

# THE ARCHAEOLOGY OF MEDIEVAL NOVGOROD

## *SERIES PREFACE*

Novgorod is one of the most intensively and continuously studied urban sites in northern Europe. Systematic excavations began in 1932 and have continued almost every year since then. The excellent preservation of organic and inorganic material in its anaerobic soils, including the structural remains of streets, properties and buildings, has made it possible to study entire quarters of the town as well as the activities of its inhabitants. With deposits up to 8 m deep in places and with well-dated sequences from the early to mid 10th century, its importance to the study of both medieval Russia and the development of Europe cannot be over emphasized. In addition, excavations have recovered many examples of the organic remains normally lost to archaeologists, including a stunning collection of birch bark letters, unique written documents of the medieval period, which now number over a thousand separate inscriptions. Because of this the site has received attention from scholars with a wide range of specialisms from differing fields including medieval archaeology, history, architecture, botany, zoology and linguistics.

This publication series presents some of the recent results obtained from international, multidisciplinary projects supported by various European universities and institutions into the origins and development of the medieval town and its hinterland. With the support of EU funding via INTAS (the International Association for the Promotion of Scientific Collaboration between the EU and former Soviet Union countries), a number of projects were initiated which have used the Novgorod area as a test bed for wider issues concerning urban origins, town-hinterland relationships, environmental analyses, trade connections, accurate chronologies, innovative artefact studies, and the development of accounting systems and the spread of written language.

These publications are the outcome of collaborative projects that have their origins in the mid 1990s when funding was obtained from INTAS to set up an international collaboration into aspects of medieval towns and their hinterlands in NW Russia. Most of the field work took place from 1993 to 2004 in and around Novgorod, but includes material from other key sites in the area such as Ryurik Gorodishche, Staraya Russa, Pskov and sites, such as Minino, in the Byeloozero region on the northern margin of the territory of Novgorod (a territory that comprised the city's own medieval state, known as Novgorod Lands, which at its height covered an area larger than modern day France).

The volumes in this series cover some of the topics currently being investigated by the Novgorod Archaeological Research Centre with the support of INTAS-funded projects and focus on the following aspects of medieval Novgorod and its region:

- The pottery from medieval Novgorod and its region (published 2006)
- Wood use in medieval Novgorod (published 2007)
- Animals and archaeology in northern medieval Russia: zooarchaeological studies in Novgorod, Gorodishche and Minino (forthcoming)
- The archaeology of Novgorod in its wider context: a study of the town, its hinterland and its territory (this volume)

The first two volumes contain papers on key materials, namely pottery and wooden artefacts. Whilst elsewhere throughout Europe pottery tends to take the lion's share of attention and wood less so, partially due to its lack of survival, in Novgorod this position is reversed. Wood survives in abundance and what's more it was used prolifically for artefacts, fuel, buildings, fences, and even streets, making it the key means of dating site levels by extensive use of dendrochronology. As pottery has never been relied on for dating purposes, its typological and scientific study has lagged behind ceramic studies in Western Europe. For this reason the pottery volume in this series has attempted to set out some preliminary findings as well as discussing differences in methodology, sampling and analysis.

It is the intention that the third volume in this series on zooarchaeological aspects of recent work in Novgorod and the Novgorod Lands will follow on from those on pottery and wood to raise issues to do with recording, sample selection, methodology, and the integration of animal studies into the social and economic context (for example the fur trade and butchery practices), as well as discussing the differences and similarities in the material from the town, its hinterland and its wider territory.

Turning to this particular volume, it was the intention from its inception that this work would include papers by both Russian and non-Russian specialists on aspects of the environmental and technological context of the relationship between urban centre and rural hinterland. This was always going to be a tall order with so much data in most areas, yet little systematic study of key materials such as pollen, animal bones, plant remains, insects, leather, and pottery. Inevitably there were essential matters to deal with first, such as sampling strategies and methodologies, something which is widely acknowledged in many of the papers contained in this volume. In this sense, this collection of papers is best viewed as a starting point for attempting to put Novgorod into a wider context. It does certainly not claim to be definitive, far from it. But if it serves to begin and extend discussion of these issues and brings some of the enormous wealth of evidence to a wider audience, then it will have succeeded.

As to the structure of this volume, it begins by examining the environmental context for the settlement pattern that developed from the 9th to 15th centuries and examining the role that various natural resources had in contributing to that pattern. After a general paper on the natural environment based on a recent palynological study commissioned as part of this project, it presents data from three study areas (the first in the Byeloozero area to the NE of Novgorod; the second in the immediate hinterland of Novgorod and the third within Novgorod itself). It will consider what, where and how certain natural resources were exploited during the medieval period in these areas. Where possible, it will also attempt to explain the processes by which these resources were produced as commodities (via craft production, centralised workshops, household production, specialised settlements, etc) and place the evidence from the three other volumes on ceramics, wood use and zooarchaeology into a wider context, concentrating on the exploitation, manufacture and consumption of these and other materials.

Mark Brisbane  
Bournemouth

*An offprint from*

**THE ARCHAEOLOGY  
OF MEDIEVAL  
NOVGOROD IN CONTEXT**

Studies in centre/periphery relations

*Edited by*

Mark A. Brisbane, Nikolaj A. Makarov  
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*With Russian translations  
by Katharine Judelson*

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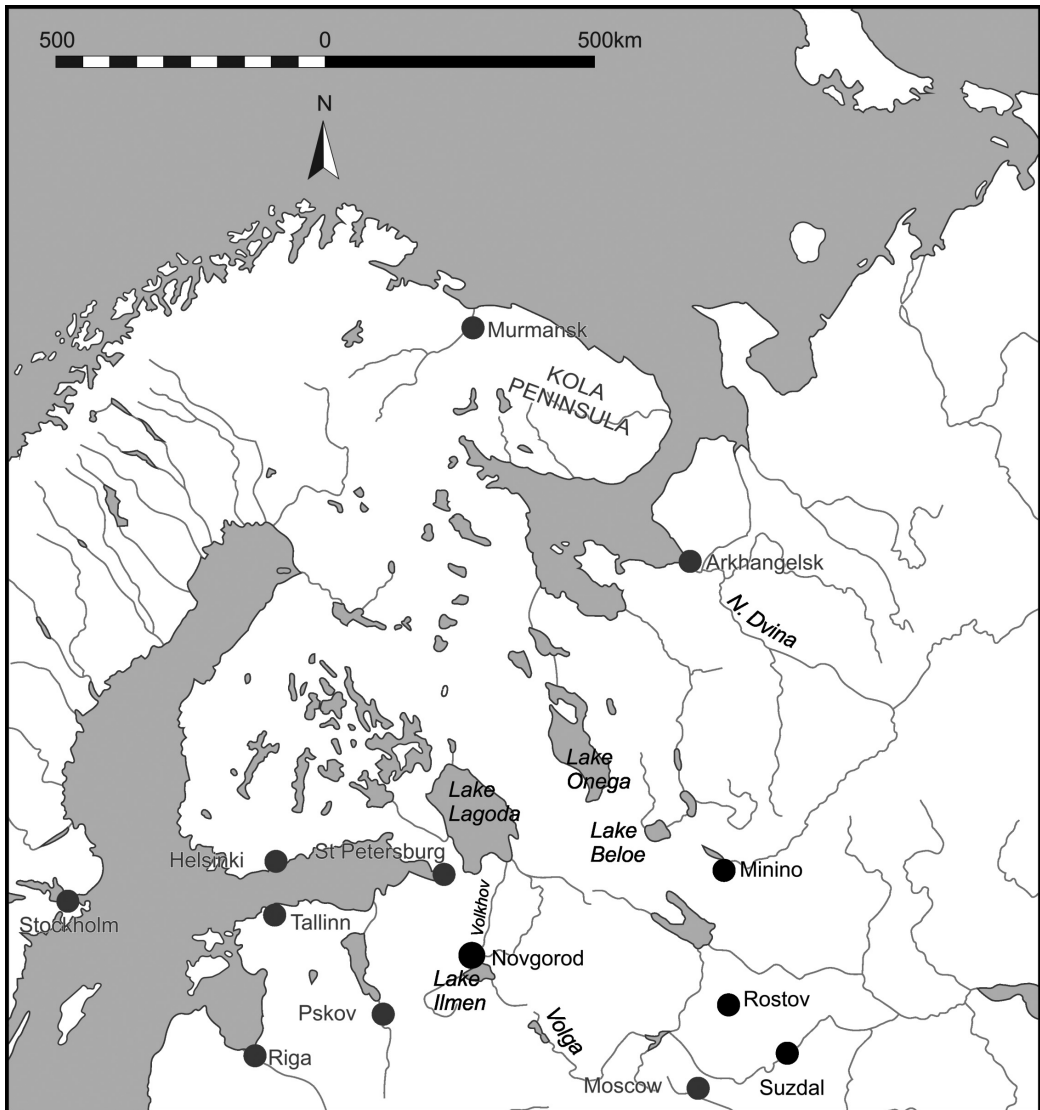
## EDITORS' PREFACE

The material in this volume, which is the fruit of collaborative research involving Russian and western European archaeologists in the framework of projects funded by INTAS, and initiated and co-ordinated by Mark Brisbane, has made it possible to bring together studies of medieval urbanization and the settlement of rural territories. It addresses specific questions raised by research aimed at piecing together economic activity and production in both towns and a range of rural settlements. Collectively the papers shed light on many aspects of the medieval economy and the cultural landscape of the northern part of Eastern Europe, which had not previously been the object of close study. In addition, they attempt to achieve a more profound and integrated interpretation of Novgorod's economic base and its utilization of resources from the centre and margins of its territory, in the development of its economy and general prosperity.

None of this study would have been possible without the dedicated research and investigation undertaken by the Novgorod Archaeological Research Centre, supported by the Novgorod State Museum, the Dept of Archaeology of Moscow State University, the Institute of Archaeology (Moscow), and the Institute for the History of Material Culture (St Petersburg). Their achievements in conducting large-scale, open-area excavations continuously since the late 1940s, as well as an excavation pedigree stretching back to 1932, has extended the rich data base for this site to such an extent that they can justifiably claim to have created one of the largest archives and collections on a medieval European city and its hinterland. Through various INTAS-supported projects (Brisbane 2001) it has been possible to bring together specialists from other parts of Europe to work collaboratively on this material.

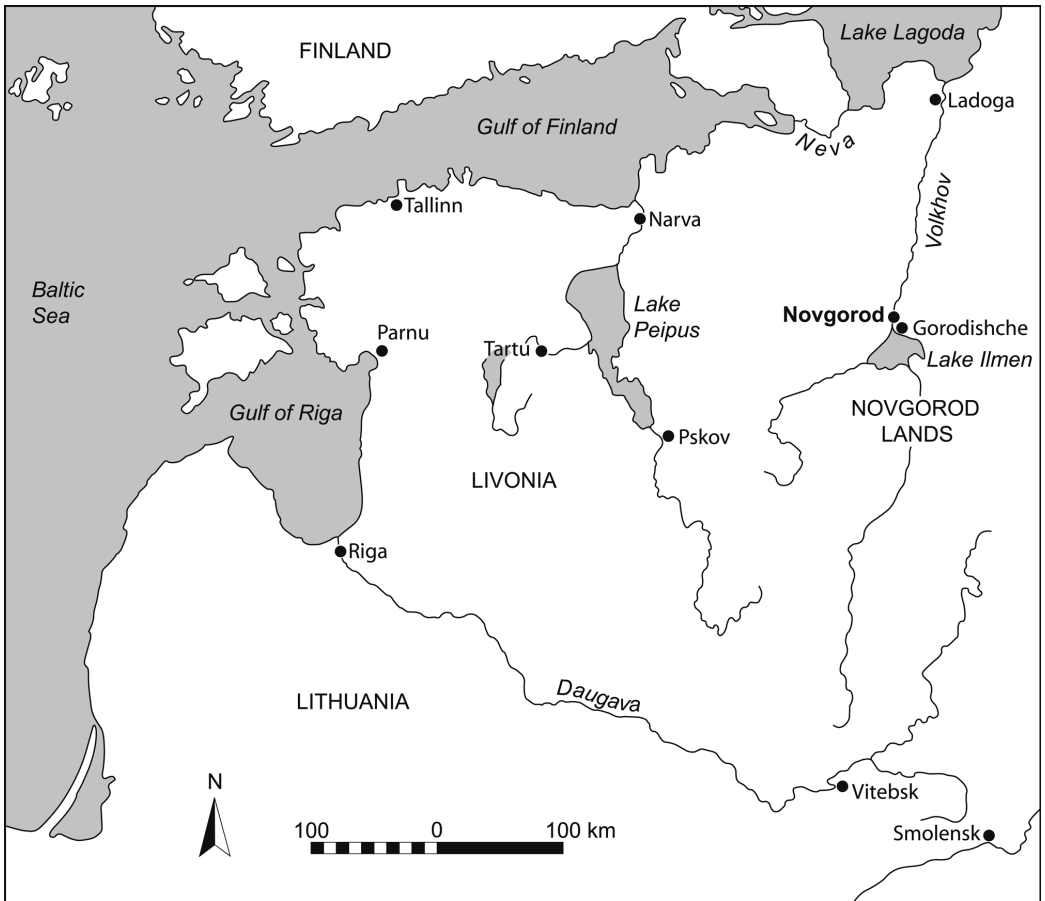
After an introductory chapter which attempts to sketch out the historical and geographical context of the Novgorod Lands, the volume moves on to a paper by Spiridonova and Aleshinskaya presenting readers with the results of their palaeobotanical research carried out in two historically significant micro-regions: (a) the area around Lake Ilmen near the fortified settlement of Ryurik Gorodishche and (b) the area around Lake Kubenskoye, where the Minino settlements have been identified and excavated. This palynological research has made it possible to piece together a detailed picture of the landscape in the two areas, at the time when settlements were being founded, and has also shown that subsequent changes in the vegetation and natural environment were determined to a significant extent by the impact of human activity. Comparisons of ranges of palynological materials from similar periods show that the emergence of an agrarian landscape around Lake Ilmen began 200 years earlier than it did in the area around Lake Kubenskoye. The results also show that the banks of the River Volkhov near the place where it emerges from Lake Ilmen,

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**Figure 1** Map showing the location of Novgorod, Lake Ilmen, Minino on Lake Kubenskoye in the Byeloozero region and other places for location purposes. Drawn by John Hodgson and Mark Dover.

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*Figure 2 Map showing the location of Novgorod and Gorodishche. Drawn by John Hodgson.*

constituted a semi-open landscape, in which woods alternated with meadows, in contrast to the wooded landscape around Lake Kubenskoye.

Five chapters are devoted to the archaeological materials from the Minino Archaeological Complex on the shores of Lake Kubenskoye, which was investigated by a team of archaeologists led by Makarov. This area can be seen as a model of a rural micro-region in the northern margins of medieval Russia. Strictly speaking, this area lies just beyond the confines of the Novgorod Lands, but as has been demonstrated by the artefacts found there, the settlements around Lake Kubenskoye were closely linked both economically and culturally with North-Western Russia in the 11th and early-12th centuries. The extremely thorough study of the medieval settlements and burial grounds in the Minino micro-region makes it possible to piece together a detailed picture of the economy, culture, commodity exchange and palaeo-environmental

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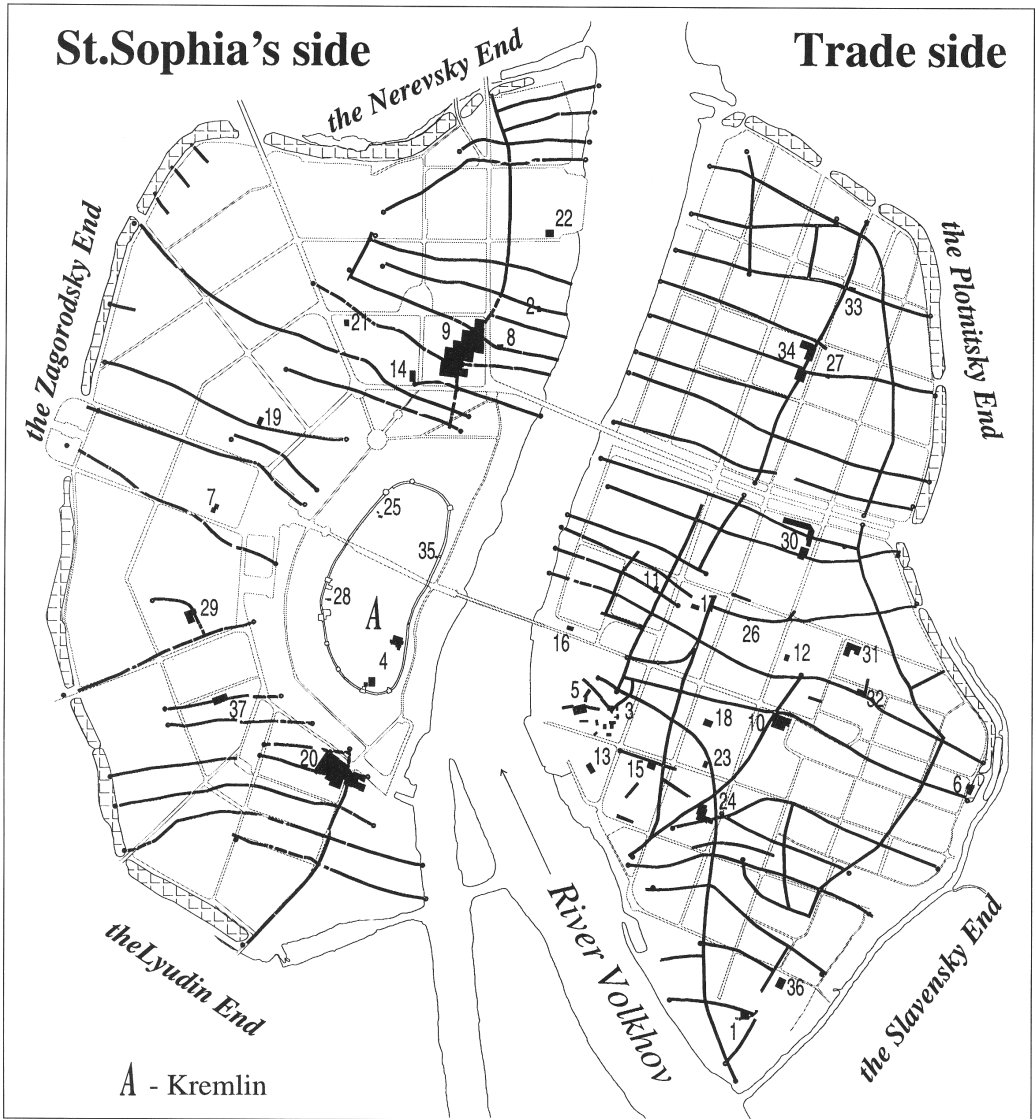
aspects of the colonization of that region. These sites are of key importance for the interpretation of relations between centre and periphery, and the influence of towns and international trade on the economy and culture of remote rural areas in the North of Russia (see various papers in Makarov 2007 and 2009).

Four chapters are devoted to Ryurik Gorodishche and the area around Lake Ilmen, which formed the original nucleus of the Novgorod Lands and were later to constitute the nearest resource base for the enormous medieval city of Novgorod. The role of Ryurik Gorodishche, as the earliest urban centre in the vicinity of Lake Ilmen, and the precursor of Novgorod, has been convincingly expounded by Nosov (1990). Features of medieval settlement in the area around Lake Ilmen, the culture of the early medieval settlements and the way in which agriculture was developed in this area have already been examined in detail (Nosov 1991: 5–37; 1992: 5–65). The chapter by Yeremeyev published here attempts to create a comprehensive map of Early Slavonic sites near Lake Ilmen, and to analyse the natural conditions encountered by the inhabitants of those settlements. The research also endeavours to identify separate rural micro-regions and to single out the main historical-geographical patterns underlying the settlement of that territory at the end of the first millennium AD. The chapter by Khvoshchinskaya examines jewellery production at Ryurik Gorodishche and other settlements near Lake Ilmen. The author demonstrates that although jewellery was being made in other settlements as well, the main centre for its manufacture was Ryurik Gorodishche, where craftsmen were making jewellery of both Slavonic and Scandinavian types and setting standards for a new material culture in the area around Lake Ilmen from the late 8th century onwards. The chapter by Toropov examines for the first time the evidence of iron production in the settlements around Lake Ilmen, which are important for any evaluation of the economic potential of the environs of Novgorod in the 10th to 13th centuries.

Six chapters are devoted to palaeo-environmental materials and the remains of production from Novgorod, which shed light on the consumption and economic activity of its citizens. Research into the leather articles, remains of textiles, household articles made of wood and metal slags found in the city enables us to appreciate Novgorod as a centre of craft production and consumption, which required a wide range of raw materials and resources to be able to produce such an enormous amount of craft articles. Clarification of the specific origins of various raw materials and completed craft articles, which made their way to Novgorod, is an interesting research subject, on which work has so far only just begun.

The final seven chapters are integrative papers which look at various materials. The first of these by Alsleben concerns plant remains, specifically domesticated cereals from Novgorod's hinterland and from the sites around Minino. This paper should be compared to the study from Novgorod by Monk and Johnston who have made tremendous inroads into the abundant material from the town. There is also a group of papers on the zooarchaeological remains summarised by Maltby (for a full account of this material see Volume 3 in this series), the fur trade by Makarov and the leather-

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The sites are numbered in the order they were excavated and are as follows: 1 - on Slavensky Hill. 2 - on Borkovaya Street. 3 + 5 - in Yaroslav's Court. 4, 25, 28 + 35 - in the Kremlin. 6 - on the eastern rampart. 7 - on Chudintsevaya Street. 8 - on Kholopya Street. 9 - Nerevsky. 10 - Ilyinsky. 11 - Buyany. 12 - Slavensky. 13 - Gotsky. 14 - Tikhvinsky. 15 - Mikhailovsky. 16 - Torgovy. 17 - Rogatitsky. 18 - Kirovsky. 19 - Lyudogoshchinsky. 20 - Troitsky. 21 - Kosmodemyansky. 22 - Dmitrievsky. 23 - Duboshin. 24 - Nutny. 26 - on Bolshevikov Street. 27 - Molotkovsky. 29 - Mikhailo-Arkhangelsky. 30 - Fedorovsky. 31 - Ipatievsky. 32 - Lukinsky. 33 - Konyukhov. 34 - Andreevsky. 36 - Polsolsky. 37 - Dobrynin.

**Figure 3** Plan of Novgorod showing the five Ends (Districts), the ramparts (cross-hatched), the street layout (known medieval streets in black and modern grid pattern dotted), and the location of excavations undertaken from 1932 to 2001. Based on plans supplied by the Novgorod State Museum. North is to the top.

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working industry by Kurbatov, which taken together offer some significant insights into the way in which animals were exploited during this period. There can be little doubt of the importance of the fur trade to the economic success of Novgorod, but these studies show a wider context for a range of economically vital animal products and attempt to move towards a holistic study of these resources.

There follows two papers on pottery and specialisation. The first of these by Brorsson examines some of the local and foreign influences in the ceramic tradition of NW Russia in this period, while the second by Orton is a fresh look at the concept of specialisation applied to the rather conservative styles of medieval Novgorodian pottery. The final chapter by Rybina presents the evidence for craft production contained within the famous birch-bark documents of Novgorod. These stunning documents now total over 1000 individual finds from excavations within the city and are an invaluable source of information on this and many other topics.



## METAL MELTING CRUCIBLES FROM MEDIEVAL NOVGOROD

*N. Eniosova and Th. Rehren*

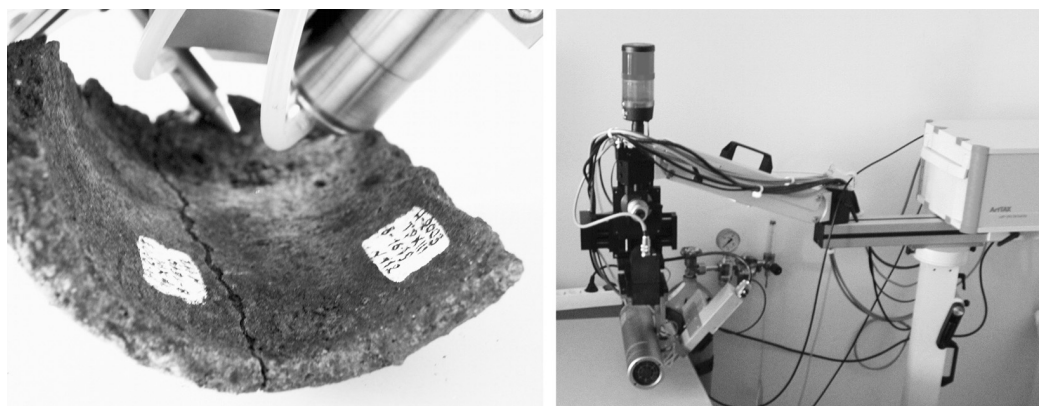
### INTRODUCTION

Systematic archaeological excavation of medieval Novgorod has brought to light a wide range of evidence for metalworking from the middle of the 10th to the late 15th centuries. More than 30 jewellers' workshops have been excavated in the five Quarters (or Ends) of the medieval town (Kolchin 1985, 261). The most frequent finds of manufacturing evidence are crucibles: they appear in great numbers of individual fragments and at least 40 complete vessels. Well-preserved structural remains of streets and properties allow a very precise dating of workshop complexes and artefacts by dendrochronological methods.

There are no indications of primary metal processing in medieval Novgorod: non-ferrous and precious metals reached the town by various routes from Western and Eastern Europe, Byzantium and the Middle East. A detailed analytical investigation of 900 copper-based objects and metalworking debris from Novgorod made by Konovalov (2008) revealed the chemical characterization of the alloys used.<sup>1</sup> The material discussed below complements this by providing evidence of metal melting, refining and casting. The relationship between finished artefacts, metalworking debris and metallic residues from the crucibles offers a unique research opportunity, based on decades of archaeological work.

### METHODOLOGY

The 120 samples from Novgorod were examined at the Department of Archaeology, Moscow State University, by optical microscopy with reference to details of their construction, fabric and the preserved traces of metal. The major part of examined samples contains metalliferous deposits instead of original metal. The identification of the metal nature was based on non-destructive ED-XRF qualitative analyses, using an instrument and software ArtTAX (Röntgenanalysen-Technik) fitted with a Mo target and semiconductor detector (Figure 13.1). Typical analytical conditions were a tube voltage of 50 kV and a current of 700  $\mu$ A. Each spectrum was recorded for 180 seconds. The measuring head contains a video camera recording a sample surface



**Figure 13.1** ED-XRF ArtTAX system with a sample positioning laser spot delimiting the position of the incident X-ray beam on the sample surface.

area of approximately  $6 \times 4$  mm. A sample positioning laser spot is used to delimit the position of the incident X-ray beam on the sample surface (Figure 13.2). Small metal prills have been analyzed with a 0.2 mm collimator. The scan/mapping device has been set up to analyze large areas of the inner and outer surface of crucible sherds.

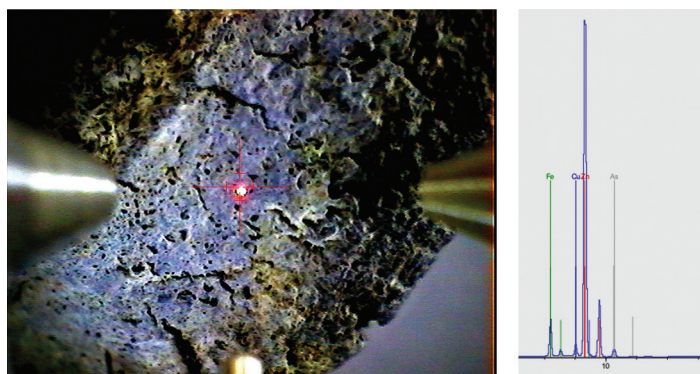
In practice, the chemical composition of metallic elements detected in crucible residues differs in many ways from its true composition due to the complicated structure of the crucible slag and its heterogeneity, as well as the influence of metal corrosion and metal surface enrichment (Bayley 1992, 817–818; Dungworth 2000, 83–86). However, with caution qualitative results can be interpreted to estimate what metal or alloy was melted in the crucible.

In addition, two polished cross-sections of crucible bodies were analysed by optical and scanning electron microscopy (SEM) at the laboratories of the Institute of Archaeology, UCL, for the compositions of ceramic fabrics and slags.

## CHRONOLOGICAL VARIATIONS

About 80% of finds derive from the Nerevsky and Troitsky sites, situated on the St. Sophia (the West) side of the river Volkhov, and the Duboshin site situated on the Trade (the East) side of the city (Figure 13.3). On the basis of morphological features crucibles are classified into 12 main types.

From the early deposits of Troitsky and Nerevsky sites (mid 10th to late 11th centuries) there are predominately open cylindrical crucibles, conical vessels with a wide triangular mouth, open flat-bottom spoons with long tubular handles, open and lidded boat-shaped vessels, and shallow dishes (Figure 13.4). They vary in height, diameter and clay fabric. The volume of the early crucibles is estimated to be from 4 up to 50 cm<sup>3</sup>, equivalent to a metal weight of between 30 and 400 grams.



**Figure 13.2** A sample surface area of approx.  $6 \times 4$  mm with positioning spot and the X-ray spectrum of the crucible lid (Troitsky XII, Property E, late 11th century).

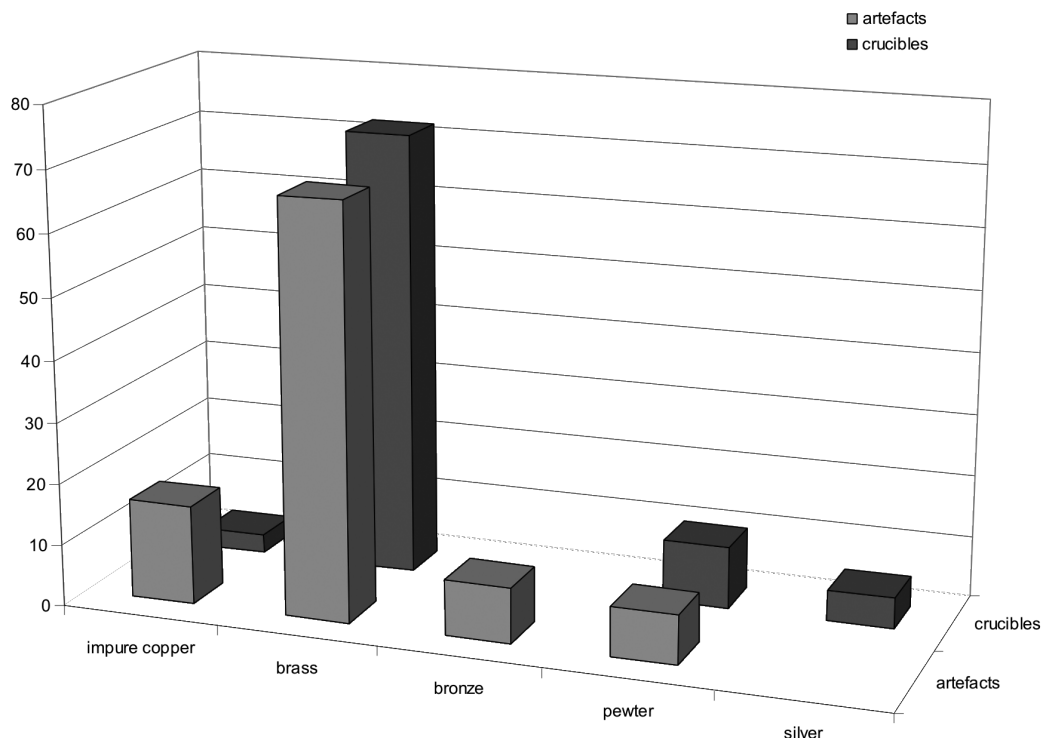


**Figure 13.3** Plan of medieval Novgorod showing the location of excavations as well as distribution and relative concentrations of crucibles. Sites: 9 – Nerevsky, 10 – Ilynsky, 14 – Tikhvinsky, 15 – Mikhilovsky, 18 – Kirovsky, 20 – Troitsky, 23 – Duboshin, 24 – Nutny, 39 – Nikitinsky.



**Figure 13.4** Selection of crucibles from the Nerevsky site, Novgorod (10th–11th centuries): 1–2) open flat-bottom spoons with tubular handles; 3) 'sealed' boat-shaped vessel; 4) boat-shaped vessel with a solid handle; 5) cylindrical crucibles.

Analysed examples of crucible charge show brass (Cu-Zn), ternary brass (Cu-Zn-Pb), impure copper, silver and pewter. The range of artefact composition is very similar, except for silver samples that have not been identified among the jewellery and metalworking debris, and bronze samples have not been found among the crucible residues (Figure 13.5). There is no particular type of metal or alloy processing in the open cylindrical crucibles and conical vessels with a wide triangular mouth. On the other hand, a group of open flat-bottomed spoons with tubular handles is a



**Figure 13.5** Composition of artefacts and crucible residues (10th–11th centuries).

good example of special purpose melting vessels (Figure 13.4.1, 2). They have been made of non-refractory red or grey clay and have no traces of vitrification or even high temperature effects. No slag or visible metal remains have been detected on the inner surface of the spoons microscopically. However, XRF analyses show that these crucibles contain lead, tin or pewter.

Shallow dishes with diameters of 55–65 mm and height of 20–25 mm were intended for small-scale silver testing or refining (Bayley 1992, 748–749). They have been made of low refractory grey clay with low alumina and high potash, soda and lime concentrations, tempered with quartz grains and charcoal. Their vitrified upper surfaces appear olive-green and dark red indicating that these dishes were heated directly from above (Figure 13.6). Silver, lead and copper were detectable on the upper surface of the shallow dishes (Table 13.1).

Source	Na <sub>2</sub> O	MgO	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	K <sub>2</sub> O	CaO	TiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	CuO	Ag <sub>2</sub> O	PbO
Ceramic fabric	1.34	0.53	3.60	49.58	2.48	0.64	0.25	1.83	21.00	4.94	13.80
Metal slag	1.28	0.50	1.93	29.68	0.98	0.72	0.27	1.93	36.85	8.38	17.48

**Table 13.1** Average composition of ceramic fabric and metal slag of the shallow dish (SEM/EDX analyses normalized to 100wt% for all elements).



## METAL MELTING CRUCIBLES FROM MEDIEVAL NOVGOROD

“Sealed” boat-shaped vessels provided with a handle placed horizontally to their back edge and with a narrow slit on the top were intended for silver refining and melting (Figure 13.4.3, 4). In contrast to the dark grey ceramic fabric of most melting vessels tempered with medium-coarse quartz grains (Figure 13.7.1), the latter group of crucibles is made of fine white or grey-light clay (Figure 13.7.2). They were used as a jeweller’s container for safe keeping of silver scrap; silver remains were identified inside the crucibles. The spout of the filled vessel was struck off only before the melting of the metal, probably once the vessel was full or a small amount of silver needed.

The dynamics of the metal craft development seem to start changing during the 12th to 13th centuries when one can see an increase of the availability of metal in Novgorod (Rybina 2001, 231). The amount of non-ferrous and precious metal objects suggest that they were produced on a large scale. This increase in availability is also testified by the increase of crucible volumes up to 100 cm<sup>3</sup> and a wide range of alloys found in the metal melting vessels of different shapes, volumes and functions (Figure 13.8). Besides brass, copper and tin-lead alloys there are now tin-bronze (Cu-Sn), leaded copper (Cu-Pb), gunmetal, sterling and debased silver and gold. The range of artefact composition, however, does not change much over the earlier period (Figure 13.9).

The largest dateable assemblage of crucibles comes from the Troitsky site. Over 120 sherds and 4 complete cylindrical round-bottomed crucibles come from property E, dated to the late 11th–early 12th century (Figure 13.10). They show a remarkable standardization with the same height (94–95 mm), diameter (45 mm), wall and bottom thickness (5 and 10 mm), volume (60 cm<sup>3</sup>) as well as a dark grey, charcoal-tempered fabric of fine clay with a small amount of quartz. The slags inside of these crucibles are very rich in zinc oxide and contain copper and lead. Undoubtedly, all these vessels were used for brass melting. Some of them had round lids preventing zinc evaporation (Figure 13.10.2). The dark violet ceramic fabric of the lids is tempered with abundant quartz grains, amounting to around 70% by volume. The main metallurgical contamination is zinc oxide, reaching up to 57% by weight together with copper and lead oxides in lower concentrations (Table 13.2).

Source	MgO	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	K <sub>2</sub> O	CaO	TiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	CuO	ZnO	PbO
Ceramic fabric	0.77	20.56	68.74	2.27	2.09	1.25	3.79	0.35	0.69	-
Metal slag	0.94	1.4	30.80	0.19	0.40	0.09	4.29	0.14	57.13	1.76

**Table 13.2** Average composition of ceramic fabric and metal slag of the cylindrical round-bottomed crucibles (SEM/EDX analyses normalized to 100wt% for all elements).

The late 12th to early 13th centuries were a period of flourishing metalworking activity on Property A of the Troitsky site, which belonged to the priests and artists of St. Sophia’s Cathedral. About 20 small crucibles were found among goldsmiths’



**Figure 13.6** *Shallow dish fragment from the Nerevsky site, Novgorod (Property B, early 11th century).*

and painters' tools, ecclesiastical and ordinary items (Kolchin *et al.* 1981, 129–135). The boat-shaped vessels were made of fine, white clay and partly closed (Figure 13.8.4). The chemical analyses of the metal prills inside these crucibles allowed us to identify debased gold and silver as well as drops of mercury. The combination of gold and silver with mercury indicates amalgam preparation. This was possibly applied to the richly decorated icon frames made of copper and found at the same workshop.

Over the course of the 14th to 15th centuries the wide variety of crucible forms and their significant quantities provide the evidence for thriving metalworking activity in the town. Open round-bottomed cylindrical or conical vessels of different size and open boat-shaped crucibles predominate in these late deposits (Figure 13.11).

Large stoneware crucibles were introduced to the casting technique in the late 14th to early 15th centuries (Figure 13.12). A remarkable concentration of stoneware melting vessels was found on the Duboshin site in the upper layers dated to the period c 1392–1415 (Gaidukov 1997, 63). They were also found at the workshops of properties



**Figure 13.7** Crucibles: 1) open boat-shaped crucible showing the ceramic fabric with abundant quartz grains ((Troitsky XII, Property E, mid-11th century); 2) 'sealed' boat-shaped crucible made of fine white clay.

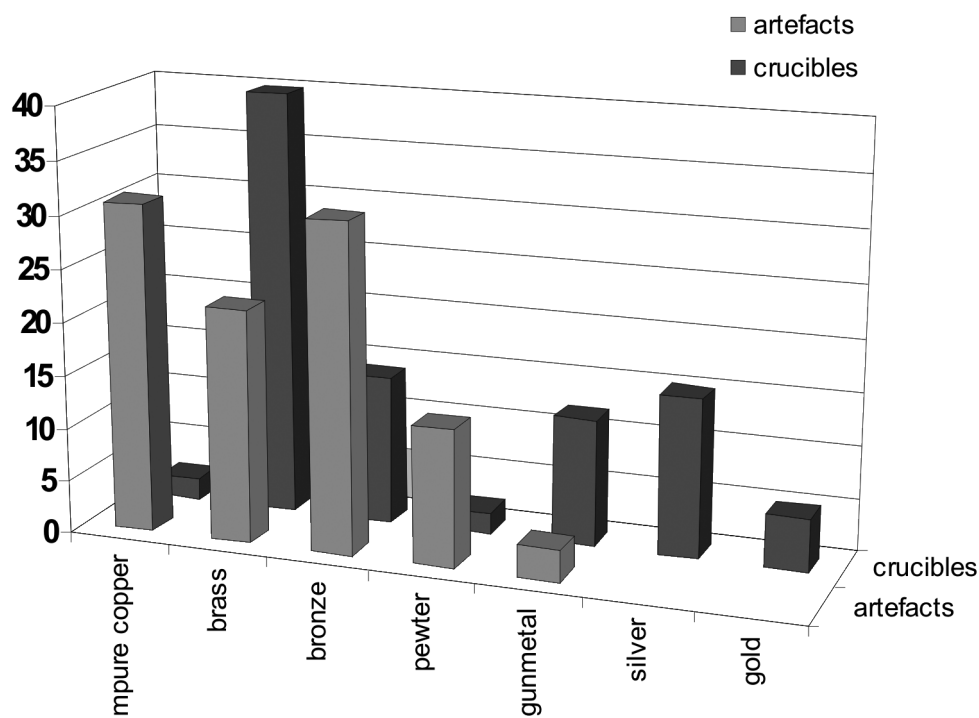




**Figure 13.8** Selection of crucibles from the Troitsky site, Novgorod (12–13th centuries): 1–2) shallow dishes for silver cupellation; 3) open boat-shaped vessel; 4) small crucibles from the priest's workshop (Property A).

B and E on the Nerevsky site, dated to 1382–1429 and from the Troitsky Property E dated to the mid 15th century (Zasurtzev 1963, 71–72; Yanin *et al.* 1996, 7). All crucibles were large enough to hold several kg of bronze, indicating an industrial scale of casting activity during the last centuries of the Novgorod republic. Remarkable concentrations of metalworking debris including copper alloy ingots, wire and scrap derive from the late deposits. Written sources testify that non-ferrous metals came

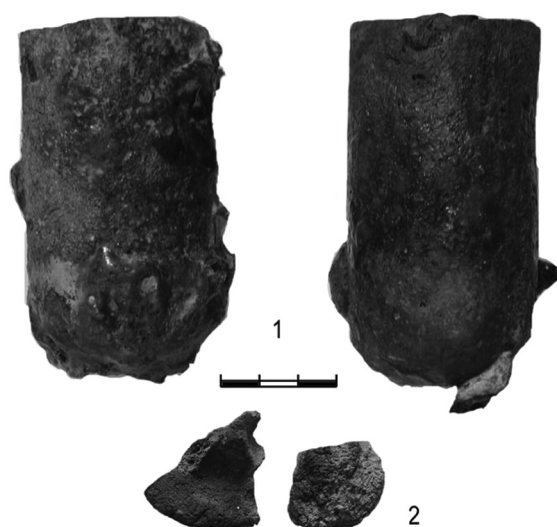
## METAL MELTING CRUCIBLES FROM MEDIEVAL NOVGOROD



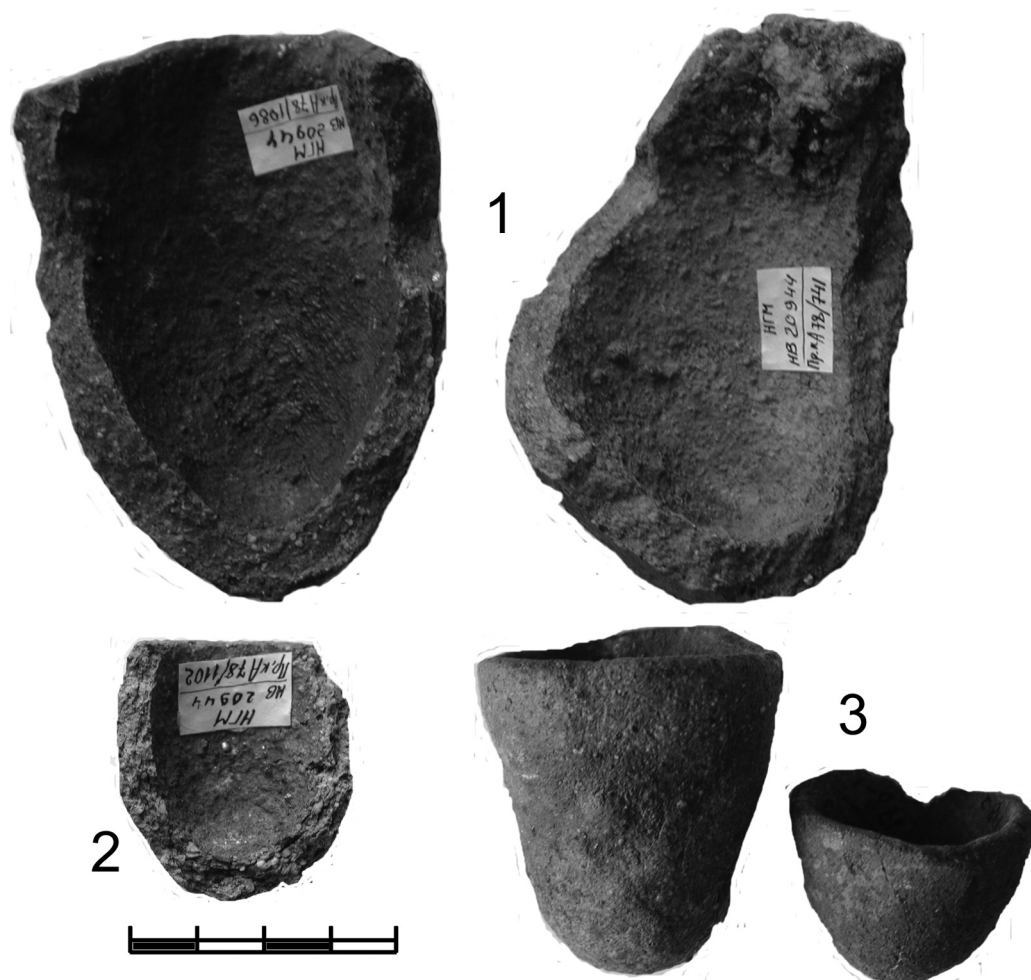
**Figure 13.9** Composition of artefacts and crucible residues (12th–13th centuries).

to Novgorod market as irregular lumps and regular ingots, wire hanks, fragments of vessels and cauldrons and reused scrap packed in big stave-built vessels (Choroshkevich 1963, 314–315). A large-size lead ingot with the stamp of the Polish king Kazimierz the Great weighing at least 151 kg discovered during excavations on the Ilynsky site allows us to estimate the scale of metal import into Novgorod in the 14th century (Yanin 1966, 324).

Lidded crucible forms continued to be in use up to the 14th century but never occurred in the 15th century. In contrast to



**Figure 13.10** Crucibles from the Troitsky site, Novgorod (Property E, late 11th to early 12th century). Standard cylindrical round-bottom vessels with lids for brass melting.

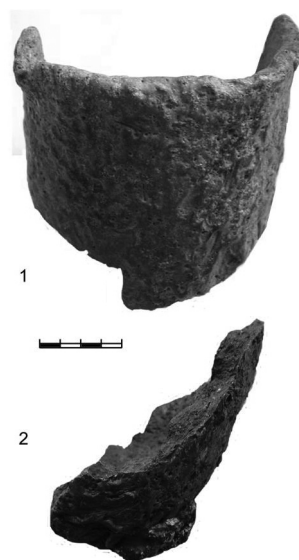


**Figure 13.11** Selection of crucibles from the Nerevsky site, Novgorod (14th–15th centuries). Cylindrical and conical vessels of different size.

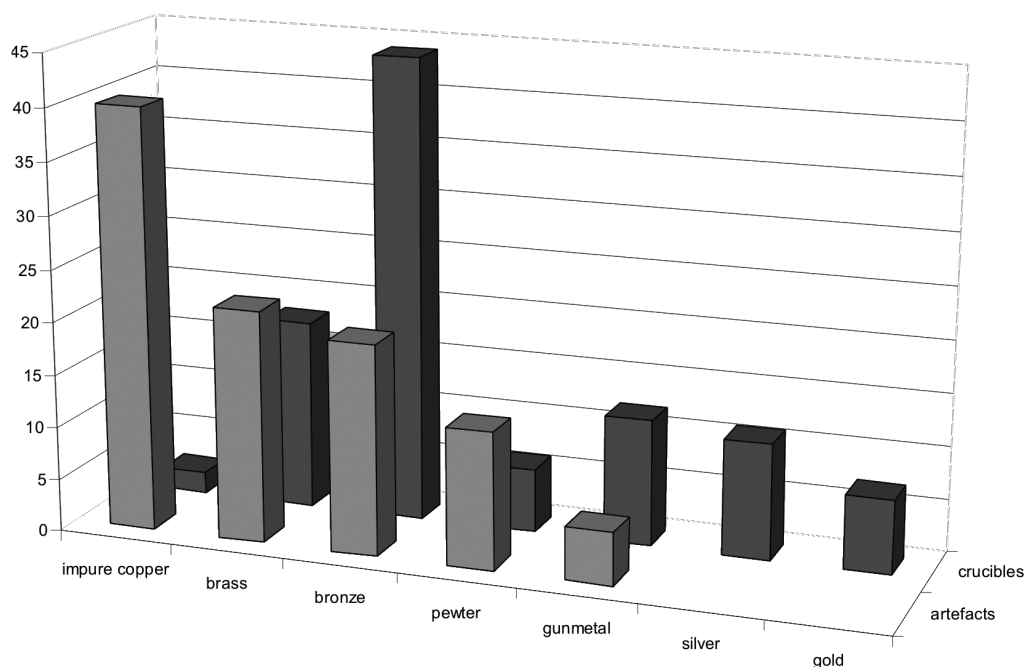
the previous periods there are no open flat-bottomed spoons with tubular handles for lead/tin melting and shallow dishes for silver testing and cupellation. Analysed examples of the crucible slags and metal remains revealed that jewellers used small vessels for the melting of gold and silver, while large crucibles were used mainly for bronze, leaded bronze and gunmetal. The compositional range of analysed objects, ingots, scrap and waste metal shows a different distribution; they include impure copper, brass, bronze and pewter (Figure 13.13).

## SUMMARY

The intensive archaeological study of medieval Novgorod over the past 75 years has produced over 3000 single crucible fragments and 40 complete vessels providing evidence of metal melting, refining and casting in the workshops situated in the five Quarters (or Ends) of the town. This study focuses on the investigation of the chronological distribution of the crucibles, their fabric, and the chemical characterization of the metal and alloys melted in vessels of different shapes and sizes. A total of 120 samples from the Nerevsky, Troitsky and Duboshin sites were examined by optical microscopy with reference to details of their construction, fabric and the preserved traces of metal slag and metal prills. The identification of the metal was provided by non-destructive ED-XRF qualitative analyses. The range of metallic residues from the crucibles, in contrast to the range of almost 900 copper-based objects'



**Figure 13.12** Large stoneware crucibles from the Duboshin site, Novgorod (late 14th–early 15th centuries).



**Figure 13.13** Composition of artefacts and crucible residues (14th–15th centuries).

composition, provides an interesting research opportunity for an estimation of the raw materials that came to jewellers' workshops from different sources.

On the basis of morphological features, the crucibles may be classified into 12 main types. From the mid-tenth to late eleventh centuries there were open cylindrical crucibles, conical vessels with a wide triangular mouth, open flat-bottomed spoons with long tubular handles, open and lidded boat-shaped vessels and shallow dishes. Analysed examples of crucible charge show brass (Cu-Zn), ternary brass (Cu-Zn-Pb), impure copper, silver and pewter. The range of artefact composition is very similar, except for silver and bronze samples.

The dynamics of the development of the metal craft seem to start changing during the 12th to 13th centuries when one can see an increase in the availability of metal in Novgorod. The amount of non-ferrous and precious metal objects suggests that they were produced on a large scale. This increase in availability is also testified by the increase of crucible volumes up to 100 cm<sup>3</sup> and a wide range of alloys found in the metal-melting vessels of different shapes, volumes and functions. Besides brass, copper and tin-lead alloys there are now tin-bronze (Cu-Sn), leaded copper (Cu-Pb), gunmetal, sterling and debased silver and gold. The range of artefact composition, however, does not change much compared with the earlier period.

Over the course of the 14th to 15th centuries the wide variety of crucible forms and their significant quantities provide the evidence for thriving metalworking activity in the town. Open round-bottomed cylindrical or conical vessels of varying size and open boat-shaped crucibles predominate in these late deposits. The increase in crucible volume testifies to an increase in the importation and availability of raw materials for non-ferrous metalworking from the 12th to the 15th centuries.

## CONCLUSIONS

The analyses of crucibles from Novgorod have shown a great variety of crucible forms, sizes and fabrics. There is some clear correlation between forms and alloy types; the shallow dishes and small boat-shaped vessels made of fine white clay were solely intended for precious metal working, and the early lidded tubular crucibles with a porous fabric are mostly used for brass melting. Open flat-bottomed spoons with long tubular handles were well fitted for lead, tin and pewter melting at low temperatures, not requiring particularly refractory ceramics. The relatively late, large stoneware crucibles were predominantly linked to bronze. On the other hand, gold, silver and pewter were all identified in both big and small cylindrical and conical vessels made of fine, medium coarse and coarse fabrics, indicating an opportunistic crucible manufacture, probably for small-scale, ad-hoc castings. There seems to be a general trend towards larger size cylindrical and conical crucibles from the 12th to the 15th centuries.

The increase of crucible volume testifies to an increase in the importation and availability of raw materials for non-ferrous metalworking. During the 11th and 12th

centuries a growing metal market in Novgorod was supplied by Gotlanders. Within a century Novgorod became a part of the Hanseatic system and the main gate in the Russian-European metal trade.

### Acknowledgements

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### Note

- 1 Konovalov (2008) obtained his data for ten major (Cu, Sn, Pb, Zn) and minor (Ag, As, Sb, Bi, Ni, Au) elements by optical emission spectroscopy.