 – 456 and cal AD 740 – 907. This period of approximately 600 years pre-dates known, large-scale agriculturalist settlement and ends close to the date of AD 800-900 that is often seen as a transitional period marked by the introduction of the Meillac ceramic sub-series. The distribution of sites from this period appears to be concentrated in the northeast of the case study area (Figure 7.08).

The four samples from chronological Group 3 create a potential range of 1718 years between 2754 – 2478 cal BC and 1268 – 1036 cal BC. This period of over 2000 years has the fewest dated samples within it and, given the age of the archaeological material, is likely to be most susceptible to issues of sampling bias. Sampling factors such as lower population densities, lower site survival rates and lower site visibility could have contributed to a relatively lower site representation of this period of indigenous activity. Also, this is the only group in which the individual date ranges do not overlap; therefore it is not possible to know if these dates are from a single phase of activity. However, there are a number of tentative conclusions that can be drawn from this group of dates. Sample 15267, from the lowest excavated stratigraphic layer of Midden 1, Cayo Caiman Mata del Coco provides the earliest archaeological evidence for indigenous activity in the case study area, dating to 2754-2478 cal BC. This would be an early date for indigenous travel to an offshore island for resource exploitation. Cayo Caiman Mata del Coco needs to be plotted against paleo-bathymetric data to determine whether it was still on an off-shore island during this period or whether this site was in fact part of a paleoshoreline of the Cuban mainland. A tentative observation can be made that the sites dated to this period are generally located in the central, north and northwest sections of the case study area. The locations of the sites with artefacts dated to this period are shown in Figure 7.09.

Absolute chronological ranges have been established for samples from 10 sites and collectively they provide evidence for over 4000 years of prehistoric island interaction in the case study area.

Chapter 8

CONCLUSIONS

8.I Archaeological Case Study from Northern Cuba

Introduction

This research project has investigated prehistoric island interaction in northern Cuba by generating a body of archaeological evidence from a case study area. In Chapter 2, the collation, analysis and discussion of existing archaeological data in Cuba highlighted a paucity of archaeology on offshore islands with which to study island interaction. Therefore if the research questions outlined in that chapter were to be addressed it required the generation of further archaeological and environmental data. The theoretical framework for research, and the influence of landscape and island archaeology on the research design, were discussed in Chapter 3. The research methods to survey a case study area and identify archaeological evidence were outlined in Chapter 4. The preceding three chapters have provided details of the collection, analysis and interpretation of archaeological evidence; following the identification of archaeological sites in the survey, excavations were conducted in order to expand the material assemblage and provide a body of data from secure and well-recorded archaeological contexts. Material analysis of artefacts from these assemblages allowed interpretation of site activities and enabled a better understanding of the nature and extent of prehistoric island interaction in the study area. This chapter will summarise and integrate those findings.

8.I.1 Archaeology on Offshore Islands

The fact that none of the surveyed islands have any fresh water source suggests that activity on these islands would have been temporary rather than permanent. It can be concluded that human activity on the islands provides evidence of interaction with other locations where sources of fresh water could be found. Therefore, evidence of past human activity on offshore islands is in itself evidence of island interaction. The archaeological surveys, discussed in Chapter 5, identified 31 locations with potential evidence for prehistoric activity in the study area. Further archaeological investigation, through targeted excavations and artefact analysis (discussed in Chapter 6) provided a more substantive body of evidence for evaluating the nature and extent of island use and interaction. Radiocarbon determinations, discussed in Chapter 7, have provided a more robust chronological framework than previously existed. This framework has helped to establish site chronologies and has facilitated comparative analysis. A reconsideration of the evidence for island interaction at the 31 potential sites identified by the survey is now possible (Table 8.01).

Table 8.01 Summary of archaeological evidence from potential sites found during the survey discussed in Chapter 5

Island	Site	Archaeology	Summary
Cayo Caiman de la Sardina	Surface Deposit 1	Selected marine shell with butchery marks	Surface deposit with evidence of prehistoric shellfish exploitation. Surface accumulation with no stratified evidence
Cayo Caiman Mata de Coco	Midden 1	Selected marine shell with butchery marks, radiocarbon determination, shell artefact	Evidence for selective shellfish exploitation and early prehistoric island interaction (2754-2478 cal BC)
Cayo Caiman Mata de Coco	Surface Deposit 1	Marine shell with butchery marks	Scattered surface deposit with evidence of shellfish exploitation. Surface accumulation with no stratigraphy.
Cayo Contrabando	Surface Deposit 1	Ceramics	Re-deposited indigenous ceramics provide evidence of prehistoric activity
Cayo Contrabando	Surface Deposit 2	Ceramics, marine shell with butchery marks, radiocarbon determination	Evidence of late prehistoric island interaction that requires further investigation (cal AD 1429-1506)
Cayo Felipe Este	Midden 1	Selected marine shell and shell artefacts	Evidence of selected shell disturbed and re-deposited by modern activity
Cayo Felipe Este	Surface Deposit 1	Marine shell with butchery marks, shell artefacts and radiocarbon determination	Surface deposit with evidence of prehistoric shellfish exploitation. Surface accumulation with no stratified evidence (cal AD 324-531)
Cayo Felipe Oeste	Surface Deposit 1	Marine shell with butchery marks	Small surface deposit with evidence of prehistoric shellfish exploitation. Surface accumulation with no stratified evidence
Cayo Flores	Surface Deposit 1	Marine shell with butchery marks and radiocarbon determination	Surface deposit with evidence of prehistoric island interaction for shellfish exploitation (1967-1759 cal BC)
Cayo Guillermo, Punta Morra	Midden 1	Marine shell with butchery marks, radiocarbon determination	Large site with stratified evidence of prehistoric island interaction for selective shellfish exploitation (cal AD 655-777)

Cayo Guillermo, Punta Morra	Rock Shelter 1	Potentially selected marine shell in island interior	Inconclusive evidence of past human activity
Cayo Guillermo, Punta Morra	Surface Deposit 1	Ceramics, shell artefacts, marine shell with butchery marks	Unstratified evidence of prehistoric marine resource exploitation
Cayo Guillermo, Punta Morra	Surface Deposit 2	Potentially selected marine shell in island interior	Inconclusive evidence of past human activity
Cayo Guillermo, Punta Morra	Surface Deposit 3	Shell artefact and marine shell in island interior	Evidence of past human activity potentially re-deposited from Midden 1 by modern human activity
Cayo Guillermo, Punta Morra	Surface Deposit 4	Selected marine shell in island interior	Inconclusive evidence of past human activity
Cayo Hijo de Guillermo Este	Cave 1	Ceramics, selected shell with butchery marks, shell artefacts, imported lithics and radiocarbon determinations	Stratified site with sequenced evidence of prehistoric activity and island interaction (cal AD 276-458), (cal AD 689-862), (cal AD 1232-1323), (cal AD 1436-1543), (cal AD 1464-1620), (cal AD 1517-1671)
Cayo Hijo de Guillermo Este	Cave 2	No archaeological material	No evidence of past human activity
Cayo Hijo de Guillermo Este	Cave 3	Marine fauna with butchery marks, shell artefacts, ceramics, radiocarbon determination	Substantive evidence from stratified site with evidence of prehistoric island interaction (1282-1031 cal BC) (1268-1036 cal BC)
Cayo Hijo de Guillermo Este	Rock Shelter 1	Selected shell with butchery marks, radiocarbon determination	Evidence of prehistoric marine resource exploitation (cal AD 1475-1639)
Cayo Hijo de Guillermo Este	Rock Shelter 2	Selected shell with butchery marks and shell artefacts	Evidence of prehistoric marine resource exploitation and processing
Cayo Hijo de Guillermo Este	Rock Shelter 3	Selected shell with butchery marks and shell artefacts	Evidence of prehistoric marine resource exploitation and processing
Cayo Hijo de Guillermo Este	Rock Shelter 4	Selected shell with butchery marks and shell artefacts	Evidence of prehistoric marine resource exploitation and processing
Cayo Hijo de Guillermo Este	Surface Deposit 1	Selected shell with butchery marks and shell artefacts, imported lithics, ceramics	Evidence of prehistoric marine resource exploitation and processing
Cayo Hijo de Guillermo Oeste	Surface Deposit 1	Ceramics, marine shell with butchery marks, radiocarbon determination	Unstratified evidence of prehistoric island interaction (cal AD 441-620)
Cayo Hijo de Guillermo Oeste	Surface Deposit 2	Selected shell and shell artefact	Evidence of past human activity possible association with unstratified material from Surface Deposit 1
Cayo Hijo de Guillermo Oeste	Surface Deposit 3	Marine shell with butchery marks and	Unstratified surface accumulation with evidence of

		shell artefact	prehistoric shellfish exploitation
Cayo Langosta	Surface Deposit 1	Marine shell with butchery marks and shell artefact, radiocarbon determination	Surface deposit with evidence of prehistoric marine resource exploitation (cal AD 740-907)
Cayo Langosta	Surface Deposit 2	Shell artefact	Evidence of prehistoric activity
Cayo Langosta	Surface Deposit 3	Imported stone artefact	Evidence of human activity
Cuban Mainland	Los Buchillones	Ceramics, selected shell with butchery marks, shell artefacts, imported lithics, radiocarbon determination	Extensive evidence of prehistoric island interaction. Radiocarbon date range (cal AD 1264-1667)
Cuban Mainland	Los Buchillones, Environs	Ceramics, imported lithics	Evidence of prehistoric human activity possibly redeposited from site of Los Buchillones

Cayo Caiman de la Sardina

This island contains a small surface collection of archaeological material that suggests small-scale prehistoric shellfish exploitation. Shell species and age indicate interaction with either the sandy-bottomed shallow waters to the south between 3 and 8m in depth or the sandy and rocky reef to the north between 8 and >50m in depth. Excavation did not identify any further stratified evidence.

Cayo Caiman Mata de Coco

Surface Deposit 1 provides unstratified evidence of past shellfish exploitation. The site of Midden 1 on Cayo Caiman Mata de Coco contains stratified archaeological evidence of targeted shellfish exploitation from the littoral zone. The radiocarbon determination from this assemblage of 2754-2478 cal BC indicates an early prehistoric date. There is no evidence of permanent settlement on this island and, like the other islands, there are no water sources on the island that would support permanent occupation. A study of the relationship between bathymetric data around this island and known sea level rise in the case study area has been carried out using paleo-environmental data collected by Peros (Peros 2005). This indicates that, unless there has been substantial seabed erosion in the local area (Peros pers. com), which appears unlikely, Cayo Caiman Mata de Coco was an island at the time of prehistoric exploitation. Therefore this site provides the earliest known evidence for movement between islands in the Cuban archipelago. The motivation for this interaction appears to have been primarily marine resource and subsistence exploitation of the shoreline.

Cayo Contrabando

There is archaeological evidence for ceramic period prehistoric activity on this island. This evidence is supported by the radiocarbon determination of cal AD 1429-1506 from Surface Deposit 2, which is contemporaneous with archaeological evidence from Los Buchillones and Cave 1 and Rock Shelter 1, Cayo Hijo de Guillermo Este. It is possible that modern activity identified at Surface Deposit 1 has also disturbed the archaeological deposits at Surface Deposit 2. Archaeological excavations are required before further interpretations of the evidence for island interaction on this island can be evaluated.

Cayo Felipe Este

A radiocarbon determination from Surface Deposit 1, of cal AD 324-531, indicates that this small accumulation of archaeological material represents prehistoric marine resource exploitation. The midden site on the island provides further possible evidence of shellfish exploitation, but this evidence has been affected by modern redeposition. The shell assemblage from Surface Deposit 1 indicates interaction with either the sandy-bottomed shallow waters to the south of the island, between 3 and 8m in depth, or the sandy and rocky reef to the north between 8 and >50m in depth. Excavations did not identify any stratified archaeological evidence.

Cayo Felipe Oeste

This island contains a small surface collection of archaeological material that suggests prehistoric shellfish exploitation. Shell species and age structure indicate interaction with either the sandy-bottomed shallow waters to the south or the sandy reef to the north. Two excavations at this surface deposit did not reveal further stratified archaeological material.

Cayo Flores

Further evidence of prehistoric human activity is found on Cayo Flores. This island has a small assemblage with evidence of prehistoric shellfish exploitation. A radiocarbon determination indicates exploitation of *Strombus gigas* between 1967-1759 cal BC. A comparison of bathymetric data around Cayo Flores with sea level data (Peros 2005) provides confirmation that this was an island during this period.

Cayo Guillermo

Extensive surface accumulations of archaeological material indicate prehistoric activity on this island. The relationships between these surface accumulations appear to have been affected by modern redeposition. Excavations at Midden 1 revealed selective shellfish exploitation focused on the exploitation of juvenile *Strombus gigas*. The large quantity of archaeological material indicates either long term or intensive human activity on this island. A radiocarbon determination provides a date of cal AD 655-777 indicating prehistoric activity at this site.

Cayo Hijo de Guillermo Este

There is extensive archaeological evidence for prehistoric activity and island interaction on the island of Hijo de Guillermo Este. Faunal remains indicate exploitation of a wide range of coastal and marine environments. There are large quantities of archaeological material in the top stratigraphic layer of each site. Radiocarbon dates from Cave 1 and Rock Shelter 1 indicate that these top stratigraphic layers of densely packed archaeological material could represent a final phase of indigenous activity. Calibrated radiocarbon dates from sites on Cayo Hijo de Guillermo provide evidence of contemporaneous human activity with Surface Deposit 2, Cayo Contrabando, and Los Buchilones.

Excavations in Cave 1 and Cave 3 indicate the possible cleaning of cave floors interspersed with successive layers of past activity. Comparisons between shell artefacts and ceramics found in the top stratigraphic layers of Cave 1 provide strong links with the site of Los Buchillones on the Cuban mainland. The presence of shell artefacts in the process of manufacture indicate that this was a processing site for artefact production before finished artefacts were redistributed to permanent occupation sites such as Los Buchillones. Calibrated radiocarbon dates of identical shell artefacts at the two sites support this hypothesis by providing similar dates of the material.

Cayo Hijo de Guillermo Oeste

This island has three surface deposits of unstratified archaeological remains. Ceramics, shell artefacts and marine resource exploitation are evident. A radiocarbon date, cal AD 441-620, indicates prehistoric shellfish exploitation. However, the contextual relationship of the archaeological material is not secure enough for expanded interpretation of this evidence, other than to say that this island has evidence of prehistoric activity and interaction with marine environments.

Cayo Langosta

There is evidence of marine shellfish exploitation at scattered surface deposits on this island. A radiocarbon determination provides a date of cal AD 740-907. There is only limited archaeological evidence available from unstratified deposits, and further investigation through archaeological excavation is required before further interpretation of prehistoric activity on this island can be made.

Los Buchillones

The coastal survey around Los Buchillones has identified a large site stretching at least 1.8km along the coast. Excavations at Los Buchillones have revealed evidence of permanent settlement with people living in stilted houses in a wetland coastal environment. Previous excavations have highlighted the importance of marine resources at the site and the nature of the relationship with marine environments and offshore islands in the case study area has been explored.

8.I.1.i Summary

Archaeology on offshore islands clearly indicates prehistoric activity. Archaeological evidence is supported by radiocarbon determinations that provide an extended chronology of prehistoric activity. The lack of fresh water indicates that the islands in the case study area were not able to support permanent settlement. The archaeological evidence indicates that activities on the islands were aimed at sustaining and enriching the lives of people in communities based on the Cuban mainland or on other islands in the archipelago that remain to be surveyed. Archaeological material found on the islands provides evidence of movement of resources between islands in the case study area. Calibrated radiocarbon dates support the archaeological evidence for movement of resources between temporary-activity sites on the islands of Cayo Hijo de Guillermo Este and Cayo Contrabando, and the permanent occupation site of Los Buchillones on the Cuban mainland.

8.I.2 Interpreting Prehistoric Island Interaction in the Case Study Area

8.I.2.i Marine Transport

Ethno-historical sources discuss the presence of large sea-going canoes in the Caribbean that could carry up to 150 people (Rouse 1992:16); however, a canoe of this size has yet to be excavated from an archaeological context in the Caribbean. At Los Buchillones, two canoe fragments have been recovered eroding from the shoreline within the area of the site but without defined archaeological context. These fragments appear to come from the same canoe and form a hull 175cm long and approximately 60cm wide. The overall length of the canoe is undeterminable but it appears to have been a single-hulled canoe carved from a single tree trunk using petaloid axes and adzes. It is hoped that more evidence of marine transport will be uncovered in future excavations. Given existing ethnohistorical evidence and archaeological evidence from Los Buchillones it is possible to conclude that canoes were the most likely form of prehistoric marine transport.

8.I.2.ii Marine Fauna

The archaeological evidence from the offshore islands clearly provides a biased interpretation in favour of activities, such as marine shellfish exploitation, that provide durable material remains. Whilst being aware of this bias against less durable remains, it is only possible to draw conclusions based on the study of material recovered.

There is extensive evidence of marine shellfish exploitation for both subsistence and shell artefact production. The use of the circular spire perforation to identify prehistoric shellfish exploitation was discussed in Chapter 4. The nine radiocarbon determinations on shells with circular spire perforations provide dates that support the use of this method to indicate prehistoric human activity. Faunal analysis has revealed variation in the assemblages from different archaeological contexts. The earliest evidence of island interaction comes from Cayo Caiman Mata de Coco (2754-2478 cal BC) where there is focused exploitation of *Cittarium pica*. This indicates travel out to this island and exploitation of shellfish from the shoreline. At Midden 1 Cayo Guillermo (cal AD 655-477), Layer 4 (cal AD 689-862) and 5 (cal AD 276-458) Cave 1 Cayo Hijo de Guillermo Este the assemblages are dominated by Strombus shells. The age structure of these shells indicates a bias in favour of juvenile specimens. This indicates travel out to these islands and exploitation of shellfish from soft-bottomed submarine habitats found between the intermediate islands in the case study area. A much more diverse faunal assemblage is found in Layer 1 (cal AD 1232-1323) in Cave 1 and Rock Shelter 1 (cal AD 1475-1639) on Cayo Hjio de Guillermo Este. These assemblages are still dominated by Strombus but they also include a wider range of shellfish species. The age structure of these assemblages indicates a bias in favour of adult specimens. The diverse range of marine fauna also includes targeted selection of certain species for artefact production. These assemblages indicate exploitation of a range of marine environments with a particular focus on the reef habitat located to the north of the case study area.

8.I.2.iii Shell artefact production

The majority of shell artefacts found in the case study area are shells with minor modifications that have been used to process marine fauna for subsistence. Handpicks and hammers are found throughout the geographic area and temporal range of sites in the case study area. The first worked shell tool with evidence of grinding and polishing is the *gubia* found in layer 4 (1282-1036 cal BC) of Cave 3, Cayo Hijo de Guillermo Este. *Gubias* appear to have been used in the process of marine resource processing. Shell scrapers, predominantly re-used valves, are found at sites throughout the case study area and indicate resource processing. Shell plates and spoons, made from large adult Strombus shells, appear to have been used as platters and containers. These artefacts indicate possible food preparation and are found in Layer 1 of Cave 1, Cayo Hijo de Guillermo Este where there is also evidence of burnt turtle bone and cracked limestone that could indicate cooking. Shell points were found on a number of islands and appear to have been used as projectiles for spear fishing. It appears likely from the point typologies that the shell points were hafted to wooden shafts. Spear fishing is still practiced in the case study area today. Ethnographic evidence suggests that it is likely that spear fishing was carried out in the clear water of the sandy bottomed and coral reef environments in the north of the case study area. Shell beads and pendants, made from *Oliva reticularis,* are found in the top stratigraphic layers of sites on Cayo Hijo de Guillermo Este. Many of these beads are found in the process of production indicating that this was the location for shell bead working.

All of these shell artefacts are also found at Los Buchillones. The similarity in shell artefacts found in Layer 1 of Cave 1 and Cave 3, Cayo Hijo de Guillermo Este combined with the similar radiocarbon dates for these same artefacts indicate that there was indigenous interaction between these locations. It appears that the purpose of this interaction was resource exploitation of marine habitats not available locally to Los Buchillones and the production of shell artefacts before exportation of finished specimens back to permanent occupation sites on the mainland.

8.I.2.iv Ceramics

Indigenous ceramics were found at Los Buchillones, and indigenous ceramics were also found on four offshore islands. There are 8 sites with indigenous ceramics in the case study area, listed in Table 8.02.

Table 8.02 List of sites from the case study area that contain indigenous ceramics

Site No.	Island	Site Name
4	Cayo Contrabando	Surface Deposit 1
5	Cayo Contrabando	Surface Deposit 2
12	Cayo Guillermo, Punta Morra	Surface Deposit 1
16	Cayo Hijo de Guillermo Este	Cave 1
18	Cayo Hijo de Guillermo Este	Cave 3
23	Cayo Hijo de Guillermo Este	Surface Deposit 1
24	Cayo Hijo de Guillermo Oeste	Surface Deposit 1
30	Cuban Mainland	Los Buchillones

The majority of these sites have ceramic fragments with no evidence of vessel form, decoration or style from which cultural classifications and detailed site interpretations can be made (Espenshade 2000; Hofman 1993; Meggers 1999). Originally, prehistoric sites with any form of ceramics would be classified as Ostionoid, with subcategorisation where possible of first phase Ostionan, second phase Meillac-Ostionoid and third phase Chican-Ostionoid for more elaborate ceramics. The rationale was that the Ostionoid culture first introduced ceramics to Cuba circa AD 600 (Carlson and Keegan 2004:87). These cultural classifications were first called into doubt by the excavations at the site of Mayari, also known as Arroyo del Palo (Tabio and Guarch 1966). More recently, extensive investigations of early ceramics in Cuba appear to have conclusively identified pre-Ostionoid ceramics (Jouravleva 2002; Ulloa Hung 1999, 2005; Ulloa Hung and Valcárcel Rojas 1997, 2002). These studies have identified early pre-Ostionoid ceramics that come from sites with early radiocarbon determinations, including AD 60 at Catunda (Ulloa Hung and Valcárcel Rojas 2002:233) and 100 BC at Herradura I (Ulloa Hung and Valcárcel Rojas 2002:232). The importance of these early ceramics for the purposes of my research is that they broaden the chronological range for ceramic use in Cuba and undermine cultural or chronological classification of sites based on the presence of ceramic typology alone.

In the case study area, Los Buchillones has a large ceramic assemblage that can be used to identify cultural classification (Rouse 1952:330). The ceramic sherds from Layer 1 in Cave 1 and Layer 1 in Cave 3, Cayo Hijo de Guillermo Este can be linked by form and style to Los Buchillones. Macroscopic analyses have identified the ceramic sherds from Surface Deposit 1, Cayo Guillermo, and Surface Deposit 1, Cayo Hijo de Guillermo Oeste, all have similar ceramic production processes to ceramics found at Los Buchillones. Therefore, Los

Buchillones is the only site in the case study area that provides a large enough ceramic assemblage for cultural classification and comparative interpretation with other sites in the region or throughout Cuba based on the classification of styles.

Ceramics were decorated with incised linear and point designs, elaborate appliqué decoration and ornate handle designs (Bashilov, *et al.* 1992; Navarro Betancourt 1973). These ceramic forms and styles can be identified as Meillac-Ostionoid (Mesa González, *et al.* 1994). Los Buchillones also contains wooden artefacts and in particular wooden vessels that provide further evidence of decorative styles and carved designs associated with the Meillac-Ostionoid tradition. The sites from the wider province that also have incised ceramics, appliqué decoration and decorated lugs associated with the Meillac-Ostionoid tradition are illustrated in Figure 8.01. This map provides superficial evidence for potential interaction between these sites. The lack of chronologies for the regional sites limits the extent to which interpretation of patterns in the origins and nature of interaction can be further identified.

8.I.2.v Long Distance Interaction

There is one ceramic style from Los Buchillones that does not fit the Meillacoid or Chicoid classifications associated with Cuba and Hispaniola. This is a distinctive basketry-impressed pottery style known as 'Palmetto' ware that is found on a number of excavated *buren* (griddle) sherds from Los Buchillones. These sherds reflect a very similar style to the basketry-impressed sherds found at Lucayan sites in the Bahamas. During the studies of archival material in the Museum of Bolivia (Bolivia municipality), I identified basketry-impressed sherds that had been excavated from Rosa de Los Chinos. These sherds (Figure 8.02) were photographed and sent to Charlene Hutcheson, a specialist in the study of basketry-impressed palmetto ware pottery (Berman and Hutcheson 2000; Hutcheson 2001), who identified the impressions on these sherds as twill-weaved basketry impressions. These twill-weaved beasketry impressions have been found at Palmetto Grove and Pigeon Creek in San Salvador (Berman and Hutcheson 2000). A study of the paste, fabric and mineralogy of basketry-impressed pottery from Los Buchillones and Rosa de los Chinos demonstrated that *buren* fragments had the same vessel form, and firing temperature as the other *buren* fragments from the same site. However, the fabric of sherds from the two sites varied due to the use of a different clay source, which was consistent with their being manufactured locally.

Presence of basketry-impressed pottery at these sites can be taken as an indication of potential interaction with the Lucayan culture of the Bahamas. Determining the nature and extent of this contact and whether its origins and timing were direct or indirect requires further investigation. It is 587km between the sites of Los Buchillones and Palmetto Grove (Figure 8.03). Evidence for other sites in Cuba with evidence of basketry-impressed pottery includes reports from sites in the Sierra de Cubitas (Calvera pers. com. 2005) and a photograph of an unprovenanced basketry-impressed sherd (Dacal Moure and Rivero de la Calle 1984:127). Further archaeological research is required if the potential for indigenous interaction between Cuba and the Bahamas is to be further explored through analysis of ceramic styles.

In addition to the ceramic vessel assemblage, there are also a number of elaborately carved wooden, stone and shell artefacts. These artefacts display stylistic traits more commonly associated with the Chican-Ostionoid Taino tradition. These elaborate styles are most easily identifiable in the carved wooden effigies and wooden stools (*duhos*) as well as occasionally in stone and shell pendants (Helms 1987:76; Ostapkowicz 1997). Chican styles in wood and stone were identified by Willey (Willey 1971:390) as "the finest examples of Taino or Chicoid art are the sculptures of wood and stone". An example of one of the wooden effigies from Los Buchillones is illustrated in Figure 8.04. This effigy has been provisionally identified as a cemi, a physical representation of a spiritual being (Fray Ramon Pané (trans. By) Griswold 1999). Less than 100 similarly carved effigies, or cemies, have been found in Cuba and the majority do not have archaeological provenance (Del Pilar Zaldívar Fernández 2003; Domínguez González 2002). However, this map shows the distribution of cemies with known provenance from Cuba, see Figure 8.05. This map shows that there is no evidence of other cemies excavated from sites in the region around Los Buchillones. A number of wooden effigies and cemies have also been found in Hispaniola (Caro Alvarez 1977; Veloz Maggiolo 1977). In addition to the wooden effigies, two quartz pendants were also found, one of which, the quartz pendant found in 1989, has close parallels to one excavated by Berman in south-east Hispaniola and illustrated in Figure 8.06 (Berman, personal communication 2006). Similarities have also been identified in the form and style of this pendant with examples found in Maya sites in northern Belize (Pendergast, personal communication 2005). This potential evidence of long distance island interaction, either direct or indirect, provides an opportunity for further investigation during future research.

8.I.3 Conclusions

Archaeological research in the case study area of northern Cuba has provided evidence of prehistoric island interaction spanning four thousand years. The archaeological evidence indicates that the primary reason for interaction was marine resource exploitation and artefact production.

The frequency of indigenous island interaction is difficult to assess without further quantification of marine resource exploitation and a better understanding of the paleoenvironment. However, for the later prehistoric period, the faunal evidence from Los Buchillones indicates that marine sourced foods were an important component of the diet and therefore that island interaction was regular. Variation in marine environment exploitation over time is potentially evident in the faunal assemblages from Cayo Caiman Mata de Coco, Cayo Guillermo and Cayo Hijo de Guillermo Este. The archaeological evidence indicates a focus on the littoral zone during the early prehistoric period on Cayo Caiman Mata de Coco. This is followed by a concentration on marine shellfish from sandy bottomed marine environments around the intermediate islands reflected in the lower stratigraphic layers of Cayo Guillermo and Cayo Hijo de Guillermo Este. However, the faunal assemblage from the later phases of prehistoric activity, on Cayo Hijo de Guillermo and at Los Buchillones, indicate more concentrated exploitation of the reef environment. There is potential to investigate the reasons behind this variation further and it is hoped that comparative isotope analysis of modern and archaeological shells will help to clarify the role of seasonality in this marine resource exploitation.

This thesis has identified initial archaeological evidence for prehistoric island interaction in northern Cuba. Based on the conclusion that the archaeological evidence for island interaction in the case study area relates to marine resource and subsistence practices and that the sites on marine islands reflect wider interaction with islandscape environments; then the reason for travel out to these offshore islands can be hypothesised as allowing access to a variety of marine environments and hence resources. Next, in the final Chapter, it is intended to model this evidence for interaction using GIS applications in order to identify potential past pathways through the islands and improve our understanding of the nature of prehistoric travel through the island environment.

Chapter 9

COMPARATIVE INTERPRETATION AND SPATIAL ANALYSIS

9.I Modelling Island Interaction through GIS Applications

Introduction

This chapter will develop spatial analyses using GIS (Witcher 1998; Zubrow 1994) to further investigate the nature of indigenous island interaction in northern Cuba. The preceding four chapters outlined and evaluated the evidence for prehistoric island interaction in a study area. The archaeological and environmental data from the study area provide an opportunity to model island interactions using GIS applications. Interpretation of the archaeological evidence for island interaction in northern Cuba can be enhanced through modelling this evidence with comparative data from wider spatial scales. As outlined in Chapter 2, part of my doctoral research included the creation of a Cuban archaeology database. Now these data can be used for comparative modelling of island interaction. Modelling island interaction was discussed in Chapter 3 and GIS applications were promoted as a potentially useful framework. In Chapter 4, I explained that the methods for archaeological fieldwork were designed to provide categories of data comparable to the Cuban archaeology database. Therefore GIS applications and spatial analysis can now be used to investigate island interaction with sites outside the case study area.

One example of how island interaction can be modelled is through tracing the movement of material to different sites in the province (Nash 2002). All of the sites within the case study area have materials that have been taken from the marine environment. However, there are a number of sites in the interior of the Cuban mainland, some over 40 km from the sea, which have evidence of marine resources. These sites are illustrated in Figure 9.01.

Therefore spatial analysis and GIS applications were used to model and provide potential interpretations for the nature of island interaction in the case study area and the wider province.

9.I.1 Site Classification

The classification of the sites within the case study area can be done based on the Tabio classification framework discussed in Chapter 2. This classification is necessary as a means of establishing comparable terms of reference for the sites within the study area and the sites in the database of all Cuban sites. Los Buchillones can be classified as an *agroalfarero* site based on the extensive ceramic collection, including griddles, and the large size of the settlement with evidence of a large sedentary community reliant on agriculture. The locations of sites in the regional area that are also identified as *agroalfarero* in the Cuban archaeology database are shown in Figure 9.02. There are 31 *agroalfarero* sites from the Cuban archaeology database within a 50km radius of Los Buchillones, the nearest being Santa Clarita over 24km away, with a range of hills known as the Lomas de Punta Alegre, in between.

The dearth of neighbouring *agroalfarero* sites has led to Los Buchillones being described as an isolated site "There are some sites that appear isolated. Such is the case for the site called Los Buchillones" (Calvera Rosés and García Lebroc 1994:1). By contrast other *agroalfarero* sites in the province are grouped. These groupings of sites have been identified as possible *cacicazgos* or chiefdoms by Calvera et al. (Calvera Rosés, *et al.* 1996:63). The names allocated by Calvera to these clusters of *agroalfarero* are Falla, Romanillo and La Cunagua, from west to east respectively. There are two *agroalfarero* sites located 45km to the west of Los Buchillones on Cayo Salinas and Cayo Rudbekia. Both are cave sites: Cueva de Rudbeckia and Cueva de Los Cuchillos. They were investigated during the Grupo Guama surveys in the 1940s in the north of Sancti Spiritus province (Rangel Rivero 2003:29). As discussed in Chapter 2, there are very limited data available from these surveys. Records show that both these caves sites contained human burials and that Cueva de los Cuchillos also contained pictograms, ceramics, lithic artefacts and textile remains (Morales Patino 1946, 1947, 1948).

As discussed in Chapter 1, *protoagricola* site classifications have been complicated in recent years by the discovery of sites with early ceramics associated with incipient agriculture. The work of Ulloa, Valcarcel and Jouravaleva has highlighted the problems with this classification; therefore, the basis upon which sites were classified as *protoagricola* in the past is not always clear. There is not enough evidence to identify *protoagricola* sites in the case study area. There are seven *protoagricola* sites within a 50km radius of the case study area. Five of these sites were found during the Grupo Guama expeditions in the 1940s with four sites on offshore islands, Playa Ginebra, Cayo Santa Maria III, Cueva las Conchas, Cayo Palma and one associated coastal settlement called Residuario el Limonar. All of these sites contain shell and lithic artefacts in association with simple undecorated indigenous ceramics. No burens or decorated ceramics were found at these sites, hence their *protoagricola* classification.

There are 36 *preagroalfarero* sites within a 50km radius of the case study area (Figure 9.03). Figure 9.03 indicates that all of the regional *preagroalfarero* sites are to the south and west of the case study area. These sites all contain a variety of polished stone artefacts, worked lithics and shell artefacts; 17 are in the chain of islands surveyed by the Grupo Guama and there is extensive evidence of shell tool production. Two of the sites have evidence of indigenous ceramics; however, given the site classification as *preagroalfarero* it must be assumed that these ceramics were found in the surface layers of the caves and not associated with the stratified archaeological deposits. Human burials have been found at a number of these *preagroalfarero* sites with little associated archaeological material. It is probable that these cave sites with human remains, and little other material remains, have been classified as *preagroalfarero* based on the lack of occipital deformation of the excavated crania, as this was a common method of site classification (Cobo Abréu, *et al.* 1996; Drusini and Luna Calderon 1997; Rivero de la Calle and Trapero Pastor 1997).

9.I.2 Cluster Analysis and Site Distribution Patterns

As discussed above, there appears to be spatial patterns in the distribution of archaeological sites and groups of *agroalfarero* sites have been previously been identified by Calvera et al. and classified as chiefdoms or *cacicazgos* (Calvera Rosés, *et al.* 1996:63). Therefore cluster analyses were conducted in order to test the spatial characteristics of the distribution of site point data within GIS. The scale at which these analyses are conducted is an important factor in determining the characteristics of spatial patterns. The cluster analyses will be carried out at a regional scale that includes all sites within a 50km radius of the case study area. The aim of these analyses is to identify whether site distributions are random, clustered or regular.

There are a number of different spatial analysis methods ranging from the 50 year old nearest-neighbour analysis (Clark and Evans 1954), that remains a useful method for identifying patterns in point distributions, to the more recent point-density analyses including the k-function method (Lloyd 2007:186). The cluster analysis selected was a kernel density analysis, which is a two-dimensional intensity analysis in ArcGIS. This analysis method was selected as it provides a "sophisticated density measure…. that produces smoother and more readily interpreted results than simple density techniques" (Conolly and Lake 2006:175). The parameters for the analysis include kernel shape and bandwidth. A raster is then created using the cumulative densities for each cell based on the overlying density kernels. The kernel analysis was conducted on the sites based on their Tabio and Rey inspired site classifications, and clusters were identified visually through variations in the density values for each raster cell. Input analyses were based on a 10,000 km^2 regional area using X-Y co-ordinates to generate the site population body.

9.I.2.i *Agroalfarero*

The kernel density analysis of the *agroalfarero* sites is illustrated in Figure 9.04. This analysis identifies a broad pattern of dispersed individual sites on the offshore islands, the coast and the interior of the Cuban mainland as well as three nucleated clusters of sites in the Cuban interior represented by the green and white intensity raster. These clusters include different numbers of sites within close proximity and provide a direct correlation with the groups of sites identified as possible chiefdoms by Calvera and colleagues (Calvera Rosés 1982; Calvera Rosés and García Lebroc 1994) and named, from west to east, Falla (Cluster 1), Romanillo (Cluster 2) and La Cunagua (Cluster 3). The sites that are found in each cluster are listed in Table 9.01.

Table 9.01 List of *agroalfarero* sites in the clusters identified in the regional area based on the kernel density analysis

Cluster 1 (west)	**Cluster 2 (south)**	**Cluster 3 (east)**	**Cluster 3 (east)**
Santa Clarita 1	Guanito	La Rosa	Puente Largo 1
Santa Clarita 2	Romanillo I	La Garita	Cueva el Majo
Santa Clarita 3	Romanillo II	Solapa La Garita	Cayo Largo 1
Santa Clarita 4		San Pedro	Cayo Largo 2
Santa Clarita 5		La Pelona	Cayo Largo 3
Mabuya		Santa Sofia I	Cayo Largo 4
Rio Palma 1		Santa Sofia 2	Las Playuelas
		San Agustin	

9.I.2.ii *Preagroalfarero*

The density analysis of *preagroalfarero* sites is revealed in Figure 9.05. There appears to be four nucleated clusters of *preagroalfarero* sites, including one on the northern offshore islands, one on the southern offshore islands and coastal zone and two in the interior of the Cuban mainland with dispersed individual sites also found in the same regions. The sites that form each of these clusters are listed in Table 9.02.

Table 9.02 List of *preagroalfarero* sites in the clusters identified in the regional area based on the kernel density analysis

Cluster 1 (north)	**Cluster 2 (west)**	**Cluster 2 (west)**	**Cluster 3 (southwest)**	**Cluster 4 (southeast)**
Cayo Santa Maria I	Cueva Pico de Loro	Cueva de Cayo Fabrica	Siboney	Cueva de los Rubies
Cayo Santa Maria IV	Cayo Aguada I (Dolina)	Cueva del Agua	La Lolita	El Laurel
Cayo Maja I	Cueva del Chino	Cueva Colon	Cedeno	Cuatro Caminos
Cueva el Muneco	Cueva del Isognomon	Cueva de Ramos	Pena de Evaristo	Cueva Angel Valdes
Cayo Las Baujas I	Cueva Plaza de Toros	Cueva de los Chivos		
Cayo Las Baujas II	Cueva de los Ninos	Cueva del Pirata		
Cayo Cobos	Residuario Cayo Salinas	Jucaro 1		

This map also shows a concentration of sites in the west of the regional area as opposed to the more easterly distribution of the *agroalfarero* sites. These clusters of sites show a wide distribution of *preagroalfarero* sites on the offshore islands, the coast and the interior of the Cuban mainland.

9.I.2.iii Discussion of the Cluster Analyses

It should be noted that all analyses are based on the best available data, which are only a sample of a potential 'real' site distribution that includes further, as yet undiscovered, sites. However, the sample of 120 archaeological sites appears sufficient to make a study of site distribution patterns useful, but there is the potential for non-archaeological bias affecting the spatial patterns. Comparisons were made between site distribution and a digitised map of modern day settlements and road network in order to identify whether this influenced site distribution patterns. Although some of the sites are close to modern roads there does not appear to be any evidence that this is affecting site distribution patterns. The concentration of *preagroalfarero* sites in the west and *agroalfarero* sites in the east could be a reflection of the survey strategies and research foci of previous archaeological studies in the province. These potential biases in the data should not be overlooked but nor should their potential limitations preclude the spatial analysis of the sites that are currently available for study.

9.I.2.iv Summary

The available site data appear to indicate three clusters of *agroalfarero* sites in the Cuban interior with dispersed individual sites on the coast and offshore islands. The survey of the case study area has identified sites on the offshore islands and evidence of *agroalfarero* period island interaction.

There appear to be four clusters of *preagroalfarero* sites on the offshore islands, coastal zone and interior of the Cuban mainland. The archaeological research in the case study area has identified further evidence of aceramic sites including a very early site on the island of Cayo Caiman Mata de Coco, the most northerly island, and also in the east on Cayo Flores and Cayo Hijo de Guillermo Este.

These cluster analyses are based on distance and do not take into account the more complex nature of landscape, in which connectivity and the potential for interaction between sites cannot be based on distance alone. Therefore further spatial analyses are required that take into account other factors that affect the potential for interaction, such as topography and visibility. By establishing a more realistic model of the islandscape, it should then be possible to model potential interaction in the form of journey times and distances, helping to provide evidence for possible pathways of movement through the island environments.

9.I.3 Landscape Topography and Digital Elevation Models

Adding the third dimension of height to two-dimensional maps of archaeological site distributions can help to provide a better context. A Digital Elevation Model (DEM) was created for the whole of Cuba using SRTM data from the NASA Aster satellite with a resolution of less than 3m elevation with $100m^2$ cell sizes. This was used to produce a DEM raster projected in UTM 1984 17N.

During the survey of the study area, the topography of each survey square was recorded and this included an estimated height above sea level. In addition, a topographic survey of Cayo Hijo de Guillermo Este was conducted using a Russian made ATK-2 Aeorological Theodolite. This topographic survey recorded 229 spot heights and produced a localised elevation model for this island inputted into ArcGIS. This provided a humanly-recorded elevation data set to compare against the satellite-produced DEM in the GIS. When modelled against the higher resolution survey elevation data, the satellite-based DEM was shown to produce accurate but coarse DEM data with an accuracy of ± 1.5m. Therefore the level of resolution in the satellite data was sufficient to generate a useful map of the elevation for the regional area.

The site location point data were mapped over the DEM using a semi-transparent hillshade, added to improve the visibility of the data. This analysis indicates a correlation between location of *agroalfarero* sites in the interior of the Cuban mainland and areas of elevation. There appears to be a link between the *agroalfarero* site clusters and the three hill ranges of Lomas de Punta Alegre, Loma de Cunagua and Sierra de Jatibonico. All of the sites in the interior of the Cuban mainland are within 7km of a range of hills. Potential hypotheses to explain this proximity to the upland areas include the regular use of mineral resources or flora and fauna that are only available in these elevated environments (Del Risco Rodríguez 1999:53). Another possibility is that visual relationships between sites and their proximity to areas of elevation produce correspondingly greater visibility. This is discussed in further detail below.

In order to provide a localised picture of topography at each site, a slope map was generated from the DEM, which showed that 27 of the 28 *agroalfarero* sites in the interior of the Cuban mainland were located on flat land that is always close to or within upland areas (Figures 9.07 and 9.08). Even the sites at high elevations in the Sierra de Jatibonico are on flat highland plains. Hypotheses for explaining the location of *agroalfarero* sites on flat open areas include the need for flat arable land and the open space to house relatively large concentrations of population. The one site on sloping ground is the cave site of Cueva de Maja in Cunagua. This small cave site approximately 45m^2, visited during fieldwork, is on sloping ground. The activities at this site require further investigation, but there is no existing evidence of permanent *agroalfarero* settlement.

The *preagroalfarero* sites on the islands and the coast of the Cuban mainland are all within 1km of the sea. The *preagroalfarero* sites in the interior of the Cuban mainland are all within 5km of the Sierra de Jatibonico hills. Furthermore the slope map analysis indicates that seven of the eleven sites are on steeply sloping ground. This reflects different site location strategies for *preagroalfarero* sites as opposed to *agroalfarero* sites.

9.I.4 Inter-site Visibility and Cumulative Viewshed Analyses

Views from sites in the study area and wider province were analysed to identify possible visual connections in the islandscape. These visual relationships were studied based on both phenomenological data recorded during the survey and through GIS based viewshed analyses carried out using Geographic Resources Analysis Support System (GRASS). The viewshed data provided from the GIS analyses will be discussed first and then compared with the phenomenological data from a sample from the same locations.

The viewshed analyses were conducted using the cumulative viewshed analysis (r.cva) program (Lake 1998) in GRASS. Six *agroalfarero* sites were selected for viewshed analyses. From the case study area, Cave 1 Cayo Hijo de Guillermo, Surface Deposit 2 Cayo Contrabando and D2-6, Los Buchillones all had indigenous ceramics and contemporaneous radiocarbon determinations. Three *agroalfarero* sites were selected from the wider region. These sites have archaeological evidence for substantial settlements with a diverse ceramic assemblage including burens and vessels with incised and appliqué decoration as well as elaborate lugs that provide further evidence for late prehistoric indigenous activity contemporaneous with selected sites from the case study area. One site was taken from each of the three clusters identified during the kernel density analyses discussed above: San Clarita 4 from Cluster 1, Guanito from Cluster 2, and La Rosa from Cluster 3.

9.I.4.i Los Buchillones

The viewshed analysis from D2-6, Los Buchillones is illustrated in Figure 9.08. The viewshed from this site includes a panoramic view of the sea to the north, west, and northeast up to a distance of 4.6km. Beyond the Bahia de Buena Vista, parts of the low-lying mangrove islands are visible between 10-16.5km to the north. No islands where evidence of past human activity has been identified are visible from Los Buchillones. The views to the south of the site are blocked by the Lomas de Punta Alegre, but it is possible to see west along the coast 8km to the mouth of the Rio Chamba. Therefore no other known *agroalfarero* sites are visible from the site of Los Buchillones.

During the coastal survey, views were recorded and this visibility data supports the viewshed analysis. Humanly-recorded views include portions of the Lomas de Punta Alegre, a good view down the west coast past the town of Punta Alegre, a restricted view east along the coast, and just about visible were a line of unidentified islands on the horizon. This view of the offshore islands was recorded in the photograph illustrated in Figure 9.09. The GIS cumulative viewshed analysis results for Los Buchillones are, therefore corroborated by the phenomenologically recorded views from the same point.

9.I.4.ii Surface Deposit 2, Cayo Contrabando

The viewshed analysis from Surface Deposit 1, Cayo Contrabando is illustrated in Figure 9.10. This map shows that only small sections of the Cuban mainland are visible from this site. These sections include the western portion of the Lomas de Punta Alegre, close to Los Buchillones, and a small portion of the Sierra de Jatibonico, close to the sites of Mabuya, Rio Palma 1 and Santa Clarita 2 of Cluster 1. Also visible are the offshore islands where indigenous ceramics were found during the survey, including a direct line of site to the entrances to Cave 1 and Cave 3 on Cayo Hijo de Guillermo Este.

The views recorded during the island survey of Cayo Contrabando note that the mangrove cover in survey squares 4061 and 4062 at Surface Deposit 2 prevented any views beyond a 10m radius. However, better views were recorded from survey square 4056, which lacked mangrove vegetation, located 50m northwest of Surface Deposit 2. A photograph of the views northeast from survey square 4056 indicate that Cayo Hijo de Guillermo Sur, Este and Oeste, Cayo Guillermo and Cayo Media Luna are visible. This provides corroborative evidence of a line of sight between a location 50m northwest of Surface Deposit 2 and Cayo Hijo de Guillermo Este. The view from survey square 4056 is illustrated in Figure 9.11.

Survey squares on the south of the island, where views of the Lomas de Punta Alegre and Sierra de Jatibonico might be visible, are obscured by mangrove vegetation. This raises the issue of vegetation cover that is not factored into the r.cva viewshed models. Clearly further paleo-environmental data are required before vegetation coverage can be factored into these viewshed models, but it can be tentatively hypothesised in the case of Surface Deposit 2 that similar mangrove coverage could have been cleared as part of any indigenous activity in the past.

9.I.4.iii Cave 1, Cayo Hijo de Guillermo Este

The viewshed from this site is displayed in Figure 9.12. This map indicates a panoramic view of the surrounding islands that includes views of all the islands where ceramics have been found, including Cayo Contrabando, Cayo Hijo de Guillermo Oeste and Cayo Guillermo. The only portion of the Cuban mainland that is visible from this site is a section of the Lomas de Punta Alegre. The site of Los Buchillones is located in the middle of this range of hills as viewed from Cayo Hijo de Guillermo Este. The island survey of Cayo Hijo de Guillermo Este recorded similar panoramic views from outside Cave 1 on the island. In addition, these views included the Lomas de Punta Alegre as the only portion of the Cuban mainland visible. This view from the entrance to Cave 1, Cayo Hijo de Guillermo Este is illustrated in Figure 9.13. Therefore the computer-based 'r.cva' viewshed analysis for Cave 1, Cayo Hijo de Guillermo Este was substantiated by the recorded views from the site described and photographed during the survey.

9.I.4.iv Santa Clarita 4, Cluster 1

The viewshed from this site is displayed in Figure 9.14. The site of Santa Clarita has good views of the Jatibonico mountain range and the Lomas de Punta Alegre behind the site of Los Buchillones. All five of the Santa Clarita sites appear to be inter-visible. The sites of Mabuya and Rio Palma 1 are not directly visible but they are within 450m and 800m of portions of the Jatibonico hills that are visible. There is patchy visibility across the plains towards the coast and portions of the Lomas del Indio are visible in the northeast. Long distance inter-site visibility is not shown by this viewshed. However, there is visual connection between Santa Clarita 4 and portions of the Sierra de Jatibonico were the sites of Mabuya and Rio Palma 1 are located and the Lomas de Punta Alegre beyond which the site of Los Buchillones is located.

9.I.4.v Guanito, Cluster 2

The viewshed from Guanito is displayed in Figure 9.15. This viewshed indicates that all of the sites in Cluster 2 were inter-visible despite a 4km separation between Guanito and Romanillo I. A large number of sites in Cluster 3 also appear to be inter-visible as is the western portion of the Cunagua Hill. None of the sites from Cluster 1 are visible but a portion of the Sierra de Jatibonico in the middle of Cluster 1 is visible. A small portion of the Lomas del Indio are visible but the Lomas de Punta Alegre are not visible as views are blocked by the foothills of the Sierra de Jatibonico where the other Cluster 2 sites of Romanillo I and II are located.

9.I.4.vi La Rosa, Cluster 3

The viewshed from La Rosa is illustrated in Figure 9.16. The viewshed from La Rosa indicates inter-visibility with a number of other sites in Cluster 3, including the site of La Garita. The sites of Guanito, Romanillo I and Romanillo II from Cluster 2 all appear to be visible from La Rosa. The sites from Cluster 1 are not visible but their broad locality in the Sierra de Jatibonico is visible. A portion of the Lomas de Punta Alegre close to Los

Buchillones is also visible, even though these hills are over 45km away. There appears to be a correlation between viewable portions of elevated areas and site location. The Lomas del Indio in the area known as the Isla del Turiago, are visible from sites within Cluster 1, 2 and 3 but there was no prior evidence of indigenous activity in this area. This opens up the potential for predictive modelling of areas for future survey [1].

9.I.4.vii Discussion of Visibility and Viewshed

It could appear that these viewshed analyses are just an elaborate model illustrating the simple observation of greater visibility of upland areas. However, the viewshed analyses identify a pattern in the portions of upland area visible and the close proximity of potentially contemporaneous sites. The viewshed analyses have been corroborated by phenomenologicaly recorded visibility data.

As with any interpretation of patterns in GIS-modelled data, there is the potential that they are the product of patterns of data selection rather than meaningful patterns in the data themselves. It is clear that there are a number of important factors that have not or cannot be taken into account in the cumulative viewshed analyses of the archaeological sites in this region. Not least of which is vegetation cover, which given the ethnohistorical evidence for mahogany forests in Cuba, could have been very high. It can be counter argued that settlements could have required large clearances of this vegetation and provided open clear spaces from which long distance views would be possible. In addition there are other factors that would have increased inter-site visibility such as smoke columns or fires from these settlements. However, despite citing some of these factors as important, it would be pure speculation to attempt to model them effectively without detailed evidence for their existence. Therefore all the viewshed analyses have to be considered as speculative models based on the best available data.

9.I.4.viii Summary

These analyses indicate that there is a connected visionscape in the case study area between Surface Deposit 2, Cayo Contrabando and Cave 1, Cayo Hijo de Guillermo Este, and that the clearest topographic feature on the Cuban mainland that is the Lomas de Punta Alegre, the centre of which marks the location of Los Buchillones. In addition, there is a visual connection between the site of Cayo Contrabando and a visible portion of the Jatibonico

[1] In January 2007, preliminary evidence of indigenous activity was discovered by local residents in the Isla del Turiago and published in ***Juventud Rebelde***, the Cuban national newspaper. Consequently, this area has been identified for future archaeological investigation by CITMA (Calvera and Valcarcel pers. com.).

mountain range, where the sites of Cluster 1 are located. The views of the Cuban interior from Los Buchillones are limited but there is a panoramic view of the sea stretching out into the Bahia de Buena Vista.

The viewshed analyses from the sites of Cluster 1, 2 and 3 in the Cuban interior indicate that these clusters of sites are all interconnected through site inter-visibility and through the visibility of upland areas close to each cluster.

Therefore these viewshed analyses indicate that the *agroalfarero* sites from the study area and the wider region are linked by visual connections that link the offshore islands, the coast and the Cuban interior. In order to establish whether these connected views are significant for further interpretation of island interaction, it is necessary to turn attention to the nature of the possible connections between these sites and consider the potential pathways of interaction between them.

9.I.5 Pathways through the Islandscape and Surface Cost Analyses

Identifying evidence of past pathways through the landscape is possible through archaeological investigation by discovery of roads, bridges and material evidence of past routes. However, identifying pathways through the sea or bodies of water can prove to be more challenging. There are a number of different methods that can be used to identify pathways and routes of interaction including archaeological, ethnographic, experimental and surface cost models. The surface cost analyses provide a potential way of analysing past pathways through both the landscape and waterscape that are required when considering island interaction.

This section will focus on the results of surface cost analyses conducted in GRASS using a modified r.walk program (Fontanari, *et al.* 2005). The advantage of this program is that it can model possible routes through the islandscape (landscape and waterscape) by creating a cell-based surface friction map of the islandscape. This model factors in topography and variations in travel speeds over land and water to create a surface cost map that calculates the time, distance and energy costs of travelling out from any individual site. Using this surface cost map, it is possible to model potential pathways between sites based on the minimum surface cost path between the two sites. There are clearly limitations to this model, not least of which is the lack of known paleoenvironmental data for the wider regional area. However, these models can help to identify patterns in potential pathways between sites, as well as generate possible travel times and distances for alternative routes. These pathways and their corresponding journey data can then be compared and their interpretative value assessed in light of the archaeological evidence.

Elevation data were taken from the DEM discussed above. The r.walk computer model factors in the increasing and decreasing speeds created by increasing and decreasing angles of inclination in the landscape with a peak downhill angle of 12 degrees generating a maximum speed of 12.2km per hour (kmph) with a base speed of 5kmph. Travelling speeds were calculated using a base line walking speed across flat open land of 10m in 7.2 seconds or 5km per hour based on the standardised walking model; this speed is based on extensive walking models conducted by Fontanari and compared to ethnographic data for walking speeds (Fontanari, *et al.* 2005). This allows the creation of topographically sensitive landscape surface cost maps.

One of the key findings of my research has been evidence for water-based journeys in the case study area. This evidence for water based travelling highlighted the need to modify the r.walk program to include water-based travel speeds. Canoes are thought to be the most common form of waterbased transportation among indigenous groups in the Caribbean (Glazier 1991:49; Robiou Lamarche 1992:69), and there is evidence for indigenous canoes at the site of Los Buchillones (Cooper 2004). The surface cost analyses for water based travel were calculated using data from an experimental canoe trip between Cayo Hijo de Guillermo Este and Los Buchillones. This trip of 32km in 2hrs 50minutes paddling time can be assumed to be a comparatively slow water speed in relation to the likely speed of past indigenous water travel, because of our lack of regular canoeing experience, comparatively poor equipment, limited route knowledge, lack of tidal timing and relatively poor weather conditions. The meteorological data recorded at CIEC on Cayo Coco for the times of the canoe trip were force 4 (Beaufort Scale) moderate winds (20-29kmph) and a 1m swell with some white caps. This experimental canoe trip was used to model the canoe travelling speed and create a surface friction for water. The speed of 32 seconds per 100 metres (11.6 kmph), based on an experimental canoe trip, required a change in the lamda coefficient of the r.walk program to .01 in order to create a surface cost map that included both land and water based travel models. These data for water transport are similar to those used by Callaghan in his computer simulated voyages and are supported by ethnographic and other experimental data (Callaghan 2001, 2003a, 2003b, 2006; Callaghan and Bray 2007).

Excavations at Los Buchillones highlight the permeable nature of the coastline in the prehistoric period with people living on the liminal edge thus blur the boundary between land and water. There are a number of navigable lagoons and lakes in the region that allow water based travel into the interior. Interviews conducted with fisherman in Punta Alegre and Maximo Gomez revealed that many of the rivers in the region were navigable and regularly travelled up and down by small boats, canoes and punts. These bodies of water, including lagoons, lakes and large rivers that were potentially navigable by canoe, were digitised to create a map of the navigable waterscape in the region, using a combination of the DEM, NASA Worldwind satellite imagery, and local Cuban maps georeferenced in ArcGIS. Without a detailed knowledge of the vegetation cover of the land, vegetation could not be factored into the surface cost analyses. It can be assumed that any land surface costs would be friction as vegetation cover only ever slows travelling speeds. Therefore the r.walk land travelling speeds were likely to be too fast rather than too slow.

R.walk analyses were then conducted to generate surface cost maps for individual sites at a regional scale. These surface cost maps were created for six *agroalfarero* sites and six *preagroalfarero* sites. All of the sites had both landscape and islandscape surface cost maps generated for comparative analysis.

These surface cost pathway maps contain the cumulative time costs in seconds to travel out from each site across all the individual $100m^2$ cells in the raster map of the regional area. Once these surface cost maps had been created, it was possible to start analysing potential pathways. This was done by rasterising the site point for the start of the pathway and then creating a terrain cost flow analysis in GRASS back to the original site. One analysis is necessary to generate the cumulative travel distances and another for the cumulative travel times. Landscape and islandscape surface cost pathways were generated for each site, except for routes between islands, where travelling by water was unavoidable.

Following these analyses in GRASS, the surface cost analyses were exported into ArcGIS for projection and comparative anlaysis. Following analysis in ArcGIS, a small algorithm error was identified in the r.walk computer simulation. This error was created when pathways went diagonally, because the computer model would still calculate for a single $100m^2$ cell and a 1 cell travel time, even though the reality is that the hypotenuse of a 100m square is in fact 141.42m with a correspondingly increased travel time. The computer model reduces the potential error by engaging a knights-move algorithm to reduce diagonal angles but a potential error remained. In some ways this is a fault of the resolution of the DEM raster that creates the surface cost maps, as it had large $100m^2$ cell sizes. However, it was possible to calculate the error and recalculate the travel times and distances. This was done by digitising and measuring the actual r.walk pathway distances in ArcGIS that included the additional diagonal cell distances to provide a 'real' distance, and then recalculating the actual travel times based on the formula:

< T/D = S therefore S x D = T – therefore - r.walk time/r.walk distance = r.walk speed – therefore - r.walk speed x 'real' distance = actual travel time >

This calculation was made for all the surface cost pathways and it revealed that the diagonal pathways involved relatively small acute diagonal angles that produce a margin of error less than 20%. It should be noted that the method of rectification also has an inherent margin of error because it relies on the r.walk average speed for the total distance to recalculate the r.walk average speed for the diagonal sections. However, this only produces a relatively small overall error of less than 1%. Having made these recalculations and projected the pathways in ArcGIS, all of these surface cost pathway analyses produced a model of travel times and distances between sites that were useful for direct relative comparison and for reconstructing potentially informative inter-site travel times, distances and routes. The surface cost pathways were generated for a sample of *agroalfarero* sites throughout the region and these are listed in Table 9.03.

9.I.5.i Pathways, Travel Times and Distances for *Agroalfarero* Sites

One way of identifying whether these computer-generated pathways have archaeological meaning is to compare them with the site location patterns. In the case study area it was possible to do this for the pathways between the known contemporaneous archaeological sites of Los Buchillones, Cayo Contrabando and Cayo Hijo de Guillermo Este. This map is illustrated in Figure 9.17. This map illustrates that the pathway from Los Buchillones to Cave 1, Cayo Hijo de Guillermo Este passes directly past Cayo Contrabando, which is the only other island with contemporaneous radiocarbon dated archaeological evidence from the case study area. Routes can be tentatively expanded to all the sites where indigenous ceramics were found in the case study area. There appears to be a connection as the pathways to Cayo Hijo de Guillermo Oeste follows a similar trajectory, only splitting after passing the same route past Cayo Contrabando.

Table 9.03 List of surface cost pathways, travel times and distances between *agroalfarero* sites the regional area

Base Site	Travel Site	Surface Cost Map	Distance r.walk	Time r.walk	Distance ArcGIS	Time ArcGIS
Los Buchillones	C1 geste	Islandscape	24.9 km	2 hrs 22 min	26.4 km	2 hrs 31 min
Los Buchillones	Contrabando	Islandscape	20.2 km	1 hr 51 min	20.9 km	1 hr 55 min
Los Buchillones	Oeste	Islandscape	25.4 km	2 hrs 23 min	27.1 km	2 hrs 33 min
Los Buchillones	Guillermo	Islandscape	25.1 km	2hrs 27 min	27.3 km	2 hrs 40 min
Los Buchillones	Guanito	Landscape	38.8 km	8 hrs 23 min	40.9 km	8 hrs 50 min
Los Buchillones	Guanito	Islandscape	44.5km	5 hrs 16 min	50.8 km	5 hrs 56 min
Los Buchillones	Santa Clarita 4	Landscape	22.7 km	5 hrs 5 min	25.2 km	5 hrs 39 min
Los Buchillones	Santa Clarita 4	Islandscape	29.5 km	3 hrs 7 min	31.3 km	3 hrs 18 min
Los Buchillones	Rio Palma	Landscape	25.2 km	6 hrs 39 min	29.8 km	7 hrs 28 min
Los Buchillones	Rio Palma	Islandscape	36.1 km	4 hrs 42 min	39.8 km	5 hrs 11 min
Los Buchillones	La Rosa	Landscape	32.1 km	8hrs 22 min	40.9 km	10 hrs 32 min
Los Buchillones	La Rosa	Islandscape	40.4 km	4 hrs 42 min	45.2 km	5 hrs 12 min
Los Buchillones	La Garita	Landscape	31.6 km	8 hrs 52 min	43.2 km	12 hrs 8 min
Los Buchillones	La Garita	Islandscape	42.7 km	4 hrs 45 min	49.4 km	5 hrs 30 min
Los Buchillones	Rosa de los Chinos	Landscape	44.5 km	10 hrs 53 min	53.2 km	12 hrs 41 min
Los Buchillones	Rosa de los Chinos	Islandscape	62.1 km	6 hrs 27 min	67.3 km	6 hrs 59 min
La Rosa	Santa Clarita 4	Landscape	34.8 km	7 hrs 29 min	36.6 km	7 hrs 52 min
La Rosa	Santa Clarita 4	Islandscape	42.9 km	6 hrs 30 min	48.3 km	7 hrs 19 min

The pathway to Cayo Guillermo indicates one of the limitations of the computer simulations as it does not factor in transitional costs between land and sea because you have to get in and out of the canoe. Therefore this pathway takes a route across a narrow island rather than going around it, which in reality would be quicker, especially as the alternative route that follows the same path past Cayo Contrabando and Cayo Hijo de Guillermo Este is only 4 minutes slower. The archaeological evidence supports this hypothesis as no archaeological evidence was found for indigenous activity on the surveyed islands along the computer-generated route to Cayo Guillermo that passes Cayo Cubera, Cayo Pilon and Cayo Mortero, whereas archaeological evidence was found along the alternative route on Cayo Contrabando and Cayo Hijo de Guillermo Este.

The potential travel times out from Los Buchillones are 1 hr 55 min to Surface Deposit 2, Cayo Contrabando and 2 hr 31 min to Cave 1, Cayo Hijo de Guillermo Este. These times would make return journeys to these sites easily possible within the daylight hours of one day. Based on an average of 12 hours daylight, this trip would allow between 7 and 8 hours of resource and subsistence exploitation of the marine habitats of the area and processing activities on the islands before returning to Los Buchillones before dark. It is possible that this 12 hour window of opportunity could also be timed with the tidal patterns in order reduce travel times out to the islands. The possible use of tides is speculative and it is possible to paddle out and back from the islands against the tide. It is also possible that people could stay out in the islands overnight. However, as summarised in Chapter 8, the archaeological evidence suggests that these island sites represent temporary work areas with no evidence of long-term occupation. Therefore, based on the archaeological interpretation that marine resource and exploitation trips from Los Buchillones involved people travelling out to the islands, it is possible to conjecture maximum travel times of up to 3 hrs out to the island sites. These times indicate that there is still plenty of time for further journeys to the different marine habitats, including pelagic waters, for marine resource exploitation.

One of the main reasons that Los Buchillones has been interpreted as remote or isolated is the distance between this coastal site and the clusters of interior sites (Calvera Rosés, *et al.* 1996). This can now be discussed in light of the analyses of the surface cost pathways between Los Buchillones and the sites in each of the three clusters of interior sites. The surface cost model for walking through the landscape between Los Buchillones and Santa Clarita 4, in Cluster 1, indicates a 5 hr 39 min walking time for a 25.2 km pathway that crosses directly over the Lomas de Punta Alegre. Therefore it is possible to walk to Santa

Clarita 4 in one day but a return journey of 11 hr of 18 min would make a day trip within daylight hours difficult. The surface cost model that allows for canoe travel across navigable water indicates a 3 hr 18 min journey time to cover a 31.3 km route. This longer route is based on canoeing west out to sea from Los Buchillones along the coast before paddling up the Rio Chambas river. These comparative routes indicate that a route that includes canoe travel is 1hr 21min faster than the walking route. This analysis also suggests that by factoring in water based travel, the site of Santa Clarita is brought closer to the journey times and travelling distances from Los Buchillones out the island sites such as the 2hr 31 min journeys 26.4 km out to Cave 1, Hijo de Guillermo Este and indicates the possibility of a return trip to Santa Clarita 4 in one day. It is important to not that these models do not include other possible intermediate sites that have not been found or that may not have survived on the Cuban mainland. Therefore the models are only based on the archaeological data available.

The surface cost pathway to La Garita in Cluster 2 indicates a 12 hr 8 min walking time for the 43.2 km journey through the landscape. This journey runs south-east from Los Buchillones crossing the lower eastern slopes of the Lomas de Punta Alegre before arcing south around the foothills of the Jatibonico hills to the site of Guanito. This is a long journey that would be a challenge to complete in one day. As discussed above, Guanito was identified as the sample site from Cluster 2 for comparative analysis based on its archaeological associations with Los Buchillones. There is a closer site from this cluster to Los Buchillones but it is only 3km closer and there are no other known sites along the walking route between Los Buchillones and Cluster 2. By comparison the surface cost pathway from Los Buchillones to Guanito, which factors in potential canoe travel, indicates a 5 hr 56 min travel time to cover 50.8 km. This route goes north-east from Los Buchillones, out to sea, and east along the coast one would turn south through the Chicola basin up the river to the Laguna de la Leche and then up another river before disembarking and walking the final 3.2 km to the site. This route passes within 1.8 km of the sites of Romanillo 1 and Romanillo II that both form part of Cluster 2; the potential significance of these site locations next to the river are elaborated on below during discussion of network analyses.

The surface cost pathway from Los Buchillones to La Rosa in Cluster 3 takes 10 hrs 42 mins to cover 40.9 km to the site. The computer model simulation goes southeast from Los Buchillones and crosses the eastern slopes of Lomas de Punta Alegre before making a straight line route to La Rosa by taking a short cut across a portion of the Chicola basin and the Laguna de Leche; consequently, these times are an underestimate as walking around the edges of bodies of water would increase the travel time. Even so, 10 hrs 42 mins is a long walk and difficult to cover in one day. Like the path to Cluster 2, there are no known sites close to this pathway that would indicate staging posts to break up the journey over two or more days. The surface cost pathway model that includes part canoe and part walking indicates an alternative journey time of 5hrs 12min to cover 45.2 km. This is less than half the journey time of the walking model. This route follows the same path from Los Buchillones as the route to Guanito before branching off east after Laguna de la Leche and following the Rio Caguana up to 3km from the site. La Rosa is the closest site of Cluster 3 to Los Buchillones. Another site from this cluster, at the foot of the Cunagua hills, is La Garita, and this too is reachable by canoe travel in 5 hr 30 min as opposed to over 12 hours by walking alone. Therefore this cluster of sites, which is the furthest cluster of sites away from Los Buchillones, is easily accessible in one day based on travel by canoe, but is not accessible in one day by walking alone.

The furthest site from Los Buchillones in the regional area is Rosa de Los Chinos in Cluster 3. The surface cost pathway based on walking takes 12hrs 41min to cover a distance of 53.2 km. However, when canoe travel is factored in, the route heads northeast out to sea from Los Buchillones and all the way along the coast, past the site of Rosa de Los Chinos and then turns back up the Rio Caonao to the site. This journey of 67.3 km takes 6 hr 59 min and brings even this furthest site in the regional area to within a journey time of less than one day. Therefore the inclusion of the waterscape when modelling island interaction changes the perspective of the islandscape and provides a different perspective of relative distance and connectivity within the province. This can be visually represented by the islandscape surface cost map from Los Buchillones that is banded at 30 min travel times from the site (Figure 9.18). This map provides an example of how the interactive space within the islandscape can be displayed visually to present alternative understandings of distance. This surface cost map illustrates how travelling along the coast and up the navigable rivers changes the way in which archaeological evidence for interaction at different sites can be interpreted. The coastal waters become a connected route for interaction running east-west along the north of Cuba with navigable rivers forming subsidiary paths up to sites and settlement clusters in the interior.

Summary

All of the archaeological sites on the offshore islands in the case study area, with evidence of contemporaneous island interaction with Los Buchillones, have return travel times of less than 5 hrs 30 min. All of the archaeological sites in the wider province, where there is evidence for permanent occupation, are within less than 5 hr 30 min of Los Buchillones and as they are permanent settlements there is the potential to stay overnight.

When travelling to sites in the interior of the Cuban mainland to the south of Los Buchillones, the journey would start by heading northeast or northwest out to sea. This helps to provide a clearer understanding of the location of Los Buchillones in, over or next to bodies of water that would have been the starting point of journeys to different parts of the islandscape.

9.I.5.ii Group 2 pre-ceramic and proto-ceramic sites

This group of sites identified in the Case Study Area has indigenous activity between AD278-907. Surface cost analyses of potential pathways between these sites can be carried out based on the known archaeological and chronological associations between the sites. These sites are all clustered with short inter-site journey times of between 15 min and 1 hr 30min and short distances of between 1 and 15 km. All of these sites appear to be areas of temporary indigenous activity and there are no permanent settlements so far identified in the case study area. As discussed above it is difficult to identify sites within the regional area that are known to be contemporaneous with the sites from group 2. There are a handful of *protoagricola* sites in the west of the region, but the reasons for their classification as early-ceramic or proto-agricola are unclear. Therefore surface cost analyses between the sites of group 2 and the wider region were not carried out, as the evidence for forming archaeological associations between these sites in the case study area and sites in regional area was not robust.

9.I.5.iii Pathways, Travel Times and Distances for *Preagroalfarero* Sites

The *preagroalfarero* covers an extended chronological period over 5000 years. This makes comparison between preceramic sites within the case study area and the wider province less meaningful as there is no evidence that the sites are contemporary. In addition, surface cost analyses are based on assumed similarities between the modern landscape and the paleo-landscape. This assumption is increasingly tenuous the further back in time the archaeological evidence is (Nyberg, *et al.* 2001). Sea-level changes between 5000BP and AD

900 are also likely to have affected the nature of the *preagroalfarero* coastal landscape dramatically. The site of Midden 1, Cayo Caiman Mata de Coco, has a radiocarbon determination contemporary with some of the earliest human activity in the Caribbean. The lowest stratigraphic layers of Cave 3 on Cayo Hijo de Guillermo Este and Surface Deposit 1 on Cayo Flores, also have early preceramic radiocarbon dates. The dates from these sites are not contemporary but they all indicate examples of different phases of early indigenous activity on these offshore islands. The archaeological evidence from Cave 1, Cayo Hijo de Guillermo Este also indicates that there is long-term indigenous activity at the same site dating back to the preceramic period. Therefore it is possible that activity at these sites could have been contemporaneous, even though the single radiocarbon determinations from each site do not overlap. There are no relative or absolute chronological indicators for the preceramic sites within the wider regional area beyond their classification as 'preceramic', based on their artefact assemblages. Therefore it is not justified to conjecture the possible relationships between these sites with the same levels of confidence as for the ceramic period sites discussed above. However, analyses were conducted between these potentially related sites in order to see whether any useful patterns in the potential for island interaction between the sites and the different island environments could be identified. The pathways between known *preagroalfarero* sites in the case study area, listed in 9.04.

The analyses discussed earlier in this chapter indicated clusters of *preagroalfarero* sites to the west of the regional area. For the purposes of the surface cost analyses, sites from each cluster were selected to provide examples of potential pathways between sites in the case study area and sites in the wider region. The sites of Cayo Cobos and Santa Maria 1 were identified as sample sites for Cluster 1. Cayo Salinas, Cayo Aguada 1 and Guinea were identified as sample sites for Cluster 2. Siboney was selected as a sample site for Cluster 3. Camejo and Laurel were selected as sample sites for Cluster 4.

The closest preceramic site to Cave 3, Cayo Hijo de Guillermo Este, from the Cuban archaeologydatabase, is Santa Maria 1 in Cluster 1. The surface cost pathway to this site takes 3 hr 22 min to travel the 36.4 km; this route northwest passes to the south of Midden 1, Cayo Caiman Mata de Coco. The closest preceramic site on the Cuban mainland to Cave 3 Hijo de Guillermo Este is Cueva de la Guinea, close to the coast on the Cuban mainland. This route takes 4 hr 43 min to travel the 41.5 km and directly passes the site of Cayo Flores, where Surface Deposit 1 also contains evidence of preceramic indigenous activity. The proximity of these routes and the site distribution is an interesting phenomenon.

Table 9.04 List of surface cost pathways, travel times and distances between *preagroalfarero* sites the regional area

Base Site	Travel Site	Surface Cost Map	Distance r.walk	Distance GIS	Time r.walk	Time GIS
C3_Geste	Guinea	Islandscape	41.5 km	33.9 km	3 hrs 51 min	3 hrs 43 min
C3_Geste	Flores	Islandscape	8.3 km	7.1 km	45 min	38 min
C3_Geste	Santa Maria 1	Islandscape	36.4 km	35.6 km	3 hrs 18 min	3 hrs 2 min
C3_Geste	M1_Coco	Islandscape	26.6 km	22.6 km	2 hrs 22 min	2 hrs 9 min
C3_Geste	Laurel	Islandscape	81.3 km	73.4 km	8 hrs 16 min	7 hrs 27 min
M1 Cayo Caiman Coco	Cayo Salinas	Islandscape with Mangrove	42.1 km	34.8 km	3 hrs 47 min	3 hrs 7 min
M1 Cayo Caiman Coco	Cobos	Islandscape	33.1 km	29.2 km	3 hrs 1 min	2 hrs 40 min
M1 Cayo Caiman Coco	Aguada	Islandscape with Mangrove	45.2 km	40.1 km	4 hrs 10 min	3 hrs 42 min
Cayo Salinas	Cueva de Chivos	Islandscape	11.6 km	11 km	1 hrs 8 min	1 hrs 4 min
Cayo Salinas	M1 Cayo Caiman Coco	Islandscape	39.4 km	33.5 km	3 hrs 37 min	3 hrs 4 min
Cayo Salinas	Aguada	Islandscape	9.3 km	8.2 km	50 min	44 min

The surface cost pathway between Midden 1, Cayo Caiman Mata de Coco and Cayo Cobos in Cluster 1 takes 3 hr 26 min to travel 33.1km. This route goes directly past the other preceramic sites of Santa Maria 1, Las Baujas I and Las Baujas II.

The surface cost pathway between Midden 1, Cayo Caiman Mata de Coco and Cayo Aguada in Cluster 2 is illustrated in Figure 9.19. The route taken in this pathway model highlights the potential dangers of surface cost analyses for paleo-landscapes (Hodell, *et al.* 1991). This route heads southeast from Cayo Caiman Mata de Coco, crosses Santa Maria and then crosses a shallow mangrove environment to Cayo Aguada. Paleo-environmental reconstructions of sea level change by Peros (Peros 2005) indicate that 5000 BP sea levels, contemporaneous with the activity at Midden 1, would have been >50cm lower than current levels. Present day bathymetric data reveals that this area to the south of Cayo Santa Maria between Clusters 1 and 2 is shallow less than 45cm and warnings are found on local navigation maps of 'area de poco profundidad' (Instituto Cubano de Hidrografía 1996). This raises doubts over whether this area would have been navigable by canoe during the preceramic period. The computer-generated routes from Midden 1, Cayo Caiman Mata de Coco to Cayo Salinas in Cluster 2 also follow a route through this shallow area to the south of Cayo Santa Maria. Perhaps the spatial distribution of the preceramic sites on the offshore islands in Cluster 1 and 2 indicate the possibility of an alternative route. All of these preceramic sites are next to a deeper sea channel with depths of between 2.1 and 7.2m and illustrated in Figure 9.20. Modelling routes between the sites in Cluster 1 and Cluster 2 shows how routes appear to follow the deep water channel southeast to north west of Cluster 2 and then southwest to northeast of cluster1; see Figure 9.21.

The rise in sea levels during this period might also have affected the nature and layout of the islands themselves, covering present landbridge connections and creating islands. The bathymetric data around the island of Cayo Caiman Mata de Coco indicates that this island is surrounded by deep water >7m in depth. This means that unless there has been significant and unidentified seabed erosion in this area, then Cayo Caiman Mata de Coco was still an offshore island at the time of the indigenous activity found at Midden 1 on the island.

These surface cost models of *preagroalfarero* sites area have allowed a superficial analysis of possible pathways between sites. In addition, they have indicated that the islandscape would have been distinctly different during the periods of indigenous activity at these sites. The archaeological site distribution on the offshore islands potentially reflects changes in sea level due to their location along a deep water channel leading out to the reef and pelagic waters of the Bahama Channel.

9.I.5.iv Comments and Discussion

The rivers and navigable watercourses are based on modern river systems and lake sizes that may have changed over time. Obstructions such as past bridges or dams have not been taken into account. In addition, the rivers are not precisely mapped as they were digitised using remote sensing satellite imagery and photocopied maps. Therefore not all of the river systems have been individually surveyed and confirmed as currently navigable by canoe. However, the possibility of obstructions on these rivers in the past raises an issue for discussion and highlights an advantage in the use of the canoe as opposed to other forms of transport (Johnstone 2001). Not only does the canoe have a very shallow draft that allows it to be paddled through shallow waters, it is also one of few watercraft that can be easily portaged around any obstacles or obstructions in a river. This is a significant advantage of the canoe as a means of transport as it can travel through a diverse range of different bodies of water including seas, lakes, wetlands and rivers. This is in contrast to the deeper drafted and heavier masted, keeled, finned or outrigger vessels commonly found in other island theatres around the world (Gosden and Pavlides 1994; Horden and Purcell 2000; Rainbird 2004; Robiou Lamarche 1992).

9.I.5.v Summary

These surface cost models are limited by the data used and cannot account for a wide variety of important factors such as vegetation, weather, tides, fatigue and general human unpredictability. However, they provide a potential indication of possible routes through the islandscape and a number of observations and possible interpretations of island interaction can be made from these models.

Water has the potential to drastically reduce the travelling times between sites, even if distances are increased. The archaeological evidence indicates regular journeys between sites in the case study area over a distance of at least 27km one way, or round trips of 54km, over water. Evidence suggests a one-way travel time of 2hr 31 min from Los Buchillones to Cave 1, Cayo Hijo de Guillermo Este, and given the archaeological evidence at this site for travel further away from this island and out to the reef, it is likely that these travel times were greater. The simulated pathway to Cayo Hjio de Guillermo Este went past Cayo Contrabando, the only other island site with radiocarbon dated archaeological material, contemporary with Cave 1 Hijo de Guillermo Este and Los Buchillones.

The initial models for travel times to the interior sites based on walking through the landscape are time consuming and the majority could not be completed in the daylight hours of one day. This has contributed to previous interpretations of isolated sites and limited interaction between sites in the interior, sites on the coast and sites on the offshore islands.

When all of the water in the region that is navigable by canoe is taken into account, the travel times between these sites can be re-modelled. The water-based journeys to all of the sites in the interior can be completed within the daylight hours of one day. Many of these journeys are up to 30% longer and sometimes take routes that go in the opposite direction from the destination site. The routes between Los Buchillones and each of the site clusters do not pass close to any known intermediate sites that could be used to break up the journey or stay overnight. Therefore models based on the evidence from the case study area for regular water based island interaction can help to illuminate alternative routes and pathways along which interaction could occur.

9.I.6 Indigenous Interaction and Network Analysis

Studying the relationship between humans living at different sites in the past has been the subject of numerous detailed archaeological studies and there are a number of useful analytical frameworks that are applicable to this research. Renfrew's (Renfrew 1975) work on trade and exchange provides a useful template that summarises the nature of potential relationships of interaction based on the trade and exchange of materials. Tracing the movement of material sourced from different marine environments in the case study area provides a useful basis on which to trace interaction in the wider region.

All the sites in the case study area have archaeological evidence of marine resources. For the wider regional area it is possible to identify the sites with marine sourced material in the Cuban archaeology database. As discussed in Chapter 2, this database includes categories of both marine faunal remains and marine shell artefacts. The regional *agroalfarero* sites that have archaeological evidence of marine resources are illustrated in illustrated 9.22. This evidence identifies potential interaction between people living at these sites in the interior and the marine habitats from where the resources originated. However, the nature of this interaction, be it direct or indirect, is unclear. In order to determine the nature of interaction, there are a number of potential models of interaction that could be applicable, Renfrew's seminal work on network analysis provides a useful model (Renfrew 1975). Renfrew's 'modes of trade' highlight the different ways in which materials can move between people including; direct access, reciprocity, down-the-line, central place redistribution, central place market-exchange and port of trade (Renfrew 1975:42).

The archaeological evidence from the case study area, discussed in Chapter 5, 6 and 7, indicates that there is direct access between the people living at Los Buchillones and the different marine environments in the case study area, followed by either direct redistribution back to the home base or more likely through indirect redistribution via temporary processing sites on the offshore islands.

It is possible to infer the motivation behind this interaction based on the nature of the materials being exploited. At Los Buchillones it is clear that there is a long term and intense use of marine resources for subsistence as well as for raw material for making tools and ornaments. There are only limited data available for the details of the marine sourced archaeological material from the interior sites. Sites classified as having elements of marine subsistence are detailed above and this would indicate a relatively regular interaction. Surface surveys of ploughed fields at Santa Clarita 1 in Cluster 1, conducted as part of my research, revealed an *Oliva reticularis* bead and a *Strombus* sp. *gubia* at the site, whilst research at the stores of the Bolivia museum identified elaborately worked marine artefacts found at La Rosa, La Garita and Rosa de Los Chinos in Cluster 3. The artefacts from Cluster 3 included *Oliva reticularis* pendants, a *Xancus angulatus* trumpet and an ornately carved manatee bone. This indicates the potential importance of marine resources, but there are no quantifiable data available to assess the relative importance of marine resources. Therefore it is not possible to indicate the regularity with which communities at these interior sites were using and exploiting materials from marine habitats. However, the previously discussed surface cost analyses can be used to indicate which of the interaction models listed above might be most applicable to the nature of the marine interaction, even without knowing the regularity with which it occurred.

The location of Cluster 1 is due south from Los Buchillones and therefore direct access to the sea from Santa Clarita 4 would have to pass within 5km of Los Buchillones. Based on the surface cost pathways discussed above, a one-way journey between Santa Clarita 4 and sources of marine fauna in the intermediate islands are 5 hr 13 min. Therefore a return journey from Santa Clarita 4 out to the marine habitats would only allow approximately 1 hr 30 mins for fishing, hunting and collecting before returning in daylight hours. An alternative hypothesis is that the marine resources found at Santa Clarita 4 are being redistributed from an intermediate site between the interior site and the marine environment. The established interaction between the offshore island sites and Los Buchillones in addition to the surface cost journey models between Los Buchillones and Santa Clarita 4 would suggest that Los Buchillones is a viable intermediate site for the redistribution of marine sourced material.

Hypothesising the basis for the redistribution of materials is difficult without a more detailed understanding of material found in Cluster 1. Whether the marine sourced material was redistributed altruistically based on close social relationships between the communities, or as a means of tribute to a centralised chiefdom of Cluster 1, or whether a prestigious elite at the 'central' site of Los Buchillones redistributed them as a means of patronage to the hinterland, is difficult to establish (Moreira de Lima 2003; Siegel 1991). Comparative archaeological evidence from elsewhere in the Caribbean suggests that family relationships (Keegan 1997; Keegan and MacLachlan 1989; Keegan, *et al.* 1998; Wilson 1997:46) could have been strong and redistribution based on socially-defined bartering and exchange would be most likely. The presence at Los Buchillones of materials that are likely to have been sourced from terrestrial environments in the interior highlights the possible materials involved in such a reciprocal relationship. The presence of imported durable materials such as flint and quartz are likely to have been accompanied by less durable materials as well, such as plants grown on the fertile soils around Santa Clarita 4, or organic resources that are only found in the higher elevated areas (Bisse 1988). The maximum height of the Lomas de Punta Alegre is 125m therefore alternative habitats are likely to have existed at the higher altitudes of Cunagua and the Sierra Jatibonico above 125m. These environments include the submontane rain forests that thrive between 400-800m above msl and cloud forests thought to have thrived between 800-1600m above msl (Del Risco Rodríguez 1999:53-55).

These interpretations for the nature of interaction between the sites of Cluster 1, Los Buchillones, Cayo Contrabando, Cayo Hijo de Guillermo Este and the marine habitats can be tested against the evidence from Cluster 2. The greater distance between the sites of Cluster 2 in the interior and the marine habitats from which materials were sourced provides further evidence of the need for intermediate sites for overnight stays or redistribution. The proximity of Romanillo I, II on the river and close to the surface cost path generated for travel between Los Buchillones and Guanito was discussed above. There are no known pack animals in the prehistoric Caribbean and so all of these marine materials would have been carried by people walking through the landscape to the interior sites. The advantage of being able to pack these materials into a canoe are clear, as large quantities of materials can be transported with relatively little energy expenditure directly from the source to the destination. This leads to the observation that if large quantities of marine materials are being transported in canoes on water through the region, then it is likely that sites close to rivers will have been used as points for secondary or tertiary redistribution. This hypothesis is highlighted by the proximity of *agroalfarero* sites with marine evidence close to navigable rivers, illustrated in Figure 9.23.

The potential for direct access to the marine habitats from the interior sites of Cluster 3 is raised by the availability of three alternative water routes out into the Bahia de Buena Vista, including via the chicola basin that passes Los Buchillones, or via the Rio Indio or the Rio Caonao. Despite this increased access to the sea, all of these sites are still in the interior of the Cuban mainland and the surface cost analyses indicate minimum travel times to the coast of between 1 hr 36 min (Rosa de Los Chinos) to 3 hr 16 (La Rosa). Furthermore, the section of the Bahia de Buena Vista where the Rio Cunagua and Rio Indio emerge has restricted access to the intermediate, reef and pelagic marine habitats. The large islands of Cayo Coco and Cayo Romano block direct access to these environments. There is a narrow channel between these islands that could allow travel out beyond. This channel is over 30km away from the mouths of the Rio Indio and Rio Caonao. Therefore when the total journey from the interior sites of Cluster 3 to the coast, then across to the channel and out beyond the islands is taken into account, direct access to the reef habitat from the sites of Cluster 3 would require one way journeys of between 50km and 85km. This entire zone is outside the case study area and there is no other archaeological evidence for indigenous activity in this area. The distances discussed above suggest that direct access to marine habitats is unlikely and therefore again indicates that an intermediate site is likely to have been involved in the redistribution of marine material. Further archaeological surveys are required along the coast between the Rio Indio and Rio Cunagua in order to test this hypothesis. However, the journey times between Los Buchillones and the interior sites of Cluster 3 indicate that marine materials could have been redistributed from this site.

9.I.7 Conclusions

There is substantive evidence for marine based transport and interaction with the offshore islands and marine environments in the case study area. Where evidence is available at Los Buchillones marine resources are an important component for both subsistence and as a raw material for artefact production. It can therefore be hypothesised that inter-island and marine environment interaction in the case study area was direct and regular.

Shallow berth canoes allow navigation up shallow rivers and also enable portage around any potential barriers such as waterfalls. Examples of canoes have been found at Los Buchillones and there is archaeological and ethnographic evidence for their use by indigenous peoples throughout Cuba and the wider Caribbean. Anyone who spends time working with the sea knows that before any trip can be attempted one needs to observe the sea and get a feel for potential meteorological conditions. An important observation of the viewshed analyses is that none of the interior sites from Cluster 1, 2 or 3 have views of the sea. This contributes to the arguments against direct access to the marine environments from the sites in the interior and supports the hypothesis of a coastal centre, such as Los Buchillones, from where marine resources were distributed to sites in the interior.

One consideration that arises from studies of the surface cost pathways is that interaction requires movement through the islandscape, with the majority of journey time spent away from site localities. Therefore views and visual connections between pathways and landscape features are important factors in tracing interaction between sites. This is particularly relevant when navigating at sea, when visual landmarks become the only means of establishing a permanent waypoint. The Lomas de Punta Alegre are a clearly visible landmark during the canoe route between Cayo Hijo de Guillermo and Los Buchillones. (Figure 9.24). With no evidence of drawn maps in the pre-Columbian Caribbean, then interaction and movement must have been carried out through pathway directions given orally, through practice and through memory. Therefore the association between sites and distinctive landscape features is raised in the concept of place and community identity.

The distribution of marine sourced materials at archaeological sites in Cuba reveals the extent to which marine materials were moving into the interior of the island. Movement of materials into the interior also raises the question of means of transport. In the case study area, Los Buchillones is 'blocked' from the interior by the Lomas de Punta Alegre. It is time consuming to walk over this range of hills. However, excavations of stilted houses in the wetland environment suggest that water based transport was common at Los Buchillones. Surface cost models of possible journeys highlighted the likelihood that navigable rivers were used to transport materials to the clusters of sites in the interior. Marine resources from the island archipelago and terrestrial resources from upland areas in the Sierra de Jatibonico and Cunagua hills could have been the basis for trade and exchange between coastal and inland sites. Certainly the quantities of shell at inland sites, some of which are over 100km from the marine habitats from which the shell came suggests interaction with communities, such as Los Buchillones, that are closer to the resources.

Given the archaeological evidence from the case study area for the use of marine transport, the question is raised concerning the degree to which coastal interaction occurred east-west along the north coast of Cuba. The movement between the sea and the interior indicates a potential element for investigation using sites in the Cuban archaeology database. The spatial scale at which observations of patterns of interaction can be observed needs to be coordinated with the confidence in interpretation (Orton 2000). However, one could argue that Los Buchillones functions as a port or centre for trade and exchange. This idea of coastal ports for interaction has been raised in Puerto Rico by Reniel Rodriguez Ramos (Rodríguez Ramos 2002:19). Therefore further evidence for interaction can be extrapolated for all of Cuba during future research that uses the database created during my research.

The settlement patterns identified above indicate a non-regular distribution with evidence of clusters of sites with similar material culture. These clusters appear to be associated with landscape features with all the *agroalfarero* settlement sites on flat clay plains in close proximity to upland areas above 150m. The *preagroalfarero* sites appear have a more disparate distribution, with sites in and around upland areas in the interior broadly following the line of the Jatibonico range, or close to the sea on the coast of the mainland and on the offshore islands.

In addition to providing information on interaction, the foregoing analyses have questioned the use of concepts, such as 'communal' and 'remote'. Previous associations have identified site groups as bounded, particularly by distance, but my studies have shown that travel times are not directly correlated to distance. Sites in the case study area have been located within a regional network of interaction through archaeological evidence and landscape data including inter site visibility, topography and pathways. Although my research is only an initial attempt to model island interaction, it provides a testable model to explain the nature and extent of island interaction in northern Cuba

BIBLIOGRAPHY

Alegria, R. E. 1997. The Study of Aboriginal Peoples: Multiple ways of knowing. In *The Indigenous People of the Caribbean*, edited by S. Wilson, pp. 9-19. University Press of Florida, Talahassee.

Allen, J. and C. Gosden. 1996. Spheres of Interaction and Integration: Modelling the colonisation of the Bismark Archipelago. In *Oceanic Culture History: Essays in Honour of Roger Green*, edited by J. Davidson, Irwin, G., Leach, F., Pawley, A. & Brown, D., pp. 183-197. vol. 1. New Zealand Journal of Archaeology Special Publication, Auckland.

Anderson, A. 2004. Islands of Ambivalence. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 251-273. Praeger, Westport.

Angelbello Izquierdo, S., L. Delgado Ceballos, O. Álvarez de la Paz and T. Eguiguren Acosta. 2002. Estudio Arqueológico del sitio Birama. Trinidad, Sancti Spíritus. *Caribe Arqueologico* 6:56-70.

Antczak, A. 1995. Mammal bone remains from the late prehistoric Amerindian sites on Los Roques archipelago, Venezuela: an interpretation. *Proceedings of the XVIth International Congress for Caribbean Archaeology* 16:83-99.

Arrom, J. J. 1997. The Creation Myths of the Taino. In *Taíno: Pre-Columbian Art and Culture from the Caribbean*, edited by F. Bercht, E. Brodsky, J. A. Farmer and D. Taylor, pp. 68-79. The Monacelli Press, New York.

Ascough, P. L., G. T. Cook and A. J. Dugmore. 2005. Methodological approaches to determining the marine radiocarbon reservoir effect. *Progress in Physical Geography* 29(4):532-547.

Ascough, P. L., G. T. Cook, A. J. Dugmore, E. M. Scott and S. P. H. T. Freeman. 2005. Influence of Mollusk Species on Marine ΔR Determinations. *Radiocarbon* 47(3):433-440.

Bailey, G. and J. Parkington. 1988. The archaeology of prehistoric coastlines: an introduction. In *The Archaeology of Prehistoric Coastlines*, edited by G. Bailey and J. Parkington. Cambridge University Press, Cambridge.

Barker, H. 1970. Critical Assessment of Radiocarbon Dating. *Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences* 269(1193):37-45.

Bartone, R. N. and A. Versteeg. 1997. The Tanki Flip Features and Structures. In *The Archaeology of Aruba: The Tanki Flip Site*, edited by A. Versteeg and S. Rostain, pp. 23-126. Archaeological Museum Aruba and the Foundation for Scientific Research in the Caribbean Region, Oranjestad.

Bashilov, V. A., V. Golenko, K. and Y. Kolomyts. 1992. The Problem of the Periodization of SubTaíno Culture in South-Central Cuba. *Russian Archaeology* 2:240-258.

Baus de Czitrom, C. 1988. *Los perros de la antigua provincia de Colima.* Instituto Nacional de Antropología, Mexico.

Bayliss, A., P. Marshall and J. Sidell. 2004. A Puzzling Body from the River Thames in London. *Radiocarbon* 46(1):285-291.

Bender, B. 1992. Theorising Landscapes of Stonehenge. *Man* 27:735-755.

Bender, B. 1995. Introduction. In *Landscape, Politics and Perspective.*, edited by B. Bender, pp. 1-18. Berg, Oxford.

Bender, B. 1995. Stonehenge-Contested Landscapes (Medieval to Present Day). In *Landscape, Politics and Perspective.*, edited by B. Bender, pp. 245-280. Berg, Oxford.

Bérard, B. 2006. Lithic Technology, One of the Ways to Complexity for Caribbean Archaeology. In *Society of American Archaeology: New Methods and Techniques in the Study of Material Culture from the Caribbean.* personal communication, San Juan, Puerto Rico.

Berman, M. J. 1994. The Colonization of the Bahama archipelago: a reappraisal. *World Archaeology* 26(1):421-441.

Berman, M. J. and C. D. Hutcheson. 2000. Impressions of a lost technology: A study of Lucayan-Taíno Basketry. *Journal of Field Archaeology* 27(4):417-435.

Binford, L. 1968. Archaeological Perspectives. In *New Perspectives in Archaeology*, edited by S. R. B. Binford, L., pp. 5-32. Aldine, Chicago.

Binford, L. 1978. Dimensional analysis of behaviour and site structure: learning from an Eskimo hunting stand. *American Antiquity* 43:330-361.

Binford, L. 1981. *Bones: Ancient Men & Modern Myths.* Academic Press, London.

Binford, L. R. 1971. Archaeology as Anthropology. In *Man's Imprint from the Past*, edited by J. Deetz, pp. 248-261. Little Brank & Company, Boston.

Bisse, J. 1988. *Arboles de Cuba.* Editorial Cientifico, Ciudad de la Habana.

Blackwell, P. G., C. E. Buck and P. J. Reimer. 2006. Important features of the new radiocarbon calibration curves. *Quarternary Science Reviews* 25(5-6):408-413.

Blanton, R. E. 2004. A comparative perspective on settlement pattern and population change in Mesoamerican and Mediterranean civilizations. In *Side-by-Side Survey: Comparative Regional Studies in the Mediterranean Word*, edited by S. Alcock, & Cherry, J. 206-240 vols. Oxbow, Oxford.

Boomert, A. 1995. Island Carib Archaeology. In *Wolves from the Sea: Readings in the Anthropology of the Native Caribbean. Caribbean series 14*, edited by N. L. Whitehead, pp. 23-35. KITLV press, Leiden.

Bradley, R. 2000. *An Archaeology of Natural Places.* Routledge, London.

Broeker, W. S. and E. A. Olson. 1961. Lamont Radiocarbon Measurements VIII. *Radiocarbon* 3:176-204.

Broodbank, C. 1999. Kythera survey: preliminary report on the 1988 season. *Annual of the British School at Athens* 94:191-214.

Broodbank, C. 2000. *An Island Archaeology of the Early Cyclades.* Cambridge University Press, Cambridge.

Callaghan, R. T. 2001. Ceramic Age Seafaring and Interaction Potential in the Antilles: A computer simulation. *Current Anthropology* 42:308-313.

Callaghan, R. T. 2003a. Comments on the Mainland Origins of the Preceramic Cultures of the Greater Antiles. *Latin American Antiquity* 14(3):323 - 338.

Callaghan, R. T. 2003b. Prehistoric trade between Ecuador and West Mexico: a computer simulation of coastal voyages. *Antiquity* 77:796-804.

Callaghan, R. T. 2006. Crossing the Guadeloupe Passage in the Caribbean Preceramic Age. In *Society of American Archaeology: New Perspectives on the Prehistoric Settlement of the Caribbean.* personal communication, San Juan, Puerto Rico.

Callaghan, R. T. and W. Bray. 2007. Simulating Prehistoric Sea Contacts between Costa Rica and Colombia. *The Journal of Island and Coastal Archaeology* 2(1):4-23.

Calvera Rosés, J. 1982. *Prospección arqueológica en el norte de Ciego de Avila, En las cercanías de Loma de Cunagua, se localizó una serie de sitios agroalfareros, cuyo patrón de asentamientos es diferente a los ya típicos. Carta Informativa, no. 39.* Dpto. de Arqueología, Instituto de Ciencias Sociales, Academia de Ciencias de Cuba.

Calvera Roses, J. and J. Febles. 1984. *Evidencias Arqueológicas de Los Buchillones, Ciego de Avila: Carta Informativa. No. 55.* Departamento de Arqueología.

Calvera Rosés, J. and A. García Lebroc. 1994. Un Sistema Lacuno-Palustre como Habitat de Comunidades Agroalfareras. In *Estudios Arqueologicos*, edited by J. Febles, L. Dominguez, F. Ortega, G. La Rosa, A. Martinez and A. Rives, pp. 66-79. Editorial Academia, La Habana.

Calvera Roses, J., J. Jardines Macias, D. Pendergast, E. Graham, A. Bekerman, O. Brito Martinez and M. Martinez Fernandez. 2001. Informe Final: Investigaciones arqueologicas conjuntas cubano - canadiense en el area de Los Buchillones. Unpublished, Ciego de Avila.

Calvera Rosés, J., E. Serrano, M. Rey, I. Pedroso and Y. Yparraguirre. 1996. El sitio arqueológico Los Buchillones. *Caribe Arqueologico* 1:59-67.

Carlson, L. A. and W. F. Keegan. 2004. Resource Depletion in the Prehistoric Northern West Indies. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 85-107. Praeger, Westport.

Carneiro, R. 1973. The Four Faces of Evolution. In *Handbook of Social and Cultural Anthropology*, edited by J. Honigmann, pp. 89-110. Rand McNally, Chicago.

Carneiro, R. L. 1988. The Circumscription Theory: Challenge and Response. *American Behavioral Scientist* 31(4):497-511.

Caro Alvarez, J. A. 1977. *Cemíes y Trigonolitos*. Mueso del Hombre Dominicano, Santo Domingo.

Chapa Brunet, T., A. Uriarte Gonzalez, J. M. Vicent Garcia, V. Mayoral Herrera and J. Pereira Sieso. 2003. Propuesta Metodologica para una Prospeccion Arqueologica Sistematica: El Caso del Guadiana Menor (Jaen, Espana). *Trabajos de Prehistoria* 60(1):11 - 34.

Cherry, J. 1987. Power in Space: archaeological and geographical studies of the state. In *Landscape and Culture: Geographical and Archaeological Perspectives*, edited by J. M. Wagstaff, pp. 146-172. Blackwell, Oxford.

Chi Kuo, C., L. Sin Weng, A. Hernández, J. Pérez Jiménez and O. Ascanio. 1990. Mapa Genetica de Suelos: Republica de Cuba. 1:250,000. Instituto Cubano de Geodesia y Cartografia, La Habana.

Childe, G. V. 1944. *The Story of Tools*. Corbetts, London.

Childe, V. G. 1925. *The Dawn of European Civilization*. Routledge & Kegan, London.

Claassen, C. 1998. *Shells*. Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Clark, P. and F. Evans. 1954. Distance to nearest neighbour as a measure of spatial relationships in populations. *Ecology* 35:445-453.

Clarke, D. 1972. *Models in Archaeology*. Methuen, London.

Clarke, D. 1973. Archaeology: The Loss of Innocence. *Antiquity* 47:6-18.

Clarke, D. 1977. *Spatial Archaeology*. Academic Press, London.

Claro, R., K. Lindeman and L. Parenti. 2001. *Ecology of Marine Fishes of Cuba*. Smithsonian Institution Press, Washington D.C.

Cobo Abréu, A., A. Lorié Gonzalez and J. Jiménez Santander. 1996. Primeras Consideraciones Antropológicas y Forenses sobre un Protoagricultor o Ceramista Temprano en el Caribe. *El Caribe Arqueologico* 1:26-30.

Colin, P. L. 1988. *Marine Invertebrates and Plants of the Living Reef*. T.F.H. Publications, Neptune City.

Colon, C. 1493 (1992). *Letters From America: Columbus's First Accounts of the 1492 Voyage*. Translated by B. W. Ife. Kings College London, London.

Conolly, J. and M. Lake. 2006. *Geographical Information Systems in Archaeology.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Conrad, G. W., C. D. Beeker and J. W. Foster. 2001. Organic Artefacts from the Manantial de la Aleta, Dominican Republic: preliminary observations and interpretations. *The Journal of Caribbean Archaeology* (Accessed Website 06/05/2003).

Cooper, J. 2004. Islas y Isleños en el Caribe: Interacción a través del paisaje. *Caribe Arqueologico* 8:91-96.

Cooper, J. and R. Valcárcel Rojas. 2004. Pre-Hispanic Settlements along the North Coast of Cuba: A pilot survey report from Los Buchillones. *Papers from the Institute of Archaeology* 15:77-81.

Cooper, J., R. Valcárcel Rojas and P. Cruz Ramírez. 2006. Gente en los cayos. Los Buchillones y sus vínculos marítimos. *Caribe Arqueologico* 9:66-75.

Córdova Armenteros, P. L. 1995. *Pesca Indocubana: de guaicanes, guacanes, bubacanes y corrales de trata.* Editorial Academia, La Habana.

Córdova Medina, A., R. Crespo Díaz and O. Jiménez Vázquez. 1997. Importancia Arqueológica y Zoológia del Sitio Solapa del Sílex. *El Caribe Arqueologico* 2:78-83.

Crespo Díaz, R. and O. Jiménez Vázquez. 2004. Arqueología precolombina del municipio Boyeros. *Gabinete de Arqueología* 3(3):67-74.

Cunningham, R. L. 1997. The Biological Impacts of 1492. In *The Indigenous People of the Caribbean,* edited by S. Wilson, pp. 29-35. University press of Florida, Talahassee.

Curet, A. L. 2005. *Caribbean Paleodemography: Population, Culture History and Sociopolitical Processes in Ancient Puerto Rico.* University of Alabama Press, Tuscaloosa.

Curet, L. A. 2004. Island Archaeology and Units of Analysis in the Study of Ancient Caribbean Societies. In *Voyages of Discovery: The Archaeology of Islands,* edited by S. Fitzpatrick, pp. 187-201. Praeger, Westport.

Curet, L. A. and J. R. Oliver. 1998. Mortuary Practices, Social Development, and Ideology in Precolumbian Puerto Rico. *Latin American Antiquity* 9(3):217-239.

Dacal Moure, R. 1978. *Artefactos de Concha en Las Communidades Aborigenes Cubanas.* Museo Anthropológico Montané, Ciudad de la Habana.

Dacal Moure, R. 2006. *Historiográfica Arqueológica de Cuba.* Editorial Asesor Pedagógico, Mexico.

Dacal Moure, R. and M. Rivero de la Calle. 1984. *Arqueologia Aborigen de Cuba.* Gente Nueva, Ciudad de la Habana.

Dacal Moure, R. and D. R. Watters. 2005. Three Stages in the History of Cuban Archaeology. In *Dialogues in Cuban Archaeology,* edited by A. L. Curet, S. L. Dawdy and G. La Rosa, pp. 29-40. The University of Alabama Press, Tuscaloosa, Alabama.

Dacal Moure, R. D. and R. d. l. Calle. 1996. *Art and archaeology of pre-Columbian Cuba.* Pittsburgh Press, Pittsburgh.

Davis, D. and K. Oldfield. Archeaological Reconnaissance of Anegada, British Virgin Islands 06/05/2003.

Davis, D. D. 1996. Revolutionary Archaeology in Cuba. *Journal of Archaeological Method and Theory* 3(3):159-188.

Davis, D. D. 2000. *Jolly Beach and the Preceramic Occupation of Antigua, West Indies.* Yale University Publications in Anthropology 84, New Haven.

Dawdy, S., A. Curet and G. La Rosa Corzo. 2005. Introduction. In *Dialogues in Cuban Archaeology*, edited by A. L. Curet, S. L. Dawdy and G. La Rosa, pp. 1-25. The University of Alabama Press, Tuscaloosa, Alabama.

De Las Casas, B. 1578 (2003). *An Account, Much Abbreviated, of the Destruction of the Indies.* Translated by A. Hurley and F. W. Knight. Hackett Publishing Company, Inc., Cambridge.

Deevey, E. S., L. J. Gralenski and V. Hoffren. 1959. Yale Natural Radiocarbon Measurements IV. *Radiocarbon* 1(1):144-172.

Del Pilar Zaldívar Fernández, M. 2003. El Cemí del Tabaco del Museo Antropólogico Montané. *Catauro: Revista Cubana de Antropologia* 5(8):178-195.

Del Risco Rodríguez, E. 1999. *Cuban Forests: Their History and Characteristics.* Editorial José Martí, La Habana.

Delgado, P. 2004. *The U.S. Caribbean Region. Wetlands and Fish: A Vital Connection.* NOAA's National Marine Fisheries Service, Silver Spring, Maryland.

Delpuech, A., C. L. Hofman and M. L. P. Hoogland. 1999. Excavations at the Site of Anse A La Gourde, Guadeloupe: Organisation, History and Environmental Setting. *Proceedings of the XVIIIth International Congress for Caribbean Archaeology* XVIII.

Dennett, D. 1995. *Darwin's Dangerous Idea: Evolution and the Meanings of Life.* Allen Lane The Penguin Press, Harmondsworth.

Departamento de Arqueología de Centro de Antropología. 2003. Atlas Arqueológico de Cuba: una estrategia científica para la investigación y la conservación del patrimonio histórico aborigen. *Catauro: Revista Cubana de Antropologia* 5(8):199-202.

Desrayaud, G. and A. Berthé. 1999. *Typo-Morphological Methodology applied to Cedrosan Saladoid Ceramics (circa I-IVth c. A.D.) at the Vive Site, Martinique.* S.R.A Martinique, Fort-de-France.

Dixon, N. 2000. *The Crannogs of Loch Tay.* University of Edinburgh Press, Edinburgh.

Dolmatoff, R. 1995. *Arqueologia Colombiana: Vision Panoramica.* Latinoamericana Ltd, Santafe de Bogota.

Domínguez González, L. 2002. *Ídolos Aborígenes de Niquero*. Colección Crísol, Bayamo.

Domínguez, L. S. 1990. Prologo a la secundo edición: Caverna, Costa y Meseta, pp. vii-xvi. Editorial de Ciencias Sociales, Ciudad de La Habana.

Domínguez, L. S. 1995. *Arqueología Colonial Cubana*. Editorial de Ciencias Sociales, La Habana.

Doran, E. J. 1958. The Caicos Conch Trade. *Geographical Review* 48(3):388-401.

Downum, C. E. and G. Burrell Brown. 1998. The Reliability of Surface Artifact Assemblages as Predictors of Subsurface Remains. In *Surface Phenomena in Archaeological Research*, edited by A. P. Sullivan, pp. 111-123. University of New Mexico Press, Albuquerque.

Drewett, P. 2000. *Prehistoric settlements in the Caribbean*. Archytype, London.

Drewett, P. 2003. Feasting at the ball game: the Belmont project, Tortola, British Virgin Islands. *Archaeology International* 6:56-59.

Drewett, P. L. 1999. *Field Archaeology: An Introduction*. Routledge, London.

Drusini, A. G. and F. Luna Calderon. 1997. Antropología Física de los Taínos de La Espanola. *El Caribe Arqueologico* 2:85-87.

Dunn, O. and J. Kelley Jr. 1989. *The Diario of Christopher Columbus's First Voyage to America 1492-1493 (Abstracted by Fray Bartolomé de Las Casas)*. University of Oklahoma Press, London.

Erlandson, J. M., T. C. Rick and R. Vellanoweth. 2004. Human Impacts on Ancient Environments: A Case Study from California's Northern Channel Islands. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 51-83. Praeger, Westport.

Espenshade, C. T. Reconstructing Household Vessel Assemblages and Site Duration At An Early Ostionoid Site from South-Central Puerto Rico 06/05/2003.

Febles Duenas, J. 1994. Nuevos aspectos sobre un residuario aborigen en San Antonio de los Banos, provincia de la Habana. In *Estudios Arqueologicos*, edited by J. Febles, L. Dominguez, F. Ortega, G. La Rosa, A. Martinez and A. Rives, pp. 166-170. Editorial Academia, La Habana.

Febles Duenas, J., J. M. Guarch Delmonte, A. Rives, R. Sánchez and M. Monteagudo. 1987. *Censo arqueológico de Cuba por tratamiento computarizado*. Folleto, Departamento de Arqueología, Centro de Antropología, Academia de Ciencias de Cuba, La Habana.

Febles Duenas, J. and A. R. Martínez. 1995. Informacion Censal Arqueologica de Cuba. In *CD ROM. Taíno: Arqueologia de Cuba*. Centro de Antropología y CEDISAC, Colima.

Febles, J. 1982. *Estudio tipológico y tecnológico del material de piedra tallada del sitio arqueológico Canímar I, Matanzas, Cuba*. Editora de la Academia de Ciencias de Cuba, La Habana.

Febles, J. 1988. *Manual para el estudio de la piedra tallada de los Aborígenes de Cuba.* Editora de la Academia de Ciencias de Cuba, La Habana.

Febles, J. and J. González. 1999. La Industria de la Concha del Residuario Maruca, Ponce, Puerto Rico. *El Caribe Arqueologico* 3:53-56.

Fewkes, J. W. 1907. *The Aborigenes of Porto Rico and Neighboring Islands.* Government Printing Office, Washington.

Fink, A. 1995. *The Survey Handbook.* The Survey Kit 1. SAGE Publications, London.

Fitzhugh, B. and T. L. Hunt. 1997. Islands as Laboratories: Archaeological research in comparative perpective. *Human Ecology* 25:379-383.

Fitzpatrick, S. and B. Diveley. 2004. Interisland Exchange in Micronesia: A Case of Monumental Proportions. In *Voyages of Discovery: The Archaeology of Islands,* edited by S. Fitzpatrick, pp. 129-146. Praeger, Westport.

Fitzpatrick, S. M. 2006. A Critical Approach to 14C Dating in the Caribbean: using chronometric hygiene to evaluate chronological control and prehistoric settlement. *Latin American Antiquity* 17(4):389-418.

Fletcher, M. and G. R. Lock. 2005. *Digging Numbers: Elementary Statistics for Archaeologists.* 2nd ed. Oxbow Books, Oxford.

Fletcher, R. 1989. The Messages of Material Behaviour: A preliminary discussion of non-verbal meaning. *One World Archaeology, The Meaning of Things: Material Culture and Symbolic Expression* No.6:33-40.

Florida Museum of Natural History. The Calusa "The Shell Indians" factsheet: www.http://fcit.usf.edu/florida/lessons/calusa/calusa.htm Accessed on 25/08/05.

Fontanari, S., M. Napolitano and F. Roberto. 2005. r.walk: GRASS GIS 6.2. http://grass.itc.it/gdp/html_grass63/r.walk.html.

Fotherington, A. S., C. Brunsdon and M. Charlton. 2000. *Quantitiative Geography: Perspectives on Spatial Data Analysis.*

Fray Ramon Pané (trans. By) Griswold, S. C. 1999. *An Account of the Antiquities of the Indians (1498).* Duke University Press, London.

García Robiou, C. 2003. La Tesis Inédita de Doctorado de Carlos García Robiou: una obra para analizar (reprinted from 1926 original). *Catauro: Revista Cubana de Antropologia* 5(8):214-232.

Garrido, O. H. and A. Kirkconnell. 2000. *Birds of Cuba.* Comstock Publishing Associates, New York.

Gervais, N. 1992. Deux Amulettes Huécoïdes: Des Symboles Inestimales. In *Archeologie,* France-Antilles.

Gillespie, R. 1989. *Radiocarbon: User's Handbook.* Oxford University Press, Oxford.

Gillings, M. and A. Wise. 1990. *GIS Guide to Good Practice.* Oxbow Books, Oxford.

Given, M. 2004. Mapping and Manuring: Can We Compare Sherd Density Figures? In *Side-by-Side Survey: Comparative Regional Studies in the Mediterranean Word*, edited by S. Alcock and J. Cherry, pp. 13-21. Oxbow, Oxford.

Glazier. 1991. Impressions of Aboriginal Technology: The Caribbean Canoe. *Proceedings of the 13th International Congress of Caribbean Archaeology* 9:149-161.

Godo, P. 1985. Los Quelonios Marinos: Importante Componente de la Dieta Aborigen. *Revista Mar y Pesca* 234:16-22.

Godo, P. 1997. El Problema del Protoagrícola de Cuba: Discusión y Perspectivas. *El Caribe Arqueologico* 2:19-30.

Godo, P. 2003. Arte Aborigen de Cuba: una mirada desde la arqueología. *Catauro: Revista Cubana de Antropologia* 5(8):125-143.

Godo, P. 2005. Mythical Expressions in the Ceramic Art of Agricultural Groups in the Prehistoric Antilles. In *Dialogues in Cuban Archaeology*, edited by L. A. Curet, S. L. Dawdy and G. La Rosa, pp. 147-162. The University of Alabama Press, Tuscaloosa, Alabama.

Godo Torres, P. P. 1994. Industrias de la concha y de la piedra no lascada del sitio arqueológico mesolítico Victoria I, provincia de Camaguey. In *Estudios Arqueologicos*, edited by J. Febles, L. Dominguez, F. Ortega, G. La Rosa, A. Martinez and A. Rives, pp. 140-165. Editorial Academia, La Habana.

Godo Torres, P. P. and R. Sampedro Hernández. 1994. Investigaciones traceológicas en los materiales líticos del sitio arqueológico 'El Mango'. Materiales de superficie. In *Estudios Arqueologicos*, edited by J. Febles, L. Dominguez, F. Ortega, G. La Rosa, A. Martinez and A. Rives, pp. 80-100. Editorial Academia, La Habana.

Goody, J. 1977. *The Domestication of the Savage Mind.* Pitman, Bath.

Gosden, C. 1994. *Social Being and Time.* Blackwell, Oxford.

Gosden, C. and C. Pavlides. 1994. Are Islands Insular? Landscape vs Seascape in the Case of the Arawe Islands, Papua New Guinea. *Archaeology in Oceania* 29:162-171.

Graham, E. 2004. The Highlands of the Lowlands: Environment and Archaeology in the Stann Creek District, Belize, Central America. *Monographs in World Archaeology* 19.

Grant, C. 2005. Caribbean Community and Cuba Relations: Thirty Years Revisited. In *Foreign policy toward Cuba : isolation or engagement?*, edited by M. Zebich-Knos and H. N. Nicol, pp. 125-138. Lexington Books, Lanham.

Grattan, D. 1988. Treatment of waterlogged wood. In *Wet Site Archaeology*, edited by B. A. Purdy, pp. 237-254. The Telford Press, Caldwell New Jersey.

Graves, M. and D. Addison. 1994. The Polynesian Settlement of the Hawaiian Archipelago. *World Archaeology, Colonisation of Islands* Vol 26:380-399.

Guarch Delmonte, J. M. 1978. *El Taino de Cuba: Ensayo de reconstrucción etno-histórica.* Academia de Ciencias de Cuba, La Habana.

Guarch Delmonte, J. M. 1990. *Estructura para Las Comunidades Aborigenes de Cuba.* Ediciones Holguin, Holguín.

Guarch Delmonte, J. M. and A. Querejeta Barceló. 1993. *Los Cemíes Olvidados.* Publicigraph, La Habana.

Guarch Delmonte, J. M., E. E. Rey Betancourt and J. Febles Duenas. 1995. Historía Aborígen de Cuba. In *CD ROM. Taíno: Arqueologia de Cuba.* Centro de Antropología y CEDISAC, Colima.

Guarch Delmonte, J. M., C. Rodríguez Arce and R. Pedroso. 1987. Investigaciones preliminares en el sitio El Chorro de Maíta. *Revista de Historia Holguín* 3:25-40.

Guerrero, J. G. 1999. El Contacto Temprano Indo-Hispánico en Santo Domingo: Una Lectura Histórica y Arqueológica. *El Caribe Arqueologico* 3:102-108.

Gumerman IV, G. 1997. Food and Complex Societies. *Journal of Archaeological Method and Theory* 4(2):105-139.

Gutiérrez Calvache, D. 2002. Sobre el Simbolismo y la Funcionalidad del Número en el Arte Rupestre de la Cueva de los Petroglifos. *Caribe Arqueologico* 6:23-34.

Haag, W. G. 1965. Pottery Typology in Certain Lesser Antilles. *American Antiquity* 31(2):242-245.

Harris, D. 1994. Introduction. In *The Archaeology of V. Gordon Childe*, edited by D. Harris, pp. 1-8. UCL Press Limited, London.

Harris, E. 1992. Stratigraphy is the Matrix of Archaeology. In *Harris Matrix Recording Systems in Archaeology*, edited by I. G. Trócoli and R. Sospedra, pp. 84-107. vol. 1. Pagés Editors, Lleida.

Harris, P. 1995. Ethnotypology: The basis for a new classification of Caribbean pottery. *Proceedings of the XVIth International Congress for Caribbean Archaeology* 16:345-366.

Hatt, G. 1935. Notes on the Archaeology of Santo Domingo. *Geografisk Tidsskrift*:9-17.

Haviser, J. B. 1995. Towards romanticized Amerindian identities among Caribbean peoples: A case study from Bonaire, Netherlands Antilles. In *Wolves from the Sea: Readings in the Anthropology of the Native Caribbean. Caribbean series 14*, edited by N. L. Whitehead, pp. 139-156. KITLV press, Leiden.

Hawkins, J. e. 1979. *The Oxford Paperback Dictionary.* 3rd ed. Oxford University Press, Oxford.

Heckenberger, M. and J. B. J Petersen. 1995. Concentric circular village patterns in the Caribbean: comparisons from Amazonia. *Proceedings of the XVIth International Congress for Caribbean Archaeology* 16:379-390.

Hedges, R. E. M., M. J. Humm, J. Foreman, G. J. Van Klinken and C. Bronk Ramsay. 1992. Developments in Sample Combustion to Carbon Dioxide, and in the Oxford AMS Carbon Dioxide Ion Source System. *Radiocarbon* 34(3):306-311.

Hegmon, M. 1992. Archaeological Research on Style. *Annual Review of Anthropology* 21:517-536.

Helms, M. W. 1987. Art Styles and Interaction Spheres in Central America and the Caribbean: Polished Black Wood in the Greater Antilles. In *Chiefdoms in the Americas*, edited by R. D. Drennam and C. A. Uribe, pp. 67-83. University Press of America, Boston.

Henderson, F. Y. 1964. *Identification of Hardwoods: A Lens Key*. Forest Products Research 25. Her Majesty's Stationery Office, London.

Hernández Godoy, S. 2003. Una aproximación a los estudios arqueológicos de Cuba y su historiografía Aborigen hasta la década del treinta. *Catauro: Revista Cubana de Antropologia* 5(8):6-18.

Hernández Oliva, C. A. and R. Arrazcaeta Delgado. 2004. Prehistoria de Cuba: una propuesta de análisis teórica y metodológico. *Caribe Arqueologico* 8:64-73.

Higham, T. Radiocarbon Web-Info: The Method Accessed 08/05/07.
http://www.c14dating.com/

Harris, M. H. and P. Drewett. 1995. Saladoid occupation of Hillcrest, Bathsheba, Barbados. *Proceedings of the XVIth International Congress for Caribbean Archaeology* 16:301-312.

Hodder, I. 1984. Post-Processual Archeaology. In *Advances in Archaeological Method and Theory*, edited by M. Schiffer, pp. 1-26. Academic Press, London.

Hodder, I. 1999. *The Archaeological Process: An Introduction*. Blackwell, Oxford.

Hodder, I. and C. Orton. 1976. *Spatial Analysis in Archaeology*. Cambridge University Press, Cambridge.

Hodell, D., J. Curtis, G. Jones, A. Higuera-Gundy and E. Brenner. 1991. Reconstruction of Caribbean Climate Change over the past 10,500 years. *Nature* 352:790-793.

Hoff, B. J. 1995. Language contact, war, and Amerindian historical tradition: The special case of the Island Carib. In *Wolves from the Sea: Readings in the Anthropology of the Native Caribbean. Caribbean series 14*, edited by N. L. Whitehead, pp. 37-59. KITLV press, Leiden.

Hofman, C. L. 1993. Inferring Inter-Island Relationships from Ceramic Style: A View from the Leeward Islands. *Proceedings of the 15th Congress for Caribbean Archaeology*:1-6 and 1-17.

Hofman, C. L., M. L. P. Hoogland and A. v. Gijn. 2005. *Crossing disciplinary boundaries and national borders. New methods and techniques in the study of archaeological materials from the Caribbean.* Scientific Studies in Caribbean Archaeology Symposium. unpublished.

Hoogland, M. and C. L. Hofman. 1993. Kelbey's Ridge 2, A 14th Century Taino Settlement on Saba, Netherlands Antilles. *Analecta Paehistorica Leidensia* 26:163-181.

Hoogland, M. L. P. and C. L. Hofman. 1999. Expansion of the Taino Cacicazgos Towards The Lesser Antilles. *Journal de la Société des Américanistes* 85:93-113.

Horden, P. and N. Purcell. 2000. *The Corrupting Sea: A Study of Mediterranean History.* Blackwell, Oxford.

Hughen, K. A., M. G. L. Baillie, E. Bard, J. W. Beck, C. J. H. Bertrand, P. G. Blackwell, C. E. Buck, G. S. Burr, K. B. Cutler, P. E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, B. Kromer, G. McCormac, S. Manning, C. B. Ramsey, P. J. Reimer, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. Talamo, F. W. Taylor, J. van der Plicht and C. E. Weyhenmeyer. 2004. Marine04 Marine Radiocarbon Age Calibration, 0–26 Cal Kyr BP. *Radiocarbon* 46(3):1059-1086.

Hulme, P. 1995. Elegy for a dying race: The Island Caribs and their visitors. In *Wolves from the Sea: Readings in the Anthropology of the Native Caribbean. Caribbean series 14*, edited by N. L. Whitehead, pp. 113-138. KITLV press, Leiden.

Humann, P. 1994. *Reef Creature Identification: Florida, Caribbean, Bahamas.* New World Publications, Jacksonville.

Hutcheson, C. 2001. Reweaving the Strands: Continued Exploration into the Basketry Technology of Prehistoric Bahamians. *Proceedings of the XVIIIth International Congress for Caribbean Archaeology* 18:185-198.

Ingold, T. 1993. The Temporality of the Landscape. *World Archeology* 25(2):152-174.

Instituto Cubano de Hidrografía. 1996. Mapa de Bahía de Buena Vista: 11428. 2nd ed. Instituto Cubano de Geodesia y Cartografia, La Habana.

Iturralde-Vinent, M. 1983. *Cuevas de Cuba: curiosidades, anécdotas y exploraciones.* Gente Nueva, La Habana.

Izquierdo Diaz, G. and A. Rives Pantoja. 1993. *Lista Tipologica de la Industria de la Concha en las Comunidades Aborigenes de Cuba y Las Antilles.* Departamento de Arqueologia, Centro de Antropologia, Academia de Ciencias de Cuba. Report.

Izquierdo Diaz, G. and R. Sampedro Hernández. 2002. Útiles de concha y unidades habitacionales de las comunidades aborigenes de Cuba. *El Caribe Arqueologico* 6:71-76.

Jardines Macias, J. and J. Calvera Roses. 1999. Estructuras de viviendas aborígenes en Los Buchillones. *El Caribe Arqueologico* 3:44-52.

Jardines Macias, J. E. and J. J. Guarch Rodríguez. 1996. Patrimonio Arquológico de una Regíon de Cuba. *El Caribe Arqueologico* 1:39-45.

Jatibonicu Taíno Tribal Nation of Boriken (Puerto Rico). 2003. http://www.taino-tribe.org/.

Johnson, M. 1999. *Archaeological Theory: An Introduction.* Blackwell, Oxford.

Johnstone, P. 2001. *The Sea-Craft of Prehistory.* Routledge, London.

Jones, A. 2002. *Archaeological Theory and Scientific Practice.* Cambridge University Press, Cambridge.

Jouravleva, I. 2002. Origen de la Alfarería de las Comunidades Protoagroalfareras de la Región Central de Cuba. *Caribe Arqueologico* 6:35-43.

Jouravleva, I. and N. González. 2000. Las varitationes climáticas y la reutilización del espacio habitacional a través de la alfarería Aborigen. *El Caribe Arqueologico* 4:35-39.

Karlsson, H. 1998. *Re-Thinking Archaeology.* Novum Grafiska, Goteborg.

Kaye, Q. 2003. A Field Survey of the Island of Carriacou, West Indies, March 2003. *Papers from the Institute of Archaeology* 14:129-135.

Kaye, Q., S. Fitzpatrick and M. Kappers. 2004. *Excavation at Grand Bay, Carriacou, West Indies.* Institute of Archaeology. Excavation Report.

Keegan, W. F. 1989. Creating the Guanahatabey (Ciboney): the modern genesis of an extinct culture. *Antiquity* 63(239):373-379.

Keegan, W. F. 1991. Lucayan Settlement Patterns and Recent Coastal Changes in the Bahamas. In *Paleoshorelines and Prehistory: An Investigation of Method,* edited by L. L. Johnson, pp. 5-14. CRC Press, London.

Keegan, W. F. 1992. *The People who discovered Columbus: The prehistory of the Bahamas.* University Press of Florida, Tallahassee.

Keegan, W. F. 1994a. Modeling dispersal in the prehistoric West Indies. *World Archeology, colonization of islands* 26(3):400-420.

Keegan, W. F. 1994b. West Indian Archaeology. 1. Overview and Foragers. *Journal of Archaeological Research* 2(3):255-284.

Keegan, W. F. 1995. Recent Climatic and Sea Level Fluctuations in Relation to West Indian Prehistory. *Proceedings of the XVIth International Congress for Caribbean Archaeology* XVI:95-104.

Keegan, W. F. 1997. No Man (or Woman) is an island. In *The Indigenous People of the Caribbean,* edited by S. Wilson, pp. 109-117. University press of Florida, Talahassee.

Keegan, W. F. 1999. Comment on Paul Rainbird, 'Islands Out of Time: Towards a Critique of Island Archaeology. *Journal of Mediterranean Archaeology* 12(2):255-258.

Keegan, W. F. and J. M. Diamond. 1987. Colonization of Islands by Humans: A biogeographical perspective. *Advances in Archaeological Method and Theory* 10:49-91.

Keegan, W. F. and M. MacLachlan. 1989. The Evolution of Avunculocal Chiefdoms: A reconstruction of Taino Kinship and Politics. *American Anthropologist* 91(3):613-630.

Keegan, W. F. and S. W. Mitchell. 1986. Possible Allochthonous Lucayan Arawak Artifact Distributions, Bahama Islands. *Journal of Field Archaeology* 13(3):255-258.

Keegan, W. F., M. MacLachlan and B. Byrne. 1998. Social Foundations of Taino *Caciques*. In *Chiefdoms and Chieftaincy in the Americas*, edited by E. M. Redmond, pp. 217-244. University Press of Florida, Gainesville.

Kelly, H. and A. Van Gijn. 2006. Application of Use Wear Analysis in the Determination of Coral Tools. In *Society of American Archaeology: New Methods and Techniques in the Study of Material Culture from the Caribbean.* personal communication, San Juan, Puerto Rico.

Kennett, D. J., B. I. Ingram, J. R. Southon and K. Wise. 2002. Differences in 14C age between stratigraphically associated charcoal and marine shell from the archaic period site of kilometer 4, southern Peru: old wood or old water? *Radiocarbon* 44(1):53-58.

Keswani, P. S. 1994. The Social Context of Animal Husbandry in Early Agricultural Societies: Ethnographic insights and an Archaeological Example from Cyprus. *Journal of Anthropological Archaeology* 13:255-277.

Kirch, P. V. 1986. Exchange Systems and Inter-Island Contact in the Transformation of an Island Society: The Tikopia Case. In *Island Societies: Archaeological Approaches to Evolution and Transformation*, edited by P. V. Kirch, pp. 33-41. Cambridge University Press, Cambridge.

Knippenberg, S. and A. v. Gijn. 1998. Flint Sources in the Lesser Antilles: Implications for Inter-Island Contact Networks. Paper presented at the Proceedings of the 63th Annual Meeting of the Society for American Archaeology, Seattle.

Kozlowski, J. K. 1974. *Preceramic Cultures in the Caribbean.* Prace Archeologiczne, Krakow.

La Rosa Corzo, G. 2003. La Ciencia Arqueológica en Cuba: retos y perspectivas en los umbrales del siglo XXI. *Catauro: Revista Cubana de Antropologia* 5(8):36-46.

La Rosa Corzo, G. 2003. La Orientacion Este De Los Entierros Aborigenes En Cuevas De Cuba: Remate De Una Fabula. *Latin American Antiquity* 14 (2):143-157.

Lake, M. 1998. r.cva: GRASS GIS 6.2.
http://www.ucl.ac.uk/~tcrnmar/GIS/r.cva_v5x_man.html.

Lape, P. V. 2004. The Isolation Metaphor in Island Archaeology. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 223-232. Praeger, Westport.

Lathrap, D. 1970. Alternative models of population movement in the tropical lowlands of South America. *Proceedings of the Congreso Internacional de Americanistas* 4(1):13-23.

Lathrap, D. and J. Oliver. 1984. The Caribbean as Positive Space. Unpublished Draft.

Layton, R. and P. Ucko. 1999. Introduction. *One World Archaeology, The Archaeology and Anthropology of Landscape*. 30:1-20.

Leal, J. H. 2005. *Bivalves*. The Bailey-Matthews Shell Museum.

Leal, J. H. 2005. *Gastropods*. The Bailey-Matthews Shell Museum.

Leiva Sánchez, A. 1999. *Las Palmas en Cuba*. Editorial Científico-Técnica, Ciudad de La Habana.

Leone, M. 1987. Towards a Critical Archaeology. *Current Anthropology* 28:283-302.

Levi-Strauss, C. 1955. *Tristes Tropiques*. Libraire Plon, Paris.

Linville, M. S. 2005. Cave Encounters: Rock Art Research in Cuba. In *Dialogues in Cuban Archaeology*, edited by L. A. Curet, S. L. Dawdy and G. La Rosa, pp. 72-99. The University of Alabama Press, Tuscaloosa, Alabama.

Lloyd, C. D. 2007. *Local Models for Spatial Analysis*. CRC Press, London.

Lock, G. R. and T. Harris. 1992. Visualizing spatial data: the importance of Geographic Information Systems. In *Archaeology and the Information Age: a global perspective*, edited by P. Reilly and S. Rahtz, pp. 81-96. vol. One World Archaeology 21. Routledge, London.

Lopez, J., A. Stoner, J. Garcia and I. Garcia-Munez. 1988. Marine Food Webs Associated with Caribbean Island Mangrove Wetlands. *Acta Cientifica* 2(2-3):94-123.

Lucas, G. 2001. *Critical Approaches to Fieldwork*. Routledge, London.

Lundberg, E. R. 1985. Interpreting the Cultural Associations of Aceramic Deposits in the Virgin Islands. *Journal of Field Archaeology* 12(2):201-212.

Lyotard, J. F. 1984. *The Postmodern Condition: A Report on Knowledge*. Manchester Universtiy Press, Manchester.

MacArthur, R. H. and E. O. Wilson. 1967. *The Theory of Island Biogeography*. Princeton University Press, Princeton.

Malacalog Website. A Database of Western Atlantic Marine Mollusca: http://www.malacolog.org/search.php?mode=details&waspid=2868 Last Accessed 20/07/2007.

Manuel Reyes, J. C. 1997. Estudios dietarios de cinco sitios "apropiadores ceramistas" del suroriente Cubano. *El Caribe Arqueologico* 2:41-49.

Marichal García, L. 1995. Bibliografía Arqueologica Cubana. In *CD ROM. Taíno: Arqueologia de Cuba*. Centro de Antropología y CEDISAC, Colima.

Martinez Arango, F. 1982. *Registro de Todos los Sitios Arqueológicos Investigados por la Sección Arqueológica Aborigen de la Universidad de Oriente*. D. F. Mexico, Ciudad de Mexico.

Martínez Fuentes, A., C. Lalueza Fox, T. P. Gilbert, A. Lazo Valdivia, F. Callafell and J. Bertranpetit. 2003. El Poblamiento antiguo del Caribe. Análisis del ADN Mitocondrial en preagroalfareros de la región occidental de Cuba. *Catauro: Revista Cubana de Antropologia* 5(8):62-74.

Martínez Gabino, A. 1987. *Estudio del sitio arqueológico Punta del Macao, Guanabo, Provincia Ciudad de la Habana.* Reporte de Investigacion del Instituto de Ciencias Historicas. Excavation Report. Copies available from 9.

Martínez Gabino, A. 1989. *Arqueología de Bacunayagua, Matanzas, Cuba.* Reporte de Investigacion del Instituto de Ciencias Historicas. Excavation Report no. 3.

Martinón-Torres, M., R. Valcárcel Rojas, J. Cooper and T. Rehren. 2007. Metals, Microanalysis and Meaning: a study of metal objects excavated from the indigenous cemetery of El Chorro de Maíta, Cuba *Journal of Archaeological Science* 34(2):194-204.

McDowell, L. 1997. *Undoing Place? Geographical Reader.* Arnold, London.

McGuire, R. H. 2002. *A Marxist Archaeology.* 2nd ed. Percheron Press, New York.

McKillop, H. I. 1985. Prehistoric Exploitation of the Manatee in the Maya and Circum-Caribbean Areas. *World Archaeology, Water Craft and Water Transport* 16(3):337-353.

Meggers, B. 1954. Environmental Limitation on the Development of Culture. *American Anthropologist* 56(5):801-824.

Meggers, B. 1999. La utilidad de secuencias cerámicas seriadas para inferir conducta social prehistórica. *El Caribe Arqueologico* 3:2-19.

Melville, E. G. K. 1997. *A plague of sheep : environmental consequences of the conquest of Mexico.* 1st paperback ed. Studies in environment and history. Cambridge University Press, Cambridge.

Mendez, E. F. 1972. *Art and Mythology of the Taino Indians of the Greater West Indies.* El Cemi, San Juan.

Mesa González, I., J. Jardines Macías and J. Calvera Rosés. 1994. Estudion preliminar de la cerámica del sitio arqueologico 'Los Buchillones', provincia de Ciego de Avila. In *Estudios Arqueologicos,* edited by J. Febles, L. Dominguez, F. Ortega, G. La Rosa, A. Martinez and A. Rives, pp. 66-79. Editorial Academia, La Habana.

Mielke, J. E. and A. Long. 1969. Smithsonian Institution Radiocarbon Measurements. *Radiocarbon* 11(1):163-182.

Mintz, S. W. 1996. Enduring Substances, Trying Theories: The Caribbean Region as Oikoumene. *The Journal of the Royal Anthropological Institute* 2(2):289-311.

Moore, J. and J. Gasco. 1990. Perishable Structures and Serial Dwellings from Coastal Chiapas. *Ancient Mesoamerica* 1:205-212.

Morales Patino, O. 1946. Qué indígenas habitaban los archipièlagos de Cayos y de Islas que rodean las costas de Cuba. Contribución del Grupo Guamá. Paper presented at the 5th Congreso Nacional de Historia La Habana, Cuba.

Morales Patino, O. 1947. Exploración del Grupo Guamá en los Cayos al este de Caibarién. *Junta Nacional de Arqueología y Etnología* 2(4-5):6-15.

Morales Patino, O. 1948. Exploración del Grupo Guamá en los Cayos Salina y Fábrica (Costa norte de Cuba al este de Caibarién). *Arquelogía* 3(6-7):6-11.

Morales Patino, O. 1950. Los Mayas de Honduras y Los Indigenas Antillanos Precolombinos. *Revista de Arqueología y Etnología* 10-11:69-100.

Moreira de Lima, L. 1999. *La Sociedad Comunitaria de Cuba.* Felix Varela, Habana.

Moreira de Lima, L. J. 2003. Hubo Cacicazgos en la Mayor de las Antilas? *Catauro: Revista Cubana de Antropologia* 5(8):144-158.

Moss, M. L. 2004. Island Societies Are Not Always Insular: Tlingit Territories in the Alexander Archipelago and the Adjacent Alaska Mainland. In *Voyages of Discovery: The Archaeology of Islands,* edited by S. Fitzpatrick, pp. 165-183. Praeger, Westport.

Museum of London Archaeology Service. 1994. *Archaeological Site Manual.* 3rd ed. Museum of London, London.

Museum of London Department of Urban Archaeology. 1980. *Site Manual. Part 1: The Written Record.* Museum of London, London.

Nash, G. 2002. Constructing Hypothetical systems of exchange: Doing Kula in the Danish Mesolithic. *British Archaeological Reports, World Islands in Prehistory: International Insular Investigations* 1095:19-30.

Navarrete Pujol, R. 1990. *Caimanes III: arqueología.* Editorial de Ciencias Sociales, La Habana.

Navarro Betancourt, E. 1973. *Motivos de Arte en la Ceramica Indocubana.* Museo Antropológico Montané, La Habana.

Newsom, L. A. and E. S. Wing. 2004. *On Land and Sea: Native American Uses of Biological Resources in the West Indies.* The University of Alabama Press, London.

Nuñez Jiménez, A. 1992. A 499 Años de la Llegada de Colón. In *El V Centenario visto desde Cuba,* edited by A. Hart Dávalos, A. Nuñez Jiménez and S. Vilaseca Forné, pp. 9-17. Ediciones Holguín, Holguín.

Nuñez Jiménez, A., R. Dacal Moure, M. Rivero de la Calle and A. Grana González. 1985. Resultados preliminares de las expediciones realizadas a los cayos del este de Caibarién. Paper presented at the Simposium XLV Aniversario de la Sociedad Espeleológica de Cuba, La Habana, Cuba.

Nyberg, J., A. Kuijpers, B. A. Malmgren and H. Kunzendorf. 2001. Late Holocene changes in precipitation and hydrography recorded in marine sediments from the Northeastern

Caribbean sea. *Quaternary Research* 56:87-102.

Olazagasti, I. 1997. The material culture of the Taino Indians. In *The Indigenous People of the Caribbean*, edited by S. Wilson, pp. 131-139. University Press of Florida, Talahassee.

Oliver, J. 1997. The Taino Cosmos. In *The Indigenous People of the Caribbean*, edited by S. Wilson, pp. 140-153. University Press of Florida, Talahassee.

Oliver, J. 2000. Gold Symbolism among Caribbean Chiefdoms: Of Feathers, Cibas, and Guanín Power among Taíno Elites. In *Precolumbian Gold: Technology, Style and Iconography*, edited by C. McEwan, pp. 196-219. British Museum Press, London.

Oliver, J. 2004. Soliloquio Cubano: An Outsider's Ruminations on Post-Revolutionary Cuban Archaeology. In *Dialogues in Cuban Archaeology*, edited by L. A. Curet, Dawdy, Shannon L. and La Rosa, Gabino. Draft Chapter: Under peer review., London.

Orejas Saco del Valle, A., M. Ruiz del Arbol Moro and O. Lopez Jimenez. 2002. Los Registros Del Paisaje en la Investigacion Arqueologica. *Archivo Espanol de Arqueologia* 75:287 - 311.

Ortiz, F. 1922. *Historia de la Arqueologia Indocubana.* Teniente Rey 27, Habana.

Orton, C. 1980. *Mathematics in Archaeology.* Collins, London.

Orton, C. 2000. *Sampling in Archaeology.* Cambridge Universtiy Press, Cambridge.

Orton, C., P. Tyers and A. Vince. 1993. *Pottery in Archaeology.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Osgood, C. 1942. *The Ciboney Culture of Cayo Redondo, Cuba.* Yale University Publications in Archaeology 25. Yale University Press, New Haven.

Ostapkowicz, J. M. 1997. To Be Seated with 'Great Courtesy and Veneration': Contextual Aspects of the Taíno Duho. In *Taíno: Pre-Columbian Art and Culture from the Caribbean*, edited by F. Bercht, E. Brodsky, J. A. Farmer and D. Taylor, pp. 56-67. The Monacelli Press, New York.

Oviedo, G. F. 1526 (1959). *Natural History of the West Indies.* Translated by S. A. Stoudemire. The University of North Carolina Press, Chapel Hill.

Parry, J., P. Sherlock and A. Maingot. 1987. *A Short History of the West Indies.* Macmillan, Caribbean.

Parsons, T. 1937. *The Structure of Social Action.* McGraw-Hill, New York.

Pascual Fraga, C., M. Aguiar Fons and N. Melo Gonzales. 1990. *Estudio de los Grupos Insulares y Zonas Litorales del Archipelago Cubano con Fines Turisticos: Cayos Coco y Romano.* Academia de Ciencias de Cuba, La Habana.

Pascual Fraga, C., M. Aguiar Fons and N. Melo Gonzales. 1990. *Estudio de los Grupos Insulares y Zonas Litorales del Archipelago Cubano con Fines Turisticos: Cayos Francés, Cobos, Las*

Brujas, Ensenachos y Santa Maria. Academia de Ciencias de Cuba, La Habana.

Patrik, L. 1985. Is there an archaeological record? In *Advances in Archaeological Method and Theory*, edited by M. Schiffer, pp. 27-62. Academic Press.

Pazdur, A., R. Awsiuk, A. Bluszcz, M. F. Pazdur, A. Walanus and A. Zastawny. 1982. Gliwice Radiocarbon Dates VII. *Radiocarbon* 24(2):171-181.

Pedroso, A. A. 1944. *Cristobal Colon: Biografía del Descubridor.* Cultura S.A. Obispo, Habana.

Pelayo López, F. 1995. The land connexion between Cuba and the American continent: a paleontologic alternative to the continental drift (sic.). *Spanish Journal of History of Natural Sciences and Technology* 1 (4):1-11.

Pendergast, D., J. Calvera, J. Jardines, E. Graham and O. Brito. 2003. Construcciones de madera en el mar: Los Buchillones, Cuba. *El Caribe Arqueologico* 7:24-32.

Pendergast, D., E. Graham, J. Calvera and J. Jardines. 1999. Houses in the Sea: Excavation and Preservation at Los Buchillones, Cuba. In *Enduring Records: The Environmental and Cultural Heritage of Wetlands*, edited by B. Purdy, pp. 71-82. University Press of Florida, Gainesville.

Pendergast, D., E. Graham, J. Calvera and J. Jardines. 2002. The houses in which they dwelt: the excavation and dating of Taino wooden structures at Los Buchillones, Cuba. *Journal of Wetland Archaeology* Vol 2:61-75.

Pérez Iglesias, L. 1999. Restos Faunísticos de Cacoyuguín I, Asentamiento Protoagrícola de Holguín. *El Caribe Arqueologico* 3:79-83.

Peros, M. C. 2000. *Coastal Environments and Taíno Population at Los Buchillones.* Masters Dissertation, University of Toronto.

Peros, M. C. 2005. *Middle to Late Holocene Environment Change and Archaeology on the North Coast of Central Cuba.* PhD Thesis, University of Toronto.

Petchey, F., T. Higham, C. Bronk Ramsey, A. Hogg and R. Cresswell. Radiocarbon Web-Info Accessed 08/05/07. http://www.c14dating.com/

Petersen, J. 1997. Taino, Island Carib and prehistoric Amerindian economies in the West Indies: Tropical Forest Adaptations to Island environments. In *The Indigenous People of the Caribbean*, edited by S. Wilson, pp. 118-130. University Press of Florida, Talahassee.

Petitjean Roget, H. 1975. *Contribution a l'étude de la Préhistoire des Petites Antilles.* PhD, École Pratique des Hautes Études.

Petitjean Roget, H. 1997. The Taino Vision. In *The Indigenous People of the Caribbean*, edited by S. Wilson, pp. 169-176. University press of Florida, Talahassee.

Petitjean-Roget, J. 1961. The Caribs, as seen through the dictionary of the Reverend Father Breton (1635-1654). *First international Convention for the study of pre-Columbian culture in the Lesser Antilles* 1(1):43-68.

Pichardo Moya, F. 1990. *Caverna Costa y Meseta.* Editorial de Ciencias Sociales, Ciudad de La Habana.

Pino, M. 1995. *Actualizacion de fechados radiocarbónicos de sitios arqueológicos de Cuba hasta diciembre de 1993.* Editorial Academia, La Habana.

Pino Rodríguez, M. and A. Córdova Medina. 2000. Actividades de los Aborígenes de Cueva del Muerto, Cifuentes, Villa Clara. *El Caribe Arqueologico* 4:53-58.

Praetzellis, A. 2003. *Dug to Death: A Tale of Archaeological Method and Mayhem.* AltaMira Press, Oxford

Preucel, R. W. and I. Hodder. 1996. Communicating present pasts. In *Contemporary Archaeology in Theory*, edited by R. W. Preucel and I. Hodder, pp. 3-20. Blackwell, Oxford.

Price, J. A. 1973. The Superorganic Fringe: Protoculture, Indioculture, and Material Culture. *Ethos* 1(2):201-218.

Purdy, B. 1988. Archaeological Wet Sites: Untapped archives of prehistoric documents. In *Wet Site Archaeology*, edited by B. A. Purdy, pp. 325-335. The Telford Press, Caldwell New Jersey.

Rainbird, P. 1999. Islands Out of Time: Towards a Critique of Island Archaeology. *Journal of Mediterranean Archeology* 12(2):216-234.

Rainbird, P. 2004. *The Archaeology of Micronesia.* Cambridge World Archaeology. Cambridge University Press, Cambridge.

Rainey, F. G. 1940. Scientific Survey of Porto Rico and the Virgin Islands. *The New York Academy of Sciences* XVIII(1):3-207.

Ramón Pané, F. 1498 (1990). *Relacion Acerca de las Antiguedades de los Indios.* Translated by J. J. Arrom. Editorial de Ciencias Sociales, La Habana.

Randall, J. E. 1983. *Caribbean Reef Fishes.* T.F.H. Publications, Neptune City.

Rangel Rivero, A. 2003. El Museo Antropológico Montané y el desarrollo de la arqueología en Cuba entre 1900 y 1960. *Catauro: Revista Cubana de Antropologia* 5(8):19-35.

Rankin Santander, A. F. 1994. Estudio del Sitio Arqueológico de 'Cabagán', Circuito Sur, Provincia de Sancti Spíritus. In *Estudios Arqueologicos*, edited by J. Febles, L. Dominguez, F. Ortega, G. La Rosa, A. Martinez and A. Rives, pp. 129-139. Editorial Academia, La Habana.

Read, D. W. 1979. Regional Sampling. In *Sampling in Archaeology*, edited by J. W. Mueller, pp. 45-60. 2nd ed. Tuscon, Arizona, The University of Arizona Press.

Read, K. R. H. 1964. Ecology and Environmental Physiology of some Puerto Rico Bivalve Molluscs and a Comparison with Boreal Forms. *Caribbean Journal of Science* 4(4):459-465.

Reimer, P. Marine Reservoir Correction Database Accessed 14/04/05. Last updated 17/02/05. http://radiocarbon.pa.qub.ac.uk/marine/

Reimer, P., McCormac F.G., Moore J., McCormick F. and Murray E.V. 2002. Marine radiocarbon reservoir corrections for the mid- to late Holocene in the eastern subpolar North Atlantic. *The Holocene* 12(2):129-35.

Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, C. J. H. Bertrand, P. G. Blackwell, C. E. Buck, G. S. Burr, K. B. Cutler, P. E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, A. G. H. Hogg, K. A., B. Kromer, G. McCormac, S. Manning, C. B. Ramsey, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. Talamo, F. W. Taylor, J. van der Plicht and C. E. Weyhenmeyer. 2004. IntCal04 Terrestrial Radiocarbon Age Calibration, 0–26 Cal Kyr BP *Radiocarbon* 46(3):1029-1058.

Reimer, P. J. and R. W. Reimer. 2001. A marine reservoir correction database and on-line interface. *Radiocarbon 43* 43(URL:http://radiocarbon.pa.qub.ac.uk/marine/):461-463.

Reitz, E. J. and E. S. Wing. 1999. *Zooarchaeology.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge.

Renfrew, C. 1973. *Before Civilization: The Radiocarbon Revolution and Prehistoric Europe.* Jonathan Cape, London.

Renfrew, C. 1975. Trade as Action at a Distance: Questions of Integration and Communication. In *Ancient Civilization and Trade*, edited by J. Sabloff and C. Lamberg-Karlovsky, pp. 3-59. University of New Mexico Press, New Mexico.

Renfrew, C. 1994. Towards a Cognitive Archaeology. In *The Ancient Mind: Elements of Cognitive Archaeology, new directions in archaeology*, edited by C. Z. Renfew, E., pp. 3-12. Cambridge University Press, Cambridge.

Renfrew, C. and P. Bahn. 1996. *Archaeology: Theories, Methods and Practice.* Thames & Hudson, London.

Retallack, G. J. 1990. *Soils of the Past: An introduction to paleopedology.* Unwin Hyman, Boston.

Reyes Cardero, J. M. 1997. Estudios Dietarios de Cinco Sitios 'apropriadores ceramistas' del Suroriente Cubano. *El Caribe Arqueologico* 2:41-49.

Reyes Cardero, J. M. 2004. Modos de Vida y Tradición Alimentaria en Grupos Apropiadores Ceramistas del Caribe. *Caribe Arqueologico* 8:39-49.

Rick, T. C., R. L. Vellanoweth and J. Erlandson, M. 2005. Radiocarbon dating and the "old shell" problem: direct dating of artifacts and cultural chronologies in coastal and other aquatic regions. *Journal of Archaeological Science* 32:1641-1648.

Righter, E. 1995. A critical look at prehistoric settlement pattern distribution in the US Virgin Island. *Proceedings of the XVIth International Congress for Caribbean Archaeology* XVI:52-64.

Rivero de la Calle, M. and J. Trapero Pastor. 1997. Estudio de los Restos Humanos Aborígenes del Sitio Arqueológico La Luz. *El Caribe Arqueologico* 2:88-93.

Rives Pantoja, A. V., J. Febles Duenas, M. E. Durán, A. Martinez and L. Dominguez. 1991.

Los sitios arqueológicos de Cuba hasta 1990. Aplicaciones de la computación electrónica. Centro de Antropología y Centro de Disenos de Sistema Automatizado, Academia de Ciencias de Cuba, La Habana.

Robaina Jaramillo, J. R., M. Celaya González and O. Pereira Pereira. 2003. La arqueología en la construcción de un discurso sobre identidad cultural en Cuba. *Catauro: Revista Cubana de Antropologia* 5(8):47-61.

Robiou Lamarche, S. 1992. La Navegacion Indigena Antillana. *Boletin del Museo del Hombre Dominicano* 25.

Rodríguez Ferrer, M. 1876. *Naturaleza y civilización de la grandiosa isla de Cuba.* Imprenta de J. Noguera, Madrid.

Rodriguez Matamoros, M. E. 1994. Reporte de nuevas evidencias artefactuales en el ajuar de concha de las comunidades aborigenes de la etapa de economia de apropriación. In *Estudios Arqueologicos,* edited by J. Febles, Dominguez, L., Ortega, F., La Rosa, G., Martinez, A. & Rives, A., pp. 13-27. Editorial Academia, La Habana.

Rodriguez, P. A. 1981. El Uso del Anzuelo Atragantador por los Aborigenes Cubanos. *Revista Mar y Pesca* 187:23-24.

Rodríguez Ramos, R. 2002. Dinámicas de Intercambio en el Puerto Rico Prehispánico. *Caribe Arqueologico* 6:16-22.

Rosario Pérez Iglesias, L., J. Jardines Macías and C. Rodríguez Arce. 2003. *Estudio Arqueozoológico en Los Buchillones. Economía y Medio Ambiente.* Centro de Investigaciones y Servicios Ambientales y Tecnológicos. Ministerio de Ciencia Technología y Medio Ambiente. Unpublished.

Roskams, S. 2001. *Excavation.* Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge

Rossignol, J. 1992. A Landscape Approach. In *Space, Time and Archaeological Landscapes.,* edited by J. W. Rossignol, L., pp. 3-14. Plenum Press, London.

Rouse, I. 1941. An Analysis of the Artifacts of the 1914-1915 Porto Rican Survey. In *Scientific Survey of Porto Rico and the Virgin Islands,* pp. 336-362, 442-453. vol. XVIII Part 2. The New York Academy of Sciences, New York.

Rouse, I. 1942. Archaeology of the Maniabon HIlls, Cuba. *Publications in Anthropology* 24.

Rouse, I. 1952. Porto Rican Prehistory: Introduction; Excavations in the west and north. *Scientific Survey of Porto Rico and the Virgin Islands* XVIII(3):307-460.

Rouse, I. 1983. Diffusion and Interaction in the Orinocco Valley and the Coast. *Proceedings of the Ninth International Congress for the Study of the Pre-Columbian Cultures of the Lesser Antilles* 9:3-14.

Rouse, I. 1986. *Migrations in Prehistory: Inferring Population Movement from Cultural Remains.* Yale University Press, New Haven

Rouse, I. 1992. *The Tainos: Rise and decline of the people who greeted Columbus.* Yale university press, New Haven.

Rouse, I., J. Cruxent, F. Olsen and A. Roosevelt. 1975. Ronquin Revisited. *Proceedings of the Sixth International Congress for the Study of Pre-Columbian Cultures of the Lesser Antilles* 6:117-122.

Rouse, I. B. 1977. Pattern and Process in West Indian Archaeology. *World Archaeology* 9(1):1-11.

Samuel, R. 1994. *Theatres of Memory.* Verso, London.

Sanderson, S. 1990. *Social Evolutionism: a critical history.* Blackwell, Oxford.

Sandweiss, D. H. and D. R. Watters. 1996. Preface: Art and archaeology of pre-Columbian Cuba, pp. xix-xxi. Pittsburgh Press, Pittsburgh.

Sanoja, M. 1965. Venezuelan Archaeology Looking Toward the West Indies. *American Antiquity* 31(2):231-236.

Schiffer, M. B. 1972. Archaeological Context and Systematic Context. *American Antiquity* 37:156-165.

Schmidt, S., M. Wolff and J. A. Vargas. 2002. Population ecology and fishery of *Cittarium pica* (Gastropoda: Trochidae) on the Caribbean coast of Costa Rica. *Revista de Biología Tropical* 50 (no. 3-4):1079-1090.

Schott, M. J. 1998. Status and role of formation theory in contemporary archaeological practice. *Journal of Archaeological Research* 6(4):229-329.

Serrand, N. and D. Bonnissent. 2005. Pre-Columbian Preceramic shellfish consumption and shell tool production: shell remains from Orient Bay, Saint-Martin, Northern Lesser Antilles. In *Archaeomalacology: Molluscs in former environments of human behaviour. Proceedings of the 9th ICAZ Conference, Durham 2002*, edited by D. E. Bar-Yosef Mayer, pp. 29-39. Oxbow Books, Oxford.

Shafer, H. J. 1997. Research Design and Sampling Techniques. In *Field Methods in Archaeology*, edited by T. R. Hester, H. J. Shafer and K. L. Feder. 7th ed. Mayfield Publishing Company, London.

Shanks, M. and C. Tilley. 1987. Archaeology into the 1990's. *Norweigan Archaeological Review* 22:1-54.

Shanks, M. T., C. 1987. *Re-Constructing Archaeology.* Cambridge University Press, Cambridge.

Shennan, S. 1989. Introduction: Archaeological approaches to Cultural Identity. *One World Archaeology, Archaeological approaches to Cultural Identity* 10:1-30.

Shennan, S. 1997. *Quantifying Archaeology.* Edinburgh University Press, Edinburgh.

Shennan, S. 2002. *Genes, Memes & Human History: Darwinian Archeology and Cultural Evolution.* Thames & Hudson, London.

Shennan, S. J. 1993. After Social Evolution: a new archaeological agenda? In *Archaeological Theory: Who sets the Agenda*, edited by N. S. Yoffee, A., pp. 53-59. Cambridge University Press, Cambridge.

Siegel, P. 1991. Political Evolution in the Caribbean. *Proceedings of the 10th Congress for Caribbean Archaeology* 10:232-250.

Siegel, P. 1996. Ideology and Culture Change in Prehistoric Puerto Rico: A view from the community. *Journal of Field Archaeology* 23(3):313-333.

Siegel, P., J. Jones, D. Pearsall and D. P. Wagner. 2001. Culture and Environment in Prehistoric Puerto Rico. *Proceedings of the XVIIIth International Congress for Caribbean Archaeology* XVIII:281-290.

Siegel, P. E., J. G. Jones, D. M. Pearsall and D. P. Wagner. 2005. Environmental and Cultural correlates in the West Indies: A View from Puerto Rico. In *Ancient Borinquen: Archaeology and Ethnohistory of Native Puerto Rico*, edited by P. E. Siegel, pp. 88-121. The University of Alabama Press, Tuscaloosa.

Simmons, I. 1996. *Changing the Face of the Earth.* Blackwell, Oxford.

Smith, A. 1994. The Need for Lapita: explaining change in the Late Holocene Pacific archaeological record. *World Archaeology* 26:366-380.

Smith, C. 1976. Regional Economic Systems: Linking Geographical Models and Socioeconomic Problems. In *Regional Analysis: Economic Systems*, edited by C. Smith, pp. 3-63. Academic Press, New York.

Steadman, D. W., P. S. Martin, R. D. E. MacPhee, A. J. T. Jull, G. McDonald, C. A. Woods, M. Iturralde-Vinent and G. W. L. Hodgins. 2005. Asynchronous extinction of late Quaternary sloths on continents and islands. Paper presented at the Proceedings of the National Academy of Sciences of the United States of America.

Steward, J. 1972. *Theory of Culture Change: the methodology of multilinear evolution.* University of Illinois Press, Chicago.

Stuckenrath, R. and J. E. Mielke. 1973. Smithsonian Institution Radiocarbon Measurements VIII. *Radiocarbon* 15(2):388-424.

Stuiver, M. and T. F. Braziunas. 1993. Modeling Atmospheric 14C Influences and 14C Ages of Marine Samples to 10,000BC. *Radiocarbon* 35(1):137-189.

Stuiver, M. and H. A. Polach. 1977. Reporting of C-14 Data - Discussion. *Radiocarbon* 19(3):355-363.

Sutty, L. 1995. Marine mammals and Amerindian cultures of the Lesser Antilles: An analysis of interaction and customs. *Proceedings of the XVIth International Congress for Caribbean Archaeology* 16:367-378.

Szaszdi Nagy, A. 1984. *Un Mundo que descubrió Colon: Las rutas del comercio prehispánico de los metales.* Museo De Colon, Cuadernos Colombinos XII, Valladolid.

Tabio, E. 1974. La Comunidad Primitiva. *Revolución y Cultura* Septiembre, 1:7-14.

Tabio, E. 1984. Nueva periodización para el estudio de las comunidades aborígenes de Cuba. *Islas* 78:37-52.

Tabio, E. and E. Rey. 1966. *Prehistoria de Cuba.* 1st ed. Academia de Ciencias de Cuba, La Habana.

Tabio, E. and E. Rey. 1979. *Prehistoria de Cuba.* 2nd ed. Editorial de Ciencias Sociales, La Habana.

Tabio, E. E. 1995. *Introducción a la Arqueología de las Antillas.* Editorial de Ciencias Sociales, La Habana.

Tabio, E. E. and J. M. Guarch. 1966. *Excavaciones en Arroyo del Palo, Mayari, Cuba.* Academia de Ciencias de la República de Cuba, La Habana.

Takamiya, H. 2004. Population Dynamics in the Prehistory of Okinawa. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 111-128. Praeger, Westport.

Taylor, R. E. 1987. *Radiocarbon Dating: An Archaeological Perspective* Academic Press, INC., London.

Terrell, J. E. 1976. Island Biogeography and Man in Melanesia. *Archaeology and Physical Anthropology in Oceania* 11(1):1-17.

Terrell, J. E. 2004. Island Models of Reticulate Evolution: The "Ancient Lagoons" Hypothethesis. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 203-222. Praeger, Westport.

Terrenato, N. 2000. The visibility of sites and the interpretation of field survey results: towards an analysis of incomplete distributions. In *Extracting meaning from poughsoil assemblages*, edited by R. Francovich, Patterson, H. & Barker, G., pp. 60-71. vol. 5. 5 vols. Oxbow, Oxford.

The British Museum. 2007 (May-August). The Caribbean before Columbus Exhibition, London.

Thomas, H. 2001. *Cuba.* Pan Books, London.

Thomas, J. 1995. The Politics of Vision and the Archaeology of Landscape. In *Landscape, Politics and Perspective.*, edited by B. Bender, pp. 19-48. Berg, Oxford.

Thomas, J. 1995. Reconfiguring the social, reconfiguring the material. In *Interpreting Archaeology: Finding meaning in the past.*, edited by I. Hodder, pp. 210-211. Routledge, London.

Thomas, J. 1995. Where are we now? Archaeological theory in the 1990s. In *Archaeological*

Theory: A world perspective, edited by P. Ucko, pp. 343-362. Routledge, London.

Tilley, C. 1994. *A Phenomenology of Landscape*. Routledge, Oxford.

Tilley, C. 1995. Art, Architecture and Landscape: Neolithic Sweden. In *Landscape, Politics and Perspective.*, edited by B. Bender, pp. 49-84. Berg, Oxford.

Tilley, C. 1999. *Metaphor and Material Culture*. Blackwell, Oxford.

Tilley, C. 2004. *The Materiality of Stone: Explorations in Landscape Phenomenology*. Berg, Oxford.

Tomé Pérez, J. 1994. Análisis de perforaciones cónicas en algunas muestras de concha. In *Estudios Arqueologicos*, edited by J. Febles, Dominguez, L., Ortega, F., La Rosa, G., Martinez, A. & Rives, A., pp. 59-65. Editorial Academia, La Habana.

Torres Etayo, D. 2004. La arqueología cubana en la encrucijada: la teoría o la empiria. *El Caribe Arqueologico* 8:2-7.

Trapero Pastor, J. O. 1999. San Fernando del Pozo. Sitio Protoagricola de Santiago de Cuba. *El Caribe Arqueologico* 3:74-78.

Trigger, B. 1994. Childe's relevance to the 1990s. In *The Archaeology of V. Gordon Childe*, edited by D. Harris, pp. 9-34. UCL Press Limited, London.

Trincado Fontán, M. N. 2000. El Aborigen, La Historiografía y La Nacionalidad Cubanas. *El Caribe Arqueologico* 4:100-105.

Trincado Fontán, M. N. and J. Ulloa Hung. 1996. Las Comunidades Meillacoides del Litoral Sudoriental de Cuba. *Caribe Arqueologico* 1:74-82.

Tucker Abbott, R. 1974. *American Seashells*. 2nd ed. Van Nostrand Reinhold, New York.

Ucko, P. 1969. Ethnography and Archaeological Interpretation of Funerary Remains. *World Archaeology*, 1:262-290.

Ucko, P. 1989. Foreward. *One World Archaeology, The Meaning of Things: Material Culture and Symbolic Expression* No.6:ix-xvii.

Ucko, P. 2000. Enlivening a 'dead' past. *Conservation and Management of Archaeological Sites* 4:67-92.

Ulloa Hung, J. 1999. Aproximación a la Ceramica Temprana en el Caribe. *El Caribe Arqueologico* 3:28-42.

Ulloa Hung, J. 2003. Arqueologica y rescate de la presencia aborigen en Cuba y el Caribe. *El Caribe Arqueologico* 7:11-15.

Ulloa Hung, J. 2005. Approaches to Early Ceramics in the Caribbean: Between Diversity and Unilineality. In *Dialogues in Cuban Archaeology*, edited by L. A. Curet, S. L. Dawdy and G. La Rosa, pp. 103-124. The University of Alabama Press, Tuscaloosa, Alabama.

Ulloa Hung, J. and R. Valcárcel Rojas. 1997. Las Comunidades Apropiadoras Ceramistas del Sudeste de Cuba: Un Estudio de su Ceramica. *El Caribe Arqueologico* 2:31-40.

Ulloa Hung, J. and R. Valcárcel Rojas. 2002. *Ceramica Temprana en el Centro del Oriente de Cuba.* View Graph Impresos, Santo Domingo.

US, N. R. C. S. 2006. Soil Survey Laboratory Soil Classification Database. United States Department of Agriculture.

Valcárcel Rojas, R. 1997. Introducción a la arqueología del contacto indohispánico en la Provincia de Holguín, Cuba. *El Caribe Arqueologico* 2:64-77.

Valcárcel Rojas, R. 2002. *Banes Precolombino: La ocupacion agricultora.* 1st ed. Ediciones Holguin, Holguin.

Valcárcel Rojas, R. 2002. Jose Manuel Guarch Delmonte: El Arqueologo. *Caribe Arqueologico* 6:112-118.

Valcárcel Rojas, R., J. C. Aguero Hernández, E. Guarch Rodríguez and R. Pedroso. 1996. La Ornamentación Incisa en la Cerámica Aborigen del Centro-Norte de Holguín, Cuba. *El Caribe Arqueologico* 1:46-58.

Valcárcel Rojas, R., J. Cooper, J. Calvera Rosés, O. Brito and M. Labrada. 2006. Postes en el Mar: Excavación de una estructura constructiva aborigen en Los Buchillones. *El Caribe Arqueologico* 9:76-88.

Valcárcel Rojas, R. and C. Rodríguez Arce. 2003. Muerte, desigualdad social y jefatura en El Chorro de Maíta. *Catauro: Revista Cubana de Antropologia* 5(8):124.

Van der Heide, G. 1979. A piece of history in conservation of waterlogged wood. In *Conservation of Waterlogged Wood,* edited by M. A. Klompe. UNESCO, Amsterdam.

Van Gijn, A. 1993. Flint exploitation on Long Island, Antigua, West-Indies. *Analecta Praehistorica Leidensia* 26:183-197.

Vargas Arenas, I. 1996. La Arqueología Social: un pradigma alternativo al angloamericano. *El Caribe Arqueologico* 1:3-7.

Vargas Arenas, I. 1997. Historia Arqueológica de Caracas. Proyecto de Arqueología Urbana. *El Caribe Arqueologico* 2:8-10.

Vargas Arenas, I. and V. Vivas. 2000. Moda de Vida, espacio social y vida cotidiana en Caracas. *El Caribe Arqueologico* 4:2-13.

Vayda, A. P. and R. A. Rappaport. 1965. Island Cultures. In *Man's Place in the Island Ecosystem: A Symposium,* edited by F. R. Fosberg, pp. 133-145. Bishop Museum Press, Honolulu.

Vega, B. 1979. *Los metales y los aborígenes de la Hispaniola.* Museo del Hombre Dominicano and Fundación García Arévalo, Santo Domingo.

Velandia Jagua, C. 2002. Estética y Arqueología: Dificultades y Problemas. *Caribe Arqueologico* 6:9-15.

Veloz Maggiolo, M. 1972. *Arqueologia Prehistorica de Santo Domingo*. McGraw-Hill, Singapore.

Veloz Maggiolo, M. 1974. La Navegacion Prehistorica. In *Apuntes sobre Prehistoria de Santo Domingo*, edited by M. Veloz Maggiolo, Santo Domingo.

Veloz Maggiolo, M. 1977. *Indigenous Art and Economy of Santo Domingo*. Ediciones Cohoba, Santo Domingo.

Veloz Maggiolo, M. (editor) 1997. *The Daily Life of the Taíno People*. The Monacelli Press, New York.

Veloz Maggiolo, M. 1999. Arqueología, Historia e Identidad. *El Caribe Arqueologico* 3:20-27.

Veloz Maggiolo, M. and G. Pantel. 1989. El modo de vida de los recolectores en la arqueología del caribe (parte II). *Boletín de Antropología Americana* 19(Julio):83-117.

Vinogradov, A. P., A. L. Devirts, E. I. Dobkina and N. G. Markova. 1968. Radiocarbon Dating in the Vernadsky Institute, Institute of Geochemistry and Analytical chemistry, Academy of Sciences, USSR, Moscow. *Radiocarbon* 10(2):454-464.

Voltaire. 1759 (1994). *Candide and other stories*. Translated by J. Pearson. Random House, London.

Wagner, E. 1978. Recent Research in Venezuelan Prehistory. In *Archaeological essays in honor of Irving B. Rouse.*, edited by R. H. Dunnell, E., pp. 319-343. Mouton Publishers, New York.

Walker, J. 1983. Use-Wear Analysis of Caribbean Flaked Stone Tools. *Proceedings of the Ninth International Congress for the Study of the Pre-Columbian Cultures of the Lesser Antilles* 9:239-248.

Wandsnider, L. 1992. Archaeological Landscape Studies. In *Space, Time and Archaeological Landscapes*, edited by J. W. Rossignol, L., pp. 285-292. Plenum Press, London.

Watters, D. 1983. Assessing the Ocean's Roles in Antillean Prehistory. *Proceedings of the Ninth International Congress for the Study of the Pre-Columbian Cultures of the Lesser Antilles* 9:531-541.

Watters, D., J. Donahue and R. Stuckenrath. 1991. Paleoshorelines and the Prehistory of Barbuda, West Indies. In *Paleoshorelines and Prehistory: An Investigation of Method*, edited by L. L. Johnson, pp. 15-51. CRC Press, London.

Watters, D. and R. Murphy. 2006. Caribbean Caribbeanists: Strategic Shifts in Collaborative Archaeological Research. In Symposium: New Perspectives on the Prehistoric Settlement of the Caribbean. In *Society of American Archaeology*, Personal Communication: San Juan, Puerto Rico.

White, J. P. 2004. Where the Wild Things Are: Prehistoric Animal Translocation in the Circum New Guinea Archipelago. In *Voyages of Discovery: The Archaeology of Islands*, edited by S. Fitzpatrick, pp. 147-164. Praeger, Westport.

Wiessner, P. 1989. Style and changing relations between the individual and society. *The Meaning of Things: Material Culture and Symbolic Expression. One World Archaeology* 6:56-62.

Willey, G. 1971. *An Introduction to American Archaeology: Volume Two South America.* Prentice-Hall, New Jersey.

Wilson, S. 1995. Pre-ceramic connections between the Caribbean and the Yucatan peninsula. *Proceedings of the XVIth International Congress for Caribbean Archaeology* 16:391-399.

Wilson, S. 1999. Cultural Pluralism and the Emergence of Complex Society in the Greater Antilles. *Proceedings of the XVIIIth International Congress for Caribbean Archaeology* 18:1-8.

Wilson, S. M. 1997. The Caribbean before European Conquest: A Chronology. In *Taíno: Pre-Columbian Art and Culture from the Caribbean,* edited by F. Bercht, E. Brodsky, J. A. Farmer and D. Taylor, pp. 15-17. The Monacelli Press, New York.

Wilson, S. M. (editor) 1997. *The Taíno Social and Political Order.* The Monacelli Press, New York.

Wilson, S. M., H. B. Iceland and T. R. Hester. 1998. Preceramic connections between Yucatan and the Caribbean. *Latin American Antiquity* 9(4):342-352.

Wing, E. 1998. *Caribbean dogs and a re-evaluation of the Cuban dog.* Florida Museum of Natural History. unpublished draft.

Wing, E. S. and S. J. Scudder. 1983. Animal Exploitation by Prehistoric People Living on a Tropical Marine Edge. In *Animals and Archaeology: 2. Shell Middens, Fishes and Birds,* edited by C. Grigson and J. Clutton-Brock. vol. 2. BAR International Series 183.

Witcher, R. E. 1998. GIS and the Landscapes of Perception. *The Archaeology of Meditteranean Landscapes: Geographical Information Systems and Landscape Archaeology.* 3:13-25.

Worboys, M. 1995. *GIS: A computing perspective.* Taylor Francis, London.

Wylie, A. 1985. The Reaction Against Analysis. In *Advances in Archaeological Method and Theory,* edited by M. Schiffer, pp. 63-111. Academic Press, London.

Zubrow, E. 1994. Knowledge Representation and Archaeology: a cognitive example using GIS. In *Space, Time and Archaeological Landscapes.,* edited by J. Rossignol and L. Wandsnider, pp. 107-118. Plenum Press, London.