THE MORPHOLOGICAL AND ANATOMICAL INTERPRETATION AND IDENTIFICATION OF CHARRED VEGETATIVE PARENCHYMATOUS PLANT REMAINS

by

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SCANNING ELECTRON MICROGRAPH ILLUSTRATIONS

Introduction

Illustrating the chapters devoted to the results and the discussion of the research presented here are a series of scanning electron micrographs contained in this, the second volume of this thesis. The seventy plates, each with ten figures, has facing them a caption page giving brief details of the taxon illustrated, the tissue and other relevant comments. The acronyms relating to the surfaces in view are explained below.

TS  Transverse Surface
LS  Longitudinal Surface
RLS Radial Longitudinal Surface
TLS Tangential Longitudinal Surface
OS  Oblique Surface

The vegetative plant tissues under study are illustrated on plates 1 to 59; additional plant and non-plant materials are illustrated on plates 60 to 64 and archaeological materials on plates 65 to 70. An index to the illustration plates is included after this.
PLATE 1

*Pteridium aquilinum*
PLATE 1

FIGURES 1 - 10: Pteridium aquilinum

FIGURE 1 Rhizome showing concentric dictyosteles separated by fibre cylinder. TS. Charred fresh.

FIGURE 2 Rhizome meristele. TS. Charred fresh.

FIGURE 3 Rhizome xylem. TS. Charred fresh.

FIGURE 4 Rhizome sclerenchyma. TS. Charred fresh.

FIGURE 5 Rhizome. Oblique fracture plane. Charred fresh.

FIGURE 6 Rhizome. TS. Charred fresh.

FIGURE 7 Rhizome parenchyma. TS. Charred fresh.

FIGURE 8 Rhizome parenchyma. TS. Charred fresh.

FIGURE 9 Rhizome parenchyma. LS. Charred fresh.

FIGURE 10 Rhizome. LS. Charred fresh.

SCALES 1, 2, 5 and 6 = 1mm. 3, 4, 7 - 9 = 100 μm.
PLATE 2

Dryopteris filix-mas
FIGURES 1 - 10: *Dryopteris filix-mas*

FIGURE 1 Rootstock showing periderm, meristele and parenchyma. TS. Charred fresh.

FIGURE 2 Rootstock periderm and cortex. TS. Charred fresh.

FIGURE 3 Rootstock periderm and cortex. TS. Charred fresh.

FIGURE 4 Rootstock; single meristele. TS. Charred Fresh.

FIGURE 5 Rootstock; xylem. TS. Charred fresh.

FIGURE 6 Rootstock; xylem TS. Charred fresh.

FIGURE 7 Rootstock; parenchyma. TS. Charred fresh.

FIGURE 8 Rootstock. LS. Charred fresh.

FIGURE 9 Rootstock; xylem. LS. Charred fresh.

FIGURE 10 Rootstock; parenchyma. LS. Charred fresh.

SCALES 1, 3 and 4 = 1mm. 2, 5 - 10 = 100 μm
PLATE 3

Polypodium interjectum
PLATE 3

FIGURES 1 - 10: Polypodium interjectum

FIGURE 1 Rhizome. TS. Charred dry.

FIGURE 2 Rhizome; parenchyma. TS. Charred dry.

FIGURE 3 Rhizome. LS. Charred dry.

FIGURE 4 Rhizome; parenchyma. LS. Charred dry.

FIGURE 5 Rhizome meristele and parenchyma. TS. Charred dry.

FIGURE 6 Rhizome meristeles. TS. Charred dry.

FIGURE 7 Rhizome meristeles. LS. Charred dry.

FIGURE 8 Rhizome. TS. Charred fresh.

FIGURE 9 Rhizome; periderm. TS. Charred fresh.

FIGURE 10 Rhizome; parenchyma. LS. Charred fresh.

SCALES 1, 3, 5, 8 and 9 = 1mm. 2, 4, 6, 7 and 10 = 100μm.
PLATE 4

Nuphar advena
PLATE 4

FIGURES 1 - 10: *Nuphar advena*

FIGURE 1 Rhizome. TS. Charred dry.

FIGURE 2 Rhizome; aerenchyma. TS. Charred dry.

FIGURE 3 Rhizome. LS. Charred dry.

FIGURE 4 Rhizome; aerenchyma. LS. Charred dry.

FIGURE 5 Rhizome; aerenchyma. LS. Charred dry.

FIGURE 6 Rhizome; starch grains. LS. Charred dry.

FIGURE 7 Rhizome; starch grains. LS. Charred dry.

FIGURE 8 Rhizome; starch grains. TS. Charred dry.

FIGURE 9 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 10 Rhizome; xylem. TS. Charred dry.

SCALES 1-4 = 1mm. 5 - 10 = 100μm
PLATE 5

*Nymphaea alba*

*Anemone nemorosa*
PLATE 5

FIGURES 1 - 5: Nymphaea alba, 6 - 10: Anemone nemorosa

FIGURE 1  Rhizome periderm and parenchyma. TS. Charred dry.

FIGURE 2  Rhizome; pith parenchyma. TS. Charred dry.

FIGURE 3  Rhizome; pith parenchyma. TS. Charred fresh.

FIGURE 4  Rhizome; aerenchyma. TS. Charred dry.

FIGURE 5  Rhizome. asterosclereides in aerenchyma. Charred dry.

FIGURE 6  Rhizome. TS. Charred dry.

FIGURE 7  Rhizome; cortex. TS. Charred dry.

FIGURE 8  Rhizome; cortical parenchyma. TS. Charred dry.

FIGURE 9  Rhizome; cortex/pith boundary, parenchyma. TS. Charred dry.

FIGURE 10 Rhizome; Pith parenchyma. TS. Charred dry.

SCALES 1, 4, 6 and 10 = 1 mm. 2, 3, 5, 7 - 9 = 100 µm
PLATE 6

Anemone nemorosa

Ranunculus ficaria
FIGURES 1 - 6: *Anemone nemorosa*, 7 - 10: *Ranunculus ficaria*

FIGURE 1 Rhizome; pith parenchyma. TS. Charred dry.

FIGURE 2 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 3 Rhizome. LS. Charred dry.

FIGURE 4 Rhizome. TS. Charred fresh.

FIGURE 5 Rhizome; parenchyma. TS. Charred fresh.

FIGURE 6 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 7 Root tuber; stele intact. TS. Charred dry.

FIGURE 8 Root tuber; stele deteriorated. TS. Charred dry.

FIGURE 9 Root tuber. LS. Charred dry.

FIGURE 10 Root tuber; parenchyma. LS. Charred dry.

SCALES 3, 4, 7 - 10 = 1mm. 1, 2, 5 and 6 = 100μm
PLATE 7

Ranunculus ficaria
PLATE 7

FIGURES 1 - 10: Ranunculus ficaria

FIGURE 1 Root tuber; parenchyma. TS and LS. Charred dry.

FIGURE 2 Root tuber; parenchyma. LS. Charred dry.

FIGURE 3 Root tuber; parenchyma. LS. Charred dry.

FIGURE 4 Root tuber; epidermis. TS. Charred dry.

FIGURE 5 Root tuber; starch grains. TS. Charred dry.

FIGURE 6 Root tuber; distal end. Charred fresh.

FIGURE 7 Root tuber; epidermal surface. Charred fresh.

FIGURE 8 Root tuber. Charred fresh.

FIGURE 9 Root tuber. TS. Charred fresh.

FIGURE 10 Root tuber TS. Charred fresh.

SCALES 6, 8 and 9 = 1mm. 1 - 4 and 7 = 100μm. 5 = 10μm.
PLATE 8

Gypsophila struthium

Beta vulgaris ssp maritima
PLATE 8

FIGURES 1 - 6: *Gypsophila struthium*, 7 - 10: *Beta vulgaris ssp maritima*

FIGURE 1 Secondary root; phloem and xylem. TS. Charred dry.

FIGURE 2 Secondary root; xylem. TS. Charred dry.

FIGURE 3 Secondary root; xylem. TS. Charred dry.

FIGURE 4 Secondary root; druses. Charred dry.

FIGURE 5 Secondary root. LS. Charred dry.

FIGURE 6 Secondary root; xylem. LS. Charred dry.

FIGURE 7 Secondary root; TS. Fractured prior to charring. Charred dry.

FIGURE 8 Secondary root; TS. Fractured prior to charring. Charred dry.

FIGURE 9 Secondary root; TS. Fractured after charring. Charred dry.

FIGURE 10 Secondary root; Pericyclic parenchyma. TS. Charred dry.

SCALES 1, 2, 5, 7 - 9 = 1mm. 3, 4, 6 and 10 = 100µm.
PLATE 9

Beta vulgaris ssp maritima

Beta vulgaris ssp vulgaris
PLATE 9

FIGURES 1 - 6: *Beta vulgaris* ssp *maritima*

7 - 10: *Beta vulgaris* ssp *vulgaris*

FIGURE 1 Secondary root. TS. Charred dry.

FIGURE 2 Secondary root. TS. Charred dry.

FIGURE 3 Secondary root. TS. Charred dry.

FIGURE 4 Secondary root. TS. Charred dry.

FIGURE 5 Secondary root. TS. Charred dry.

FIGURE 6 Secondary root. TS. Charred dry.

FIGURE 7 Secondary root. TS. Charred dry.

FIGURE 8 Secondary root. TS. Charred dry.

FIGURE 9 Secondary root. TS. Charred dry.

FIGURE 10 Secondary root. TS. Charred dry.

SCALES 1, 2, 4, 6 - 10 = 1mm. 3 and 5 = 100μm.
Beta vulgaris ssp vulgaris
Polygonum bistorta
FIGURES 1 - 5: *Beta vulgaris* ssp *vulgaris*

6 - 10: *Polygonum bistorta*

FIGURE 1 Secondary root. TS. Charred dry.

FIGURE 2 Secondary root; parenchyma. TS. Charred dry.

FIGURE 3 Secondary root. TS. Charred fresh.

FIGURE 4 Secondary root. TS. Charred fresh.

FIGURE 5 Secondary root. TS. Charred fresh.

FIGURE 6 Rootstock. TS. Charred dry.

FIGURE 7 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 8 Rootstock; cortical parenchyma. TS. Charred dry.

FIGURE 9 Rootstock; pith parenchyma. TS. Charred dry.

FIGURE 10 Rootstock; xylem. LS. Charred dry.

SCALES 1, 3 - 9 = 1mm. 2 and 10 = 100μm.
PLATE 11

Polygonum bistorta

Rheum palaestinum

Rheum rhaponticum
PLATE 11

FIGURES 1 - 2: Polygonum bistorta, 3 - 7: Rheum palaestinum
8 - 10: Rheum rhaponticum

FIGURE 1 Rootstock; xylem. LS. Charred dry.

FIGURE 2 Rootstock; druse. Charred dry.

FIGURE 3 Rootstock; xylem. TS. Charred dry

FIGURE 4 Rootstock; xylem. TS. Charred dry.

FIGURE 5 Rootstock; xylem. TS. Charred dry.

FIGURE 6 Rootstock; LS. Charred dry.

FIGURE 7 Rootstock; LS. Charred dry.

FIGURE 8 Rootstock; TS. Charred fresh.

FIGURE 9 Rootstock; TS. Charred fresh.

FIGURE 10 Rootstock; TS Charred fresh.

SCALES 3, 4, 6 - 10 = 1mm. 2 and 5 = 100µm. 1 = 10µm
PLATE 12

Rheum rhaponticum

Bryonia dioica
PLATE 12

FIGURES 1 - 6: *Rheum rhaponticum*, 7 - 10: *Bryonia dioica*

FIGURE 1 Rootstock. TS. Charred dry.

FIGURE 2 Rootstock; xylem. TS. Charred dry.

FIGURE 3 Rootstock. LS. Charred dry.

FIGURE 4 Rootstock. LS. Charred dry.

FIGURE 5 Rootstock; xylem. OS. Charred dry.

FIGURE 6 Rootstock; druse. Charred dry.

FIGURE 7 Root tuber; periderm. TS. Charred dry.

FIGURE 8 Root tuber; periderm. TS. Charred dry.

FIGURE 9 Root tuber; deteriorated tissue. TS. Charred dry.

FIGURE 10 Root tuber; deteriorated cortex. TS. Charred dry.

SCALES 3, 7 - 10 = 1mm. 1, 2, 4 - 6 = 100μm
PLATE 13

Bryonia dioica

Armoracia rusticana
PLATE 13

FIGURES 1 - 5: Byronia dioica, 6 - 10: Armoracia rusticana

FIGURE 1 Root tuber; cortex. TS. Charred dry.

FIGURE 2 Root tuber; vesicle wall. TS. Charred dry.

FIGURE 3 Root tuber. LS. Charred dry.

FIGURE 4 Root tuber. LS. Charred dry.

FIGURE 5 Root tuber; vesicle wall. LS. Charred dry.

FIGURE 6 Secondary root; phloem (top), xylem (bottom). TS. Charred dry.

FIGURE 7 Secondary root; phloem. TS. Charred dry.

FIGURE 8 Secondary root; xylem. TS. Charred dry.

FIGURE 9 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 10 Secondary root; xylem. LS. Charred dry.

SCALES 3 - 5 = 1mm. 1, 2, 6 - 10 = 100μm.
PLATE 14

*Armoracia rusticana*

*Brassica campestris ssp rapifera*

*Crambe cordifolia*
PLATE 14

FIGURES 1 - 2: Armoracia rusticana, 3 - 7: Brassica campestris
            ssp rapifera, 8 - 10: Crambe cordifolia

FIGURE 1 Secondary root; xylem. LS. Charred dry.

FIGURE 2 Secondary root; xylem. LS. Charred dry.

FIGURE 3 Secondary root; deteriorated parenchyma. TS. Charred dry.

FIGURE 4 Secondary root; deteriorated parenchyma. TS. Charred dry.

FIGURE 5 Secondary root; deteriorated parenchyma. LS. Charred dry.

FIGURE 6 Secondary root; deteriorated parenchyma. LS. Charred dry.

FIGURE 7 Secondary root; deteriorated parenchyma. LS. Charred dry.

FIGURE 8 Secondary root. TS. Charred dry.

FIGURE 9 Secondary root. TS. Charred dry.

FIGURE 10 Secondary root. LS. Charred dry.

SCALES  5, 6 and 8 = 1mm. 1, 3, 4, 7, 9 and 10 =100μm. 2 = 10μm.
PLATE 15

*Crambe cordifolia*

*Crambe maritima*
PLATE 15

FIGURES 1 - 7: Crambe cordefolia, 8 - 10: Crambe maritima

FIGURE 1 Secondary root; parenchyma. LS. Charred dry.

FIGURE 2 Secondary root; xylem. LS. Charred dry.

FIGURE 3 Secondary root. TS. Charred dry.

FIGURE 4 Secondary root. TS. Charred dry.

FIGURE 5 Secondary root; xylem. TS. Charred dry.

FIGURE 6 Secondary root; parenchyma. TS. Charred dry.

FIGURE 7 Secondary root. LS. Charred dry.

FIGURE 8 Secondary root. TS. Charred dry.

FIGURE 9 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; xylem. TS. Charred dry.

SCALES  3, 7 and 8 = 1mm. 1, 2, 4, 5, 9 and 10 = 100 μm.
PLATE 16

*Crambe maritima*

*Raphanus sativus*

ssp *radiculata*
PLATE 16

FIGURES 1 - 7: Crambe maritima, 8 - 10: Raphanus sativus

FIGURE 1 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 2 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 3 Secondary root; pith parenchyma. TS. Charred dry.

FIGURE 4 Secondary root; pith parenchyma starch grains. TS. Charred dry

FIGURE 5 Secondary root. TS. Charred fresh.

FIGURE 6 Secondary root; xylem. TS. Charred fresh.

FIGURE 7 Secondary root; phloem. TS. Charred fresh.

FIGURE 8 Secondary root. TS. Charred dry.

FIGURE 9 Secondary root; parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; parenchyma. TS. Charred dry.

SCALES 1, 3, 5, 6, 8 and 10 = 1mm. 2, 4, 7 and 9 = 100μm
FIGURES 1 - 7: *Crambe maritima*, 8 - 10: *Raphanus sativus*

FIGURE 1 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 2 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 3 Secondary root; pith parenchyma. TS. Charred dry.

FIGURE 4 Secondary root; pith parenchyma starch grains. TS. Charred dry.

FIGURE 5 Secondary root. TS. Charred fresh.

FIGURE 6 Secondary root; xylem. TS. Charred fresh.

FIGURE 7 Secondary root; phloem. TS. Charred fresh.

FIGURE 8 Secondary root. TS. Charred dry.

FIGURE 9 Secondary root; parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; parenchyma. TS. Charred dry.

SCALES 1, 3, 5, 6, 8 and 10 = 1mm. 2, 4, 7 and 9 = 100μm
PLATE 17

*Raphanus sativus*

ssp *radiculata*

*Cyclamen persicum*
PLATE 17

FIGURES 1 - 2: Raphanus sativus, 3 - 10: Cyclamen persicum

FIGURE 1 Secondary root; xylem. TS. Charred dry.

FIGURE 2 Secondary root; parenchyma. LS. Charred dry.

FIGURE 3 Stem tuber; periderm. TS. Charred dry.

FIGURE 4 Stem tuber; parenchyma. TS. Charred dry.

FIGURE 5 Stem tuber; parenchyma. TS. Charred dry.

FIGURE 6 Stem tuber; small vascular bundle. TS. Charred dry.

FIGURE 7 Stem tuber; xylem of large vascular bundle. TS. Charred dry.

FIGURE 8 Stem tuber; parenchyma. TS. Charred fresh.

FIGURE 9 Stem tuber; parenchyma. TS. Charred fresh.

FIGURE 10 Stem tuber; parenchyma. TS. Charred fresh.

SCALES 2 - 4 and 10 = 1mm. 1, 5 - 9 = 100μm
PLATE 18

*Cyclamen persicum*

*Potentilla anserina*

*Lathyrus linifolius*
FIGURES 1 - 2: *Cyclamen persicum*, 3 - 8: *Potentilla anserina*  
9 - 10: *Lathyrus linifolius*

FIGURE 1 Stem tuber; vascular bundle. TS. Charred dry.

FIGURE 2 Stem tuber; xylem. LS. Charred dry.

FIGURE 3 Root. TS. Charred dry.

FIGURE 4 Root; cortex. TS Charred dry.

FIGURE 5 Root; deteriorated xylem. TS. Charred dry.

FIGURE 6 Root; parenchyma. TS. Charred dry.

FIGURE 7 Root; deteriorated xylem. TS. Charred dry.

FIGURE 8 Root; parenchyma. TS. Charred dry.

FIGURE 9 Root tuber. TS. Charred dry.

FIGURE 10 Root tuber; parenchyma. TS. Charred dry.

**SCALES**  
3 - 5 and 9 = 1 mm. 1, 2, 6 - 8 and 10 = 100 μm.
PLATE 19

Lathyrus linifolius
PLATE 19

FIGURE 1 - 10: *Lathyrus linifolius*

FIGURE 1 Root tuber; parenchyma. LS. Charred dry.

FIGURE 2 Root tuber; parenchyma. TS. Charred dry.

FIGURE 3 Root tuber; parenchyma. LS. Charred dry.

FIGURE 4 Root tuber; starch grains. Charred dry.

FIGURE 5 Root tuber. Charred fresh.

FIGURE 6 Root tuber. Charred fresh.

FIGURE 7 Root tuber; cortex. TS. Charred fresh.

FIGURE 8 Root tuber; parenchyma. TS. Charred fresh.

FIGURE 9 Root tuber; parenchyma. TS. Charred fresh.

FIGURE 10 Root tuber; parenchyma. TS. Charred fresh.

SCALES 5 and 6 = 1mm. 1 - 3, 7 - 10 = 100µm. 4 = 10µm
PLATE 20

Oenothera biennis
FIGURES 1 - 10: Oenothera biennis

FIGURE 1 Secondary root; periderm and phloem. TS. Charred dry.

FIGURE 2 Secondary root; xylem. TS. Charred dry.

FIGURE 3 Secondary root; xylem and pith. TS. Charred dry.

FIGURE 4 Secondary root; pith. TS. Charred dry.

FIGURE 5 Secondary root; xylem. TS. Charred dry.

FIGURE 6 Secondary root; xylem. RLS. Charred dry.

FIGURE 7 Secondary root; xylem. TLS. Charred dry.

FIGURE 8 Secondary root; xylem. TLS. Charred dry.

FIGURE 9 Secondary root; xylem. TLS. Charred dry.

FIGURE 10 Secondary root; xylem. TLS. Charred dry.

SCALES 1 - 3, 6, 7 and 9 = 1mm. 4, 5, 8 and 10 = 100µm.
PLATE 21

Biebersteinia multifida

Erodium glaucophyllum

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PLATE 21

FIGURES 1 - 9: Biebersteinia multifida, 10: Erodium glaucophyllum

FIGURE 1 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 2 Secondary root; vesicle in phloem. TS. Charred dry.

FIGURE 3 Secondary root; xylem. TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred dry.

FIGURE 5 Secondary root; xylem. TS. Charred dry.

FIGURE 6 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 7 Secondary root; xylem. OS. Charred dry.

FIGURE 8 Secondary root. LS. Charred fresh.

FIGURE 9 Secondary root. LS. Charred fresh.

FIGURE 10 Stem tuber. TS. Charred dry.

SCALES 1 - 3, 8 and 10 = 1mm. 4 - 7 and 9 = 100μm.
PLATE 22

Erodium glaucophyllum

Conopodium majus

Daucus carota ssp sativus
FIGURES 1 - 5: Erodium glaucophyllum, 6 - 9: Conopodium majus, 10: Daucus carota ssp sativus

FIGURE 1 Stem tuber; epidermis and cortical parenchyma.
TS. Charred dry.

FIGURE 2 Stem tuber; parenchyma. TS. Charred dry.

FIGURE 3 Stem tuber; vascular bundle. TS. Charred dry.

FIGURE 4 Stem tuber; vascular bundle. TS. Charred dry.

FIGURE 5 Stem tuber; xylem. TS. Charred dry.

FIGURE 6 Root tuber. TS. Charred dry.

FIGURE 7 Root tuber; cortex. TS. Charred dry.

FIGURE 8 Root tuber; cortex. TS. Charred dry.

FIGURE 9 Root tuber; parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; phloem parenchyma. TS. Charred dry.

Scales 1 - 3, 6 - 10 = 1mm. 2, 4 and 5 = 100μm.
PLATE 23

Daucus carota ssp sativus
PLATE 23

FIGURES 1 - 10: *Daucus carota* ssp *sativus*

FIGURE 1 Secondary root; phloem parenchyma. TS. Charred fresh.

FIGURE 2 Secondary root; xylem. TS. Charred dry.

FIGURE 3 Secondary root; xylem TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred fresh.

FIGURE 5 Secondary root; xylem. TS. Charred fresh.

FIGURE 6 Secondary root; cambial region. TS. Charred dry.

FIGURE 7 Secondary root; xylem parenchyma. TS. Charred fresh.

FIGURE 8 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 9 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; xylem TS. Charred fresh.

SCALES 1, 2, 4 - 7, 9 and 10 = 1mm. 3 and 8 = 100μm.
PLATE 24

*Daucus carota* ssp *sativus*

*Eryngium maritimum*

*Heracleum sphondylium*
PLATE 24

FIGURES 1 - 2: Daucus carota ssp sativus, 3 - 9: Eryngium maritimum, 10: Heracleum sphondylium

FIGURE 1 Secondary root; xylem. TS. Charred dry.

FIGURE 2 Secondary root; vesicle wall. LS. Charred fresh.

FIGURE 3 Secondary root. TS. Charred dry.

FIGURE 4 Secondary root. TS. Charred dry.

FIGURE 5 Secondary root; xylem and pith. TS. Charred dry.

FIGURE 6 Secondary root; phloem and periderm. TS. Charred dry.

FIGURE 7 Secondary root. LS. Charred dry.

FIGURE 8 Secondary root; xylem. LS. Charred dry.

FIGURE 9 Secondary root; druse. Charred dry.

Figure 10 Secondary root; xylem. TS. Charred dry.

SCALES 3 - 5, 7 and 10 = 1mm. 1 - 2, 6 and 8 = 100μm. 9 = 10μm.
PLATE 25

Heracleum sphondylium
PLATE 25

FIGURES 1 - 10: *Heracleum sphondylium*

FIGURE 1  Secondary root; phloem. TS. Charred dry.

FIGURE 2  Secondary root; xylem. TS. Charred dry.

FIGURE 3  Secondary root; xylem. TS. Charred dry.

FIGURE 4  Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 5  Secondary root; xylem. LS. Charred dry.

FIGURE 6  Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 7  Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 8  Secondary root; phloem. TS. Charred fresh.

FIGURE 9  Secondary root; xylem. TS. Charred fresh.

FIGURE 10 Secondary root; xylem. TS. Charred fresh.

SCALES  1 - 4 = 1 mm.  5 - 10 = 100 μm
PLATE 26

Heracleum sphondylium

Myrrhis odorata
PLATE 26

FIGURES 1 - 7: *Heracleum sphondylium*, 8 - 10: *Myrrhis odorata*

FIGURE 1 Secondary root; xylem. TS. Charred fresh.

FIGURE 2 Secondary root; xylem. LS. Charred fresh.

FIGURE 3 Secondary root; xylem. LS. Charred fresh.

FIGURE 4 Secondary root; xylem. LS. Charred fresh.

FIGURE 5 Secondary root; xylem. LS. Charred fresh.

FIGURE 6 Secondary root; xylem. LS. Charred fresh.

FIGURE 7 Secondary root; xylem. LS. Charred fresh.

FIGURE 8 Secondary root. TS. Charred dry.

FIGURE 9 Secondary root; phloem. TS. Charred dry.

FIGURE 10 Secondary root; Phloem and xylem. TS. Charred dry.

SCALES 1, 2, 5, 7 - 10 = 1mm. 3, 4 and 6 = 100μm.
PLATE 27

Myrrhis odorata

Pastinaca sativa
PLATE 27

FIGURES 1 - 4: Myrrhis odorata, 5 - 10: Pastinaca sativa

FIGURE 1  Secondary root; Phloem. TS. Charred dry.

FIGURE 2  Secondary root; xylem. TS. Charred dry.

FIGURE 3  Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 4  Secondary root; xylem. TS. Charred dry.

FIGURE 5  Secondary root. TS. Charred dry.

FIGURE 6  Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 7  Secondary root. TS. Charred dry

FIGURE 8  Secondary root; xylem and phloem. TS. Charred dry.

FIGURE 9  Secondary root; xylem. TS. Charred dry.

FIGURE 10 Secondary root; xylem. TS. Charred dry.

Scales 1, 2, 5, 7 and 9 = 1mm. 3, 4, 8 and 10 = 100µm.
PLATE 28

Pastinaca sativa

Gentiana lutea
FIGURES 1 - 4: Pastinaca sativa, 5 - 10: Gentiana lutea

FIGURE 1 Secondary root; phloem. LS. Charred dry.

FIGURE 2 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 3 Secondary root; xylem. TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred dry.

FIGURE 5 Secondary root. TS. Charred dry.

FIGURE 6 Secondary root. TS. Charred dry.

FIGURE 7 Secondary root; xylem. TS. Charred dry.

FIGURE 8 Secondary root; xylem. LS. Charred dry.

FIGURE 9 Secondary root; xylem. LS. Charred dry.

FIGURE 10 Secondary root; phloem parenchyma. LS. Charred dry.

SCALES 1, 3, 5, 6 and 9 = 1mm. 2, 4, 7, 8 and 10 = 100μm.
PLATE 29

Withania somnifera

Lithospermum erythrorhizon
FIGURES 1 - 9: *Withania somnifera*, 10: *Lithospermum erythrorhizon*

FIGURE 1 Root tuber. TS. Charred dry.

FIGURE 2 Root tuber; phloem parenchyma. TS. Charred dry.

FIGURE 3 Root tuber; cambium and xylem. TS. Charred dry.

FIGURE 4 Root tuber; xylem parenchyma. TS. Charred dry.

FIGURE 5 Root tuber; xylem parenchyma. TS. Charred dry.

FIGURE 6 Root tuber; xylem parenchyma. TS. Charred dry.

FIGURE 7 Root tuber; starch grains. TS. Charred dry.

FIGURE 8 Root tuber; starch grains. TS. Charred dry.

FIGURE 9 Root tuber; xylem. TS. Charred dry.

FIGURE 10 Secondary root; periderm phloem and xylem. TS Charred dry.

SCALES 1 and 2 = 1mm. 3 - 10 = 100µm.
PLATE 30

Lithospermum erythrorhizon
Symphytum officinale
PLATE 30

FIGURES 1 - 4: Lithospermum erythrorhizon, 5 - 10:

Symphytum officinale

FIGURE 1 Secondary root; xylem. TS. Charred dry.

FIGURE 2 Secondary root; xylem. RLS. Charred dry.

FIGURE 3 Secondary root; xylem. TLS. Charred dry.

FIGURE 4 Secondary root; phloem. LS. Charred dry.

FIGURE 5 Secondary root; phloem. TS. Charred dry.

FIGURE 6 Secondary root; xylem. TS. Charred dry.

FIGURE 7 Secondary root; phloem. TS. Charred dry.

FIGURE 8 Secondary root; xylem. TS. Charred dry.

FIGURE 9 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 10 Secondary root; xylem parenchyma. LS. Charred dry.

SCALES 4 - 9 = 1mm. 1 - 3 and 10 = 100µm.
PLATE 31

Cistanche tubulsa

Anacyclus pyrethrum
FIGURES 1 - 9: *Cistanche tubulosa*, 10: *Anacyclus pyrethrum*

FIGURE 1 Inflorescence. TS. Charred dry.

FIGURE 2 Inflorescence. TS. Charred dry.

FIGURE 3 Inflorescence; parenchyma. TS. Charred dry.

FIGURE 4 Inflorescence; parenchyma. TS. Charred dry.

FIGURE 5 Inflorescence; vascular bundle. TS. Charred dry.

FIGURE 6 Inflorescence. TS. Charred fresh.

FIGURE 7 Inflorescence; parenchyma. TS. Charred fresh.

FIGURE 8 Inflorescence; parenchyma. TS. Charred fresh.

FIGURE 9 Inflorescence; parenchyma. TS. Charred fresh.

FIGURE 10 Secondary root. TS. Charred dry.

SCALES 1 - 3, 6, 8 and 10 = 1mm. 4 - 5, 7 and 9 = 100μm.
PLATE 32

*Anacyclus pyrethrum*

*Arctium minus*
PLATE 32

FIGURES 1 - 8: *Anacyclus pyrethrum*. 9 - 10: *Arctium minus*

FIGURE 1 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 2 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 3 Secondary root; secretory cavities. TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred dry.

FIGURE 5 Secondary root; pith parenchyma. TS. Charred dry.

FIGURE 6 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 7 Secondary root; secretory cavities. LS. Charred dry.

FIGURE 8 Secondary root; xylem. LS. Charred dry.

FIGURE 9 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; xylem. TS. Charred dry.

SCALES 1, 2 and 10 = 1mm. 3 - 9 = 100μm.
PLATE 33

Arctium minus
PLATE 33

FIGURES 1 - 10: *Arctium minus*

FIGURE 1 Secondary root; xylem. TS. Charred dry.

FIGURE 2 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 3 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 4 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 5 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 6 Secondary root; xylem parenchyma. TS. Charred fresh.

FIGURE 7 Secondary root. LS. Charred fresh.

FIGURE 8 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 9 Secondary root; pith parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; xylem. LS. Charred dry.

**SCALES** 1 - 3 and 7 = 1mm. 4 - 6 and 8 - 10 = 100μm.
PLATE 34

*Cichorium intybus*

*Doronicum grandiflorum*
PLATE 34

FIGURES 1 - 6: *Cichorium intybus*, 7 - 10: *Doronicum grandiflorum*

FIGURE 1 Secondary root. TS. Charred dry.

FIGURE 2 Secondary root. TS. Charred dry.

FIGURE 3 Secondary root; xylem. TS. Charred dry.

FIGURE 4 Secondary root; xylem. LS. Charred dry.

FIGURE 5 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 6 Secondary root; xylem parenchyma. LS. Charred fresh.

FIGURE 7 Stolon. TS. Charred fresh

FIGURE 8 Stolon; cortex and vascular bundle. TS. Charred fresh.

FIGURE 9 Stolon; vascular tissue. TS. Charred fresh.

FIGURE 10 Stolon; parenchyma. TS. Charred fresh.

SCALES 1 - 3 and 7 = 1mm. 4 - 6 and 8 - 10 = 100 μm.
PLATE 35

*Doronicum grandiflorum*

*Inula helinium*
PLATE 35

FIGURES 1 - 6: *Doronicum grandiflorum*, 7 - 10: *Inula helüniüm*

FIGURE 1 Stolon; pith. TS. Charred dry.

FIGURE 2 Stolon; parenchyma. TS. Charred dry.

FIGURE 3 Stolon; parenchyma. TS. Charred dry.

FIGURE 4 Stolon. LS. Charred dry.

FIGURE 5 Stolon; outer parenchyma. TS. Charred dry.

FIGURE 6 Stolon; inner parenchyma. TS. Charred dry.

FIGURE 7 Secondary root. TS. Charred dry.

FIGURE 8 Secondary root; secretory cavity. Fracture showing both TS and LS. Charred dry.

FIGURE 9 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; xylem parenchyma. TS. Charred dry.

SCALES 1, 2, 4, 7 and 8 = 1mm. 3, 5, 6, 9 and 10 = 100μm.
PLATE 36

*Inula helinium*

*Saussurea lappa*

*Scorzonera hispanica*
PLATE 36

FIGURES 1 - 2: *Inula heli*ni*um, 3 - 8: *Saussurea lep*pa

9 - 10: *Scorzonera hispanica*

FIGURE 1 Secondary root. LS. Charred dry.

FIGURE 2 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 3 Secondary root. TS. Charred dry.

FIGURE 4 Secondary root. TS. Charred dry.

FIGURE 5 Secondary root; xylem and secretory cavities. TS. Charred dry.

FIGURE 6 Secondary root; xylem. TS. Charred dry.

FIGURE 7 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 8 Secondary root; xylem. LS. Charred dry.

FIGURE 9 Secondary root. TS. Charred dry.

FIGURE 10 Secondary root; periderm and cortex. TS. Charred dry.

SCALES 1, 3 - 5, 8 - 10 = 1mm. 2, 6 and 7 = 100μm.
PLATE 37

Scorzonera hispanica
Scorzonera judaica
PLATE 37

FIGURES 1 – 6: Scorzonera hispanica, 7 – 10: Scorzonera judaica

FIGURE 1 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 2 Secondary root; xylem. TS. Charred dry.

FIGURE 3 Secondary root; cortex. TS. Charred fresh.

FIGURE 4 Secondary root; xylem. TS. Charred fresh.

FIGURE 5 Secondary root; xylem. TS. Charred fresh.

FIGURE 6 Secondary root; xylem parenchyma. TS. Charred fresh.

FIGURE 7 Secondary root; periderm and cortex. TS. Charred dry.

FIGURE 8 Secondary root; xylem parenchyma. TS. Charred fresh.

FIGURE 9 Secondary root; xylem parenchyma. TS. Charred fresh.

FIGURE 10 Secondary root; xylem parenchyma. TS. Charred fresh.

SCALES 2 – 5 and 7 – 9 = 1mm. 1, 6 and 10 = 100µm.
PLATE 38

Scorzonera judaica

Scorzonera schweinfurthii
PLATE 38

FIGURES 1 - 3: Scorzonera judaica, 4 - 10: Scorzonera schweinfurthii

FIGURE 1 Secondary root; periderm and cortex. LS. Charred dry.

FIGURE 2 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 3 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 4 Secondary root; xylem parenchyma. LS. Charred dry.

FIGURE 5 Secondary root; periderm, cortex and xylem parenchyma. TS. Charred dry.

FIGURE 6 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 7 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 8 Secondary root; xylem. TS. Charred dry.

FIGURE 9 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 10 Secondary root; xylem parenchyma. TS. Charred dry.

SCALES 2, 4 - 7, 9 - 10 = 1mm. 1, 3 and 8 = 100μm.
PLATE 39

Taraxacum officinale
PLATE 39

FIGURES 1 - 10: Taraxacum officinale

FIGURE 1 Secondary root. TS. Charred dry.

FIGURE 2 Secondary root. TS. Charred dry.

FIGURE 3 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred dry.

FIGURE 5 Secondary root; xylem. TS. Charred dry.

FIGURE 6 Secondary root; xylem. TS. Charred dry.

FIGURE 7 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 8 Secondary root; xylem. LS. Charred dry.

FIGURE 9 Secondary root; xylem. LS. Charred dry.

FIGURE 10 Secondary root; xylem. LS. Charred dry.

Scales 1 - 2 and 7 - 9 = 1mm. 3 - 6 and 10 = 100μm.
FIGURES 1 - 10: *Taraxacum officinale*

FIGURE 1 Secondary root. TS. Charred dry.

FIGURE 2 Secondary root. TS. Charred dry.

FIGURE 3 Secondary root; phloem parenchyma. TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred dry.

FIGURE 5 Secondary root; xylem. TS. Charred dry.

FIGURE 6 Secondary root; xylem. TS. Charred dry.

FIGURE 7 Secondary root; phloem parenchyma. LS. Charred dry.

FIGURE 8 Secondary root; xylem. LS. Charred dry.

FIGURE 9 Secondary root; xylem. LS. Charred dry.

FIGURE 10 Secondary root; xylem. LS. Charred dry.

SCALES 1 - 2 and 7 - 9 = 1mm. 3 - 6 and 10 = 100μm.
PLATE 40

Tragopogon pratensis

Butomus umbellatus
FIGURES 1 - 7: *Tragopogon pratensis*, 8 - 10: *Butomus umbellatus*

FIGURE 1 Secondary root. TS. Charred dry.

FIGURE 2 Secondary root; pith. TS. Charred dry.

FIGURE 3 Secondary root; periderm, phloem and xylem. TS. Charred dry.

FIGURE 4 Secondary root; xylem. TS. Charred dry.

FIGURE 5 Secondary root; xylem. TS. Charred dry.

FIGURE 6 Secondary root; xylem. LS. Charred dry.

FIGURE 7 Secondary root; xylem parenchyma. TS. Charred dry.

FIGURE 8 Rhisome. TS. Charred dry.

FIGURE 9 Rhizome; vascular bundles. TS. Charred dry.

FIGURE 10 Rhizome; vascular bundles. TS. Charred dry.

SCALES 1 - 2, 6 and 8 = 1mm. 3 - 5, 7, 9 and 10 = 100μm.
PLATE 41

Butomus umbellatus

Alisma plantago-aquatica
FIGURES 1 - 4: *Butomus umbellatus*, 5 - 10: *Alisma plantago aquatica*

FIGURE 1 Rhizome; parenchyma. TS. Charred dry.

FIGURE 2 Rhizome; parenchyma. LS. Charred dry.

FIGURE 3 Rhizome; parenchyma. LS. Charred dry.

FIGURE 4 Rhizome; parenchyma. LS. Charred dry.

FIGURE 5 Rootstock; aerenchyma. TS. Charred dry.

FIGURE 6 Rootstock; aerenchyma. TS. Charred dry.

FIGURE 7 Rootstock; aerenchyma. TS. Charred dry.

FIGURE 8 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 9 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 10 Rootstock; vascular bundle. TS. Charred dry.

SCALES 5 and 7 = 1mm. 1 - 4, 6 and 8 - 10 = 100μm.
PLATE 42

*Alisma plantago-aquatica*

*Sagittaria sagittifolium*

*Arrhenatherum elatius*

ssp *bulbosus*
PLATE 42

FIGURES 1: *Alisma plantago-aquatica*, 2–8: *Sagittaria sagittifolia*, 9–10: *Arrhenatherum elatius ssp. bulbosus*

FIGURE 1  Rootstock; vascular bundle. TS. Charred dry.

FIGURE 2  Stolon tuber. TS Charred dry.

FIGURE 3  Stolon tuber; epidermis and parenchyma. TS. Charred dry.

FIGURE 4  Stolon tuber; parenchyma. TS. Charred dry.

FIGURE 5  Stolon tuber; parenchyma. TS. Charred dry.

FIGURE 6  Stolon tuber; parenchyma. TS. Charred dry.

FIGURE 7  Stolon tuber; parenchyma. TS. Charred dry.

FIGURE 8  Stolon tuber; parenchyma. TS. Charred dry.

FIGURE 9  Rootstock. TS. Charred dry.

FIGURE 10  Rootstock; outer vascular bundles. TS. Charred dry.

SCALES  2–6 and 9 = 1mm. 1, 7, 8 and 10 = 100μm.
PLATE 43

Arrhenatherum elatius
ssp bulbosus

Hordeum bulbosum
PLATE 43

FIGURES 1 - 6: *Arrhenatherum elatius* ssp *bulbosus*

7 - 10: *Hordeum bulbosum*

FIGURE 1 Rootstock. TS. Charred dry

FIGURE 2 Rootstock. TS. Charred dry.

FIGURE 3 Rootstock; parenchyma. TS. Charred dry.

FIGURE 4 Rootstock. LS. Charred dry.

FIGURE 5 Rootstock; xylem. LS. Charred dry.

FIGURE 6 Rootstock. TS. Charred fresh.

FIGURE 7 Rootstock. TS. Charred dry.

FIGURE 8 Rootstock; parenchyma. TS. Charred dry.

FIGURE 9 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 10 Rootstock. LS. Charred dry.

SCALES 1, 2, 4, 6, 7 and 10 = 1mm. 3, 5, 8 and 9 = 100μm.
PLATE 44

Hordeum bulbosum

Cyperus esculentus
PLATE 44

FIGURES 1 - 3: Hordeum bulbosum, 4 - 10: Cyperus esculentus

FIGURE 1 Rootstock. LS. Charred dry.

FIGURE 2 Rootstock; parenchyma. LS. Charred dry.

FIGURE 3 Rootstock; vascular bundle. LS. Charred dry.

FIGURE 4 Rhizome tuber; rhizome detachment scar. Charred dry.

FIGURE 5 Rhizome tuber; adventitious root scar. Charred dry.

FIGURE 6 Rhizome tuber; external surface. Charred dry.

FIGURE 7 Rhizome tuber; apical bud. Charred dry.

FIGURE 8 Rhizome tuber; apical bud. Charred dry.

FIGURE 9 Rhizome tuber; apical bud. Charred dry.

FIGURE 10 Rhizome tuber; cortex. TS. Charred dry.

Scales 1, 4, 5, 7 - 9 = 1mm. 2, 3, 6 and 10 = 100μm.
PLATE 45

Cyperus esculentus

Cyperus longus
FIGURES 1 - 7: *Cyperus esculentus*, 8 - 10: *Cyperus longus*.

FIGURE 1 Rhizome tuber; epidermis. TS. Charred dry.

FIGURE 2 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 3 Rhizome tuber; endodermis. TS. Charred dry.

FIGURE 4 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 5 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 6 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 7 Rhizome tuber; xylem. TS. Charred dry.

FIGURE 8 Rhizome. TS. Charred dry.

FIGURE 9 Rhizome; cortex. TS. Charred dry.

FIGURE 10 Rhizome; endodermis and stele. TS. Charred dry.

SCALES 3 and 8 = 1 mm. 1, 2, 4 - 7 and 9 - 10 = 100 μm.
PLATE 46

Cyperus longus

Cyperus rotundus
PLATE 46

FIGURES 1 - 5: Cyperus longus, 6 - 10: Cyperus esculentus

FIGURE 1 Rhizome; stele. TS. Charred dry.

FIGURE 2 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 3 Rhizome; parenchyma. LS. Charred dry.

FIGURE 4 Rhizome; parenchyma. LS. Charred dry.

FIGURE 5 Rhizome; vascular bundle. LS. Charred dry.

FIGURE 6 Rhizome tuber; external surface showing scale leaf scars. Charred dry.

FIGURE 7 Rhizome tuber; scale leaf xylem tract. Charred dry.

FIGURE 8 Rhizome tuber. LS. Charred dry.

FIGURE 9 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 10 Rhizome tuber; vascular bundles. TS. Charred dry.

SCALES  6, 8 and 9 = 1mm. 1 - 5, 7 and 10 = 100μm.
PLATE 47

Cyperus rotundus
Schoenoplectus tabernamontani
FIGURES 1 - 8: *Cyperus esculentus*. 9 - 10: *Schoenoplectus taberna montani*.

FIGURE 1 Rhizome tuber; vascular bundle. TS. Charred dry.

FIGURE 2 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 3 Rhizome tuber; parenchyma. TS. Charred dry.

FIGURE 4 Rhizome tuber. LS. Charred dry.

FIGURE 5 Rhizome tuber; vascular bundle. LS. Charred dry.

FIGURE 6 Rhizome tuber; vascular bundle LS. Charred dry.

FIGURE 7 Rhizome tuber; xylem. LS. Charred dry.

FIGURE 8 Rhizome tuber. LS. Charred dry.

FIGURE 9 Rhizome; aerenchyma. TS. Charred dry.

FIGURE 10 Rhizome; aerenchyma. TS. Charred dry.

SCALES 4, 8 and 9 = 1mm. 1 - 3, 5, 6 and 10 = 100μm. 7 = 10μm.
PLATE 48

*Schoenoplectus tabernamontani*

*Scirpus maritimus*

*Typha angustifolia*
PLATE 48

FIGURES 1-2: Schoenoplectus tabernamontani, 3-9: Scirpus maritimus, 10: Typha angustifolia

FIGURE 1 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 2 Rhizome; parenchyma. LS. Charred dry.

FIGURE 3 Rootstock. TS. Charred dry.

FIGURE 4 Rootstock; parenchyma. TS. Charred dry.

FIGURE 5 Rootstock; parenchyma. TS. Charred dry.

FIGURE 6 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 7 Rootstock; vascular bundles. TS. Charred dry.

FIGURE 8 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 9 Rootstock; parenchyma. LS. Charred dry.

FIGURE 10 Rhizome; endodermis and stele. TS. Charred dry.

SCALES 2, 3 and 10 = 1mm. 1, 4-9 = 100μm.
PLATE 49

*Typha angustifolia*

*Typha latifolia*

*Sparganium erectum*
PLATE 49

FIGURES 1: *Typha angustifolia*, 2-8: *Typha latifolia*, 9-10: *Sparganium erectum*

FIGURE 1 Rhizome; endodermis and stele. TS. Charred dry.

FIGURE 2 Rhizome; endodermis and stele. TS. Charred dry.

FIGURE 3 Rhizome; xylem. TS. Charred dry.

FIGURE 4 Rhizome; cortex and endodermis. LS. Charred dry.

FIGURE 5 Rhizome; stele. LS. Charred dry.

FIGURE 6 Rhizome; stele. LS. Charred dry.

FIGURE 7 Rhizome; parenchyma. LS. Charred dry.

FIGURE 8 Rhizome; xylem. LS. Charred dry.

FIGURE 9 Rhizome; cortex, endodermis and stele. TS. Charred dry.

FIGURE 10 Rhizome; cortex. TS. Charred dry.

SCALES 1, 2 and 5 = 1mm. 3, 4, 6 - 10 = 100µm.
PLATE 50

*Sparganium erectum*

*Alpinia galanga*
PLATE 50

FIGURES 1 - 5: Sparganium erectum, 6 - 10: Alpinia galanga

FIGURE 1 Rhizome; parenchyma. TS. Charred dry.

FIGURE 2 Rhizome; parenchyma. TS. Charred dry.

FIGURE 3 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 4 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 5 Rhizome; parenchyma. LS. Charred dry.

FIGURE 6 Rhizome. TS. Charred dry.

FIGURE 7 Rhizome. TS. Charred dry.

FIGURE 8 Rhizome. TS. Charred dry.

FIGURE 9 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 10 Rhizome; xylem and phloem. TS. Charred dry.

SCALES 6 and 7 = 1mm. 1 - 5 and 8 - 10 = 100μm.
PLATE 51

*Alpinia galanga*

*Curcuma domestica*
PLATE 51

FIGURES 1 - 5: Alpinia galanga, 6 - 10: Curcuma domestica

FIGURE 1 Rhizome; vascular bundle fibre cap. TS. Charred dry.

FIGURE 2 Rhizome. LS. Charred dry.

FIGURE 3 Rhizome. LS. Charred dry.

FIGURE 4 Rhizome; parenchyma. LS. Charred dry.

FIGURE 5 Rhizome; xylem. LS. Charred dry.

FIGURE 6 Rhizome. TS. Charred dry.

FIGURE 7 Rhizome; epidermis and cortical parenchyma. TS. Charred dry.

FIGURE 8 Rhizome; parenchyma. TS. Charred dry.

FIGURE 9 Rhizome; parenchyma. TS. Charred dry.

FIGURE 10 Rhizome; vascular bundle. TS. Charred dry.

SCALES 2, 6 and 8 = 1 mm. 3 - 5, 7 - 10 = 100 μm. 1 = 10 μm.
PLATE 52

Curcuma domestica

Zingiber officinale
PLATE 52

FIGURES 1 - 6: Curcuma domestica, 7 - 10: Zingiber officinale

FIGURE 1 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 2 Rhizome. LS. Charred dry.

FIGURE 3 Rhizome; parenchyma. LS. Charred dry.

FIGURE 4 Rhizome; xylem. LS. Charred dry.

FIGURE 5 Rhizome; xylem. LS. Charred fresh.

FIGURE 6 Rhizome; parenchyma. LS. Charred fresh.

FIGURE 7 Rhizome. TS. Charred dry.

FIGURE 8 Rhizome. TS. Charred dry.

FIGURE 9 Rhizome; cortex. TS. Charred dry.

FIGURE 10 Rhizome; stelar parenchyma. TS. Charred dry.

SCALES 2, 6 and 7 = 1mm. 1, 3 - 5, 8 - 10 = 100µm.
PLATE 53

*Zingiber officinale*

*Acorus calamus*
PLATE 53

FIGURES 1 - 8: Zingiber officinale, 9 - 10: Acorus calamus

FIGURE 1 Rhizome; parenchyma. TS. Charred dry.

FIGURE 2 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 3 Rhizome. LS. Charred dry.

FIGURE 4 Rhizome. TS. Charred fresh.

FIGURE 5 Rhizome. TS. Charred fresh.

FIGURE 6 Rhizome; parenchyma. TS. Charred fresh.

FIGURE 7 Rhizome. LS. Charred fresh.

FIGURE 8 Rhizome. LS. Charred fresh.

FIGURE 9 Rhizome. TS. Charred dry.

FIGURE 10 Rhizome; endodermis. TS. Charred dry.

SCALES 3 - 7, 9 and 10 = 1mm. 1, 2 and 8 = 100μm.
PLATE 54

Acorus calamus

Arum maculatum
PLATE 54

FIGURES 1 - 5: *Acorus calamus*, 6 - 10: *Arum maculatum*

FIGURE 1 Rhizome; aerenchyma and vascular bundle. TS. Charred dry.

FIGURE 2 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 3 Rhizome. LS. Charred dry.

FIGURE 4 Rhizome; aerenchyma. LS. Charred dry.

FIGURE 5 Rhizome; vascular bundle. LS. Charred dry.

FIGURE 6 Rootstock. TS. Charred dry.

FIGURE 7 Rootstock; parenchyma. OS. Charred dry.

FIGURE 8 Rootstock; parenchyma. OS. Charred dry.

FIGURE 9 Rootstock; parenchyma. OS. Charred dry.

FIGURE 10 Rootstock; parenchyma. OS. Charred dry.

SCALES 3 and 5 - 7 = 1mm. 1, 2, 4 and 8 - 10 = 100μm.
PLATE 55

Arum maculatum

Crocus sativus
PLATE 55

FIGURES 1 - 6: *Arum maculatum*, 7 - 10: *Crocus sativus*

FIGURE 1 Rootstock; parenchyma. OS. Charred dry.

FIGURE 2 Rootstock; parenchyma. OS. Charred dry.

FIGURE 3 Rootstock; parenchyma. OS. Charred dry.

FIGURE 4 Rootstock; parenchyma. OS. Charred dry.

FIGURE 5 Rootstock; parenchyma. OS. Charred dry.

FIGURE 6 Rootstock; parenchyma. OS. Charred dry.

FIGURE 7 Corm. TS. Charred dry.

FIGURE 8 Corm. TS. Charred dry.

FIGURE 9 Corm; parenchyma. TS. Charred dry.

FIGURE 10 Corm; vascular bundle. TS. Charred dry.

SCALES 1, 5, 7 and 9 = 1mm. 2 - 4, 6, 8 and 10 = 100µm.
PLATE 56

FIGURES 1 - 6: Crocus sativus, 7 - 10: Asphodelus aestivus

FIGURE 1 Corm. LS. Charred dry.

FIGURE 2 Corm; vascular bundle. LS. Charred dry.

FIGURE 3 Corm; vascular bundle. TS. Charred dry.

FIGURE 4 Corm. TS. Charred fresh

FIGURE 5 Corm. TS. Charred fresh.

FIGURE 6 Corm. TS. Charred fresh

FIGURE 7 Root tuber. TS. Charred dry.

FIGURE 8 Root tuber; endodermis. TS. Charred dry.

FIGURE 9 Root tuber; endodermis. TS. Charred dry.

FIGURE 10 Root tuber; epidermis. TS. Charred dry.

SCALES 1, 4, 5, 7 and 8 = 1mm. 2, 3, 6, 9 and 10 = 100μm.
PLATE 57

*Asphodelus aestivus*

*Polygonatum X hybridum*
FIGURES 1 - 9: Asphodelus aestivus, 10: Polygonatum X hybridum

FIGURE 1 Root tuber; parenchyma. TS. Charred dry.

FIGURE 2 Root tuber; parenchyma. LS. Charred dry.

FIGURE 3 Root tuber. TS. Charred fresh.

FIGURE 4 Root tuber. TS. Charred fresh.

FIGURE 5 Root tuber. TS. Charred fresh.

FIGURE 6 Root tuber; parenchyma. TS. Charred fresh.

FIGURE 7 Root tuber; parenchyma. TS. Charred fresh.

FIGURE 8 Root tuber; raphides. Charred fresh.

FIGURE 9 Root tuber. LS. Charred fresh.

FIGURE 10 Rhizome; external surface. Charred dry.

SCALES 2 - 5, 9 and 10 = 1mm. 1, 6 and 8 = 100μm.
PLATE 58

Polygonatum X hybridum

Tanus communis
FIGURES 1 - 7: *Polygonatum X hybridum*, 8 - 10: *Tamus communis*

FIGURE 1 Rhizome; aerial stem detachment scar. Charred dry.

FIGURE 2 Rhizome; epidermis. TS. Charred dry.

FIGURE 3 Rhizome; parenchyma. TS. Charred dry.

FIGURE 4 Rhizome; parenchyma. TS. Charred dry.

FIGURE 5 Rhizome; vascular bundle. TS. Charred dry.

FIGURE 6 Rhizome; parenchyma. LS. Charred dry.

FIGURE 7 Rhizome; parenchyma. LS. Charred dry.

FIGURE 8 Rootstock; parenchyma. TS. Charred dry.

FIGURE 9 Rootstock; parenchyma. TS. Charred dry.

FIGURE 10 Rootstock; parenchyma. TS. Charred dry.

SCALES 1, 3, 4, 6, 8 and 9 = 1mm. 2, 5, 7 and 10 = 100μm.
PLATE 59

*Tamus communis*

*Orchis mascula*
FIGURES 1 - 4: *Tamus communis*, 5 - 10: *Orchis mascula*

FIGURE 1 Rootstock; vascular bundle. TS. Charred dry.

FIGURE 2 Rootstock; xylem. TS. Charred dry.

FIGURE 3 Rootstock; raphides. Charred dry.

FIGURE 4 Rootstock; raphides. Charred dry.

FIGURE 5 Root tuber; parenchyma. OS. Charred dry.

FIGURE 6 Root tuber; parenchyma. OS. Charred dry.

FIGURE 7 Root tuber; parenchyma. OS. Charred dry.

FIGURE 8 Root tuber; parenchyma. OS. Charred dry.

FIGURE 9 Root tuber; parenchyma. OS. Charred dry.

FIGURE 10 Root tuber; vascular bundle. TS. Charred dry.

SCALES 5 and 8 = 1mm. 1 - 4, 6, 7, 9 and 10 = 100μm.
PLATE 60

Quercus robur (fruit)
PLATE 60

FIGURES 1 - 10: Quercus robur

FIGURE 1 Fruit. TS. Charred dry.

FIGURE 2 Fruit. TS. Charred dry.

FIGURE 3 Fruit; parenchyma. TS. Charred dry.

FIGURE 4 Fruit; parenchyma. TS. Charred dry.

FIGURE 5 Fruit. LS. Charred dry.

FIGURE 6 Fruit; parenchyma. LS. Charred dry.

FIGURE 7 Fruit; parenchyma. LS. Charred dry.

FIGURE 8 Fruit. LS. Charred dry.

FIGURE 9 Fruit. LS. Charred dry,

FIGURE 10 Fruit; parenchyma. LS. Charred dry.

SCALES 1, 2, 5, 8 and 9 = 1mm. 3, 4, 6, 7 and 10 = 100μm.
PLATE 61

*Quercus robur* (gall)

*Ficus carica*
PLATE 61

FIGURES 1-8: Quercus robur, 9-10: Ficus carica

FIGURE 1 Andricus sp gall; outer tissue. TS. Charred dry.

FIGURE 2 Andricus sp gall; outer parenchyma. TS. Charred dry.

FIGURE 3 Andricus sp gall; outer parenchyma. TS. Charred dry.

FIGURE 4 Andricus sp gall; inner tissue. TS. Charred dry.

FIGURE 5 Andricus sp gall; inner parenchyma. TS. Charred dry.

FIGURE 6 Andricus sp gall; inner parenchyma. TS. Charred dry.

FIGURE 7 Andricus sp gall; vascular bundle. TS. Charred dry.

FIGURE 8 Andricus sp. gall; vascular bundle. LS. Charred dry.

FIGURE 9 Fruit; swollen recepticle wall; TS. Charred dry.

FIGURE 10 Fruit; swollen recepticle wall; TS. Charred dry.

SCALES 1, 2, 4, 5, 9 and 10 = 1mm. 3, 6, 7 and 8 = 100μm
PLATE 62

*Ficus carica*

*Malus domestica*
PLATE 62

FIGURES 1 - 4: Ficus carica, 5 - 10: Malus domestic

FIGURE 1 Fruit; seeds embedded in swollen recepticle wall. Charred dry.

FIGURE 2 Fruit; seeds embedded in swollen recepticle wall. Charred dry.

FIGURE 3 Fruit; swollen recepticle wall. LS. Charred dry.

FIGURE 4 Fruit; recepticle wall vascular bundle. TS. Charred dry.

FIGURE 5 Fruit; outer parenchyma of swollen recepticle. TS. Charred dry.

FIGURE 6 Fruit; outer parenchyma of swollen parenchyma. TS. Charred dry.

FIGURE 7 Fruit; outer parenchyma of swollen parenchyma. TS. Charred dry.

FIGURE 8 Fruit; inner parenchyma of swollen recepticle. TS. Charred dry.

FIGURE 9 Fruit; inner parenchyma of swollen recepticle. TS. Charred dry.

FIGURE 10 Fruit; inner parenchyma of swollen recepticle. TS. Charred dry.

SCALES 1, 2, 5 and 8 - 10 = 1mm. 3, 4, 6 and 7 = 100μm.
PLATE 63

Hordeum vulgare

Secale cereale
PLATE 63

FIGURES 1 - 7: *Hordeum vulgare*, 8 - 10: *Secale cereale*

FIGURE 1 Caryopsis. TS. Charred dry.

FIGURE 2 Caryopsis. TS. Charred dry.

FIGURE 3 Caryopsis. TS. Charred dry.

FIGURE 4 Caryopsis. TS. Charred dry.

FIGURE 5 Caryopsis. TS. Charred dry.

FIGURE 6 Caryopsis. TS. Charred dry.

FIGURE 7 Caryopsis. TS. Charred dry.

FIGURE 8 Caryopsis. TS. Charred dry.

FIGURE 9 Caryopsis. TS. Charred dry.

FIGURE 10 Caryopsis. TS. Charred dry

SCALES 1, 2, 4, 5, 7 and 8 = 1mm. 3, 6, 9 and 10 = 100μm.
PLATE 64

Goat dung
Donkey dung
FIGURES 1 - 7: Goat dung, 8 - 10: Donkey dung

FIGURE 1 Outer surface. Charred dry.

FIGURE 2 Outer surface. Charred dry.

FIGURE 3 OS. Charred dry.

FIGURE 4 OS. Charred dry.

FIGURE 5 OS. Charred dry.

FIGURE 6 OS. Charred dry.

FIGURE 7 OS. Charred dry.

FIGURE 8 OS. Charred dry.

FIGURE 9 OS. Charred dry.

FIGURE 10 OS. Charred dry.

SCALES 3 - 5, 8 and 9 = 1mm. 1, 2, 6, 7 and 10 = 100μm.
PLATE 65

Aqaba remains
FIGURES 1 - 10: Charred remains of *Sparganium* sp recovered from oven sites in Aqaba, Southern Jordan.

FIGURE 1 Rhizome. TS.

FIGURE 2 Rhizome. TS.

FIGURE 3 Rhizome; parenchyma. TS.

FIGURE 4 Rhizome; vascular bundle from outer tissue. TS.

FIGURE 5 Rhizome; vascular bundle from outer tissue. TS.

FIGURE 6 Rhizome; vascular bundle from inner tissue. TS.

FIGURE 7 Rhizome; vascular bundle from inner tissue. TS.

FIGURE 8 Rhizome; inner vascular bundle sclerenchymatous cap. TS.

FIGURE 9 Rhizome; outer vascular bundle xylem. TS.

FIGURE 10 Rhizome; outer vascular bundle xylem. TS.

SCALES 1 - 4, 6 and 7 = 1mm. 5, 8, 9 and 10 = 100µm.
PLATE 66

Aqaba remains
FIGURES 1 - 10: Charred remains of *Sparganium* sp recovered from oven sites in Aqaba, Southern Jordan.

**FIGURE 1** Rhizome; parenchyma with fibre bundle. TS.

**FIGURE 2** Rhizome; fibre bundle. TS.

**FIGURE 3** Rhizome; parenchyma. TS.

**FIGURE 4** Rhizome; parenchyma. TS.

**FIGURE 5** Rhizome. LS.

**FIGURE 6** Rhizome; parenchyma. LS.

**FIGURE 7** Rhizome; parenchyma. LS.

**FIGURE 8** Rhizome; vascular bundle sclerenchymatous cap. LS.

**FIGURE 9** Rhizome; vascular bundle sclerenchymatous cap. LS.

**FIGURE 10** Rhizome; fibre bundle. LS.

**SCALES**

5 = 1mm. 1 - 4 and 6 - 10 = 100μm.
PLATE 67

Stonehenge remains
PLATE 67

FIGURES 1 - 10; Root tuber remains from Stonehenge. Type 1

FIGURE 1 Root tuber. LS.

FIGURE 2 Root tuber. LS.

FIGURE 3 Root tuber. LS.

FIGURE 4 Root tuber. LS.

FIGURE 5 Root tuber, LS.

FIGURE 6 Root tuber. TS.

FIGURE 7 Root tuber. TS.

FIGURE 8 Root tuber. TS.

FIGURE 9 Root tuber. TS.

FIGURE 10 Root tuber. TS.

SCALES 1, 2, 4 - 8 and 9 1mm. 3 and 10 = 100μm.
PLATE 68

Stonehenge remains
FIGURES 1 – 10: Root tuber remains from Stonehenge. Type 2.

FIGURE 1  Root tuber. TS.

FIGURE 2  Root tuber. TS.

FIGURE 3  Root tuber. TS.

FIGURE 4  Root tuber. TS.

FIGURE 5  Root tuber. LS.

FIGURE 6  Root tuber. LS.

FIGURE 7  Root tuber. TS.

FIGURE 8  Root tuber. TS.

FIGURE 9  Root tuber. LS.

FIGURE 10 Root tuber. LS.

SCALES 1, 2, 4 - 7 and 9 = 1mm. 3, 8 and 10 = 100μm.
PLATE 69

Wadi Kubbeniya remains
FIGURES 1 - 10: *Cyperus rotundus* remains recovered from Wadi Kubbaniya, Egypt

FIGURE 1 Rhizome tuber; rhizome detachment scar.

FIGURE 2 Rhizome tuber; rhizome detachment scar.

FIGURE 3 Rhizome tuber; rhizome detachment scar.

FIGURE 4 Rhizome tuber; rhizome detachment scar, vascular bundle.

FIGURE 5 Rhizome tuber; rhizome detachment scar.

FIGURE 6 Rhizome tuber; rhizome detachment scar.

FIGURE 7 Rhizome tuber; rhizome detachment scar.

FIGURE 8 Rhizome tuber; rhizome detachment scar, vascular bundle.

FIGURE 9 Rhizome tuber; fragment surface.

FIGURE 10 Rhizome tuber; fragment surface.

SCALES 1, 5, 6 and 9 = 1mm. 2 - 4, 7, 8 and 10 = 100μm.
Wadi Kubbaniya remains
PLATE 70

FIGURES 1 - 10: *Cyperus rotundus* remains recovered from Wadi Kubbaniya, Egypt

FIGURE 1 Rhizome tuber; parenchyma.

FIGURE 2 Rhizome tuber; parenchyma.

FIGURE 3 Rhizome tuber; parenchyma.

FIGURE 4 Rhizome tuber; parenchyma.

FIGURE 5 Rhizome tuber; parenchyma.

FIGURE 6 Rhizome tuber; vascular bundle. TS.

FIGURE 7 Rhizome tuber; vascular bundle. TS.

FIGURE 8 Rhizome tuber; vascular bundle. LS.

FIGURE 9 Rhizome tuber; vascular bundle. LS.

FIGURE 10 Rhizome tuber; vascular bundle. LS.

SCALES 1 - 10 = 100μm.
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