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AN ARCHAEOLOGICAL STUDY OF
BAKING AND BREAD
IN NEW KINGDOM EGYPT

Volume 2



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LIST OF APPENDICES

Appendix A: Installations and artefacts related to cereal processing and baking at the Workmen's Village, Amarna.

Appendix B: Installations and artefacts related to cereal processing and baking at Deir el-Medina.

LIST OF TABLES

- 1.1: A theoretical framework for the archaeological study of food provision.
- 2.1: Published baking scenes from New Kingdom tombs.
- 2.2: Flow charts of baking as interpreted from primary sources by Wreszinski (1926), Klebs (1934) and Vandier (1964).
- 2.3: Flow charts of ancient Egyptian baking as presented in some selected general accounts.
- 3.1: Wheat starch granule loss of birefringence in excess water over a range of temperatures.
- 5.1: Dimensions of ancient limestone mortar used in emmer processing experiments.
- 5.2: Proportion of chaff and grain in emmer spikelets.
- 5.3: Flow chart of experimental emmer processing from stored spikelets to flour.
- 6.1: Ancient Egyptian bread loaves examined, and mode of analysis.
- 6.2: Ancient Egyptian bread form and macroscopic structure.
- 6.3: Ancient Egyptian loaf shape categories.
- 6.4: Observations of ancient Egyptian bread specimens using high power optical microscopy with transmitted and polarizing light, and iodine staining, of wet mounts.
- 6.5: Observations of ancient Egyptian bread specimens using scanning electron microscopy.
- 6.6: Sugar content of loaf 001.
- 6.7: Characterization of loaves studied with optical and scanning electron microscopy according to the models proposed in Ch. 6.V.
- 6.8: Finds of ceramic platters from houses in the North Suburb and the houses of the Workmen's Village at the site of Amarna.

LIST OF FIGURES

- 2.1: A baking scene from the tomb of Nebamun at Thebes (#17).
- 3.1: The major components of the ears of emmer, free threshing wheat, and barley.
- 3.2: The major components of the cereal grain.
- 3.3: Part of an emmer grain aleurone cell.
- 3.4: The structure of the glucose molecule.
- 3.5: The structure of amylose.
- 3.6: The structure of amylopectin.
- 3.7: The different stages of starch gelatinization as seen with the scanning electron microscope, according to the scale devised by Rockland *et al.* (1977).
- 3.8: A simplified view of the different amylase enzyme actions which occur in the germinating cereal grain.
- 3.9: Events which occur in the bread loaf during modern baking.
- 4.1: Recording sheet used to note details of ancient Egyptian bread loaves.
- 4.2: The drying regime of emmer grain in the spikelet, prepared as comparative material.
- 4.3: The starchy endosperm of modern raw emmer grain, seen with scanning electron microscopy.
- 4.4: The starchy endosperm of modern emmer grain after the spikelet was exposed to dry heat.
- 4.5: The starchy endosperm of modern emmer grain which had been soaked and heated in the spikelet.
- 5.1: Plan of the houses of the Workmen's Village, Amarna.
- 5.2: Plan of the houses of the Workmen's Village, Deir el-Medina.
- 5.3: An ancient deep sieve found at Deir el-Medina.
- 5.4: An ancient shallow coiled basket found at Deir el-Medina.
- 5.5: An ancient deep coiled basket found at Deir el-Medina.
- 5.6: An ancient coiled basket found at Dra' Abu el-Naga'.
- 5.7: Experimental ancient limestone mortar.
- 5.8: The ancient quern emplacement from Gate St. 8, Amarna.

LIST OF FIGURES (continued)

- 5.9: Experimental emmer processing: picking through the spikelets by hand.
- 5.10: Experimental emmer processing: the waste items removed by hand sorting of emmer spikelets.
- 5.11: Experimental emmer processing: the spikelets after hand cleaning.
- 5.12: Outlines of the base of the ancient pestle and the base of the replica pestle.
- 5.13: Replica wooden pestle.
- 5.14: Experimental ancient mortar emplaced in the ground ready for pounding.
- 5.15: Experimental ancient mortar, with spikelets and water.
- 5.16: The change in volume of unpounded and pounded spikelets.
- 5.17: Pounding the emmer spikelets in the ancient limestone mortar with the replica wooden pestle.
- 5.18: A selection of some of the material which scattered out of the mortar during pounding.
- 5.19: The emmer spikelets after pounding.
- 5.20: The pounded emmer spikelets drying in the sun.
- 5.21: The modern coiled basket used for winnowing, and dried, pounded spikelets ready to be winnowed.
- 5.22: Diagram of the initial winnowing movement used to separate the emmer chaff and grain in the basket.
- 5.23: The result of the initial winnowing movement.
- 5.24: Diagram of the second winnowing movement.
- 5.25: Result of the second winnowing movement.
- 5.26: Diagram of the third winnowing movement.
- 5.27: Result of the third winnowing movement.
- 5.28: Diagram of the fourth winnowing movement.
- 5.29: Removal of the fine chaff from the basket.
- 5.30: The material remaining in the basket after most of the light chaff has been winnowed out.
- 5.31: The separation of grain from spikelets and most of the other heavy chaff after the removal of the light chaff.

LIST OF FIGURES (continued)

- 5.32: The separation of clean grain from heavy chaff and spikelets.
- 5.33: The chaff left in the coarse sieve after removal of the whole grain.
- 5.34: A sample of clean grain.
- 5.35: An ancient granite quern stone used for experimental grinding.
- 5.36: The ancient quartzitic sandstone hand stone used for experimental milling.
- 5.37: Experimental grinding.
- 5.38: Diagram of the diagonal motion across the quern stone.
- 5.39: Coarsely ground flour on the quern.
- 5.40: Finely ground flour on the quern.
- 5.41: Experimentally produced emmer flour.
- 5.42: Plan of NE.V, Deir el-Medina.
- 5.43: Plan of NE.VIII, Deir el-Medina.
- 5.44: Plan of Long Wall St. 7, Workmen's Village, Amarna.
- 5.45: Plan of Main St. 5, Workmen's Village, Amarna.
- 5.46: Plan of East St. 10, Workmen's Village, Amarna.
- 5.47: Plan of part of the Central City, Amarna.
- 6.1: A selection of bread loaves from the tomb of Kha.
- 6.2: Another selection of bread loaves from the tomb of Kha.
- 6.3: Sketch of loaf 023, from Deir el-Medina, now in the Louvre, an example of a crater loaf.
- 6.4: Sketch of loaf 028 and loaf 029.
- 6.5: Some bread from the tomb of Kha.
- 6.6: More bread from the tomb of Kha.
- 6.7: Flat bread from the tomb of Imhotep (QV 46).
- 6.8: Starch microstructure in loaf 017.
- 6.9: Frass (insect excreta) in bread specimens.
- 6.10: Some examples of fungal hyphae on ancient bread.
- 6.11: Evidence for enzyme attack on starch in ancient Egyptian

LIST OF FIGURES (continued)

bread.

- 6.12: Starch from loaf 014.
- 6.13: Starch from loaf 023.
- 6.14: Modern yeast cells.
- 6.15: A yeast cell in the matrix of loaf 024.
- 6.16: Possible yeast cells in loaf 014.
- 6.17: Possible yeast cells in loaf 021.
- 6.18: Possible yeast cells in loaf 029.
- 6.19: Experimental round oven.
- 6.20: Heating the experimental oven in preparation for baking.
- 6.21: Raw emmer cakes made from experimentally ground flour.
- 6.22: Experimental emmer bread baking in the oven.
- 6.23: Experimental emmer loaves after baking.
- 6.24: A plan of the whole site of Amarna.
- 6.25: An example of the long, narrow, tapered New Kingdom bread mould.
- 6.26: Plan of the Central City and part of the Main City at Amarna.
- 6.27: Two examples of typical ceramic platters from Amarna.

APPENDIX A: INSTALLATIONS AND ARTEFACTS RELATED TO CEREAL PROCESSING AND BAKING AT THE WORKMEN'S VILLAGE, AMARNA

Sources:

PEET, T. Eric, and C. Leonard WOOLLEY (1923) The City of Akhenaten. Part I. Excavations of 1921 and 1922 at el-'Amarneh. London: Egypt Exploration Society.

KEMP, Barry (ed.) (1986) Amarna Reports III. London: Egypt Exploration Society.

KEMP, Barry (ed.) (1987) Amarna Reports IV. London: Egypt Exploration Society.

CEREAL PROCESSING AND BAKING ARTEFACTS/INSTALLATIONS LISTED BY HOUSE

The location of finds are listed by houses, accompanied by a brief description of room location and installation where such information is provided (wording of publication retained).

[WV, 00] - refers to the page number from Peet and Woolley, 1923;

[K86, 00] - refers to the page number from Kemp, 1986;

[K87, 00] - refers to the page number from Kemp, 1987.

(A/B) - refers to house type: A = stairs at rear of house; B = stairs at front of house.

Sieves

East St. 12 (B): front hall, palm-fibre sieve, 33 cm diameter, 22/51. [WV, 72]

Gate St. 12 (B): kitchen, circular sieve, edging of palm fibre bound with palm leaf, mesh with a web of palm fibre crossed by warp of palm leaf, 21 cm diameter, 21/301; fragments of 1 similar sieve, 21/401, fragment similar sieve, raised edges of palm leaf, resembling shallow basket with sieve bottom, 21/405. [WV, 74]

Main St. 8 (A): front hall, 23.5 cm diameter, 22/103. [WV, 79]

Mortars and possible mortars

Main Street: outside # 1, stone mortar let into ground as jar stand. [WV, 68]

Main Street: opposite # 4, stone bowl rimmed with stones and mud, found with jar in position. [WV, 68]

Main Street: opposite # 8, jar stand consisting of stone bowl with mud rim 0.40 m high. [WV, 68]

West Street: outside # 15, stone bowl (jar stand) let into ground with remains of built stone rim around it. [WV, 69]

East St. 1: in centre of floor of south west corner of site, a depression, diameter 0.45 m by 0.25 m deep, for a stone bowl? [WV, 70]

East St. 10 (B): Into floor is let a mortar of hard white limestone. [WV, 64; Pl. XVII #6]

East St. 11 (B): front hall?; let into the paving, an hour-glass-shaped stone ring-stand, 0.20 m high by 0.25m: a second, 0.20 m high by 0.16 m diameter, found on mud floor just outside paved area. [WV, 72]

East St. 12 (B): front hall, set amongst these stone mortar, 0.20 m diameter, by 0.12 m deep. [WV, 72]

Gate St. 9 (A): front room south; originally set in floor, plucked out by pillagers. [K87, 32]

Gate St. 11 (B): living room; hour glass shaped vase-stand of limestone. [WV, 73, Pl. XIV, #6]

Main St. 1 (B): kitchen; mortar let into floor. [WV, 75]

Main St. 2 (A): front hall?; no description, plan suggests mortar found. [WV, 75]

Main St. 6 (A): front hall; stone mortar 0.20 m deep. [WV, 77, Pl. XVII, #5]

Main St. 7 (A): front hall; against south wall stone mortar sunk in floor with raised mud rim 0.40 m high; diameter 0.45 m, let into floor near front door, a stone pot stand, bowl shaped, and another against south jam of door to living room; living room; stone pot stand let into floor. [WV, 78]

Main St. 8 (A): front hall; shallow stone circular bowl, loose find. [WV, 79]



APPENDIX A continued.

Mortars and possible mortars, continued

- Main St. 9 (A): front hall; stone circular bowl, diameter 0.24 m, loose find. [WV, 80]
Main St. 10 (B): front hall; stone mortar sunk flush with floor, near front door, stone jar stand sunk in floor with mud rim around it 0.35 m high, incomplete on north side, by the side of this opening 0.15 m wide is peg driven into floor and projecting 0.18 m. [WV, 80]
Main St. 11 (A): front hall; shallow limestone mortar, diameter 0.20 m, depth 0.12 m, loose find. [WV, 81]
Main St. 12 (B): front hall; stone mortar, diameter 0.23 m, depth 0.12 m. [WV, 82]
Long Wall St. 2 (B): kitchen; sunk in floor. [WV, 83]
Long Wall St. 6 (A): front room, 52 x 29 cm. [unpublished]
Long Wall St. 7 (A): front hall; stone mortar let into floor and flanked with large stones 0.30 m high - probably jar stand. [WV, 83, Fig. 12]
Long Wall St. 8 (A): front hall; stone bowl (jar stand) let into floor and rimmed with stone and mud 0.40 m high. [WV 84]
Long Wall St. 9 (A): front hall; stone mortar sunk in floor. [WV, 84]
Long Wall St. 10 (A): front hall; stone mortar sunk in floor; living room; limestone mortar, loose find. [WV, 84, 85]
Long Wall St. 11 (A): front hall; stone mortar sunk in floor. [WV, 85]
West St. 2/3: front room; set with mud brick and mud plaster. [K87, 8-9]
West St. 16 (A): front hall; stone mortar sunk in floor, kitchen; circular shallow stone mortar, diameter 0.30 m, loose find. [WV, 87]
West St. 17 (A): front hall; stone bowl (jar stand) sunk in floor. [WV, 88]
West St. 18 (A): kitchen/staircase; stone mortar sunk flush with floor. [WV, 88]
West St. 20 (A): front hall; mortar sunk in floor. [WV, 89]
West St. 22 (A): front room; stone mortar sunk in floor. [WV, 90]
West St. 24 (A): front hall; stone bowl (jar stand) let into floor. [WV, 91]

Pestles

Wood:

- Main Street: opposite #8, wooden pounder. [WV, 68]
Main St. 6 (A): front hall; wooden pestle, 22/149. [WV, 77, 78]
Main St. 8 (A): living room, wooden pounder; kitchen/staircase, wooden pounder [WV, 79]
Main St. 9 (A): front hall; wooden pestle. [WV, 80]
West St. 13 (A): front hall; wooden pestle, 0.55 m long. [WV, 86]

Stone:

- East St. 1: s-e corner, 2 stone pounders. [WV, 70]
Main St. 10 (B): kitchen; granite pounder. [WV, 81]
Long Wall St. 1 (B): kitchen; stone pounder. [WV, 82]

Quern emplacements

Identification fairly definite:

- East St. 1: south west room; double fireplace, lime plastered. [WV, 70]
East St. 10 (B): front hall; square hearth 0.30 m high, north of this a square hob 0.35 m above bed of hearth. [WV, 71]
East St. 11 (B): kitchen; hearth 0.35 m high, cement coated: between it and west wall a shallow bin cement lined. [WV, 72]
Gate St. 8 (A): front room south; top destroyed. [K86, 3, 5]

Quern emplacements, continued

- Gate St. 11 (B): kitchen; pedestal of brick of usual type with two shallow elliptical depressions in upper surface, whole whitewashed. [WV, 73]
- Main St. 1 (B): kitchen; bin 0.20 m high, inner angles rounded off and face lime-plastered. Next to it, box-hearth 0.55 m high, top heavily lime-plastered, having two shallow troughs lying north by south with a flat hob between. The outline of the smoke-blackened patch on the wall above suggests that the box-hearth was originally a vaulted oven. [WV, 75]
- Main St. 4 (A): front hall; square brick bin (or hearth?) lime-plastered, the top divided into three shallow compartments: south of this a shallow bin formed by lime-plastered mud coping. [WV, 76]
- Main St. 5 (B): kitchen; curious round fronted hearth 0.30 m high, top divided into 3 depressions; next to it an enclosure made by a low curved mud coping. Walls originally lime washed, later mud plastered. [WV, 77, Fig. 11]
- Main St. 6 (A): front hall; double enclosure 0.35 m high the north compartment of brick, probably a hearth, the south compartment a bin (?) with as base a (broken) clay dish, diameter 0.55 m. [WV, 77]
- Main St. 7 (A): front hall; remains of box hearth, wall face above smoke blackened. [WV, 78]
- Main St. 9 (A): front hall; square vaulted bin or oven 0.35 m high, north of it a lime plastered bin 0.15 m high. Fireplace in south east corner (?). [WV, 79]
- Main St. 10 (B): front hall; box hearth 0.40 m high and lime plastered bin 0.15 m high. [WV, 80]
- Main St. 11 (A): front hall; box hearth 0.40 m high and bin 0.10 m high. [WV, 81]
- Long Wall St. 2 (A): kitchen; box hearth 0.40 m high and bin 0.10 m high. [WV, 83]
- Long Wall St. 6 (A): front room; much destroyed. [unpublished]
- Long Wall St. 7 (A): front hall, double manger or bin with stone step in front of the south compartment. [WV, 83]
- Long Wall St. 8 (A): kitchen; box hearth lime plastered above, in s-w corner, remains of bin also lime plastered. [WV, 84]
- Long Wall St. 9 (A): front hall south; against north wall, box hearth (late addition); in north west corner a bin lime plastered 0.85 m high. [WV, 84]
- Long Wall St. 10 (A): front hall; bin 0.15 m high; lime washed inside, next to it a fireplace 0.25 m high open to south. [WV, 84]
- Long Wall St. 11 (A): Against north wall a brick bin 0.60 m high, in north east angle bin only 0.05 m high. In north east corner a solid block 0.40 m high. {Description not consistent} [WV, 85]
- Long Wall St. 12 (A): kitchen/staircase; trough fireplace in centre 0.55 m high, lime plastered inside; bin north of it full of barley husks. [WV, 86]
- West St. 2/3: western end of south annexe; top destroyed. [K87, 5]
- West St. 13 (A): front hall, against south wall, brick manger (?), in south east corner brick platform 0.05m high. [WV, 86]
- West St. 15 (A): kitchen; trough fireplace 0.35 m high, with shallow bin against its west side, both lime plastered. [WV, 87]
- West St. 16 (A): front hall; against north wall, box hearth 0.20 m high, in north east corner stone platform for bin. [WV, 87]
- West St. 17 (A): front hall; against south wall box hearth with remains of shallow bin in south west corner. [WV, 88]
- West St. 18 (A): kitchen; against east wall, solid brick hearth and shallow bin in north east corner. [WV, 88]
- West St. 19 (A): front hall; box hearth 0.25 m high; in south west corner low-fronted bin; both lime plastered. [WV, 88]
- West St. 20 (A): front hall; box hearth 0.50 m high, lime plastered; in north east corner shallow bin, lime plastered. [WV, 89]

APPENDIX A continued.

Quern emplacements, continued

- West St. 21 (A): front hall; against south wall box hearth 0.40 m high, and in south west corner low fronted bin, both lime washed. [WV, 89]
West St. 22 (A): front room; box hearth 0.40 m high. In north east corner, shallow lime plastered bin. Lime plaster also on wall face above hearth. [WV, 90]
West St. 23 (A): kitchen; box hearth 0.50 m high and shallow bin in north west corner. [WV, 90]

Identification uncertain:

- East St. 12 (B): kitchen; against south wall, box hearth with stoke hole in west side. [WV, 73]
Main St. 12 (B): front hall; box hearth, no other bin beside, no description, plan unclear. [WV, 82]

Loose quern stones

- Main St. 6 (A): front hall; flat granite rubbing-quern 0.45m by 0.20m. [WV, 78]
Main St. 8 (A): front hall; flat saddle quern red sandstone 0.34m by 0.18m. [WV, 79]
Gate St. 9 (A): high in fill; 2/3 fragment quartzitic sandstone. Find 6634, in unit [2075]. [unpublished]
Long Wall St. 6 (A): surface level; complete red-brown quartzitic sandstone 31.5 x 16 x 8.4 cm, find 49. [unpublished]
West St. 2/3: western end of south annexe; complete grey quartzitic sandstone. Find 17,544, in unit [2760]. [unpublished]
West St. 18 (A): kitchen/staircase; flat quern. [WV, 88]
West St. 19 (A): staircase; rough millstone. [WV, 89]
West St. 20 (A): front hall; stone quern. [WV, 89]

Ovens

- East St. 10 (B): kitchen; 0.70 m high, diameter 0.37 m. [WV, 71]
East St. 12 (B): kitchen; oven 1.00 m high. [WV, 73]
Gate St. 11 (B): kitchen; fuel still in position and a charred stick. [WV, 74]
Main St. 4 (A): kitchen; pot-lined oven with solid wall-continuation to south. [WV, 76]
Main St. 5 (B): kitchen; pot lined. [WV, 77]
Main St. 6 (A): kitchen; no trace of oven, but walls smoke blackened in patches. [WV, 78]
Main St. 8 (A): kitchen/staircase; oven 0.80 m high; shallow impression in hob to south apparently used as charcoal grate (charcoal found beside it and in cupboard below stairs.) [WV, 79]
Main St. 9 (A): kitchen; plastered walls completely smoke blackened. South east corner two pot lined ovens 0.50 m and 0.60 m high. Much charcoal in ovens, room deep in ashes and burnt straw. [WV, 80]
Main St. 10 (B): kitchen; pot lined oven. [WV, 81]
Main St. 11 (A): kitchen/staircase; pot lined oven full of ashes. Whole floor of room covered with layer straw ash 0.60 m thick, and clean sand above. [WV, 82]
Long Wall St. 6 (A): rear room north. [unpublished]
Long Wall St. 7 (A): kitchen; pot lined oven 0.75 m high. Against n wall, stone base of open hearth, wall blackened above. [WV, 83]
Long Wall St. 8 (A): front hall; circular oven 0.60m high; ashes 0.05m thick all over this part of floor. [WV, 84]
West St. 13 (A): kitchen; pot lined oven. [WV, 86]
West St. 16 (A): kitchen; pot lined oven. [WV, 87]
West St. 20 (A): kitchen/staircase; pot lined oven 0.80 m high [WV, 89]
West St. 24 (A): kitchen/staircase; pot lined oven (0.80 m high) [WV, 91]

APPENDIX A continued.

HOUSES GROUPED ACCORDING TO PRESENCE/ABSENCE AND LOCATION OF INSTALLATIONS

Mortars

Type A (back staircase)	Type B (front staircase)	Other
FRONT	FRONT	
Gate St. 9 West St. 20	Main St. 10	East St. 1 (south west corner)
Main St. 6 West St. 22	Main St. 12	West St. 2/3 (front room; south annexe)
Main St. 7 West St. 23	East St. 12	
Main St. 8 West St. 24		
Main St. 9		
Main St. 10		
Long Wall St. 6		
Long Wall St. 7		
Long Wall St. 8		
Long Wall St. 9		
Long Wall St. 11		
BACK	BACK	NOT FULLY EXCAVATED OR DESCRIBED, THEREFORE UNKNOWN
West St. 18	East St. 10	Gate St. 11
	East St. 11 ?	Gate St. 12
	Main St. 1	Main St. 2
		Long Wall St. 1
		West St. 15
OTHER	OTHER	NONE FOUND
Main St. 7		Gate St. 8
Long Wall St. 2		Main St. 3
Long Wall St. 10		Main St. 4
West St. 16		Main St. 5
		Long Wall St. 12
		West St. 13
		West St. 19
		West St. 21
		West St. 26

APPENDIX A continued.

RELATIONSHIP OF QUERN EMPLACEMENTS TO MORTARS

Quern emplacement at front:

Mortar at front	Mortar at back	Both back and front	No mortar/mortar outside
Main St 6 (A)	East St. 10 (B)	West St. 16 (A)	
Main St 7 (A)			Gate St 8 (A)
Main St 9 (A)			Main St 4 (A)
Main St 11 (A)			West St 13 (A)
Long Wall St 6 (A)			West St 19 (A)
Long Wall St 7 (A)			West St 21 (A)
Long Wall St 9 (A)			West St 26 (A)
Long Wall St 10 (A)			
Long Wall St 11 (A)			
West St 17 (A)			
West St 20 (A)			
West St 22 (A)			
Main St 10 (B)			
Main St 12 (B)			

Quern emplacement at back:

Mortar at front	Mortar at back	Both front and back	No mortar/mortar outside
Long Wall St 8 (A)	Long Wall 2 (A)	East St 11 (B)	Long Wall 12 (A)
[West St 23 (A)]*	West St 18 (A)		West St 15 (A)
	Main St 1 (B)		Main St 5 (B)

* probably not functioning as a house at end of village occupation

Other house type	Uncertain	Mortar, no emplacement	Neither
East St 1	East St 12 (B)	Gate St 9 (A)	Main St 3 (no stairs)
West St 2/3	Main St 2 (A)	Main St 8 (A)	
	Gate St 11 (B) not fully excavated	West St 24 (no stairs)	
	Gate St 12 (B) not fully excavated		
	Long Wall St 1 (B) not fully excavated		

APPENDIX A continued.

Quern emplacements

Type A (back staircase)	Type B (front staircase)	Other
FRONT	FRONT	
Gate St. 8 West St. 13	East St. 10	East St. 1
Main St. 2 West St. 16	Main St. 10	West St. 2/3
Main St. 4 West St. 17	Main St. 12	
Main St. 6 West St. 19		
Main St. 7 West St. 20		
Main St. 9 West St. 21		UNCERTAIN
Main St. 11 West St. 22		
Long Wall St. 6 West St. 26		East St. 12
Long Wall St. 7		
Long Wall St. 9		
Long Wall St. 10		
Long Wall St. 11		
BACK	BACK	NOT FULLY EXCAVATED OR DESCRIBED, THEREFORE UNKNOWN
Long Wall St. 2	East St. 11	
Long Wall St. 8	Gate St. 11	Gate St. 12
Long Wall St. 12	Main St. 1	Long Wall St. 1
West St. 15	Main St. 5	
West St. 18		
West St. 23		
OTHER	OTHER	NONE FOUND
		Gate St. 9
		Main St. 3
		Main St. 8
		West St. 24

qe = quern emplacement; qs = quern stone

qe & qs	no qe, qs	no qe, no qs
Main St. 6 both front hall	Main St. 8, front hall	East St. 12
West St. 2/3 western part of s. annexe		Gate St. 9
West St. 13 both front hall?		Main St. 3
West St. 18 both kitchen		West St. 24
West St. 19, qs stairs, qe front hall		
West St. 20 front hall		

Uncertain: Gate St. 12, Main St. 2, Long Wall St. 1
Emplacement, no quern stone: remainder

APPENDIX B: INSTALLATIONS AND ARTEFACTS RELATED TO CEREAL PROCESSING AND BAKING AT DEIR EL-MEDINA.

Source:

BRUYERE, Bernard (1939) Rapport sur les fouilles de Deir el-Médineh (1934-1935). Troisième partie: Le village, les décharges publiques, la station de repos du col de la vallée des rois. Cairo: Institut Français d'Archéologie Orientale.

CEREAL PROCESSING AND BAKING ARTEFACTS/INSTALLATIONS LISTED BY HOUSE

The location of finds are listed by house, accompanied by a brief description of room location and installation where such information is provided (wording of publication retained). [D] - indicates that the house was been damaged or destroyed prior to excavation. [000] - refers to the page number (in some cases, also plate and figure) on which each entry can be found in the publication.

Plaited mats, sieves

(NB: No description is provided for this type of artefact, and there is no way to assess whether these finds are associated with cereal processing or not. They are included for the sake of completeness.)

- NE.VII: room II, a plaited rush mat. [251]
- NE.XVI: [D] In the region of the last 5 houses of the NE quarter and the first 3 houses of the SE, a large quantity of objects were recovered throughout this area including palm and rush baskets, coarse sieves, and winnowing baskets. [262]
- SE.VIII: cellar, willow basket. [276]
- NW.VI: room II cellar, containing plaited halfa grass mat. [282]
- NW.XXV: several baskets. [299]
- NW.XXVI: [D] room III, straw mats. [299]

Querns and quern emplacements

Quern emplacements, described as "kneading trough" in publication.

- NE.II: room 3, traces in north-east corner. [243]
- NE.III: kitchen 1, traces near the entrance. [244]
- NE.V: kitchen, well preserved, brick, six coats whitewash [250, Pl. XIII, upper left, upper right]
- NE.VIII: kitchen. [252]
- NE.XIV: room 1, brick, whitewashed several times. [260, Pl. XIII, lower right, Fig. 24]
- NE.XIX: [D] south-east room, three coats whitewash. [263]
- SE.II: kitchen. [266]
- SE.IV: [D] kitchen, traces. [269]
- NW.I: room at end of passage, remains with four layers whitewash. [280]
- NW.IX: kitchen. [284]
- NW.XII: kitchen. [287]
- C.II: [D] room 1. [302, Pl. XIII, lower left]

APPENDIX B continued.

Quern stones.

- NE.I: location not stated, hand stone and grain grinding stones. [243]
NE.V: kitchen, stone to grind grain. [250]
NE.XIII: location not stated, fragments of granite grinders and kneading slabs. [260]
NE.XIV: location not stated, pink granite grinding slab. [260]
NE.XVI: [D] from the region of the last 5 houses of the N.E. quarter, and first 3 of S.E., black or pink granite grinding and mixing slabs. [262]
SE.IX: [D] location not stated, granite kneading slabs. [276]
NW.XII: location not stated, elongated oval pink granite grinding slab. [287]
C.I: location not stated, granite grinders. [302]
C.IV: apparently various rooms of the house, (2-several) granite grinding slabs. [304]
SW.V: kitchen III, elliptical black granite grinding stone. [328]

Mortars (numerals refer to number found)

- NE.II: room III, 3 set into ground. [243]
NE.III: kitchen 1, 2 in floor surrounded by margin of little stones. [244, Pl. VIII, upper left]
NE.IV: kitchen [not mentioned in text, marked on plan]
NE.V: kitchen, 1. [250, Pl. XIII, upper left, upper right]
NE.VI: room II, beneath staircase, 1. [251]
NE.VII: room II, 2 round, 1 square. [251]
NE.VIII: kitchen, 2. [252]
NE.IX: kitchen, 2. [253]
NE.X: kitchen, 2. [255]
NE.XI: room III, 1 (+ 1?, location not stated) [256, 257]
NE.XII: room IV, fragments of mortars. [259, 260]
NE.XIV: location not stated, 1. [260]
NE.XVI: [D] cubbyhole under stairs, 1. [262]
NE.XIX: [D] south-east corner room, 2. [263]
SE.I: north-east room, 2. [not mentioned in text, marked on plan]
SE.II: room III, 2; kitchen, 1. [266]
SE.III: [D] narrow southern passageway, 3. [268]
SE.VI: room VI, 1. [271]
SE.VII: easternmost room, 1, 40 cm diam., 45 cm height. [273]
NW.II: kitchen, 1. [280]
NW.IX: kitchen, 1 (or more?). [284]
NW.XIX: [D] room II, 1. [295]
NW.XX: north-east room, 1. [not mentioned in text, marked on plan]
NW.XXIV: room III or IV, 1. [298]
NW.XXVI: [D] room III, 1 set in north east angle, number of broken mortars from various excavators placed here also, I presume not all from this house. [299]
C.I: room IV, 1. [302]
C.IV: room IV, 2. [304]
C.VII: kitchen, 1 set in floor. [311]
SW.I: room I, 1. [313]
SW.IV: front room, 1 square, height 30 cm, depth 25 cm, side of square, 52 cm, diameter of hollow at top, 37 cm. [323]
SW.V: room IV, 1, kitchen, 2 set in ground, 1 full of lime. [326, 327]
SW.VI: kitchen, 2 embedded in floor. [331]

APPENDIX B continued.

Ovens (numerals refer to number found)

- NE.I: kitchen, 1 mentioned in text: 65 cm diameter, thickness internal ceramic 4 cm,; 2 marked on plan. [241]
- NE.II: kitchen, oven destroyed, traces of 1 visible, walls blackened by smoke. [244]
- NE.III: kitchen 1, traces 1 small square oven, smoke blackened above; kitchen 2, 2 round ovens, well preserved, height 80 cm, internal diameter at base 80 cm, at the top 50 cm. Internal ceramic 4 cm, external mud coating 15 cm, circular impressions of a jar neck. [244, Pl. XIV, #1]
- NE.IV: kitchen, 2 round, diameter 70 cm [246]
- NE.V: kitchen, 1, 70 cm diameter. [250]
- NE.VIII: kitchen, 2. [252]
- NE.IX: kitchen, traces of 1. [253]
- NE.X: kitchen, traces of 1. [254]
- NE.XI: kitchen, traces of 1. [256]
- NE.XII: kitchen, traces of smoke at oven emplacement, oven itself not mentioned, and not shown on plan. [257]
- NE.XIII: kitchen, traces 1 large round oven, 90 cm (dimension not given). [259]
- NE.XIV: room IV, originally kitchen, traces 2, smoke blackening under second rendering. [260]
- NE.XIX: [D] south-east room, traces 1 round oven, signs of soot on wall. [263]
- SE.II: kitchen, 1 round oven, diameter 70 cm, height 80 cm, mud coating imprinted with circles 5 cm diameter, on little platform against north wall. [266]
- SE.III: [D] southern passageway, 1. [268]
- SE.VI: room VI, 1 round, 75 cm (dimension not given). [271]
- SE.VII: kitchen, traces 1, smoke blackened walls. [273]
- NW.I: room at far end of passage, 1. [280]
- NW.II: kitchen, remains 1. [280]
- NW.III: north east room, 1. [not mentioned in text, noted on plan]
- NW.IX: kitchen, 1, walls smoke blackened. [284]
- NW.XII: kitchen, 2. [287]
- NW.XIII: [D] kitchen, traces 1. [288]
- NW.XVI: [D] one of western rooms identified as kitchen, no oven, but smoke blackened south wall. [293]
- C.V: kitchen, 1. [305]
- C.VI: kitchen, traces 2, walls smoke blackened. [309]
- C.VII: kitchen, 1. [311]
- SW.II: room V or VI, traces 1 with ashes and smoke blackening. [318]
- SW.V: kitchen, 2 quite well preserved. [327]
- SW.VI: kitchen, traces (number unspecified). [331]

APPENDIX B continued.

HOUSES GROUPED ACCORDING TO PRESENCE/ABSENCE OF INSTALLATIONS

Mortars

Houses with no mortars	Houses with one mortar	Houses with more than one mortar
NE.I NE.XII NE.XV [D] NE.XVII [D] NE.XVIII [D] SE.IV [D] SE.V SE.VIII NW.I NW.III NW.IV NW.V NW.VI NW.VII NW.VIII NW.X NW.XI NW.XII NW.XIII [D] NW.XIV NW.XV [D] NW.XVI [D] NW.XVII [D] NW.XVIII [D] NW.XXI NW.XXIII NW.XXV NW.XXVII [D] C.II [D] C.VI SW.III [D]	NE.IV, back NE.V, back NE.VI, under stairs NE.XI, back NE.XIV, back NE.XVI, under stairs SE.VI, back SE.VII, back SE.IX, back NW.II, back NW.IX, back NW.XIX, middle NW.XX, back NW.XXII, back NW.XXIV, location? NW.XXVI, back C.I, back C.III, front C.V, back C.VII, back SW.I, front SW.II, front SW.IV, front	NE.II, 3, back NE.III, 2, back NE.VII, 3, back NE.VIII, 2, front NE.IX, 2, back NE.X, 2, back NE.XIX, 2, back SE.I, 2, back SE.II, 3, back SE.III, 3, back C.IV, 2, back SW.V, 2 side, 1 back SW.VI, 2 front
		Other
		NE.XIII, broken frags, back

APPENDIX B continued.

Querns

qe = quern emplacement; qs = quern stone [D] = house damaged or destroyed

qe & qs	qe, no qs	no qe, qs
NE.V NE.XIV NE.XIX SE.II NW.XII	NE.II NE.III NE.VIII SE.IV [D] NW.I C.II [D]	NE.I NE.XIII NE.XVI [D] NE.XVII [D] NE.XVIII [D] SE.I SE.III SE.IX NW.IX NW.XXVI [D] C.I C.IV SW.V

	no qe, no qs	
NE.IV NE.VI, NE.VII, NE.IX, NE.X, NE.XI, NE.XII, NE.XV [D], SE.V, SE.VI, SE.VII, SE.VIII, NW.II NW.III NW.IV	NW.V NW.VI, NW.VII, NW.VIII, NW.X, NW.XI, NW.XIII, NW.XIV, NW.XV [D], NW.XVI [D], NW.XVII [D], NW.XVIII [D], NW.XIX [D], NW.XX NW.XXI	NW.XXII [D] NW.XXIII, NW.XXIV, NW.XXV NW.XXVII [D] C.III [D] C.V C.VI C.VII SW.I SW.II SW.III [D] SW.IV SW.VI

Table 1.1: A theoretical framework for the archaeological study of food provision.
(adapted from Goody, 1982: 37).

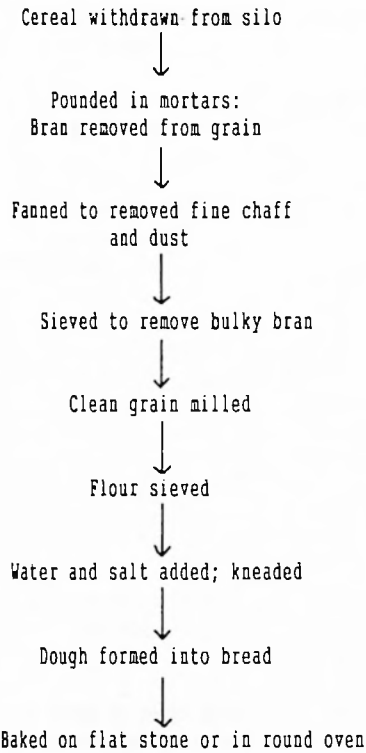
PROCESSES	PHASES	LOCUS	PREDOMINANT CULTURAL FACTORS
Growing/ Animal husbandry	Procurement	Farm/Fishery/ Hunting-gathering area	Economics: Primary production; Work organization; Technology of food production.
Allocating/ Storing	Distribution	Granary/Market	Politics: Rent/tribute/tax/potlatch. Divisions of domestic unit. Decisions on seed, sale, consumption.
Cooking	Preparation	Kitchen	Social: Division and stratification of labour. Economics: technology of preparation.
Eating	Consumption	Table/Eating area	Social: identity and differentiation of groups. Ritual: examples - feasts, prohibitions.
Clearing up	Disposal	"Scullery"	Social: what is disposed of vs. consumed. Ritual.

Table 2.1: Published New Kingdom tombs with wall paintings showing baking scenes. All tombs date to the 18th Dynasty (c. 1550-1307 BC) with the exception of Ramesses III (1194-1163 BC). All are located at Thebes. In addition to the tomb paintings listed here, an Amarna relief from Hermopolis, now the Brooklyn Museum (62.149), shows two different baking methods in separate chambers (Cooney, 1965: 73).

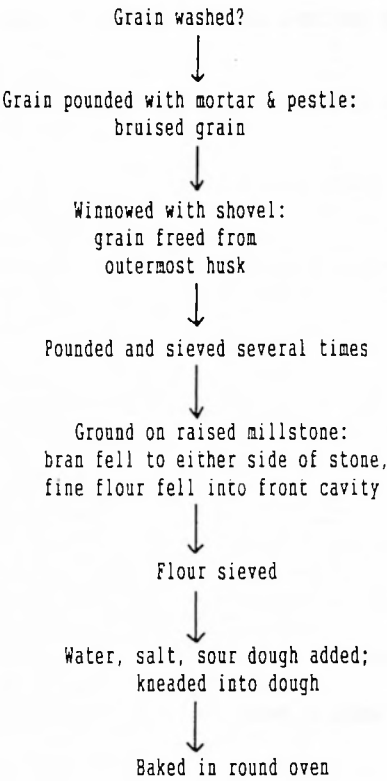
TOMB NAME	TOMB #	PUBLICATION
Nebamun	17	Wreszinski, 1923: Pl. 125 Säve-Söderbergh, 1957: 24-25, Pl. 22
Huy	40	Davies and Gardiner, 1920a: Pl. 36
Neferhotep	49	Davies, 1933: 38, Pl. 45
Amenemhet	53	Wreszinski, 1923: Pl. 87b, 180
Ken-Amun	93	Wreszinski, 1923: Pl. 301-302 Davies, 1930: 51-52, Pl. 7, 58-59
Rekh-mi-re	100	Virey, 1889: 46-48; Pl. 1, 9, 11, 12 Newberry, 1900: 35, 38-39, Pl. 12-14, 22 Wreszinski, 1923: 324-330 Davies, 1943: 38-39, 43-45, Pl. 38, 41, 48-51
Dhutnufer	104	Davies, 1929: 240, Fig. 1A, 1B
Ramesses III		Vandier, 1964: Fig. 152 (see also Darby et al., 1977: Fig. 12.14)

Table 2.2: Flow charts of baking as interpreted from primary sources by Wreszinski (1926: 1-15); Klebs (1934:176-177); Vandier (1964: 308).

1. WRESZINSKI'S INTERPRETATION



2. KLEBS' INTERPRETATION



3. VANDIER'S INTERPRETATION

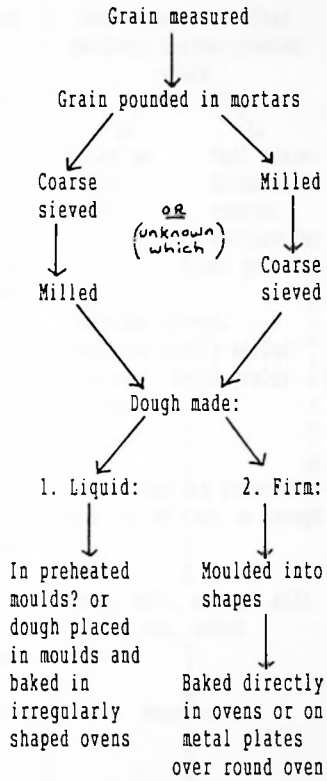


Table 2.3: Flow charts of ancient Egyptian baking as presented in some selected general accounts.

1. DARBY et al. (1977: 502-12)	2. SIST (1987: 55-56)	3. WILSON (1988: 12-14)	4. STROUHAL (1992: 125-126)
(NB: pounding ignored in this account) Cereal winnowed ↓ Pounded and ground on saddle quern: crushed grain ↓ Cribbled and sieved with rush or papyrus sieves: largely wholemeal flour ↓ Kneaded, by hand or with feet in tubs ↓ Salt and spices might be added ↓ Sour dough or yeast added: semi-solid preparation ↓ Baked: 1. On open fire 2. Over ashes 3. On horizontal slab over oven 4. Preheated moulds 5. (Later way) pressed against preheated internal cylindrical oven walls	Grain cleaned by sieving ↓ Ground to flour with long pestle in mortar ↓ Sieved to remove impurities ↓ Milled ↓ Flour mixed with water (Leavened at some stage) ↓ Baked: 1. Directly on fire 2. Slabs of stone over flames 3. (New Kingdom only: Loaves attached to internal walls of cylindrical oven	Cereal sometimes parched ↓ Grain crushed in mortar ↓ Milled on saddle quern ↓ Sieved: coarse flour and whole and partly crushed grain ↓ Flour mixed with water, salt ↓ Baked: 1. Directly on flat stone over fire 2. Baking floor inside clay oven 3. Slapped on pottery wall of oven 4. Cooked in ashes of fire	Stone pestles on flat mortars: coarse crushed grain ↓ Milled on saddle quern ↓ Sometimes sieved: never thoroughly milled or sieved: whole grains in bread ↓ Dough mixed and kneaded by hand, or by feet in trough ↓ Yeast, salt, spices, milk, etc. added ↓ Dough rose ↓ Moulded or shaped ↓ Baked: 1. (Early way) open fire or embers 2. (Early way) simple hob 3. (Old Kingdom onward) preheated thick moulds 4. (Middle Kingdom onward) ledge inside tall oven

Table 3.1: Wheat starch granule loss of birefringence compared to susceptibility to glucoamylase over increased temperature. This table shows a comparison between the extent to which birefringence is lost amongst a population of wheat starch granules, and the extent of gelatinization as measured by the susceptibility of those granules to glucoamylase in excess water, over a range of temperatures. Susceptibility of starch granules to glucoamylase is a better measure of the true extent of gelatinization. The data show that loss of birefringence occurs before starch granules are fully gelatinized. (Data from Goering et al., 1974: 767.)

Temperature °C	% loss of birefringence	% gelatinization (susceptibility to glucoamylase)
55	46.8	9
60	77.3	27
65	100	70
75	-	81

Table 5.1: Ancient limestone mortar used in experiments.
Measurements to nearest half centimeter.

Dimension measured	Measurement (cm)
Maximum exterior diameter	31.5
Rim exterior diameter	26.5
Base exterior diameter	14
Exterior height: base to rim	22
Interior rim diameter	22
Approximate diameter, interior base	8.5
Interior height, base to rim	14
Base thickness	8
Total capacity (to rim)	2.4 L

Table 5.2: Proportion of chaff and grain for emmer
spikelets separated by hand.

Material	Weight (g)	Volume (mL) (more or less packed)
Whole spikelets	50	95
Chaff	11.2	120
Grain	38.7	51
Chaff as a percentage of spikelets	22.5%	46.3% *
Grain as a percentage of spikelets	77.5%	53.7%

* Based on difference between spikelets and grain volume.

Table 5.3: Flow chart of experimental cereal processing from stored spikelets to flour.
 Times are based on a single, unskilled individual carrying out all tasks.

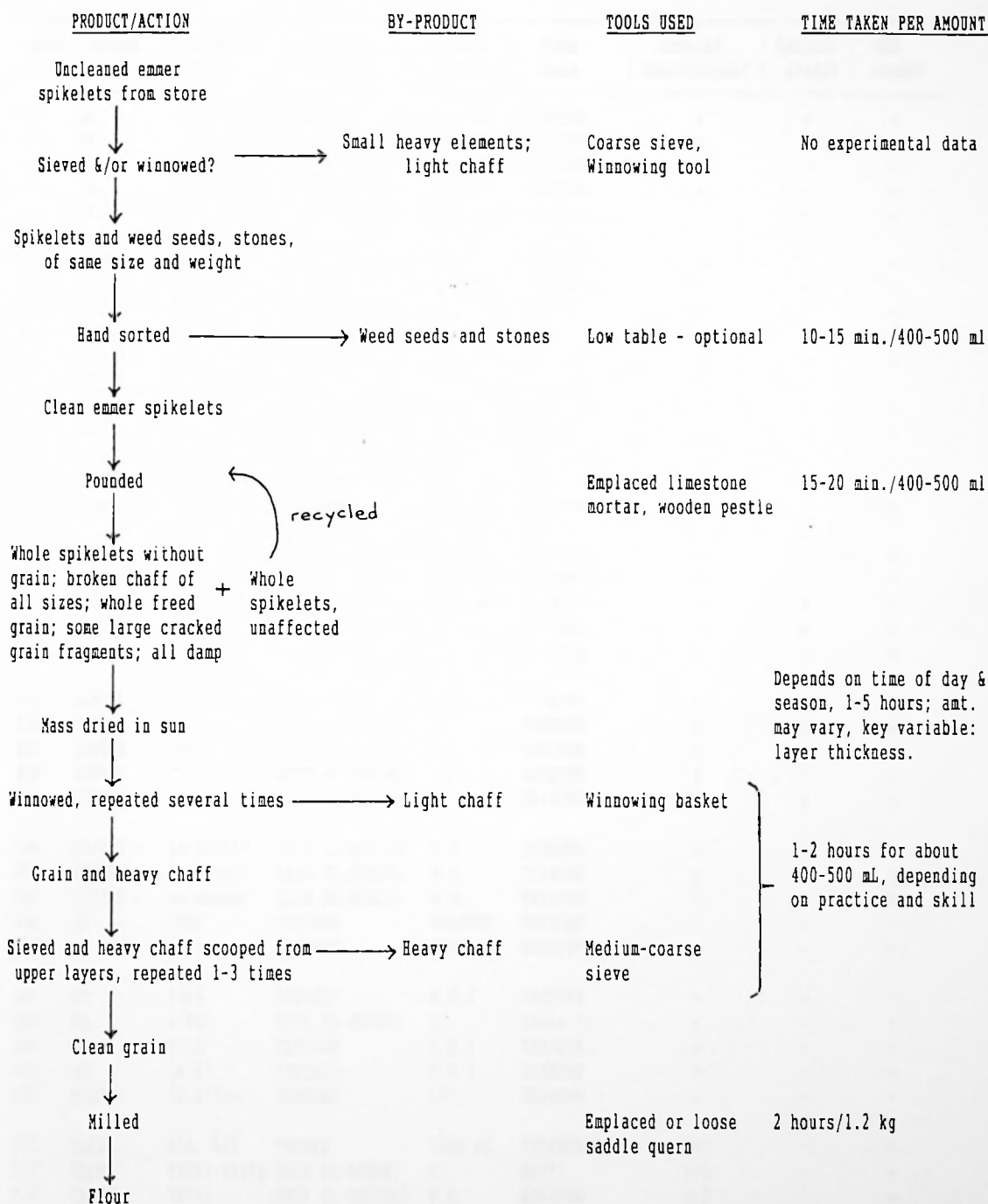


Table 6.1: Ancient Egyptian bread loaves examined, and mode of analysis.

NB: Brackets indicate loaves not handled and examined directly, but observed in museum cases.

Inven- tory #	Museum	Accession Number	Original location	Date (Dynasty)	Tomb name	General description?	Optical study?	SEM study?
001	BM	5391 (B&C)	UNKNOWN	UNKNOWN	UNKNOWN	+	+	+
002	BM	5348 (WS)	UNKNOWN	UNKNOWN	UNKNOWN	+	-	-
003	BM	5359	UNKNOWN	UNKNOWN	UNKNOWN	+	-	-
004	BM	15745;	UNKNOWN	UNKNOWN	UNKNOWN	+	-	-
005	BM	5351	UNKNOWN	UNKNOWN	UNKNOWN	+	-	-
006	TURIN	7019	UNKNOWN	18?	UNKNOWN	+	-	-
007	TURIN	7020	UNKNOWN	18?	UNKNOWN	+	-	-
008	TURIN	?	DEIR EL-MEDINA	18	KHA	+	-	-
009	TURIN	?	DEIR EL-MEDINA	18	KHA	+	-	-
010	TURIN	?	DEIR EL-MEDINA	18	KHA	+	-	-
011	TURIN	?	DEIR EL-MEDINA	18	KHA	+	-	-
012	TURIN	?	DEIR EL-MEDINA	18	KHA	+	-	-
013	TURIN	?	DEIR EL-MEDINA	18	KHA	+	-	-
014	ASHMOLEAN	1921.1395	SEDMENT	9	Cem. 2100	+	+	+
015	ASHMOLEAN	1167	UNKNOWN	UNKNOWN	UNKNOWN	+	+	+
017	ASHMOLEAN	1961.524	THEBES?	UNKNOWN	UNKNOWN	+	+	+
018	ASHMOLEAN	1878.162	THEBES	UNKNOWN	UNKNOWN	+	-	-
019	ASHMOLEAN	1885.234	THEBES	UNKNOWN	UNKNOWN	+	-	-
021	LOUVRE	E14 554	DEIR EL-MEDINA	18	UNKNOWN	+	+	+
022	LOUVRE	E14 555	DEIR EL-MEDINA	18	UNKNOWN	+	+	+
023	LOUVRE	E14 673	DEIR EL-MEDINA	18	UNKNOWN	+	+	+
024	LOUVRE	?	DEIR EL-MEDINA	18	UNKNOWN	+	+	+
025	LOUVRE	4084	DEIR EL-MEDINA	18	UNKNOWN	+	-	-
028	LOUVRE	21983	DEIR EL-MEDINA	18	UNKNOWN	+	+	+
029	LOUVRE	E16410	DEIR EL-MEDINA	18	UNKNOWN	+	+	+
048	LOUVRE	in E14617	DEIR EL-MEDINA	N.K.	UNKNOWN	+	+	+
049	LOUVRE	in E14617	DEIR EL-MEDINA	N.K.	UNKNOWN	+	+	+
064	LOUVRE	no number	DEIR EL-MEDINA	N.K.	UNKNOWN	+	+	+
065	BM	5341	UNKNOWN	UNKNOWN	UNKNOWN	+	-	-
066	BM	5341	UNKNOWN	UNKNOWN	UNKNOWN	+	-	-
067	BM	5346	THEBES?	N.K.?	UNKNOWN	+	-	-
068	BM	40942	DEIR EL-BAHARI	11	(note 1)	+	-	-
069	BM	5353	UNKNOWN	N.K.?	UNKNOWN	+	-	-
070	BM	36193	THEBES?	N.K.?	UNKNOWN	+	-	-
071	BOSTON	72.4757c	UNKNOWN	18?	UNKNOWN	+	-	-
072	CAIRO	644, 645	THEBES	1320 BC	TUTANKHAMUN	(+)	-	-
073	CAIRO	49095-49098	DEIR EL-BAHARI	11	MAIT?	(+)	-	-
074	CAIRO	38643	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
075	CAIRO	38644	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
075	CAIRO	38645	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
077	CAIRO	no number	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
078	CAIRO	no number	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
079	CAIRO	no number	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
080	CAIRO	71599	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-
082	CAIRO	71598	DEIR EL-MEDINA?	N.K.	UNKNOWN	(+)	-	-

note 1: From temple of Menjhotep debris.

Table 6.2: Ancient Egyptian bread form and macroscopic structure. Scale of relative texture: 1-very fine; 2-medium meal; 3-coarse meal; 4-endosperm fragments $\frac{1}{2}$ grain in size or greater; 5-whole grains present. Abbreviations for macro-inclusions: B-barley; E-emmer; L-Lolium; bl-black; ch-chaff; frag-fragment; gl-glume; gr-grain; LEG-leguminous; pc-piece; sl-slightly; spklt-spikelet; v-very; unid-unidentified; + - large numbers of; ++ - very large numbers of. Other abbreviations: N/R - not recorded; NR - nearly; MED - medium; BR - browd; SRFC - surface.

Inven- tory #	Museum	Accession Number	Original location	Date (Dynasty)	Tomb name	General shape	Selected comments on form and decoration	Maximum length mm	Maximum width mm	Depth mm (range)	Colour	Macro inclusions	Relative texture	Structure	Method of Formation
001	BM	5391 (B&C)	UNKNOWN	UNKNOWN	UNKNOWN	(note 1)	(note 1);	(note 1)	(note 1)	(note 1)	ORANGE TO NR. BLACK	E rachis, few L, few large culms, B?	2-5	(WEEVILS)	BY HAND
002	BM	5348 (WS)	UNKNOWN	UNKNOWN	UNKNOWN	FRAG. CRATER		85	63	19-36	DARK BROWN	+L, E gr, some fine ch, ash underside	3-4	SL. POROUS	HAND, ?TOOL
003	BM	5359	UNKNOWN	UNKNOWN	UNKNOWN	FRAGMENT		55	35	21	DARK BROWN	E grain, 1 pc ch,	1;4	(WEEVILS)	BY HAND
004	BM	15745; 85-7.23.41	UNKNOWN	UNKNOWN	UNKNOWN	FRAGMENT	PROBABLY MODERN	111	60	25-33	PALE BROWN	few v. fine ch underside	1	POROUS	BY HAND
005	BM	5351	UNKNOWN	UNKNOWN	UNKNOWN	FRAG CRATER		77	49	11-28	DARK BROWN	E grain, few fine ch, gypsum frag	4	(WEEVILS)	BY HAND
006	TURIN	7019	UNKNOWN	18?	UNKNOWN	ISOSCELES TRIANGLE	VERY FLAT; LONG; NEARLY COMPLETE	280	130	30	ORANGY BROWN	E spklt, gl, +L. +fine ch	2-4	SL. POROUS	BY HAND
007	TURIN	7020	UNKNOWN	18?	UNKNOWN	CRATER	(note 2)	160-180	160-180	30	ORANGY BROWN	+L E/B??	2-4	SL. POROUS?	BY HAND
008	TURIN	? (note 3)	DEIR EL-MEDINA	18	KHA	BOWTIE	BOWED CROSS-SECTION; SLIGHTLY CHIPPED.	200	80	10	MED. BROWN	+ fine ch, some E ch	?	POROUS	BY HAND
009	TURIN	?	DEIR EL-MEDINA	18	KHA	FISH?(COMPLETE)	DOUBLED OVER PIECE OF DOUGH, BANDED BY TWO THIN STRIPS ON TOP SURFACE	90	27	12	DARK BROWN	none seen	?	?	BY HAND
010	TURIN	?	DEIR EL-MEDINA	18	KHA	VULVAR (note 4)	IMPRESSED CENTRAL INDENTATION, ENCIRCLED BY FINE PRICKED HOLES	205	165	50	RED BROWN	none seen	?	?	HAND&TOOLS
011	TURIN	? (note 5)	DEIR EL-MEDINA	18	KHA	SPLIT LOAF 2 JOINED PARTS	1 SIDE PARTIALLY SLASHED W. KNIFE, ARC OF SMALL IMPRESSED DISKS ABOVE.	c.210	c. 175	100	N/R	hard to see, + ch	2-4?	FINE, DENSE	HAND&TOOLS
012	TURIN	?	DEIR EL-MEDINA	18	KHA	FLAT DISK	CENTRAL INDENTATION MADE WITH FINGER	155	131	23	GOLD BROWN	none seen	1	?	BY HAND
013	TURIN	?	DEIR EL-MEDINA	18	KHA	V. FLAT DISK	V. THIN, PINCHED UP RIM C. 1cm FROM EDGE	175	175	14	LIGHT BROWN	+ fine ch, E & B gr.	?	?	BY HAND
014	ASHMOLEAN	1921.1395	SEDIMENT	9	CEM 2100	CRATER		140	140	30	BROWN ORANGE	surface bl ash, few ch, E gl, L?	1-2	?	BY HAND
015	ASHMOLEAN	1167	UNKNOWN	UNKNOWN	UNKNOWN	EQUILATERAL TRIANGLE	MUCH THICKER REL. TO TURIN TRIANGLE, POINTS AND SIDES SMOOTHLY ROUNDED	135(note6)		40	DARK BROWN	E gl spklt fork	?	(WEEVILS)	BY HAND
017	ASHMOLEAN	1961.524	THEBES?	UNKNOWN	UNKNOWN	FRAG. CRATER	V. RAISED EDGE CENTRAL DEPRESSION, BASE V. THIN	125	70	45	ORANGE-BROWN	E gl, 1 E gr, unid seed, L? sl. ch,	1-2	SL. POROUS	BY HAND
018	ASHMOLEAN	1878.162	THEBES	UNKNOWN	UNKNOWN	SMALL FRAG.		20			PALE BROWN	v little ch	3-4	DRY?	?BY HAND
019	ASHMOLEAN	1885.234	THEBES	UNKNOWN	UNKNOWN	SMALL FRAG.	PROBABLY MODERN	/	/	/	V. PALE BR.	v little ch	1	V. POROUS	?
021	LOUVRE	E14 554	DEIR EL-MEDINA	18	UNKNOWN	THIN FLAT DISK	RUFFLED EDGES, TOP INDENTED W. FINGERS	106		10	DARK BROWN	v few fine shreds ch	1-2	(WEEVILS)	BY HAND
022	LOUVRE	E14 555	DEIR EL-MEDINA	18	UNKNOWN	EQUILATERAL TRIANGLE	RELATIVELY THICK, POINTS, SIDES SMOOTHLY ROUND.	(note 7)	/	30	PALE YELLOW	+ whole gr, most E, few B, L, coarse ch	1;5	POROUS	BY HAND
023	LOUVRE	E14 673	DEIR EL-MEDINA	18	UNKNOWN	CRATER	CENTRAL ROUND DEPRESSION, WHOLE MADE OF COILS	170	163	15-30	ORANGY BROWN	v few fine shreds ch small unid flecks	1	?-WAXED UP	BY HAND
024	LOUVRE	?	DEIR EL-MEDINA	18	UNKNOWN	FRAG.	UNKNOWN	/	/	10	DARK BROWN	no trace cereal frag	1	VERY FINE	?
025	LOUVRE	4084	DEIR EL-MEDINA	18	UNKNOWN	FRAG.	THIN, BOWL-SHAPED, CUPPED OVER MOULD	95	57	10-20	N/R	none seen	1-2	FINE	MOULDED
028	LOUVRE	21983	DEIR EL-MEDINA	18	UNKNOWN	CONE	NARROW, SHORT, INCOMPLETE	110	40	40	PALE BROWN	B gr, L, no ch seen	2;5	N/R	BY HAND
029	LOUVRE	E16410	DEIR EL-MEDINA	18	UNKNOWN	CONE	AS 028; FAINT SWEET SCENT	114	40	24-37	MED. BROWN	1 B gr, L, no ch	1;5	(WEEVILS)	BY HAND
048	LOUVRE	in E14617	DEIR EL-MEDINA	N.K.	UNKNOWN	SMALL FRAG.	BROKEN OFF ORIGINAL LOAF WHEN FRESH	/	/	/	GOLD YELLOW	none seen	1	DENSE	?
049	LOUVRE	in E14617	DEIR EL-MEDINA	N.K.	UNKNOWN	SMALL FRAG.	BROKEN OFF ORIGINAL LOAF WHEN FRESH	/	/	20	N/R	none seen	N/R	POROUS	?
064	LOUVRE	no number	DEIR EL-MEDINA	N.K.	UNKNOWN	FLAT DISK	NO DEPRESSION, REL. THIN	/	/	/	V DARK BROWN	none seen	(WEEVILS)	(WEEVILS)	BY HAND
065	BM	5341	UNKNOWN	UNKNOWN	UNKNOWN	ROUND DISK	HAND IMPRINT UNDERSIDE	140	140	13	DULL BROWN	+L, E spklt, gl gr, 1-2 B gr	3-4	POROUS	BY HAND
066	BM	5341	UNKNOWN	UNKNOWN	UNKNOWN	ROUND DISK	SMALLER THAN 065; HAND & FINGER PRINTS LOAF SL BOWED CONVEX BELOW/CONCAVE ABOVE	115	107	11	DULL BROWN	Smear ash? Flat LEG.	3-5	POROUS	BY HAND
067	BM	5346	THEBES?	N.K.?	UNKNOWN	ROUND, THICK, IRREGULAR	BASE MOULDED, TOP RING ADDED, NEAT INDENTATIONS, INCOMPLETE	85	58	43	DARK BROWN	Date stones, calyx E rachis, gr; fruit?	1-2	FINE, DENSE	MOULDED

Table 6.2: Ancient Egyptian bread form and macroscopic structure. Scale of relative texture: 1-very fine; 2-medium meal; 3-coarse meal; 4-endosperm fragments $\frac{1}{2}$ grain in size or greater; 5-whole grains present.
(cont'd) Abbreviations for macro-inclusions: B-barley; E-emmer; L-lolium; bl-black; ch-chaff; frag-fragment; gl-glume; gr-grain; LEG-leguminous; pc-piece; sl-slightly; spklt-spikelet; v-very; unid-unidentified;
+ - large numbers of; ++ - very large numbers of. Other abbreviations: N/R - not recorded; NR - nearly; MED - medium; BR - brown; SRFC - surface.

Inven- tory #	Museum	Accession Number	Original location	Date (Dynasty)	Tomb name	General shape	Selected comments on form and decoration	Maxima length mm	Maxima width mm	Depth mm (range)	Colour	Macro inclusions	Relative texture	Structure	Method of Formation
068	BM	40942	DEIR EL-BAHARI	11	(note 8)	EQUILATERAL TRIANGLE	ROUNDED POINTS, BOWED SIDES	188(note 9)	235	20	PALE YELLOW	++L, terminal E spklt	1-5	HEAVY, SOLID MOULDED?	
069	BM	5353	UNKNOWN	N.K.?	UNKNOWN	FOUR LOBED	LOBES TURNED UP FROM BODY OF LOAF HOLE PIERCED THROUGH	60	45	10	GREEN-BROWN	Bit unid ch	1-3	SL. POROUS	BY HAND
070	BM	36193	THEBES?	N.K.?	UNKNOWN	TAPERED ROLL	BOTH ENDS TAPERED, ONE TIP SMOOTHED	155	47	35	PALE BROWN	White stone, 1L, E gr	3-5	POROUS	BY HAND
072	CAIRO	644, 645	THEBES	1320 BC	TUTANKHAMON	HALF DISK	'TI' SHAPE, 10 ON DISPLAY	c.100-150 (note 10)		c.10-60	MED. BROWN	Unid shreds -leaf? peel?; coriander	?	?	BY HAND?
073A,D	CAIRO	49095, 49098	DEIR EL-BAHARI	11	MAIT?	EQUILATERAL TRIANGLE	VERY LARGE, ROUNDED POINTS AND SIDES VERY COARSE TEXTURE, THIN FLAKY CRUST	c. 200-250		c.30-50	SRFC WHITISH /YELLOWISH	E gr; unid ch	1-5	QT. POROUS?	?
073B	CAIRO	49096	DEIR EL-BAHARI	11	MAIT?	AS 073A,D	AS 073A,D	*		*	*	E gr, +B gr, unid ch	1,4-5	QT. POROUS?	?
073C	CAIRO	49097	DEIR EL-BAHARI	11	MAIT?	AS 073A,D	SHAPE AS OTHERS, TEXTURE MUCH FINER, MANY FEWER WHOLE GR, NO THIN CRUST. CONVEXLY BOWED, FORMED BY COILING, PRICKED DOTS AROUND INDENTATION.	/	/	/	N/R	?	?	?	BY HAND
074	CAIRO	38643	DEIR EL-MEDINA?	N.K.	UNKNOWN	CRATER	LIKE 011; ONE SIDE KNIFE SLASHED, V. FINE IMPRESSED OVAL PATTERNS ABOVE	/	/	/	MED. BROWN	?	3	DENSE?	HAND & TOOLS
075	CAIRO	38644	DEIR EL-MEDINA?	N.K.	UNKNOWN	SPLIT LOAF	FLAT LOAF, ALSO LIKE RAM'S HEAD SHAPE EDGES RAISED WITH EXTRA DOUGH	/	c. 200	c. 10	N/R	?	3-4	?	BY HAND
076	CAIRO	38645	DEIR EL-MEDINA?	N.K.	UNKNOWN	PAPYRUS HEAD	EDGES RAISED WITH EXTRA DOUGH	c. 150	c. 70	c. 10	MED. BROWN	?	?	?	BY HAND
077	CAIRO	no number	DEIR EL-MEDINA?	N.K.	UNKNOWN	RACQUET	LIKE 008	c. 200	/	/	MED. BROWN	?	?	?	BY HAND
078	CAIRO	no number	DEIR EL-MEDINA?	N.K.	UNKNOWN	BOWTIE	SMALL ROUNDEL WITH PINCHED, SCALLOPED EDGES, V. FLAT, CURVED UPWARDS	c. 60		c. 5	MED. BROWN	?	?	?	BY HAND
079	CAIRO	no number	DEIR EL-MEDINA?	N.K.	UNKNOWN	FLAT DISK									
080	CAIRO	71599	DEIR EL-MEDINA?	N.K.	UNKNOWN	LENS SHAPED	THICK IN CENTRE, EDGES SMOOTHLY, SHARPLY TAPERED; SQUARE STAMP ON UPPER SURFACE	c. 200		c. 80	DINGY BROWN	?	1	V. DENSE?	?
081	CAIRO	71598	DEIR EL-MEDINA?	N.K.	UNKNOWN	LENS SHAPED	UNDERSIDE LINED WITH FINE CLOTH	c. 200		c. 80	DARK BROWN	?	1	V. DENSE?	?
071	BOSTON	72.4757c	UNKNOWN	18?	UNKNOWN	FRAG. CONE	OUTER SURFACE SMOOTH	c. 160		c. 55	DARK PURPLE	Fig seeds	N/A	DENSE	?

note 1: many sizes, shapes, broken frags. bread from one basket, all same colour, texture, etc.

note 2: 4 loaves of this form from same type of dough.

note 3: 3½ loaves of this type from same tomb.

note 4: several other loaves of this type from tomb of Kha, number not recorded. Two others of this type probably from Deir el-Medina on display in Cairo Museum, Room 4 U.

note 5: 10 loaves of this type from same tomb.

note 6: longest side measured.

note 7: Edges measured 150x160x160 mm.

note 8: From temple of Menjhotep debris.

note 9: Different measurement method from other triangular loaves: greatest length from tip to base = length.

note 10: Measurement across base.

Table 6.3: Ancient Egyptian loaf shape categories, using data from
Table 6.2. NB: fragments of indeterminate shape are
not included.

CIRCULAR

- flat, thin:
021; 064; 065; 066; 079.
- more or less flat, central depression:
002; 005; 007; 010; 012; 013; 014; 017; 023; 074.
- lens shaped:
080; 081.

TRIANGULAR

- more or less equilateral:
015; 022; 068; 073.
- more or less isosceles:
006.

CONICAL

028; 029; 071.

TAPERED ROLL

070.

HALF DISK

072.

MORE OR LESS FLAT, SHAPED

008; 069; 076; 077; 078.

SPLIT LOAF

011; 075.

DECORATED FORMS

009.

MOULDED

025; 067.

Table 6.4: Ancient Egyptian bread loaves: results of observations under transmitted and polarizing light microscopy, and iodine staining, of crushed samples suspended in water mounts.

Inven- tory #	Museum	Accession Number	Original location	Date (Dynasty)	Observations using transmitted light: Free starch granules.	Observations using transmitted light: Endosperm chunks and starch granules within them.	Structure of material stained with iodine	Results of iodine stain
001	BM	5391 (B&C)	UNKNOWN	UNKNOWN	Few. Unmarked: biref; ringed, pitted, channelled: largely biref, some clear. Some sl. distorted. Some dispersed clouds of flecks.	Swollen &/or distorted, heavily ringed/channelled. clear. Some partially to heavily ringed, undistorted: most biref, some partially biref.	Large chunks, few free granules: Little chunks emitting streams of material: V. few free granules: Clouds, streams small frags, large dense chunks:	Deep purple-black, violet edged. Violet. Pale violet. Dark reddish-brown.
014	ASHMOLEAN	1921.1395	SEDIMENT	9	Some large, distorted, bent, swollen: clear. Swollen or undistorted: some fully biref, most clear; some pitted: clear or slightly biref.	Almost all clear; some fully biref, no sign of modification.	All little frags, all free granules: Some irregular chunks, most small, one large:	Deep purple. Brownish.
015	ASHMOLEAN	1167	UNKNOWN	UNKNOWN	Essentially no free granules.	Almost all irregular: clear.	Chunks: Huge amts thin sheets dispersing from chunks:	Deep violet black. Reddish brown.
017	ASHMOLEAN	1961.524	THEBES?	UNKNOWN	Bardly any, mostly undistorted: biref. One pitted and ringed.	Lots of chunks, almost all clear, some small patches within them: biref.	Everything:	Deeply purple black.
021	LOUVRE	E14 554	DEIR EL-MEDINA N.K.		Relatively few, nearly all w. concentric rings, some channelled: most clear, some biref.	Many l.granules channelled, many granules clear, some faintly to strongly biref, small granules: clear.	Chunks & large free granules: Most tiny frags, diffuse chunks, small granules: Few free pieces and in some chunks: Very few pieces: Small chips:	Dark purple. Medium purple. Bright magenta purple. Brownish purple. Unstained dark golden orange.
022	LOUVRE	E14 555	DEIR EL-MEDINA N.K.		No free granules.	No signs pitting or ringing, but v. distorted: clear.	Endosperm chunks:	Deep purple-black. Dark violet. Violet brown.
023	LOUVRE	E14 673	DEIR EL-MEDINA N.K.		Greyish cloudy masses: clear; A few free granules in cloudy masses: some pits &/or rings: clear or some biref: unmodified: biref.	Many v. distorted, bent, few partly ringed: clear; some less distorted, strongly ringed: v. slight biref.	Small particles, dispersed masses, chunks: Small amount at edges of chunks:	Deep purple-black. Dark violet Dark violet-brown.
024	LOUVRE	?	DEIR EL-MEDINA N.K.		None seen.	Almost all clear, v. few small granules biref.	Chunks & v. small particles: Longs streams trailing from some chunks:	Dark purple-black. Reddish-brown.
028	LOUVRE	21983	DEIR EL-MEDINA N.K.		Few: biref.	Most granules packed, distorted, shrivelled, with heavy concentric rings: mostly clear; few w. residual biref. Many small granules visible.	Almost everything, some granules embedded in lighter matrix: Some parts of endosperm chunks: Many small particles: Some chunks:	Deep purple-black. Dark violet. Intense violet. Dark reddish-brown.
029	LOUVRE	E16410	DEIR EL-MEDINA N.K.		Grey clouds dispersed material: clear.	Large chunks: v. shrivelled and distorted (more than 028), many with tightly packed concentric rings: clear.	Large chunks, small particles: A few dense small chunks: Some streams of material:	Deep purple-black to dark violet. Deep violet-bluish. Reddish-violet.
048	LOUVRE	in E14617	DEIR EL-MEDINA N.K.		Large dispersed greyish masses: clear; trapping free granules: fully biref. Free granules, ringed: fully or partially biref.	Many fine to large chunks, granules within: many pitted: biref; some strongly ringed: fully partially biref; many distorted: clear. Few unpitted, unringed: biref.	Small discrete chunks: Dispersed grey masses:	Purple-black. Magenta. Brown magenta. Deep violet w. brownish tinge.
049	LOUVRE	in E14617	DEIR EL-MEDINA N.K.		Some. Condition not noted.	Some bent and distorted: clear; most have concentric rings and pits: mainly biref but many clear. (Whole range modification showing whole range biref.)	All little particles, all free granules: Granules within endosperm: Some free granules: Some individual granules:	Very dark purple. Purple-black to deep violet. Violet. Violet-bluish.
064	LOUVRE	no number	DEIR EL-MEDINA N.K.		No free granules seen. Grey dispersed chunks: clear.	Heavily distorted: clear; distorted with concentric rings: partially biref.	Fine dispersed particles, large chunks: Many chunks: Some streams of material:	Deep purple-black. Deep violet. Violet-magenta. Reddish-violet. Reddish-brown.

Table 6.5: Ancient Egyptian bread loaves: results of observations using scanning electron microscopy.

Inventory #	Museum	Accession Number	Original location	Date (Dynasty)	State of starch granules on RJH Scale. (+)										Degree of enzyme attack on starch granules	Yeast	Other
					S-0	S-1	S-2	S-3	S-4	S-5	S-5/6	S-6					
001	BM	5391 (B&C)	UNKNOWN	UNKNOWN				+	+	+				+	Heavily gelatinized, but may be pitted.	Uncertain	Cereal beard hairs; spicules; particulate matter; bran.
014	ASHMOLEAN	1921.1395	SEDMENT	9							+			+	Possible pitting, one hollow starch granule.	Uncertain	Fungal hyphae; crystals; unknown 'spiral'; bran.
015	ASHMOLEAN	1167	UNKNOWN	UNKNOWN							+			+	Broken frags. starch?	None seen	Fungal hyphae; crystals; unknown particulate matter; spiral similar to 014.
017	ASHMOLEAN	1961.524	TREBES?	UNKNOWN		+	+	+	+	+				+	None seen, matrix full of holes.	None seen	Cereal beard hair; fungal hyphae.
021	LOUVRE	E14 554	DEIR EL-MEDINA	N.K.		+				+				+	Some pitting.	Uncertain	Vascular tissue; frass; particulate matter - starch related?
022	LOUVRE	E14 555	DEIR EL-MEDINA	N.K.								+		+	Hint of pitting, laminated area.	None seen	Fungal hyphae; unknown non-cereal material, apparently deliberately added; fine particulate matter.
023	LOUVRE	E14 673	DEIR EL-MEDINA	N.K.							+	+		+	Some pitting.	None seen	Bran; particulate matter - starch related?; layered texture, unknown cause.
024	LOUVRE	?	DEIR EL-MEDINA	N.K.										+	Channels.	Present	Fungal hyphae; bran? smooth particulate matter; possible bacteria.
028	LOUVRE	21983	DEIR EL-MEDINA	N.K.							+			+	Equatorial groove defined. Suggestion of pitting, obscured by gelatinization	None seen	Frass; fibres; heated protein strands?
029	LOUVRE	E16410	DEIR EL-MEDINA	N.K.		+	+	+		+				+	Possible pits, channelled groove, hollowed small starch granule.	Uncertain	Fungal hyphae; bran; small granules, crystals, starch varies over sample.
048	LOUVRE	in E14617	DEIR EL-MEDINA	N.K.		+	+			+	+			+	Pitting.	None seen	Fungal hyphae; fine particulate matter, (bacteria?)
049	LOUVRE	in E14617	DEIR EL-MEDINA	N.K.		+					+			+	Degraded (and heated) starch, channels, pits.	None seen	Bran; fungal hyphae; unidentified particulate matter.
064	LOUVRE	no number	DEIR EL-MEDINA	N.K.							+			+	Some channelling.	None seen	Fungal hyphae; crystals; small starch particles, gelatinized.

* RJH scale of starch gelatinization: S-0: ungelatinized. S-1: swollen. S-2: dimpled or indented; S-3: doughnut; S-4: rubber raft; S-5: pancake; S-6: dispersed. (Rockland et al., 1977). See Fig. 3.7 for representations of the different stages of gelatinization.

Table 6.6: Sugar content of loaf 001. Sugars were determined using the Englyst Method (Englyst et al., 1989; Englyst and Kingman, 1990), and the analysis was carried out in the laboratory of Dr. Hans Englyst. All sugars listed are monosaccharides, with the exception of uronic acid, which is a substituted sugar.

Saccharide	Quantity (g/100 g dry matter)
(Total non-starch saccharide)	5.1
Cellulose	2.2
Rhamnose	-
Fucose	0.1
Arabinose	0.2
Xylose	0.6
Mannose	0.3
Galactose	0.2
Glucose	0.9
Uronic acid	0.6

Table 6.7: Characterization of analysed loaves, according to models proposed in Ch. 6.V. The notation "cf" indicates that the designation is probable but not certain.

LOAF #	PROPOSED METHOD OF PRODUCTION	COMMENTS
001	C-1	
014	cf C-1	
015	cf C-1	C-1 is the best fit, assuming a very wet dough.
017	A	
021	C-1	
022	C-1/D	Cannot determine the process with the evidence available.
023	D	Supported by presence of shattered starch.
024	C-1	
028	C-1/D	Cannot determined the process with the evidence available. N.B. No sweet scent.
029	cf D	N.B. Sweet scent.
048	D	Supported by presence of shattered starch and absence of red-brown staining material.
049	C-1	
064	C-1/D	Probably D, supported by presence of shattered starch and heavily distorted granules, but few streams of violet to red-brown staining material suggests C1 is a possibility.

SUMMARY OF MODELS:

- A: Spikelets not soaked, only sprinkled with water when pounded - processed to flour according to procedure outlined in Table 5.3 - dough made - baked.
- B: Spikelets soaked - dried enough for dehusking - damp grain milled into paste - paste baked.
- C-1: Spikelets soaked, grains germinate - air dried - processed to flour according to procedure outlined in Table 5.3 - moist dough made - baked.
- C-2: Spikelets soaked, grains germinate - air dried - processed to flour according to procedure outlined in Table 5.3 - stiff 'dry' dough made - baked.
- D: Spikelets soaked, grains germinate - roasted - processed to flour according to procedure outlined in Table 5.3 - dough made - baked.

Table 6.8: Finds of platters from houses in the North Suburb and the houses of the Workmen's village at the site of Amarna.

Key to references:

P & W: Peet and Woolley, 1923;

F & P: Frankfort and Pendlebury, 1933;

AR IV: Kemp, 1987;

N/D: house not described in text.

North Suburb

House	Reference	Comments
S.35.3	F & P: N/D	Type II.5; small house, no oven on plan, stairs.
T.33.1	F & P: 68	Type II.5; estate, no oven on plan, stairs.
T.35.6		Type II.4; outbuildings to east.
T.35.9	F & P: 41	Type II.5; medium house, courtyard oven.
T.35.10	F & P: 38	Type II.5; small house, no oven on plan, no stairs.
T.35.14	F & P: N/D	Type II.5; medium house, no oven on plan, stairs.
U.33.10	F & P: 74	Type II.5; small house, no oven, stairs.
U.36.34	F & P: 22	Type II.5; large house, no oven on plan, but text mentions kitchen, stairs.

Workmen's Village (all mentions of Type III pottery from P & W transcribed, see Ch. 6.VIII.C.3 for chapel finds)

House	Reference	Comments
East 1	P & W: 71	III/?: on staircase; III: bedroom.
East 10	Peet, 1921: 177	Rough flat dish with low ridge; in oven.
East 12	P & W: 73	III: in kitchen.
Gate 8	AR IV: 134-8	Bread platters; total of 3 in house.
Gate 11	P & W: 73 unpublished	III/1020A: in oven and elsewhere. III/1020C, unfired, III/1020.
Main 1	P & W: 74	Flat bread tray: living room.
Main 3	unpublished	III/1020B
Main 5	P & W: 77	III/132: living room; III/33: bedroom.
Main 6	P & W: 78	Fragments of baking dish: front hall.
Long Wall 7	P & W: 83	III/34: Front hall.

Fig. 2.1: A baking scene from the tomb of Nebamun at Thebes (#17), dating to the 18th Dynasty (1550-1307 BC). The figure on the right seems to be engaged in cutting a round object, possibly a loaf. The two left-hand figures are preparing round or disk-shaped bread, which is baked in a cylindrical oven. Note the representations of loaves above the figures, showing a row of round or disk-shaped bread and a row of paddle-shaped or racquet-shaped bread, both decorated with markings. Drawing by Kate Spence after S  ve-S  derbergh, 1957, Plate 22.

Fig. 3.1: The major components of representative cereal ears. Emmer, a glume wheat, is shown above. Upon threshing, the ear breaks up into spikelets, which need further processing to free the grain and separate it from the spikelet chaff. In comparison, the threshed ears of bread wheat, to the lower left, break up into free grain and chaff, with most of the rachis segments staying attached to each other. When threshed, the ears of hulled barley break up into the hulled grain, a small amount of fine chaff from the glumes, and the joined rachis segments. From Hillman, 1981, reproduced with permission of the author.

Fig. 2.1

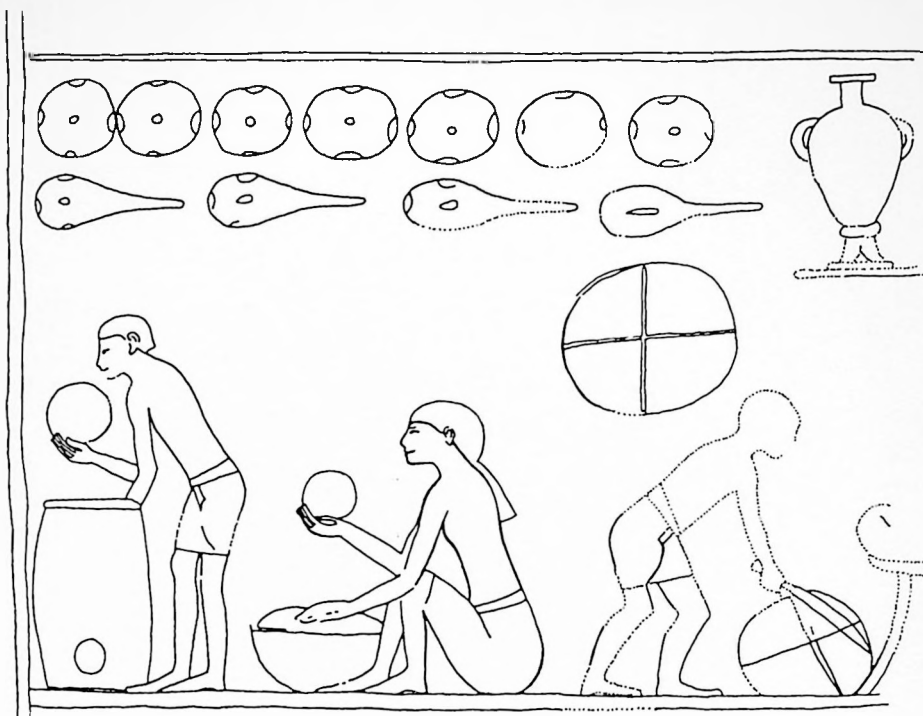
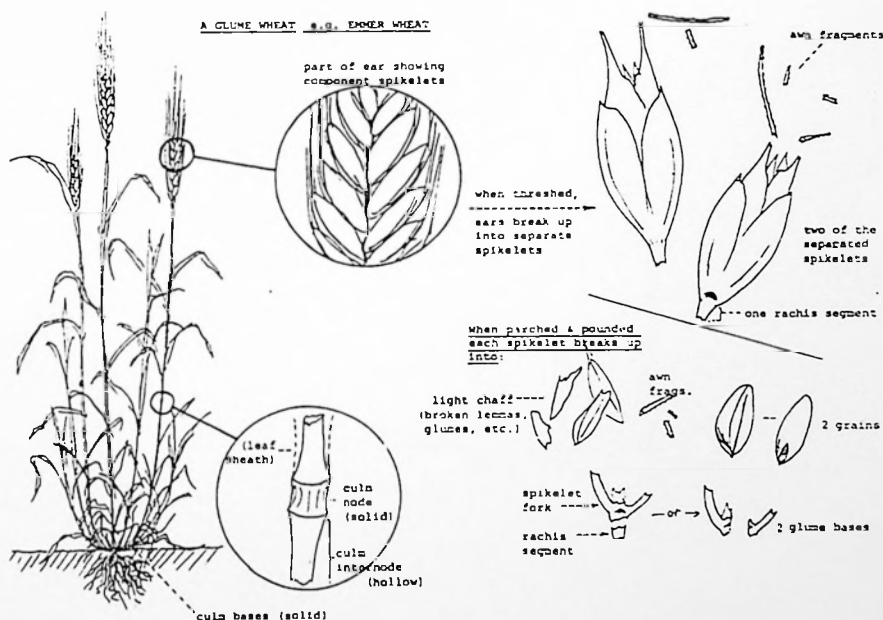
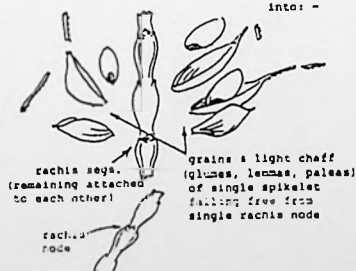


Fig. 3.1



FREE-THRESHING WHEAT e.g. BREAD WHEAT

when threshed the ear immediately breaks up into: -



6-ROWED, HULLED BARLEY

when threshed the ear immediately breaks up into: -

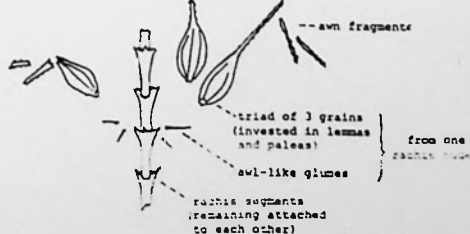


Fig. 3.2: The major components of the cereal grain, shown in longitudinal and cross sections. The bran layer is composed of several different tissue layers which are represented schematically here. Drawing by Kate Spence.

Fig. 3.3: Scanning electron micrograph of part of an emmer grain aleurone cell. The aleurone cell is on the left, with the typical interior granular texture (G). To the right is starchy endosperm (S).

Fig. 3.4: The structure of the glucose molecule. The molecule is composed of six carbons (numbered conventionally in the diagram), five of which make up a ring, together with one oxygen molecule. Attached to each carbon atom is one hydrogen atom and one oxygen-hydrogen group (called an hydroxyl group). Depending on the configuration of the atom involved in inter-molecular bonds, the linkages which glucose makes with other glucose molecules can be in the "α" or "β" form. The configuration of linkages in starch are all in the α form.

Fig. 3.2

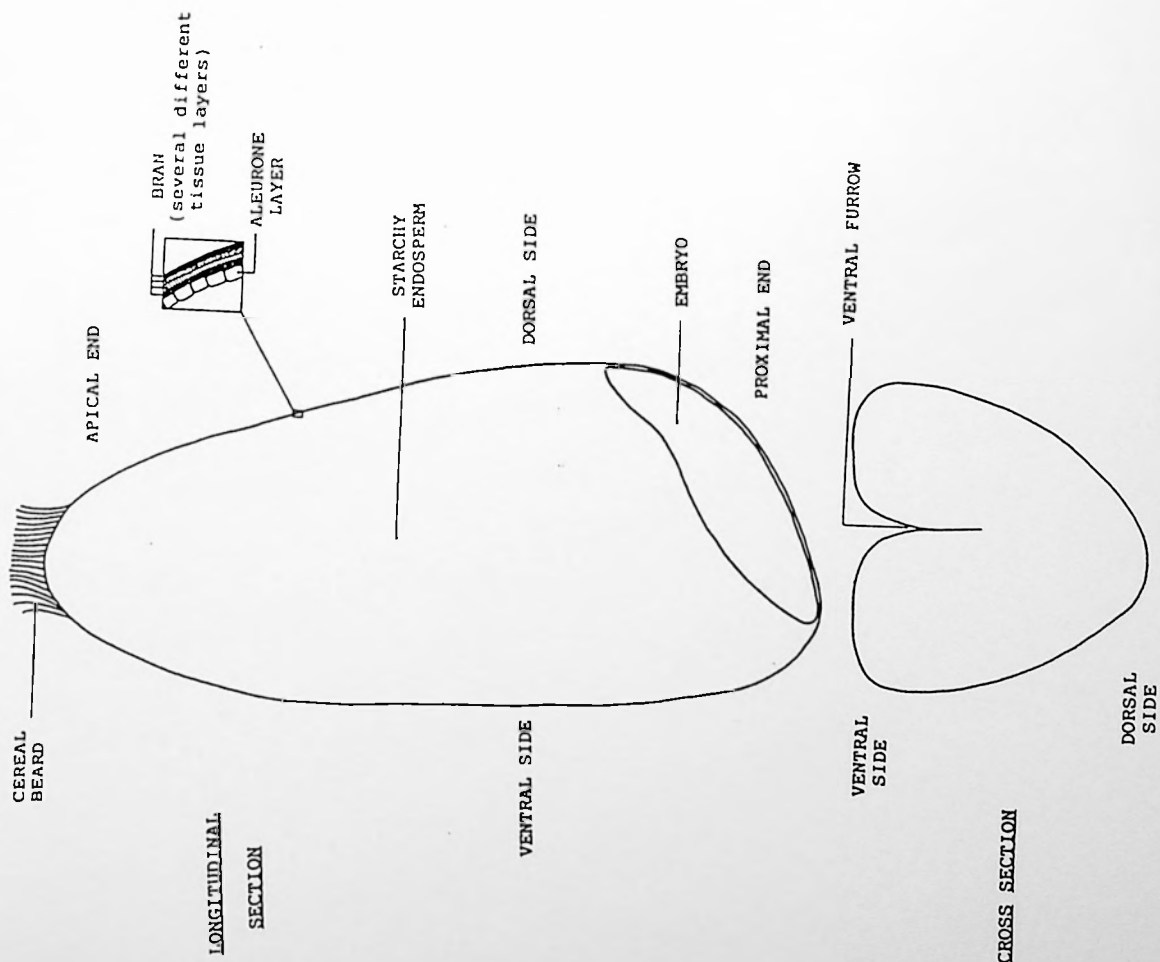


Fig. 3.3



Fig. 3.4

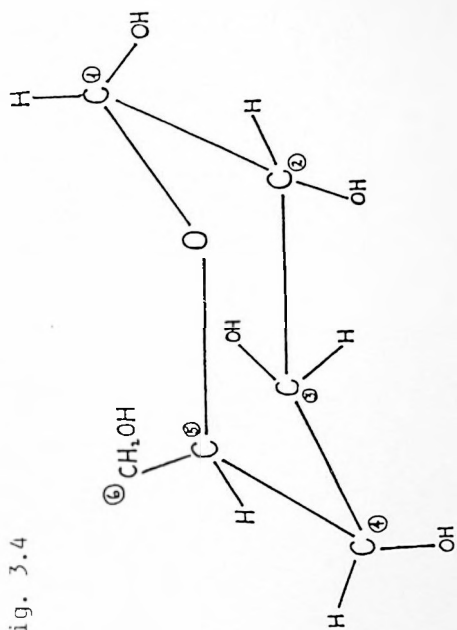


Fig. 3.5: The structure of amylose.

(a) Representation of a portion of amylose, showing the α -1,4 linkages between glucose units. Attached hydrogen and ring carbon atoms have been omitted for clarity. All the glucose units are joined by their #1 and #4 carbon atoms. Enzymes act at the non-reducing ends of the molecule. After Kennedy et al. (1987) with modifications after Coultate (1989).

(b) A simplified diagram of the linear amylose molecule.

Fig. 3.6: The structure of amylopectin.

(a) Representation of a portion of amylopectin, showing the α -1,4 and α -1,6 linkages. Attached hydrogen and ring carbon atoms have been omitted for clarity. The linear sections of the molecule are made up of glucose units joined by their #1 and #4 carbon atoms, while the branch points are formed by a link between #1 and #6 carbon atoms. After Kearsley and Sicard (1989) with modifications after Coultate (1989).

(b) A simplified diagram of a portion of the branched amylopectin molecule.

Fig. 3.5

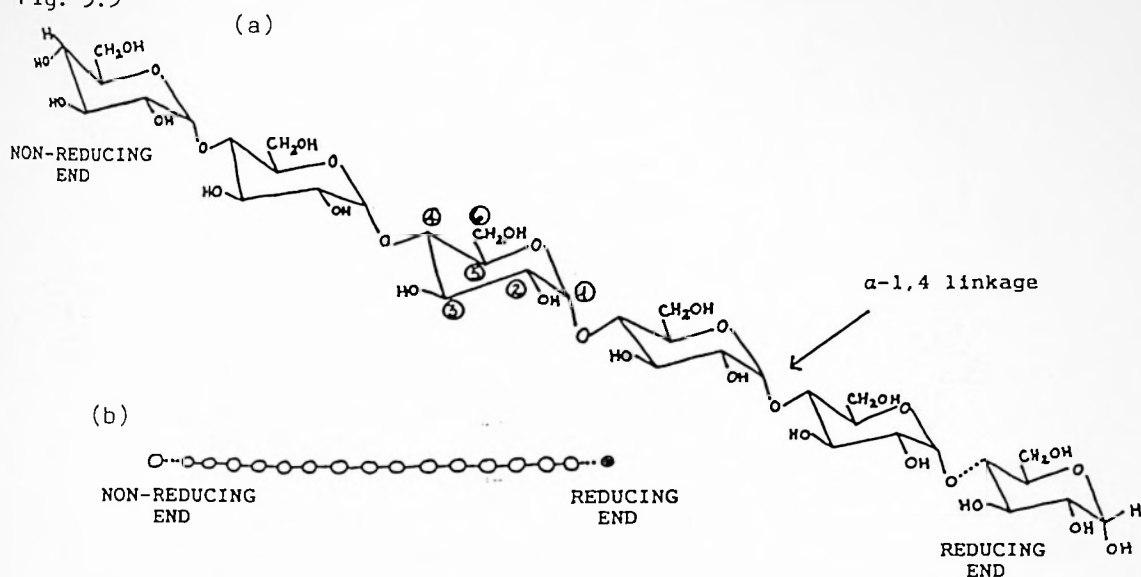


Fig. 3.6

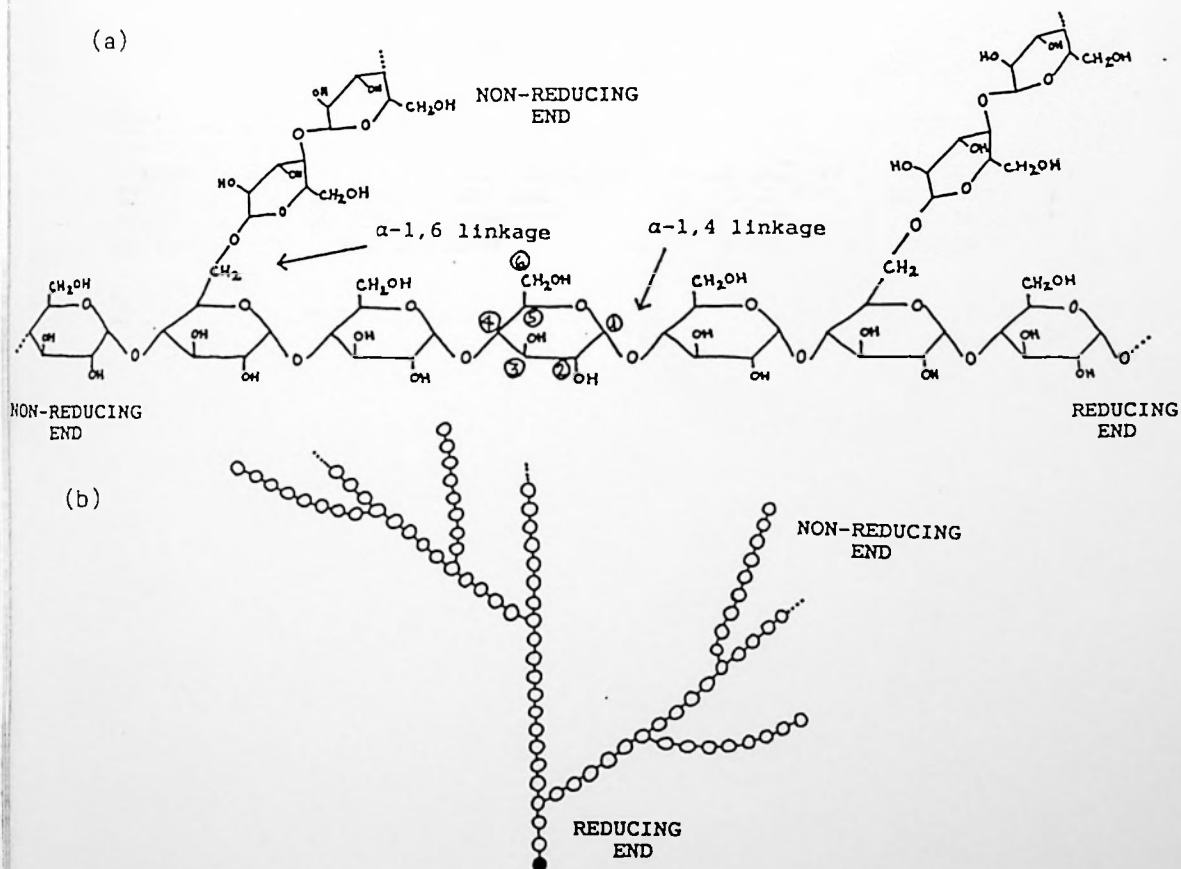


Fig. 3.7: Schematic representations of Lima bean starch granules, illustrating the different stages of gelatinization as seen with the scanning electron microscope according to the scale devised by Rockland *et al.* (1977). The different stages are as follows: S-0: ungelatinized; S-1: swollen; S-2: dimpled or indented; S-3: doughnut; S-4: rubber raft; S-5: pancake; S-6 (not shown): dispersed. Note the different scale for the starch granules in stages S-0 and S-1, and the later stages. Drawing by Kate Spence.

Fig. 3.7

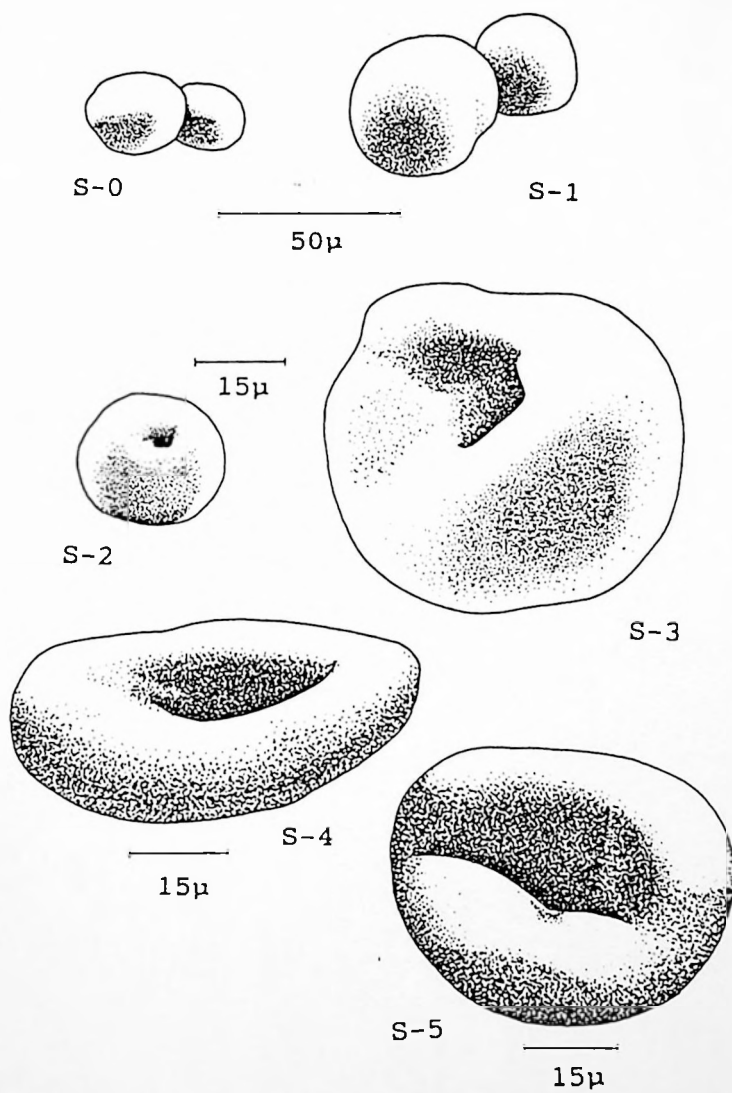


Fig. 3.8: Schematic diagram indicating a simplified view of the different amylase enzyme actions which occur in the germinating cereal grain. After Manners, 1974, MacLeod, 1979, and Greenwood and Munro, 1979.

(a) A representation of the effect of the different amylases on amylose and amylopectin. Amylose and amylopectin are represented as shown in Figs. 3.5b and 3.6b. Although the enzymes and starch molecules have been shown separately, it should be remembered that, apart from the initial attack by α -amylase, all these processes take place concurrently. In this diagram, intermediate products are shown, as well as the small dextrin chains and simple sugars which are produced after prolonged enzyme action. The most abundant simple sugar produced as a result of germination is maltose.

(b) The action of enzymes on the starch granule, showing the order of action of the different enzymes active in the germinating grain.

Fig. 3.8

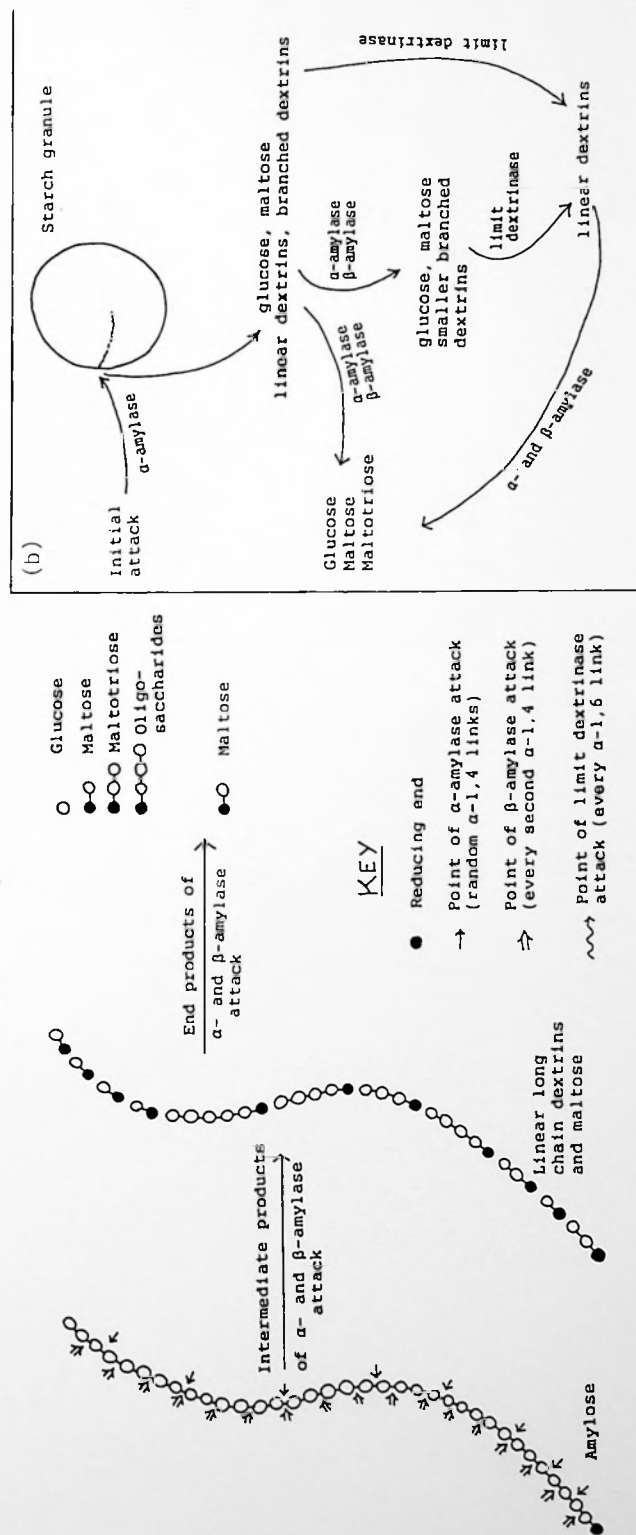
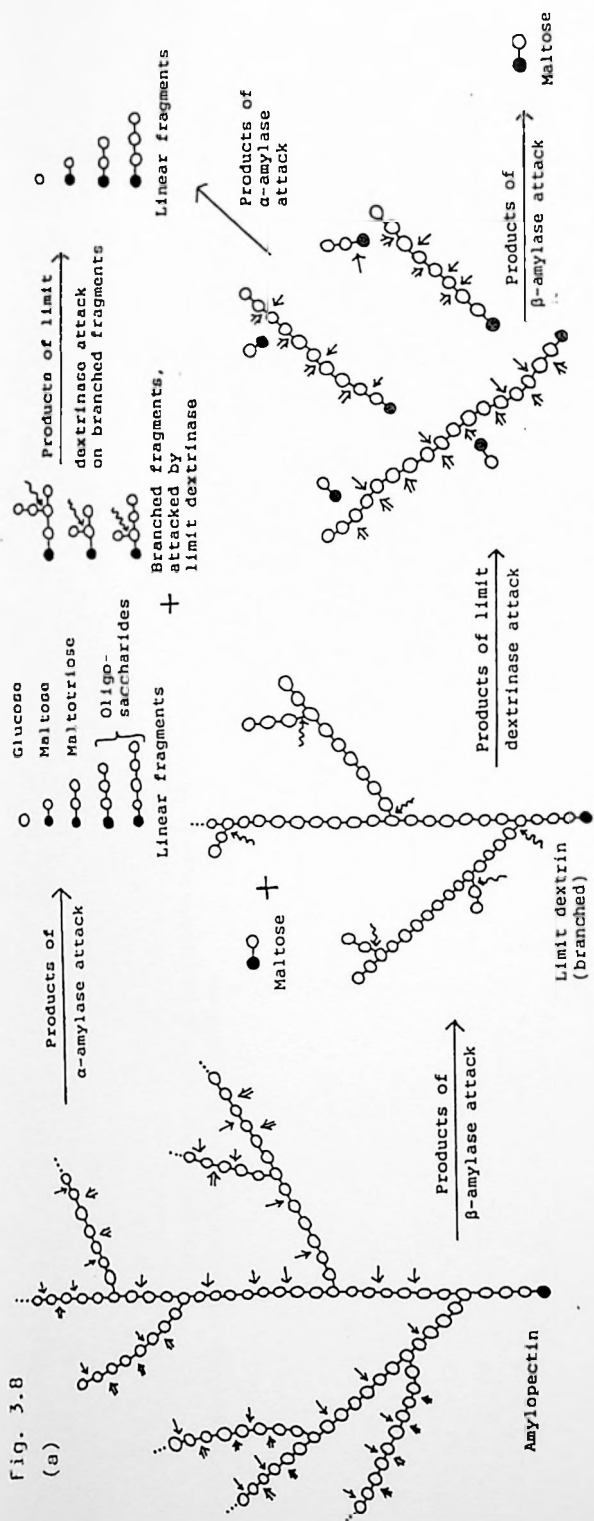


Fig. 3.9: Events which occur in the bread loaf when white pan bread is baked in a modern tunnel oven and the temperatures at which various processes begin and end. (Data from Stear, 1990.) Although the baking procedure and bread recipe is totally different to the ancient Egyptian method, many of the events which occur at specific temperatures are the same or similar. Enzymes are deactivated at specific temperatures, while starch will gelatinize over a range of temperatures depending on the loaf conditions (for example, moisture, acidity).

Fig. 3.9

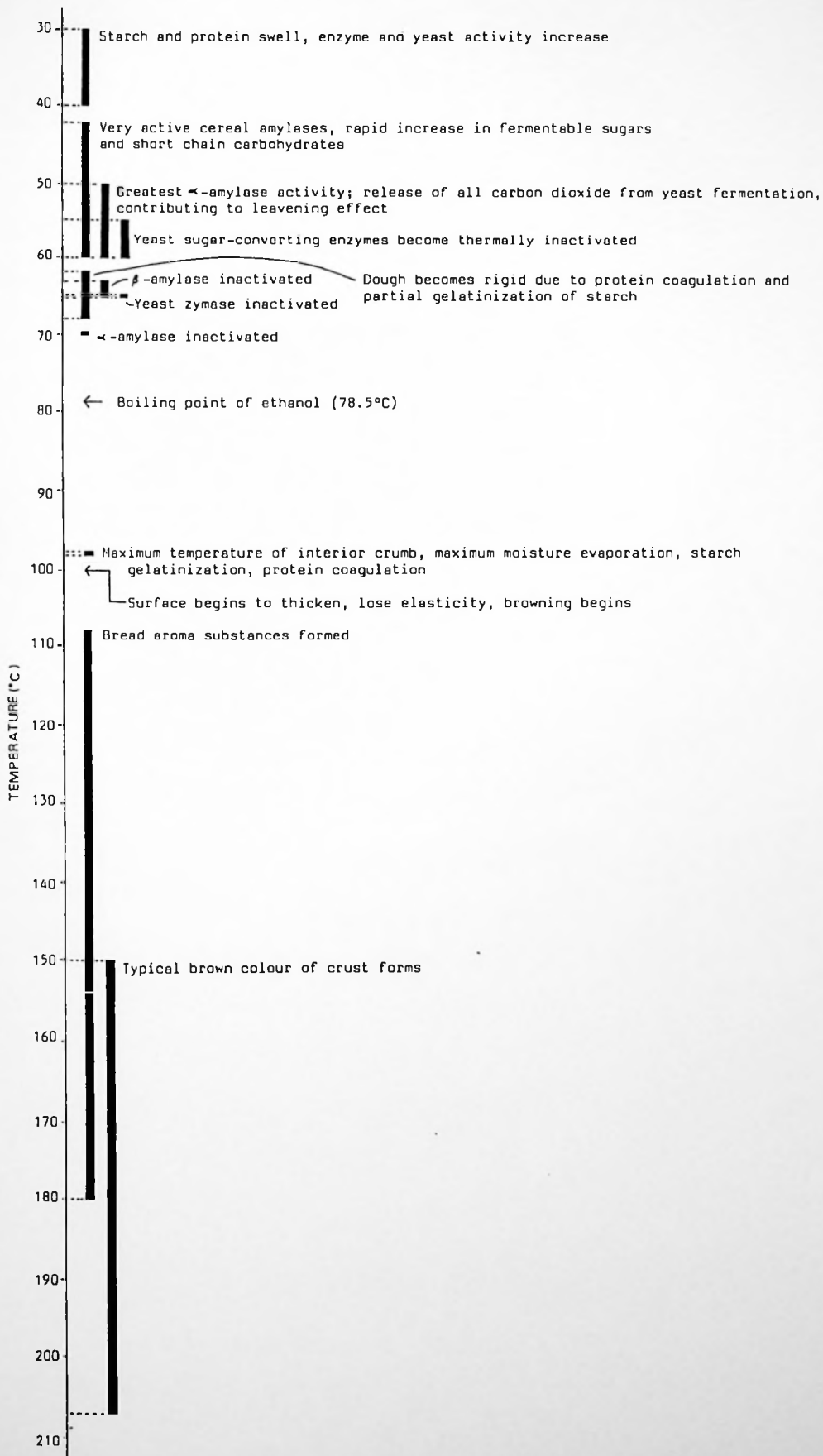


Fig. 4.1: Recording sheet used to note details of ancient Egyptian bread loaves.

Provenance

Description

This image shows a full page of dot grid paper. The background is a solid light gray color. Overlaid on this background is a precise grid of small, dark gray or black dots. The dots are arranged in perfectly straight horizontal and vertical rows, creating a series of small squares across the entire page. There are no margins, text, or other markings present.

A rectangular area filled with a grid of small dots, intended for writing or drawing.

Cored? Y/N, pg: . SEM? Y/N, pg: . Extracted? Y/N, pg:

Fig. 4.2: The drying regime of emmer grain in the spikelet, prepared as comparative material. See text (Ch. 4.V) for an explanation of the different preparation regimes, labelled C, D, E, and F. As is indicated by the dotted line, the 'C' and 'D' batches were placed in the drying cabinet when the temperature was over 65°C, which may well have caused the starch to gelatinize. Although the other batches were also heated above 57°C (the temperature of onset of gelatinization of wheat starch), as the starch was in the undisturbed grain, it is likely that few starch granules were gelatinized (see Ch. 3.VI.D.3).

Fig. 4.3: The starchy endosperm of modern raw emmer grain, seen with scanning electron microscopy. A: large, A-type starch granule; B: small, B-type starch granule; C: protein matrix. The smooth, somewhat irregular disk shaped large starch granules are firmly embedded in the closely adhering protein matrix. The small, more or less spherical, starch granules are distributed in the interstices between the large granules. The close packing of large and small starch granules in the starchy endosperm sometimes cause indentation marks on large granules (D) and may cause small granules to become compressed and angular (E).

Fig. 4.2

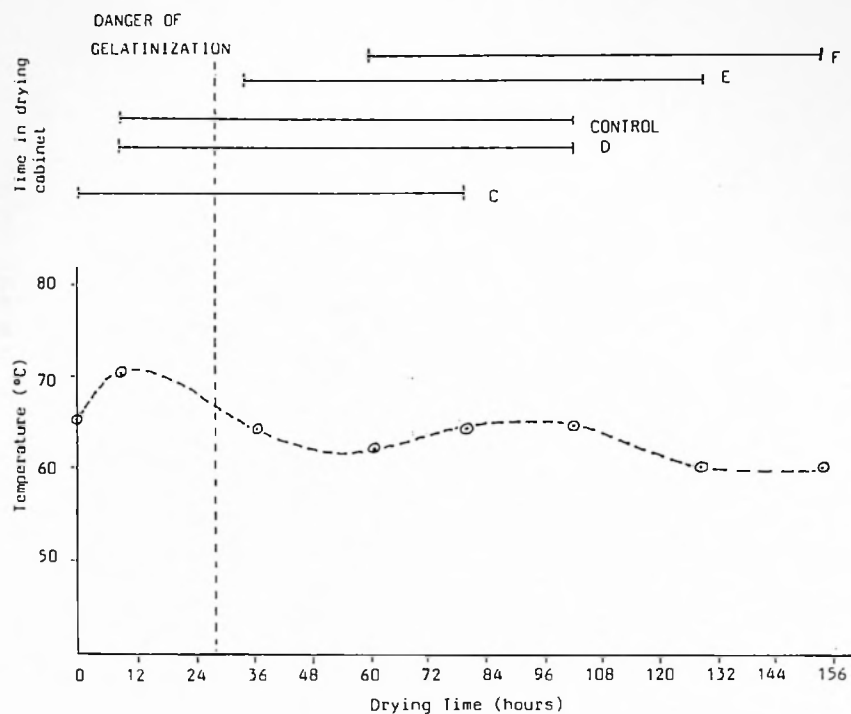


Fig. 4.3

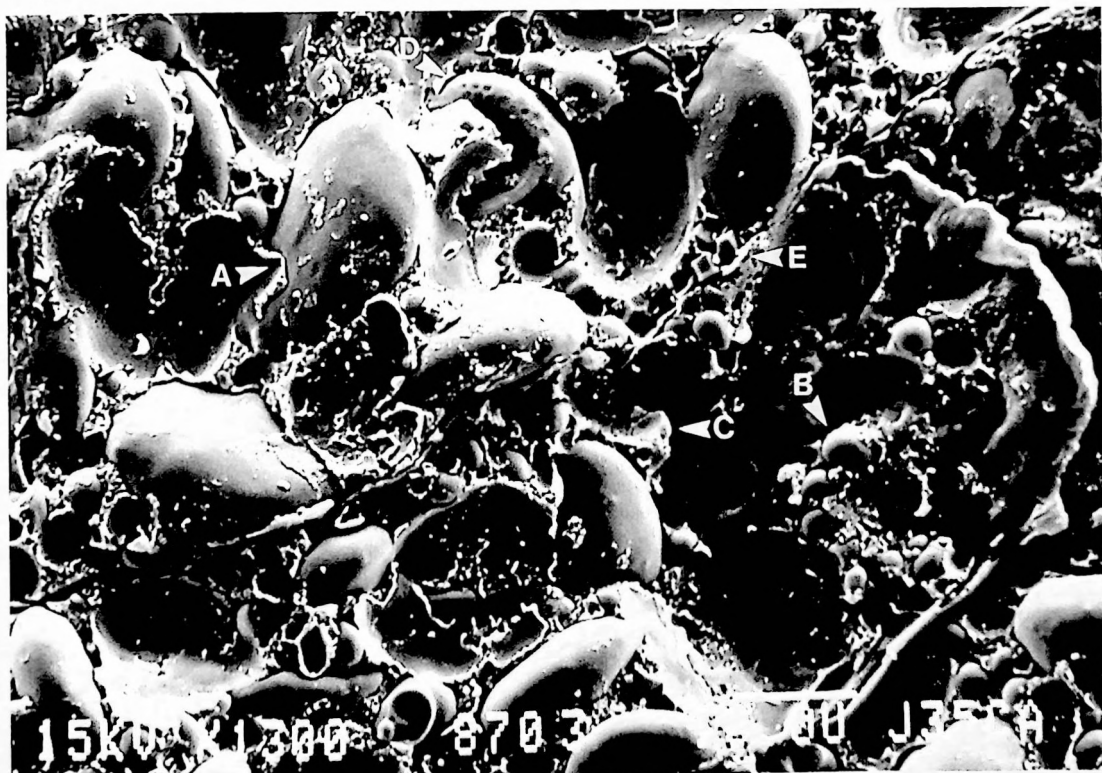


Fig. 4.4: The starchy endosperm of modern emmer grain after the spikelet was exposed to dry heat up to about 150°C. The structure of the protein matrix (C) has changed markedly from the structure of protein in untreated emmer grain; it has shrunk away from the starch granules. The morphology of both the large, A-type starch granules (A) and the small, B-type starch granules (B) remains unchanged. There is no sign of distortion, pitting, or other damage.

Fig. 4.5: The starchy endosperm of modern emmer grain which had been soaked and exposed to temperatures of about 85-90°C when still in the spikelet. With this wet heat treatment, the protein matrix (C) has shrunk away from the starch granules. Many of the large starch granules have gelatinized. They are swelled and flattened into pancake forms (A). Although some of the small starch granules have also flattened and begun to disperse (D), others still retain the spherical morphology of ungelatinized starch (B).

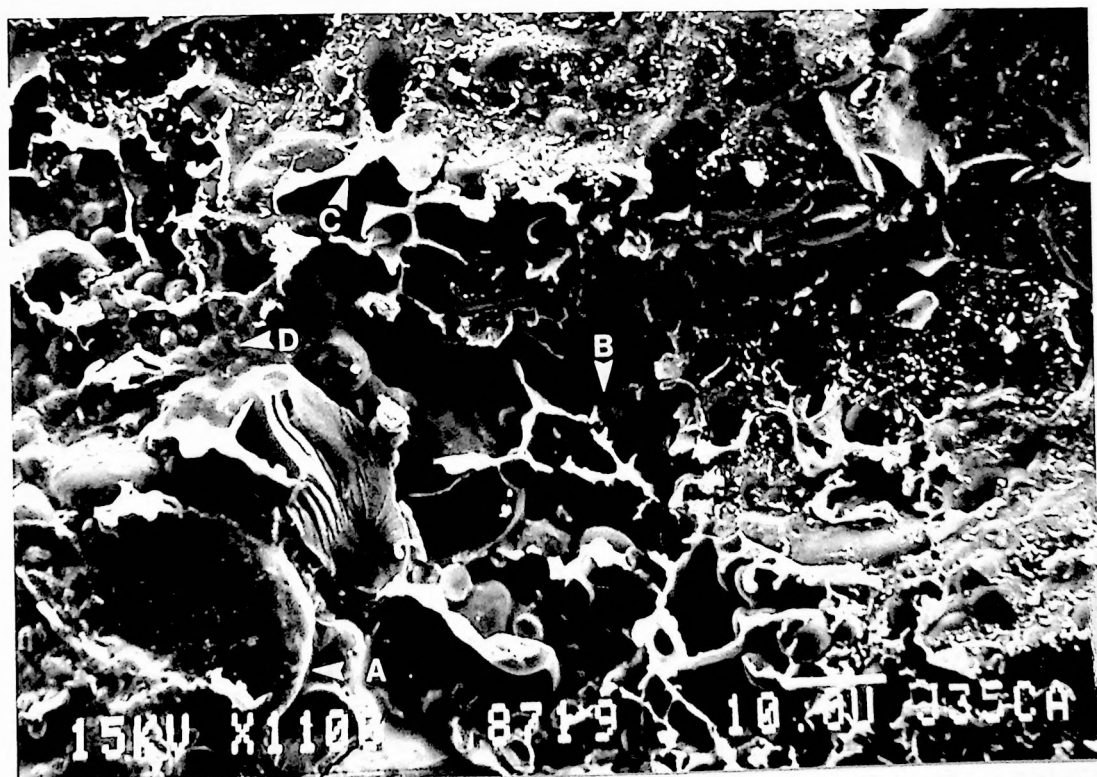
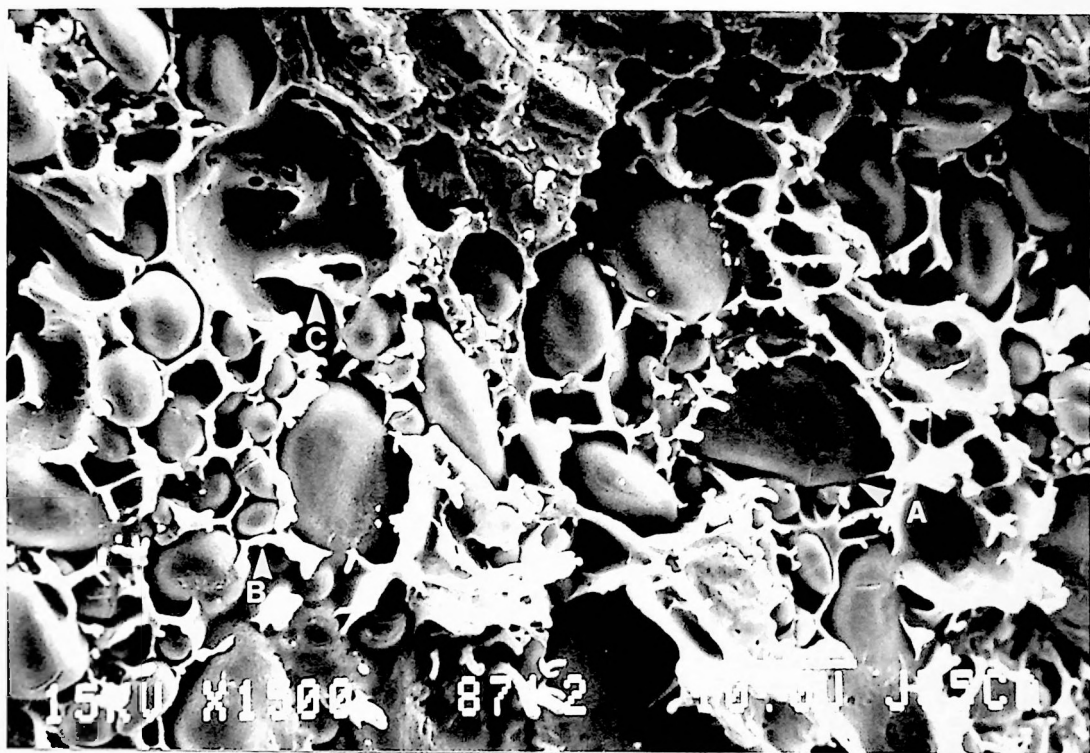
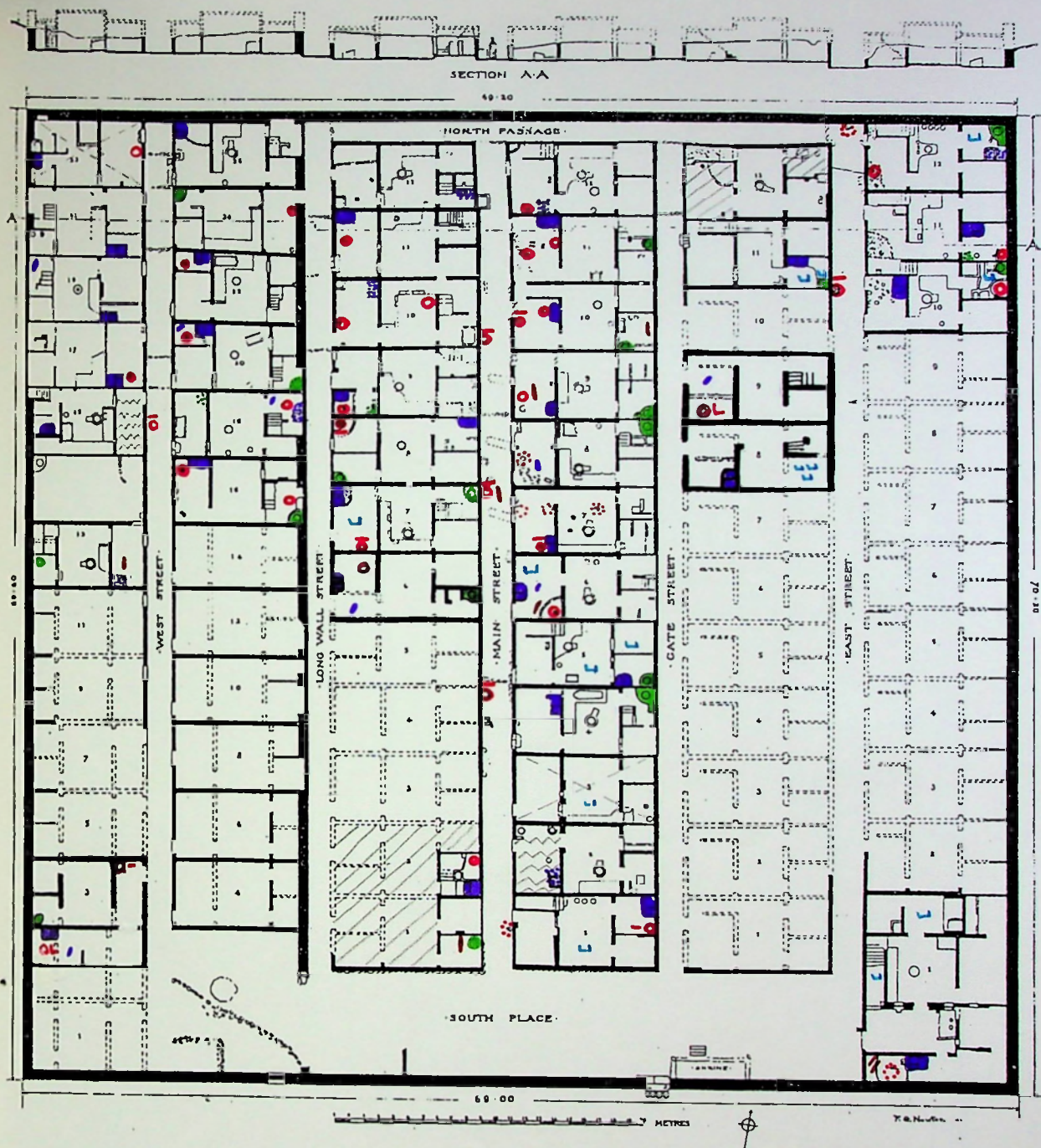


Fig. 5.1: Plan of the houses of the Workmen's Village, Amarna, with
cereal preparation and baking tools and installations
marked. After Peet and Woolley, 1923: Plate XVI.

Fig. 5.1



KEY

- | | |
|-------------------|------------------------------|
| ● Oven | ■ Guern emplacement |
| ⊗ Probable oven | ⊗ Possible guern emplacement |
| ○ Mortar | ● Loose guern |
| ⊗ Possible mortar | ▮ Pestle/pounder |
| OL Loose mortar | ▮ Ceramic platter |
| ○ Mortar with rim | |

Probably not
normal residence

Not excavated or
not fully excavated

No description in
excavation
report

Fig. 5.2: Plan of the houses of the Workmen's Village, Deir el-Medina, with cereal preparation and baking tools and installations marked. After Bruyère, 1939: Plate I.

Fig. 5.2

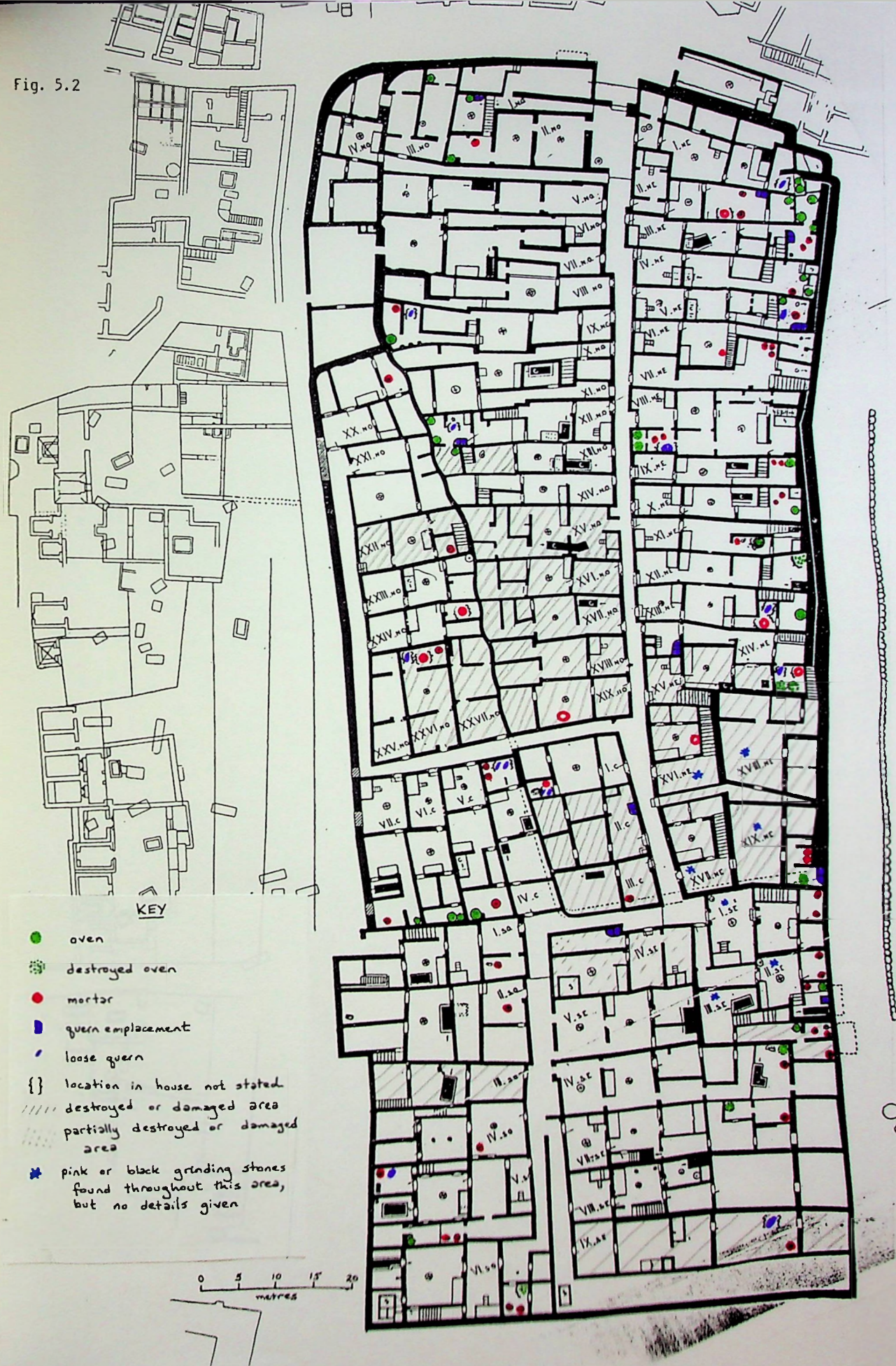


Fig. 5.3: An ancient sieve found at Deir el-Medina (exact location unrecorded). It is about 40 cm in diameter, and the rim is made up of four to five coils of basketry, so that the sieve depth is about 6.3 cm. The sieve mesh is apparently made of rush. Drawing by Kate Spence from Gourlay, 1981: 129, Plate IX, B, number 10.177.

Fig. 5.4: An ancient coiled basket with a flaring rim, found at Deir el-Medina (exact location unrecorded). The total diameter is 38 cm. The shallow shape would have been suited to small scale hand winnowing of pounded spikelets indoors or in a restricted space, without wind assistance. Drawing by Kate Spence from Gourlay, 1981: 73-74, Plate VI.E, number 10.9.

Fig. 5.5: An ancient coiled basket with a deep, steeply sloping rim, found at Deir el-Medina (exact location unrecorded). The total diameter is 26 cm. This deep type of basket would not have been suited to small scale hand winnowing of pounded spikelets without wind assistance. Drawing by Kate Spence from Gourlay, 1981: 73, Plate VI.D.

Fig. 5.6: An ancient coiled basket found at the New Kingdom necropolis of Dra' Abu el-Naga', but of unknown date and exact provenance. It is about 50 cm in diameter, and the lipless edge is reinforced by a stitched border. It would have been well suited to small scale hand winnowing of pounded spikelets. Drawing by Kate Spence after Schäfer, 1908: 172.

Fig. 5.3

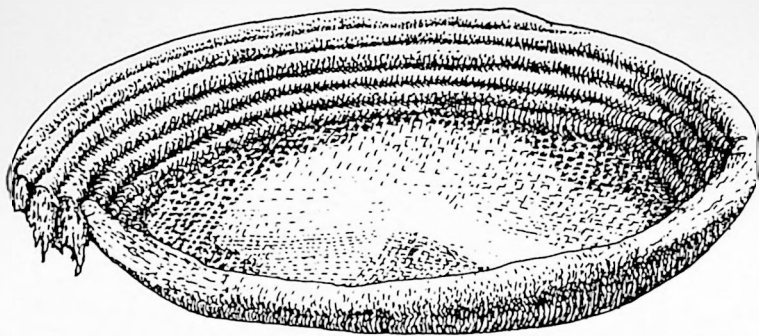


Fig. 5.4

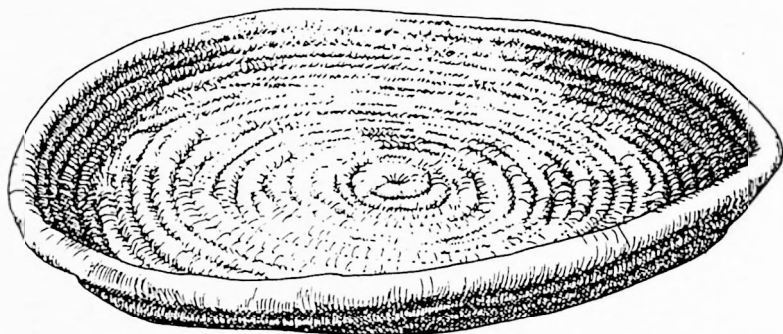


Fig. 5.5

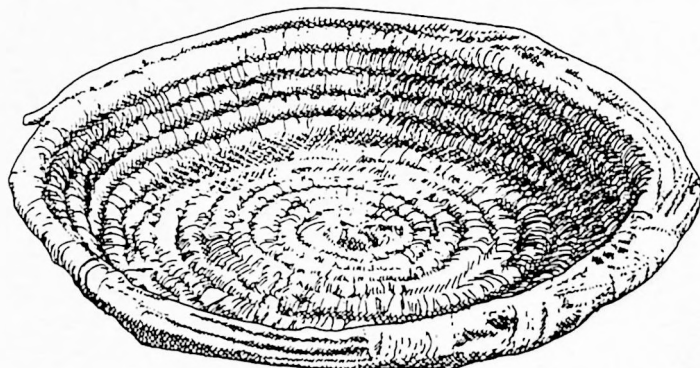


Fig. 5.6

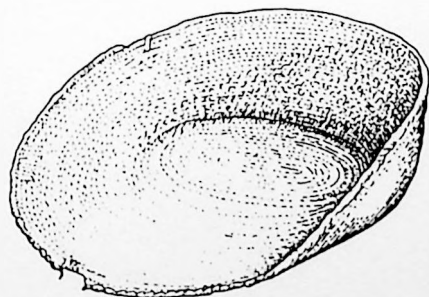


Fig. 5.7 Experimental ancient limestone mortar from Gate St. 9,
Workmen's Village, Amarna.

(a) Side view, showing the exterior, which has been tapered by chiselling, but left rough.

(b) Interior view. Note the flanged interior curve, the robust thick walls, and the roughness of part of the interior, caused by imperfections in the limestone. Most of the interior has been worn very smooth.

(c) Section and interior views of the mortar. Note especially the robustness of the walls and base. Originals by A. Boyce. From Samuel, 1989: 261, Fig. 12.3.

Fig. 5.7 (a)



(b)



(c)

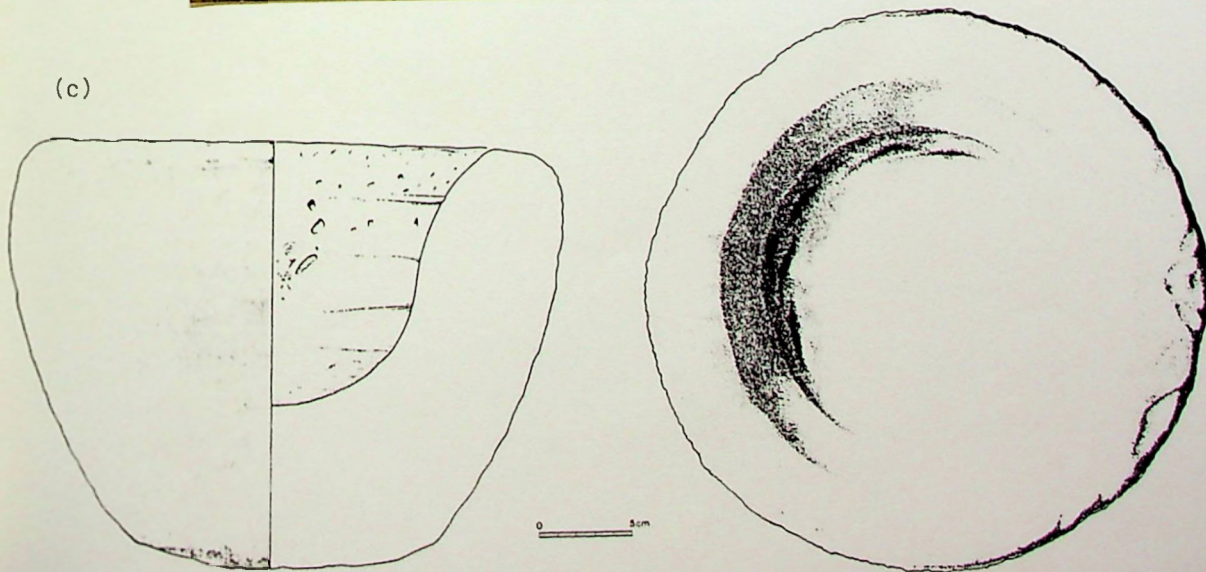


Fig. 5.8: The ancient quern emplacement from Gate St. 8, Amarna. All measurements in centimetres. Drawings by Kate Spence.

- (a) Plan of the emplacement, based on measurements of the ancient emplacement.
- (b) Elevation of the emplacement, after Kemp, 1986a: 4, Fig. 1.2.
- (c) Perspective reconstruction of the quern emplacement as it would have looked in use with the quern stone in position.

Fig. 5.8

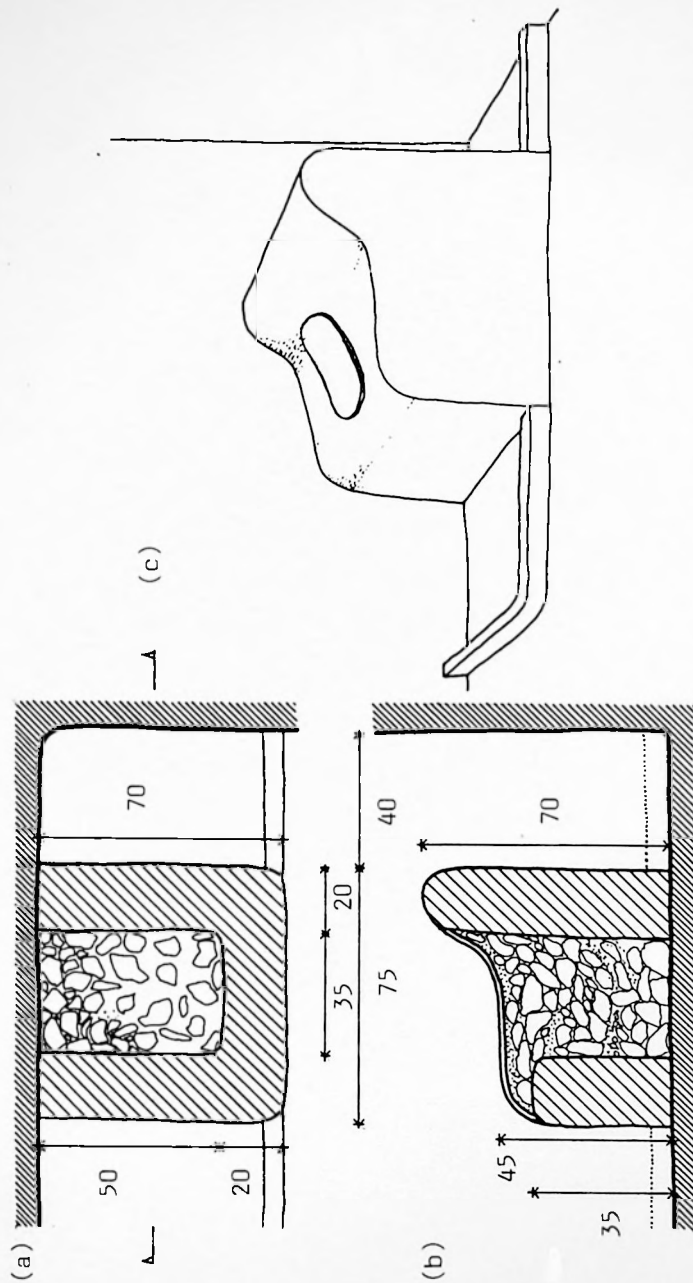


Fig. 5.9: Experimental emmer processing: picking through spikelets by hand to remove unwanted items. Photograph by Catherine Powell.

Fig. 5.10: Experimental emmer processing: the waste removed by hand sorting of emmer spikelets. Items extracted include culm nodes, weed seeds, including various weed grasses, small clumps of earth and stones. Scale bar is 1 cm. Photograph by Gwil Owen.

Fig. 5.11: Experimental emmer processing: the spikelets after hand cleaning. Note the weed grass seed still left (W), and the few loose emmer grains (E). Scale bar is 1 cm. Photograph by Gwil Owen.



Fig. 5.12: Outlines of the base of the ancient pestle (below) found from the front room of Main St. 6, Workmen's village (shown in Peet and Woolley, 1923: Pl. XIX, #1, right), and the base of the replica pestle (above) modelled on the ancient specimen. Shown actual size. Drawing by Kate Spence.

Fig. 5.13: Replica wooden pestle. Note the slight warp curving most clearly about the knot on the left. The scale bar is one metre, marked in 25 cm intervals.

Fig. 5.12

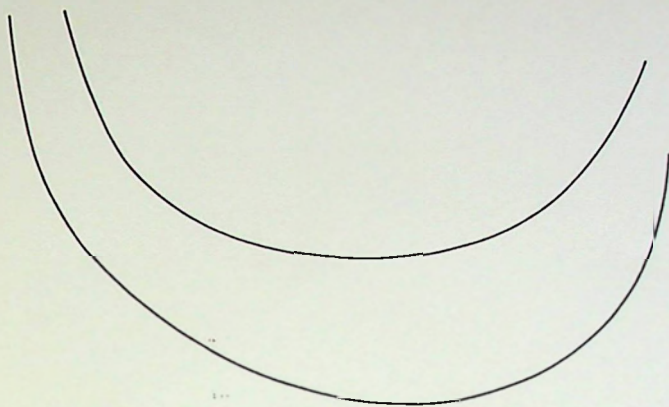


Fig. 5.13



Fig. 5.14: Experimental ancient mortar, shown in Fig. 5.7, emplaced in the ground ready for pounding. The rim protrudes slightly above ground level to prevent dust and dirt being kicked inside.

Fig. 5.15: Experimental ancient mortar, with about half a litre of spikelets in it as well as water to moisten the spikelets, ready for pounding.

Fig. 5.16: The change in volume of unpounded and pounded spikelets.

(a) Dry spikelets ready for pounding. The distance between the level of the spikelets and the rim of the mortar is 9 cm (from 3 cm to 12 cm).

(b) Moistened, pounded spikelets. The distance between the level of the spikelets and the rim of the mortar is now 7 cm (from 3 cm to 10 cm).



Fig. 5.17: Experimental emmer processing: in the ancient limestone mortar with the replica wooden pestle. This is about the maximum height I was able to lift the pestle and still control it so that it could be directed into the mortar without hitting the rim. Photograph by Paul Nicholson.

Fig. 5.18: Experimental emmer processing: a selection of some of the material which scattered out of the mortar during pounding. The assemblage includes whole unbreached emmer spikelets (W), shredded empty spikelets (E), whole glumes usually attached to the rachis segment (G), fine chaff (F), and grain (C). The short green fragments (T) are pieces which fell from the roof of the hut in which the experiments were carried out. Scale bar is 1 cm. Photograph by Gwyl Owen.

Fig. 5.19: Experimental emmer processing: the emmer spikelets after pounding. Note the large quantity of freed, whole grain. Although the whole spikelets appear to be unbreached, many have been divested of their grain. There are still a substantial quantity of unaffected spikelets.



Fig. 5.20: Experimental emmer processing: the pounded emmer spikelets drying in the sun. The pounded spikelets shown here come from a total of one litre of dry spikelets, pounded in two lots of 500 mL.

Fig. 5.21: Experimental emmer processing: the modern coiled basket used for winnowing, and a handful of dried, pounded spikelets ready to be winnowed.

Fig. 5.22: Diagram of the initial winnowing movement used to separate the emmer chaff and grain in the basket. The basket was held at a steep angle, the lower edge nearest the body, and in this position the whole basket shaken away and towards the body. Drawing by Kate Spence.

Fig. 5.23: The result of the initial winnowing movement. The heavier items have shifted and rolled to the bottom edge of the basket, with a scatter of grain and light chaff running up to the top edge of the basket. The grain and light chaff are at the bottom of this photograph.

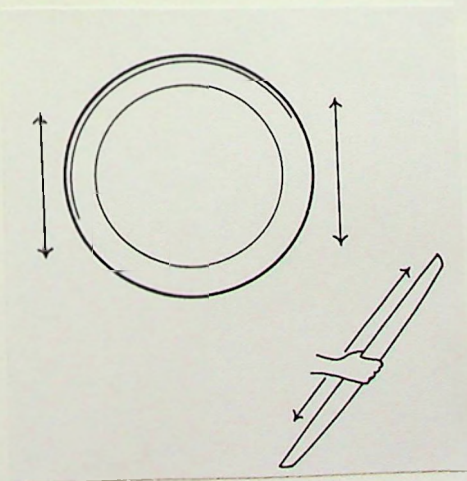
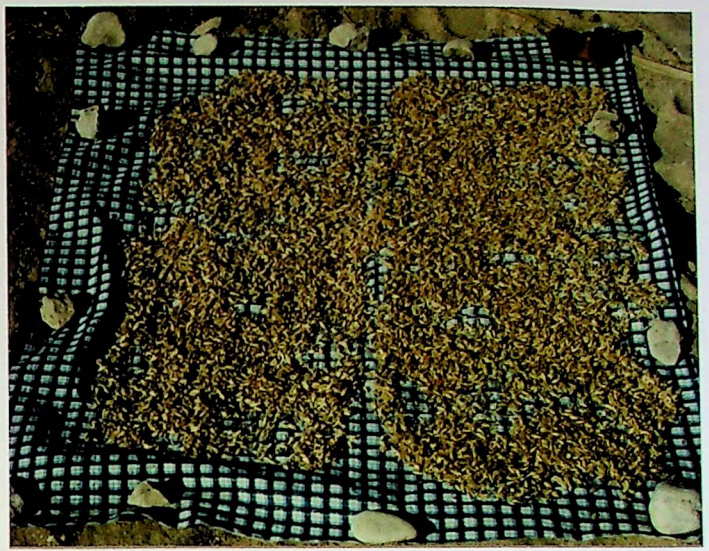


Fig. 5.24: Diagram of the second winnowing movement. The basket, held at a fairly steep angle, was waggled back and forth. The top of the basket was moved in a large arc towards and away from the body, while the bottom of the basket remained more or less stationary. Drawing by Kate Spence.

Fig. 5.25: Result of the second winnowing movement. The heavier items in the bottom of the basket have remained almost stationary, while the material in the top of the sieve has spread out, separating the fine light chaff from the grain.

Fig. 5.26: Diagram of the third winnowing movement. The basket, held at a fairly steep angle, was tipped from side to side. The lower side was held almost stationary, while the top was tipped in a broad arc. Drawing by Kate Spence.

Fig. 5.27: Result of the third winnowing movement. The heavier items remain almost stationary at the lower edge, while the material at the upper edge is almost pure fine chaff. Below the collection of fine chaff is clean grain.

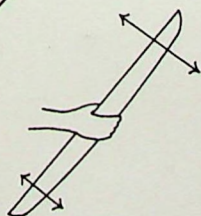
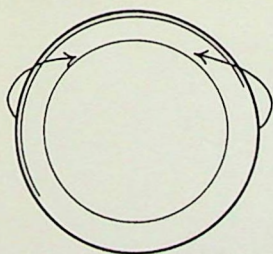
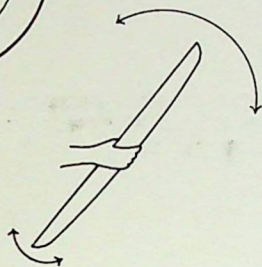
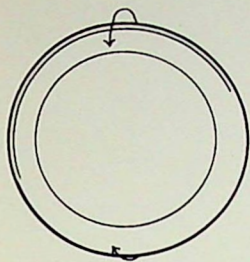


Fig. 5.28: Diagram of the fourth winnowing movement. While the grain and chaff in the basket were tossed into the air, the basket was quickly moved in a tight zigzag motion. This helped to separate better the fine chaff from the rest of the material. Drawing by Kate Spence.

Fig. 5.29: Removal of the fine chaff from the basket.

(a) The upper edge of the basket was flipped sharply upwards, throwing the light chaff which had accumulated there over the edge and onto the ground. At the same time the grain and other items which were in the centre of the basket shifted to the basket edge.

(b) A selection of the light material which was flicked out of the winnowing basket. This is composed mainly of lemmas and paleas, along with some glumes and heavier items such as whole spikelet forks with the glumes attached but the grain and inner chaff stripped out. There are also a few pieces of small grain fragments. Photograph by Gwil Owen.

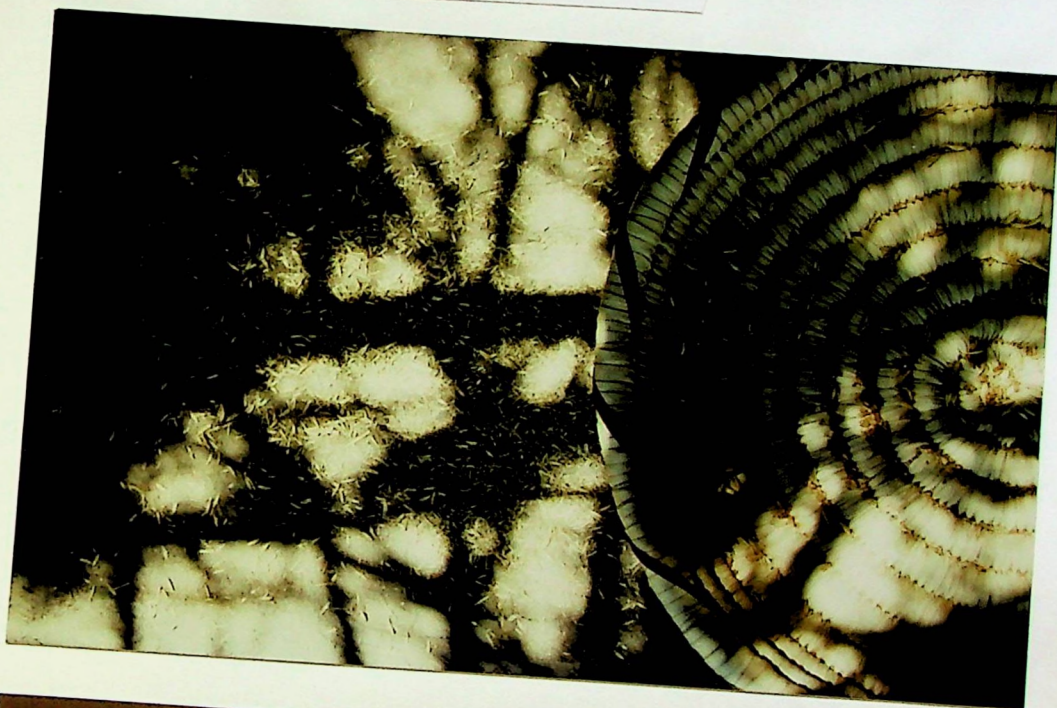
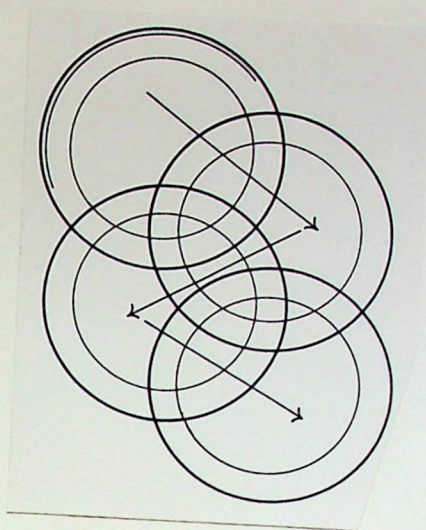


Fig. 5.30: The material remaining in the basket after most of the light chaff has been winnowed out. This is composed of a mixture of clean grain, whole empty spikelets, and whole unbreached spikelets, as well as small heavy chaff such as glumes and spikelet forks.

Fig. 5.31: The separation of grain from spikelets and most of the other heavy chaff in the winnowing basket after the removal of the light chaff. The grain is at the bottom of this photograph.



Fig. 5.32: The separation of clean grain from heavy chaff and spikelets. In the plastic jug on the upper left is whole grain separated in the winnowing basket as shown in Fig. 5.31, and removed by hand. On the cloth below is whole grain which was sieved from the remaining heavy chaff and spikelets with a 3.18 mm geological sieve. In the sieve to the upper right is what remained, mainly the heavy chaff and spikelets, but also some grain. There is still quite a lot of chaff mixed up with the grain. Most of this is composed of whole terminal emmer spikelets which are about the same size as the whole grain.

Fig. 5.33: The chaff left in the coarse sieve after removal of the whole grain. This is composed mainly of empty spikelets, but there are also some whole unbreached spikelets, spikelets with one grain still trapped, and whole grains. Scale is 1 cm. Photograph by Gwil Owen.

Fig. 5.34: A sample of clean grain obtained by a combination of winnowing from heavy chaff in the basket, and sieving through the 3.18 mm geological sieve. Much of the bran has been shredded. Some of the chaff has been picked out by hand, but there are still a few spikelet forks remaining. Note the few free threshing wheat grains (F) and a hulled barley grain (B). Scale is 1 cm. Photograph by Gwil Owen.



Fig. 5.35: An ancient granite quern stone from the Main City of Amarna, used for experimental grinding.

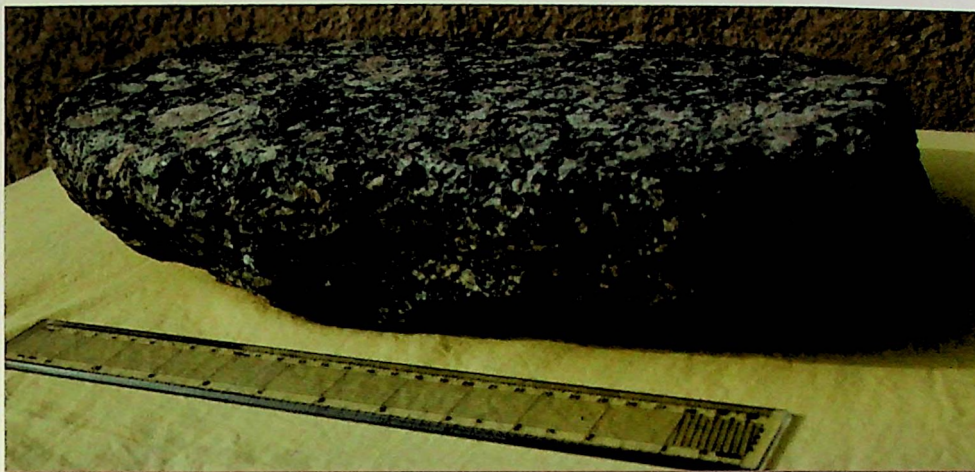
(a) Oblique view showing the smooth flat surface, and the roughly chiselled underside.

(b) The grinding surface. Most of the surface is slightly roughened, but both tips have been worn so much anciently that they are polished.

(c) Drawings of the experimental ancient quern. The exaggerated surface rendering shows the roughened surface and the polished tips. The side view shows the slight concave longitudinal curve, while the cross section shows the slight convex curve across the breadth. Originals by A. Boyce. From Samuel, 1989: 262, Fig. 12.4.

Fig. 5.35

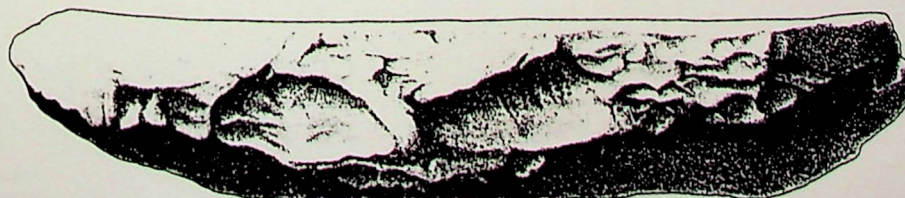
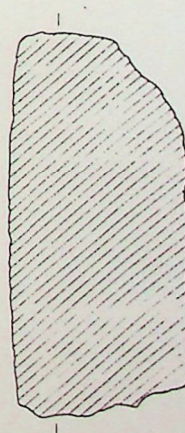
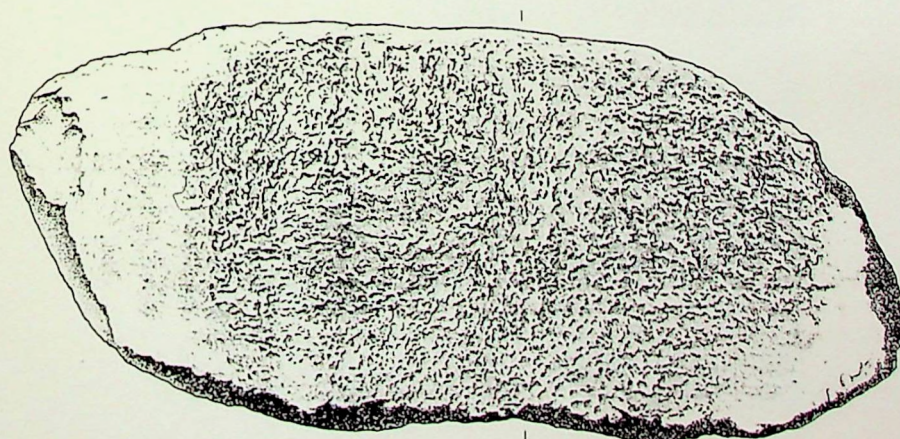
(a)



(b)



(c)



0 5cm

Fig. 5.36: The ancient quartzitic sandstone hand stone used for experimental milling.

(a) Top view.

(b) Working flat underside.

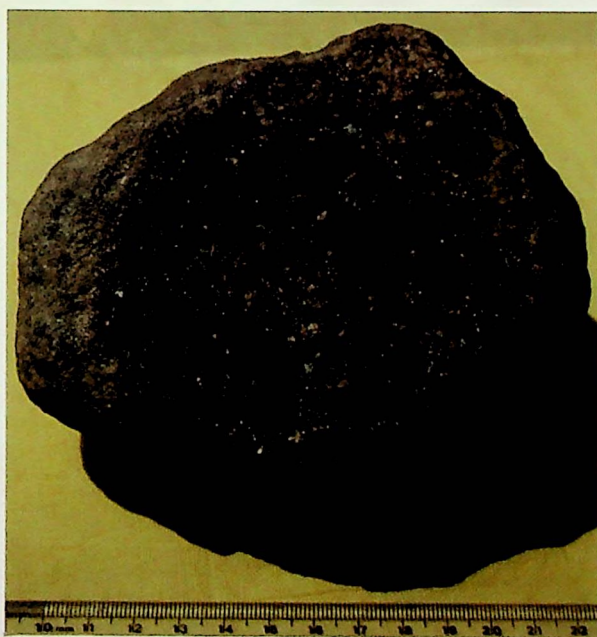


Fig. 5.37: Experimental grinding on the replica quern emplacement with the ancient granite saddle quern and ancient quartzitic sandstone hand stone. Both photographs by Paul Nicholson.

(a) Side view. Note how the lower body is firmly wedged between the back of the emplacement and the structural wall behind. The upper body is free to rock back and forth, bearing down on the quern.

(b) Front view.

Fig. 5.38: Diagram of the diagonal motion across the quern stone occasionally used to move grain and meal at the edges of the stone back into the centre. Drawing by Kate Spence.

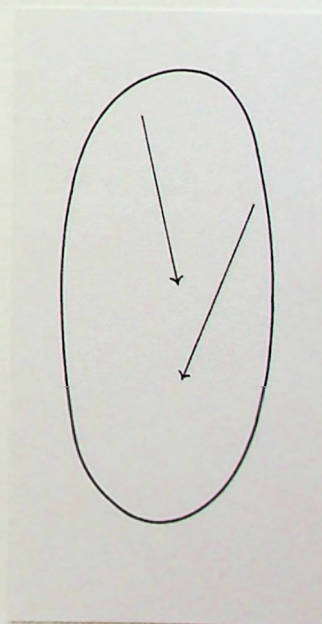


Fig. 5.39: Coarsely ground flour on the quern.

Fig. 5.40: Finely ground flour on the quern.

Fig. 5.41: Experimentally produced emmer flour.

(a) A basket of flour obtained from 1.2 kg of reasonably cleaned grain.

(b) A sample of flour. Note the chaff and the range of particle sizes. The range of sizes was deliberately produced to show that it was possible to grind anything from a coarse meal to a fine flour with the saddle quern. Scale bar is 1 cm. Photograph by Gwil Owen.

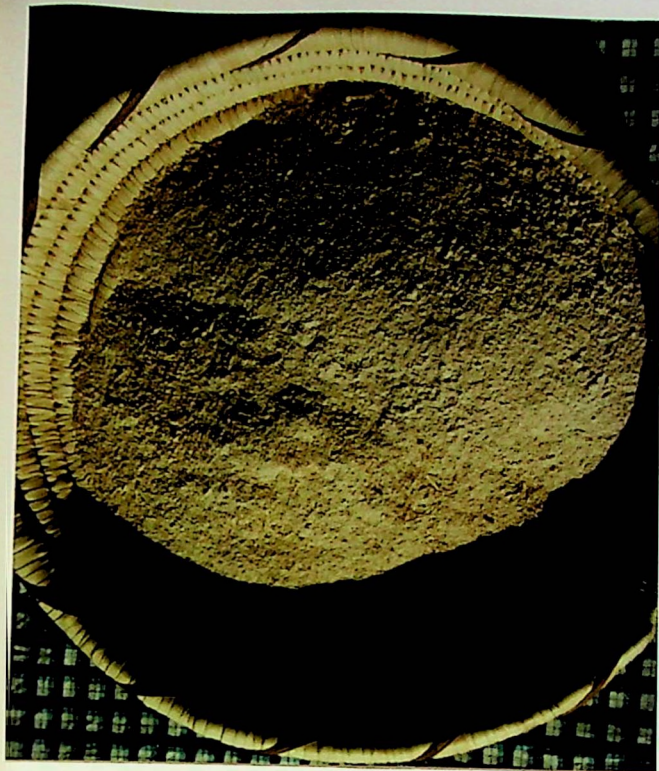


Fig. 5.43: Plan of NE.VIII, Deir el-Medina. The cereal processing installations are coded as in Fig. 5.42. The small purple object indicates that a loose quern stone was found together with the cereal processing installations. After Bruyère, 1939, Plate. I.

Fig. 5.42: Plan of NE.V, Deir el-Medina, with the quern emplacement (estimated position) in purple, the two mortars in red, and the two ovens in green. After Bruyère, 1939, Plate I.

Fig. 5.46: Plan of East St. 10, Workmen's Village, Amarna, with the cereal processing installations coded as in Fig. 5.42. After Peet and Woolley, 1923: Plate XVI.

Fig. 5.45: Plan of Main St. 5, Workmen's Village, Amarna, with the cereal processing installations coded as in Fig. 5.42. After Peet and Woolley, 1923: Plate XVI.

Fig. 5.44: Plan of Long Wall St. 7, Workmen's Village, Amarna, with the cereal processing installations coded as in Fig. 5.42. After Peet and Woolley, 1923: Plate XVI.

Fig. 5.43

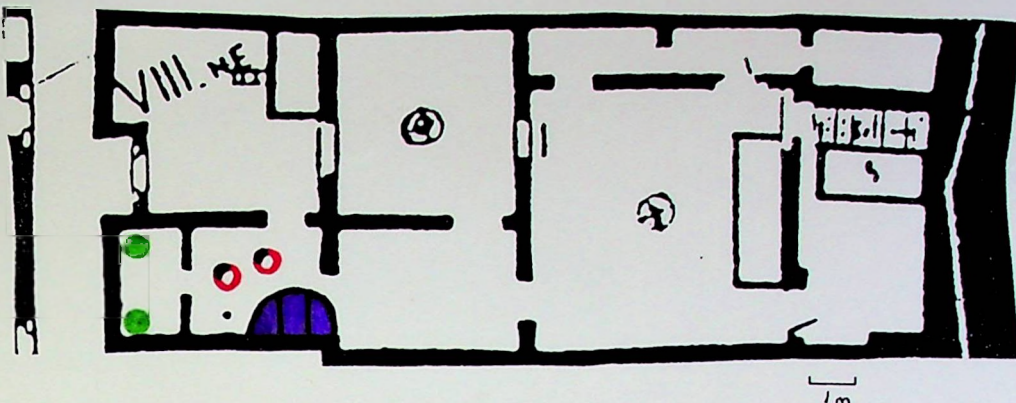


Fig. 5.42

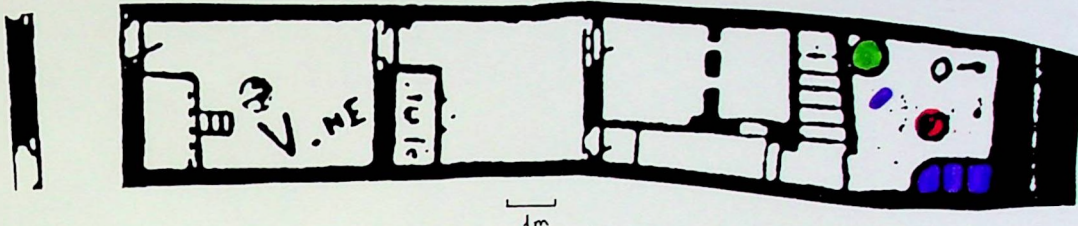


Fig. 5.46

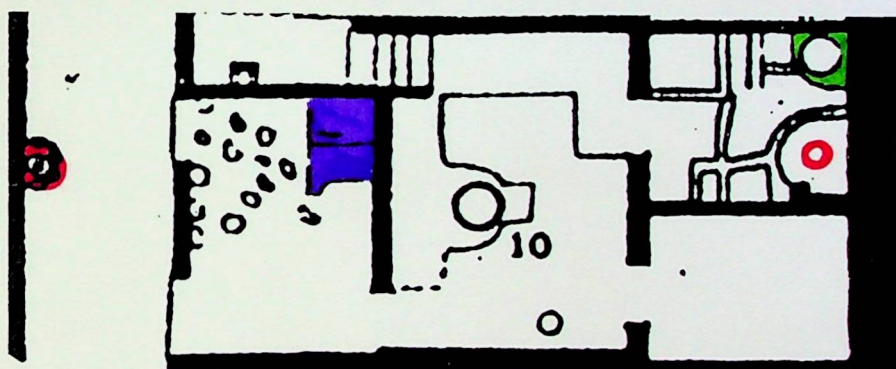


Fig. 5.45

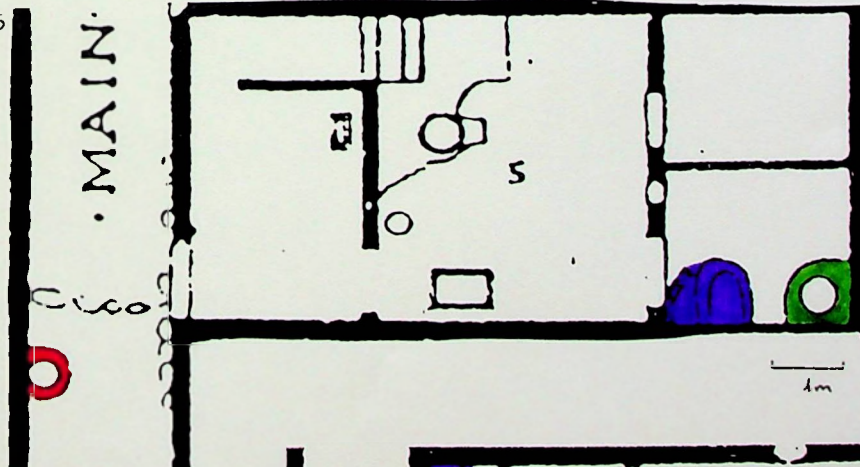


Fig. 5.44

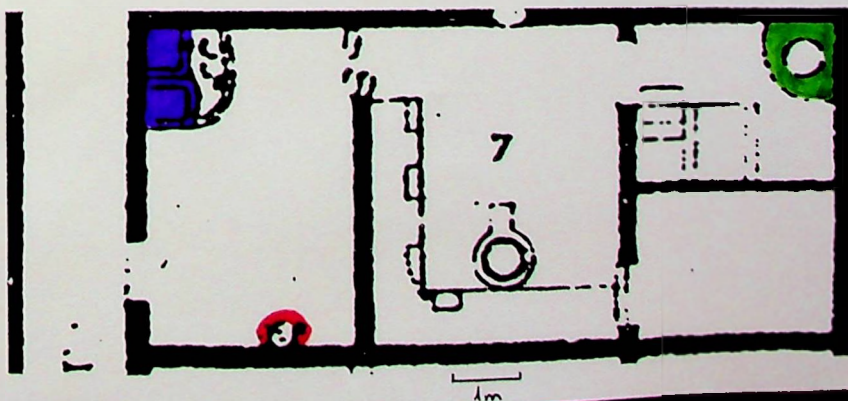


Fig. 5.47: Plan of part of the Central City. It shows the location of the room with 45 mortars in building R 42.9, and the suggested route of pounded spikelets to the area where a large concentration of querns were found. From this 'grindery area', flour must have gone to the great range of bakeries running along the southern perimeter of the Greater Aten Temple, while chaff might have been taken to building S 40.1, where cattle were probably kept. After Pendlebury, 1951, Plate I.

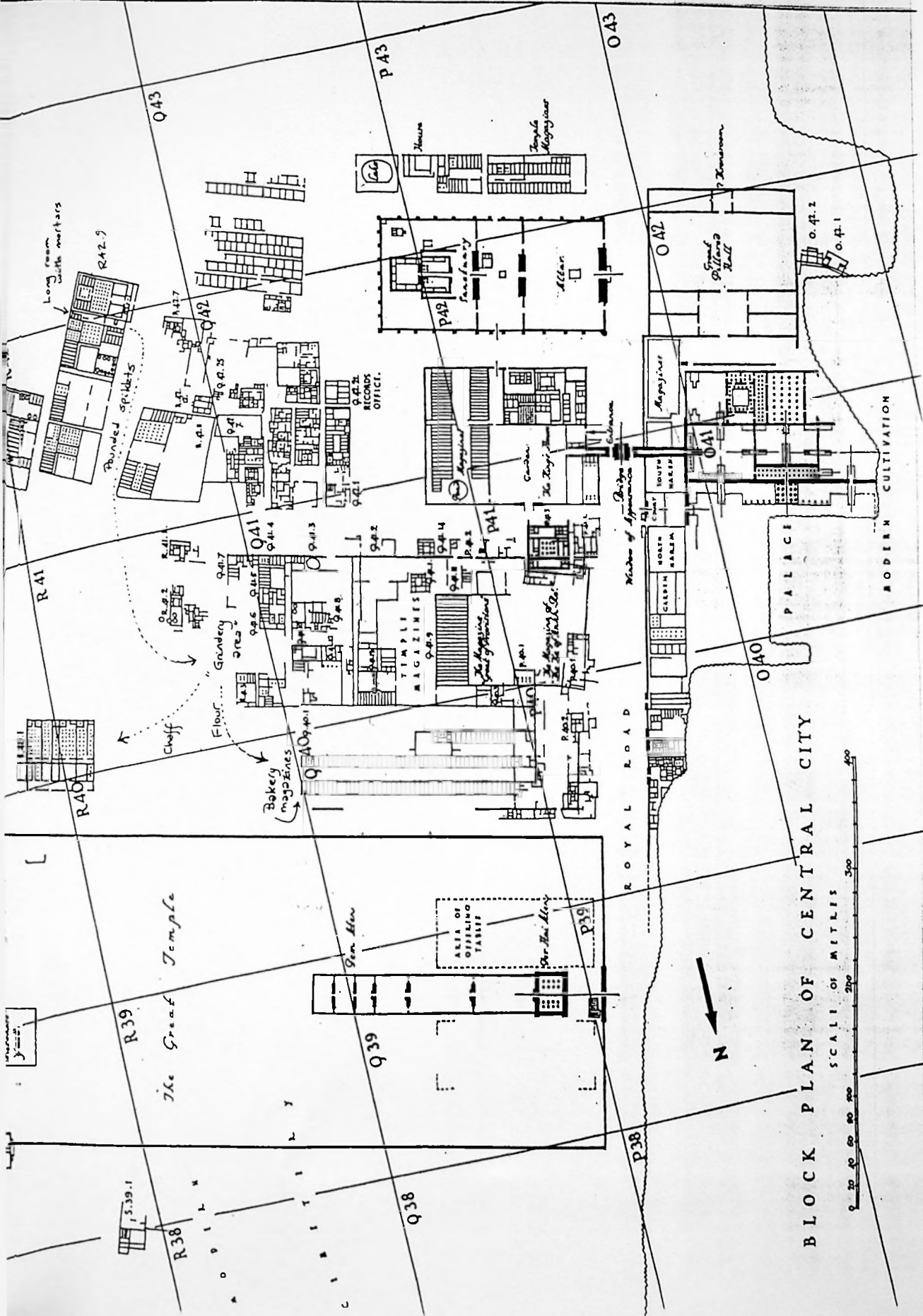


Fig. 6.1: A selection of bread loaves from the 18th Dynasty tomb of Kha, Deir el-Medina, now in the Turin Egyptian Museum. Shapes discussed in the text include: ridged disk corresponding to 013 (1); disk with small indentation similar to 012 (2); vulvar shape corresponding to 010 (3). The vulvar loaf to the centre right shows a ring of pricked holes around the central indentation. Photograph courtesy of the Turin Egyptian Museum.

Fig. 6.2: A selection of bread loaves from the 18th Dynasty tomb of Kha, Deir el-Medina, now in the Turin Egyptian Museum. Several of the shapes discussed in the text are shown. In the middle row, far left and centre, are vulvar shapes, corresponding to 010. The right hand loaf has a ring of pricked holes around the central indentation, but these are difficult to distinguish from weevil holes in the photograph. In the back row and middle right are split loaves corresponding to 011. Note the palm frond nets, the slashes in the sides of each, the central crack running across the loaves (most clearly seen on the loaf on the far right, back row), and the lightly impressed circular or oval decorations above and below the slash (most clearly seen on the loaf to the far right, middle row). In the front row and right side are bowtie shaped loaves corresponding to 008. I am very grateful to Dagmar Winzer for this photograph, as well as Fig. 6.5, 6.6, 6.7, and permission to use them.



Fig. 6.3: Sketch of loaf 023, from Deir el-Medina, now in the Louvre, an example of a crater loaf. Both the upper side and lower side are shown. The seams in the lower side are especially visible, indicating how the bread was built up from individual coils and pieces of dough. The numbers refer to the general order of addition of each piece. Where two pieces have the same number, the exact order of addition is uncertain. Drawing by Kate Spence.

Fig. 6.4: Sketch of loaf 029 in some views and loaf 028 in cross section, both examples of conical loaves. Loaf 029 is shown in cross section, side view, and from below (i.e. the underside). The irregularity of the loaf, and the flattened undersides as seen in the cross sections of both loaves, clearly demonstrate that these specimens were formed by hand, not in conical moulds. Drawing by Kate Spence.

Fig. 6.3

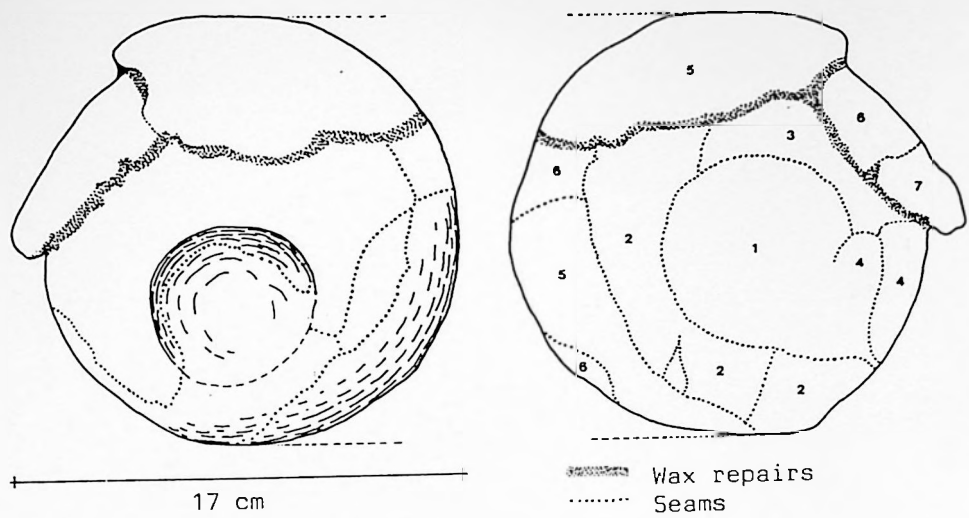


Fig. 6.4

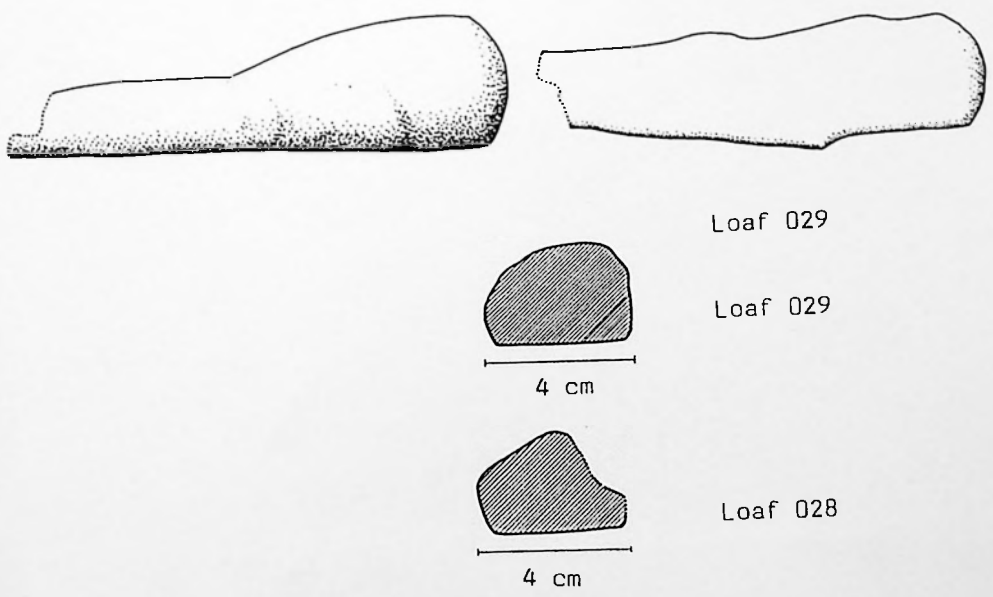


Fig. 6.5: Some bread from the 18th Dynasty tomb of Kha, Deir el-Medina, now at the Turin Egyptian Museum. This photograph overlaps with Fig. 6.6. Back and centre: split loaves (011); front far left: racquet shape; centre front: variation on the racquet shape with bent 'handle'; front right: trussed animal. Photograph by Dagmar Winzer.

Fig. 6.6: Some bread from the 18th Dynasty tomb of Kha, Deir el-Medina, now at the Turin Egyptian Museum. Back and centre: split loaves (011). The palm frond matting is clearly seen, and, except for the middle right loaf, the deep slashes in the sides of the loaves, and the cracks down the centre indicating they were made in two halves. The lightly impressed circle decorations are clear on the middle right loaf. Front left: fish-shaped bread (009); front right: racquet shape, similar in form to 077. Compare this shape to the racquet-shaped loaves depicted in the tomb of Nebamun (Fig. 2.1). Photograph by Dagmar Winzer.

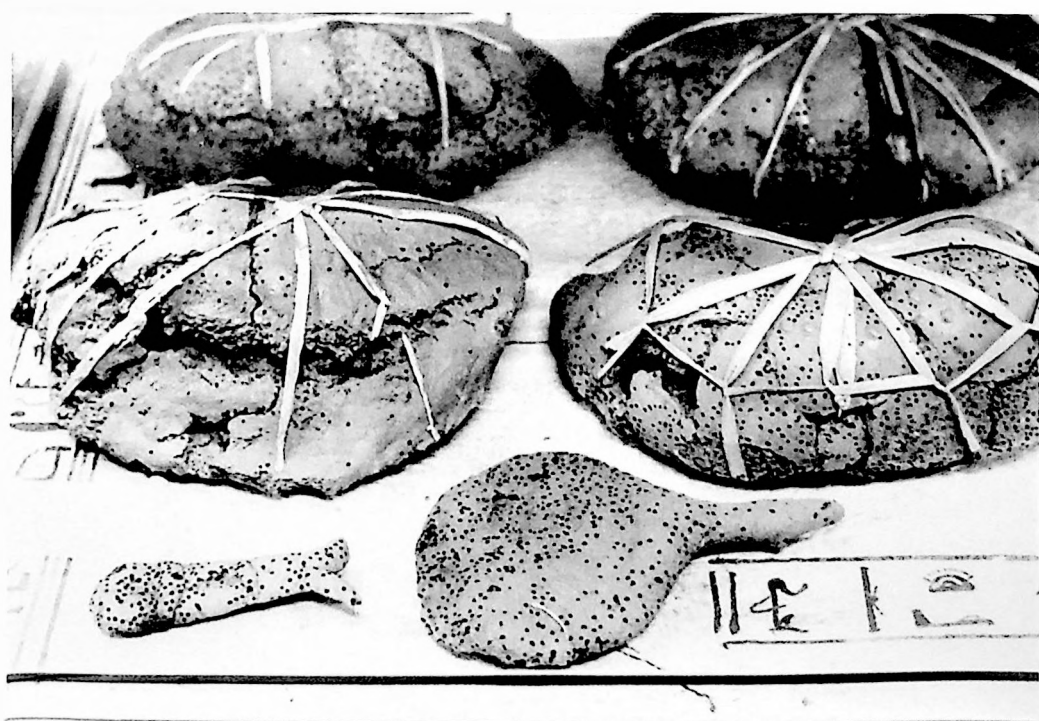
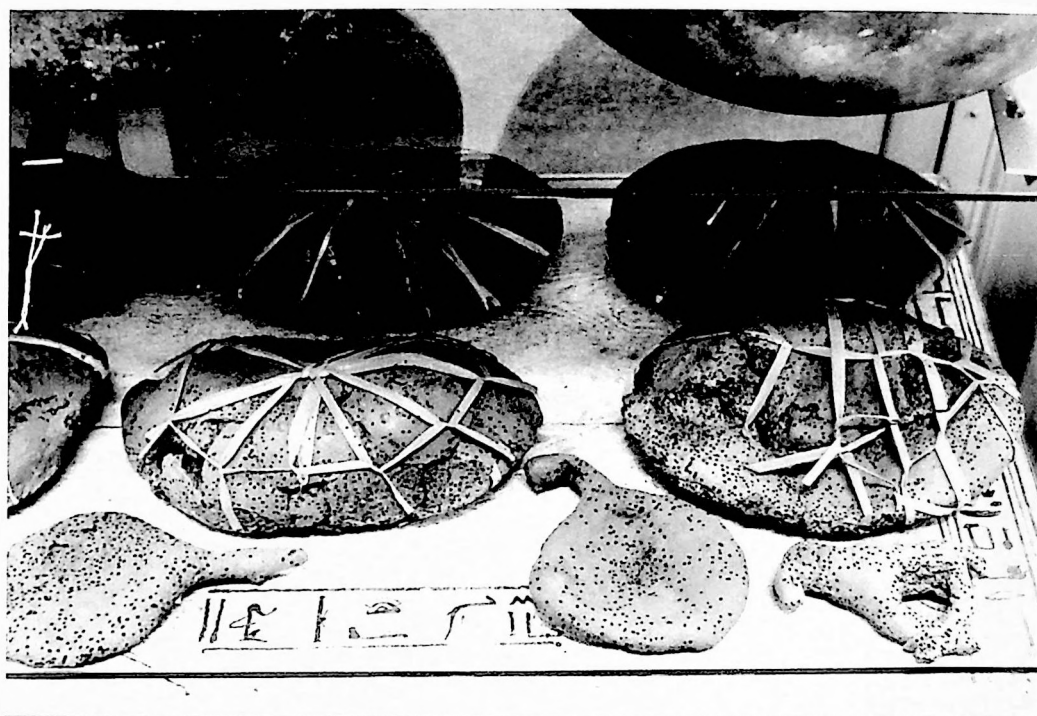


Fig. 6.7: Flat bread in the form of an isosceles triangle (006), from the tomb of Imhotep, an 18th Dynasty vizier buried in the Valley of the Queens (QV 46), now on display at the Turin Egyptian Museum. Photograph by Dagmar Winzer.



Fig. 6.8: Starch microstructure in loaf 017.

(a) Large and small starch granules lining an air pocket in the crumb matrix. The granules are swollen (S) and dimpled (D) but largely retain their individual boundaries. One large granule (M) still retains packing marks on its surface. There is apparently some protein (P) in between the starch granules, but it forms a very discontinuous matrix full of holes. Much of the crumb structure appears to be formed by gelatinized starch, as would be expected from a loaf made with gluten-free dough.

(b) An air pocket where the starch granules have lost their individual boundaries and have dispersed into a continuous matrix. The long thin structures (F) running across the surface of the starch are filamentous fungi.

Fig. 6.9: Frass (insect excreta) in bread specimens.

(a) Frass (F) adhering to the crumb of loaf 021.

(b) Frass adhering to the crumb of loaf 028.

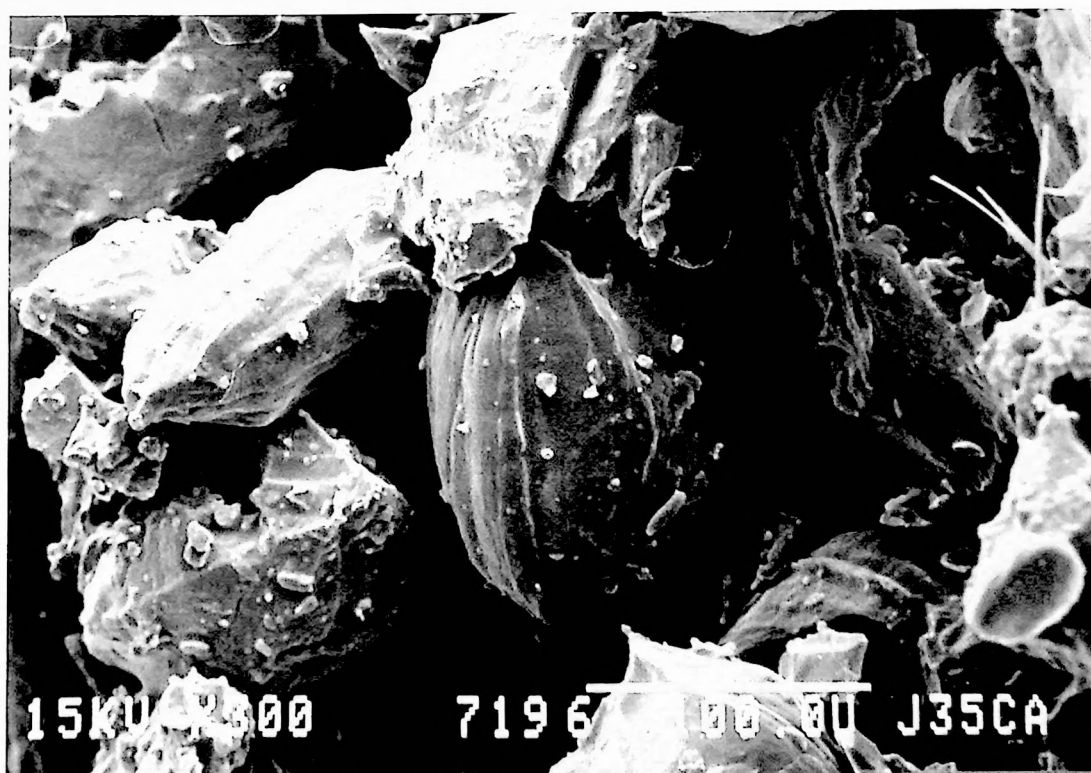
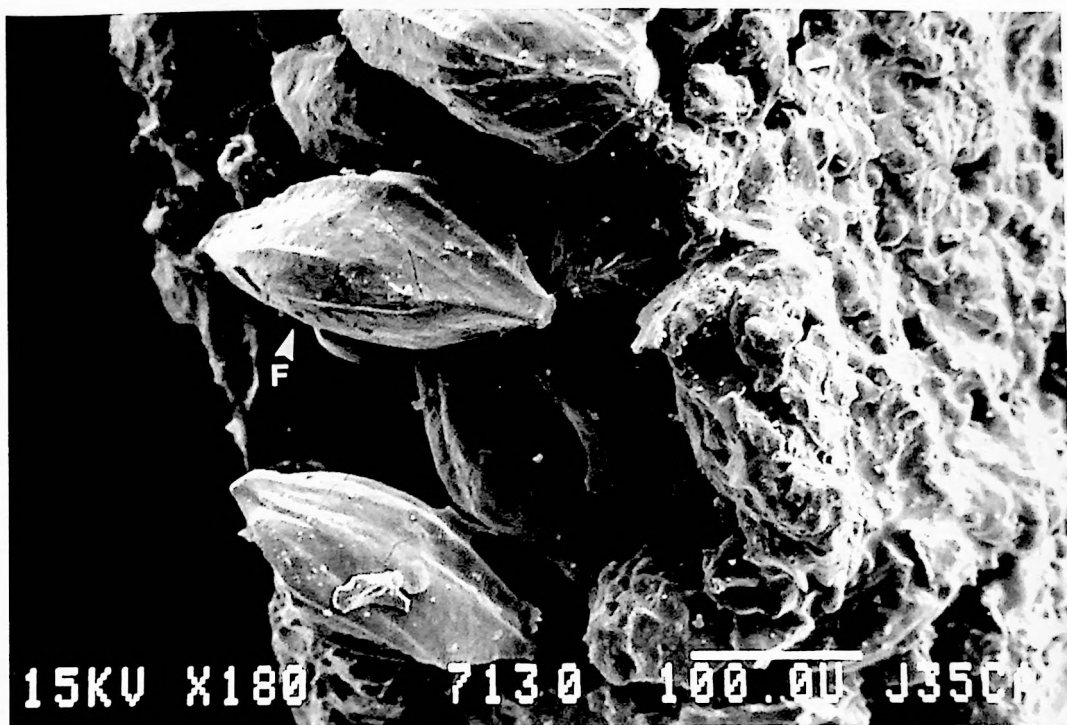


Fig. 6.10: Some examples of fungal hyphae on samples of ancient bread.

(a) From loaf 017. Starch granules (S) can be seen forming a cratered surface, across which run a network of fungal hyphae (H).

(b) From loaf 024. Note that the scale is different from 10 (a) and 10 (c). Fungal hyphae (H), parts of which seem to be covered in a fine fibrous network (N) cover much of the field of view. They overlie the crumb matrix which appears to be composed in this area of very dispersed starch (S).

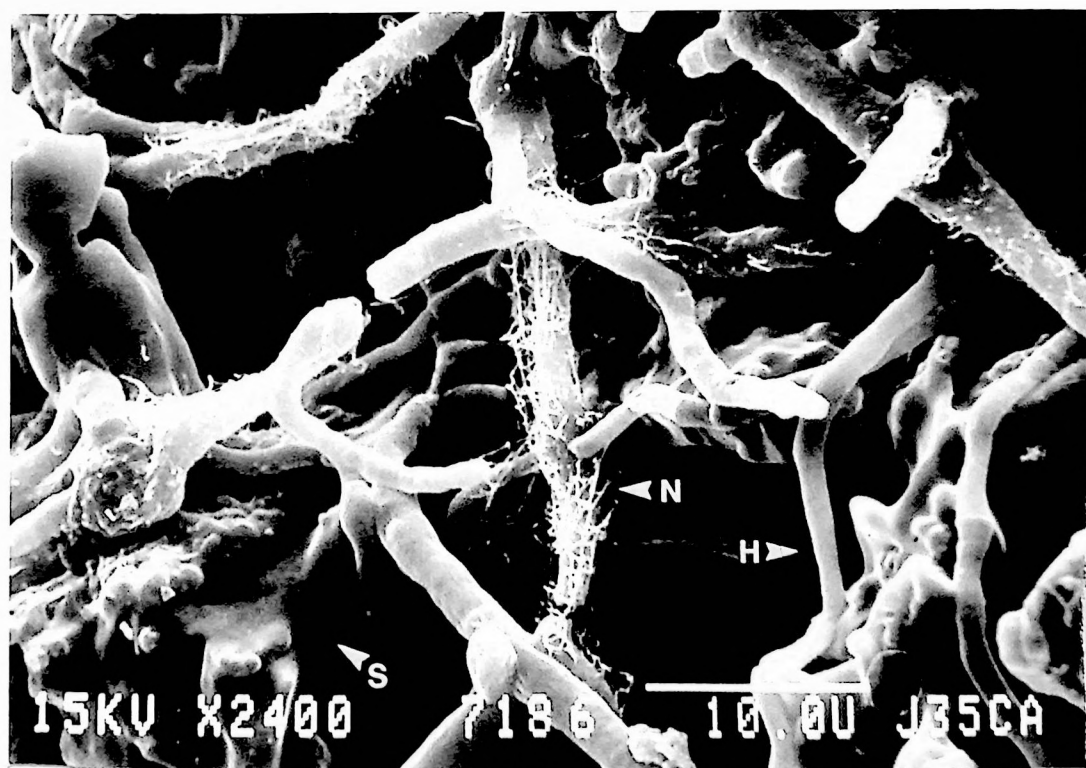
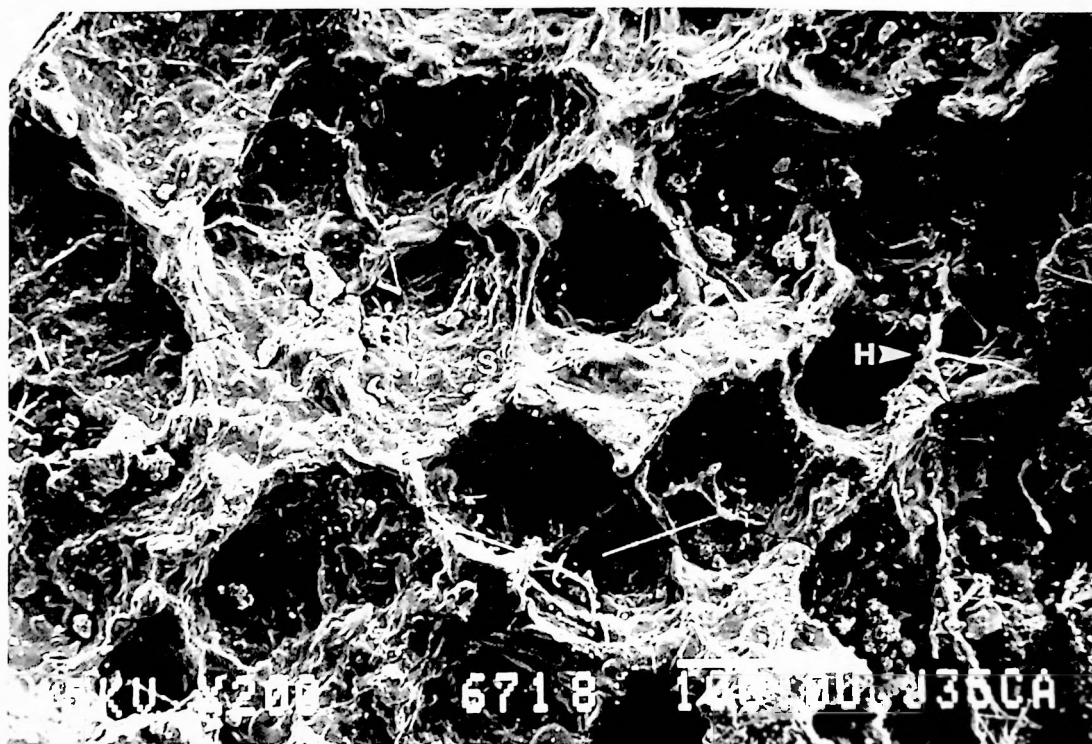


Fig. 6.10: Some examples of fungal hyphae on samples of ancient bread.

(c) From loaf 024. Fungal hyphae (H) run over agglomerations of material (G) which are too large to be individual starch granules. They are probably composed of starch, but the process which caused this appearance is unknown. The large round object (R) has not been identified.

Fig. 6.11: Evidence for enzyme attack on starch in several different specimens of ancient Egyptian bread.

(a) From loaf 021. The large starch granules (A) in this view have pits (P) marking their surfaces. The equatorial groove (E) of one large granule is visible. Although the large starch granules have swollen and flattened, the small starch granules (B), embedded in a matrix which may be composed of protein or dispersed starch, retain their spherical morphology. The few pits in the dispersed matrix (M) may be from pitted gelatinized starch, or may be holes in the protein matrix.

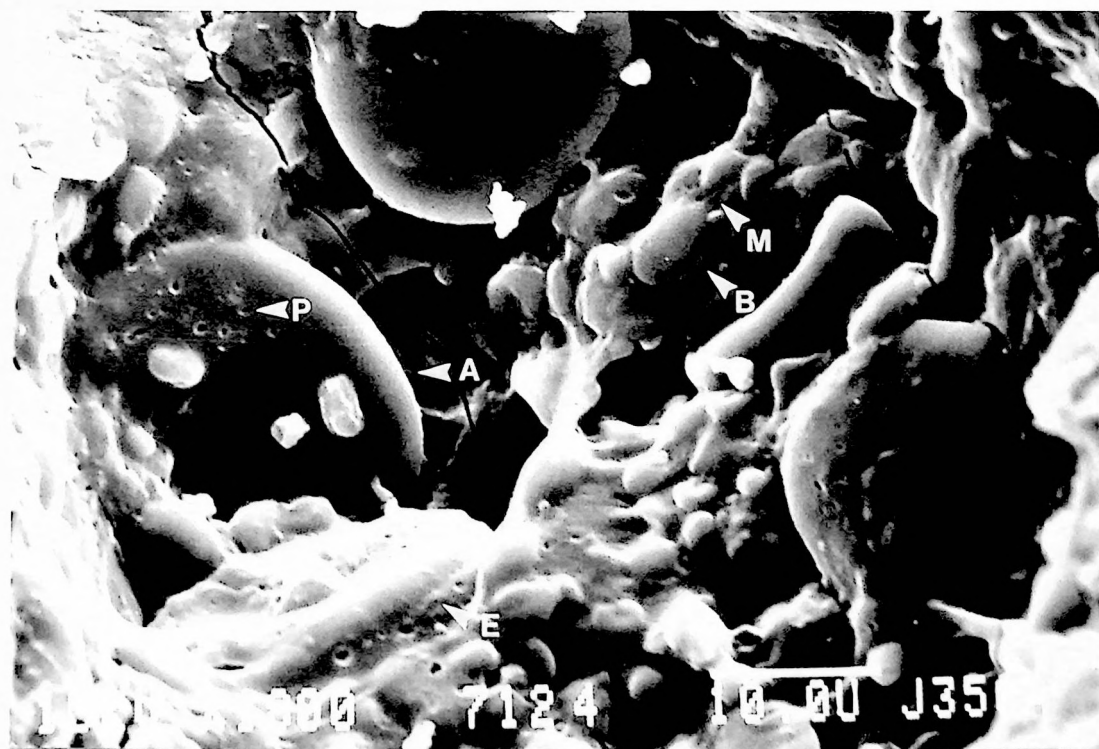
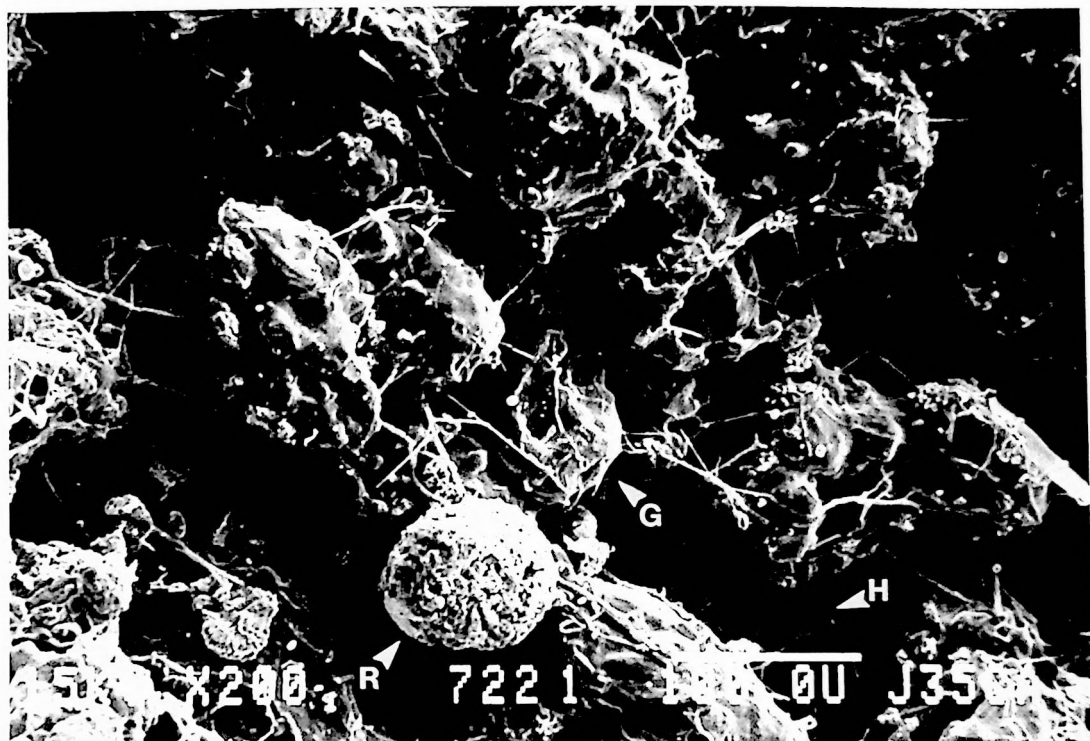


Fig. 6.11: Evidence for enzyme attack on starch in several different specimens of ancient Egyptian bread.

(b) From loaf 023. Although the starch in this view is distorted and dispersed, some pits are still distinct on the surface (P).

(c) From loaf 029. A hollowed small starch granule (S) is clearly visible, with prominent laminations. This hollowed shape is typical of enzyme attack on small starch granules of wheat. Other small starch granules which have been attacked by enzymes (H) show a similar appearance but are somewhat less obvious in this photograph.

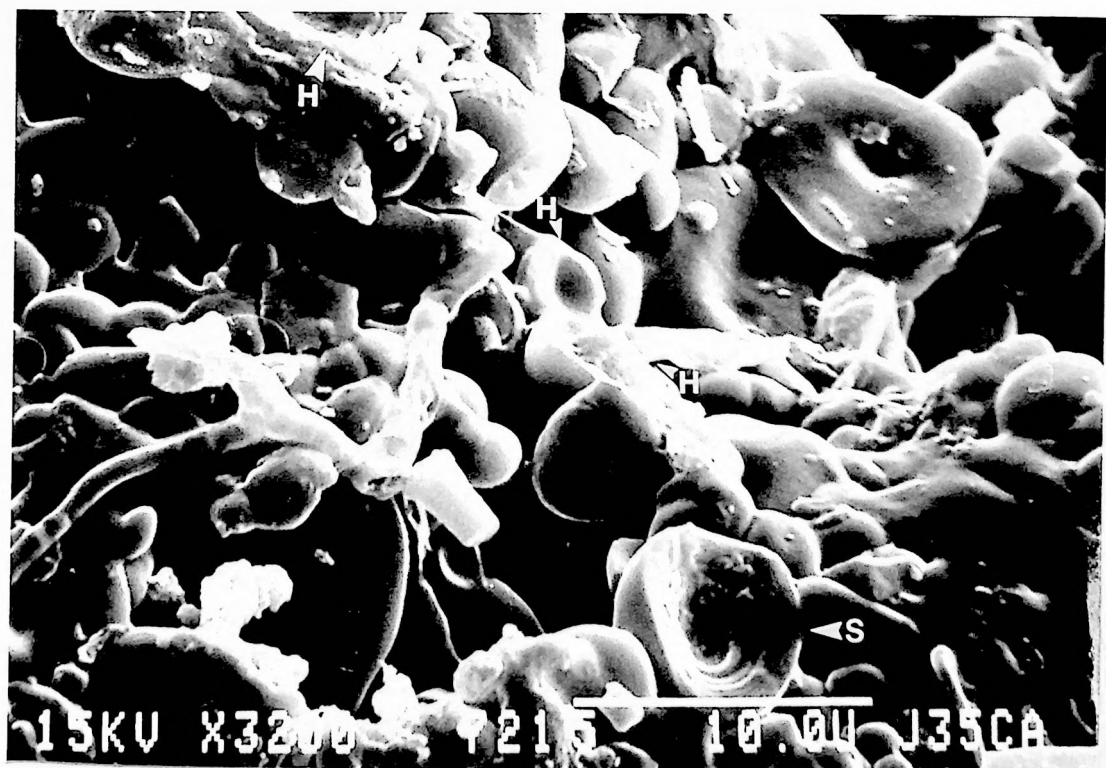
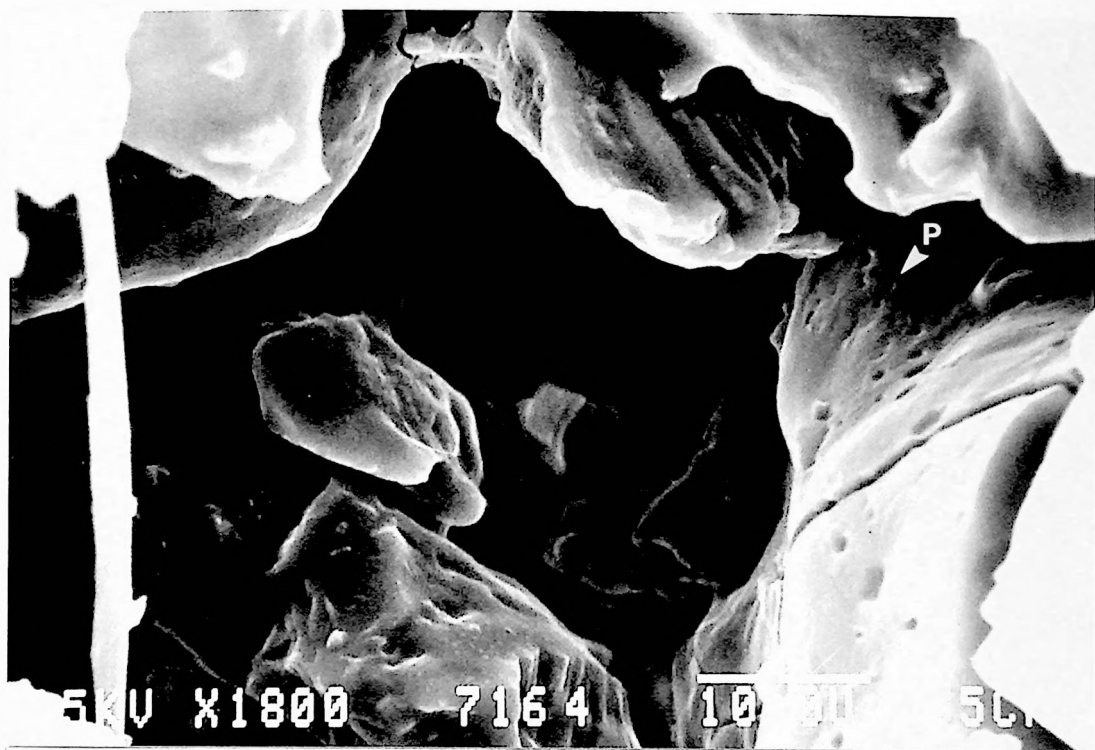


Fig. 6.11: Evidence for enzyme attack on starch in several different specimens of ancient Egyptian bread.

(d) From loaf 049. There are no whole granules, but many fragments, showing heavy laminations and hollowed interiors typical of enzymatic attack (L). Some pits are visible on the surface of a broken granule (P). The particulate texture indicates that advanced enzymatic breakdown has destroyed the coherent structure of unmodified starch, while the glassy looking material (G) is gelatinized, dispersed starch.

(e) From loaf 049. The centre is taken up by a large starch granule nearly destroyed by enzymatic attack (Q). The process has left behind only a shell with the typical channelled laminations of enzymatic breakdown. Other fragments of degraded starch with laminations still visible are also present (L), while a hollowed small granule (H) lies just above the central large shell. Much of the material visible in this micrograph consists of particulate starch resulting from extensive enzymatic attack.

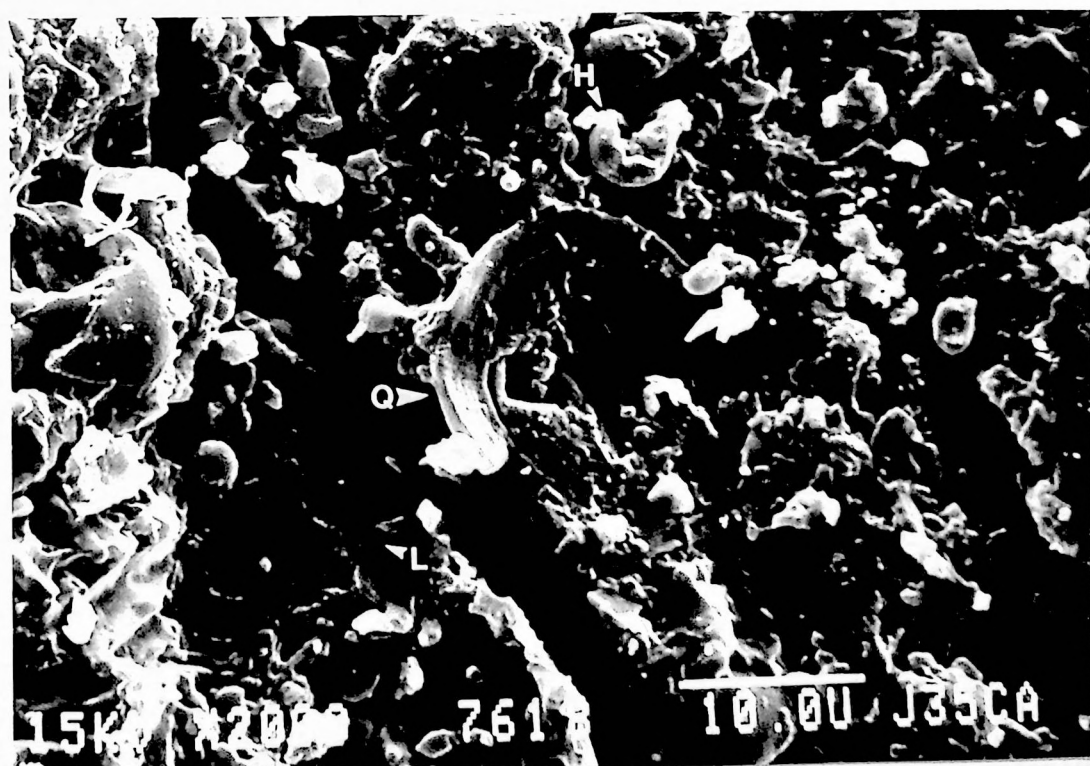
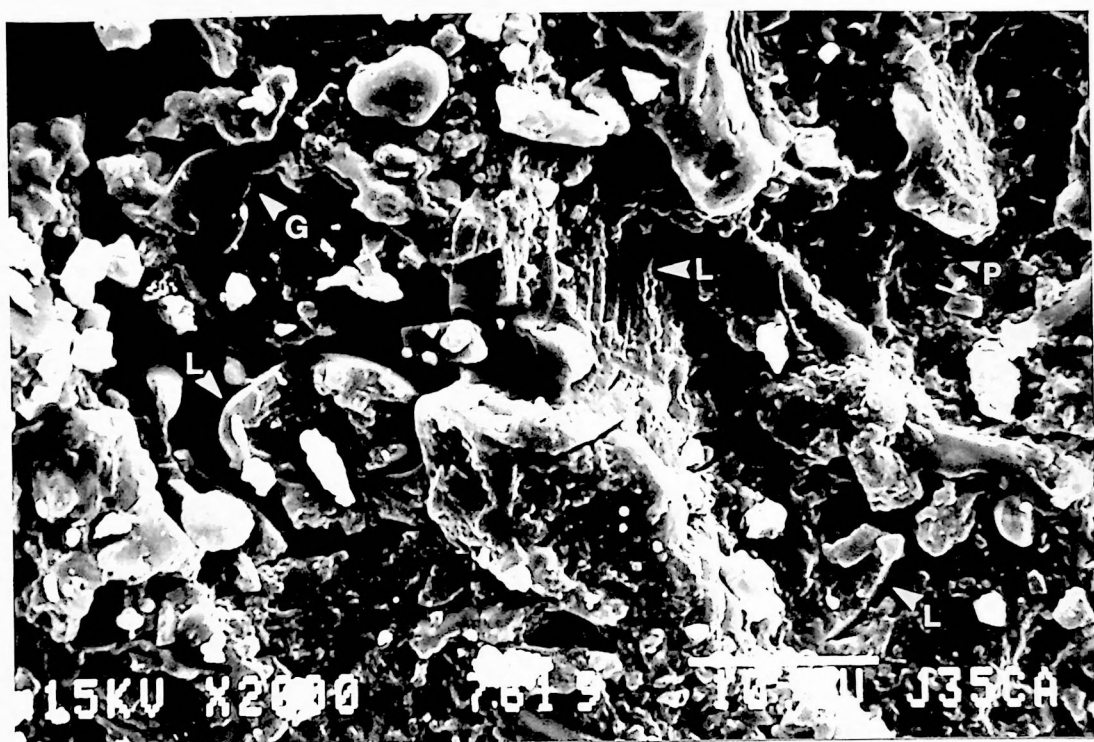


Fig. 6.12: Starch from loaf 014. The starch is gelatinized, appearing as rubber raft shaped - S-4 (F), flattened into a pancake shape - S-5 (C), and dispersed - S-6 (D). Some of the material which appears pierced by many small holes is probably protein matrix (M). The prominent spicules (K) have not yet been identified, but could be analysed with microprobe techniques.

Fig. 6.13: Starch from loaf 023. Note the fine particulate material in the lower right area (W) and the transition to gelatinized starch (V). The lumps on the left of the micrograph (U) are too large to be individual starch granules and although they probably consist of starch, the reasons for their appearance remain unknown.

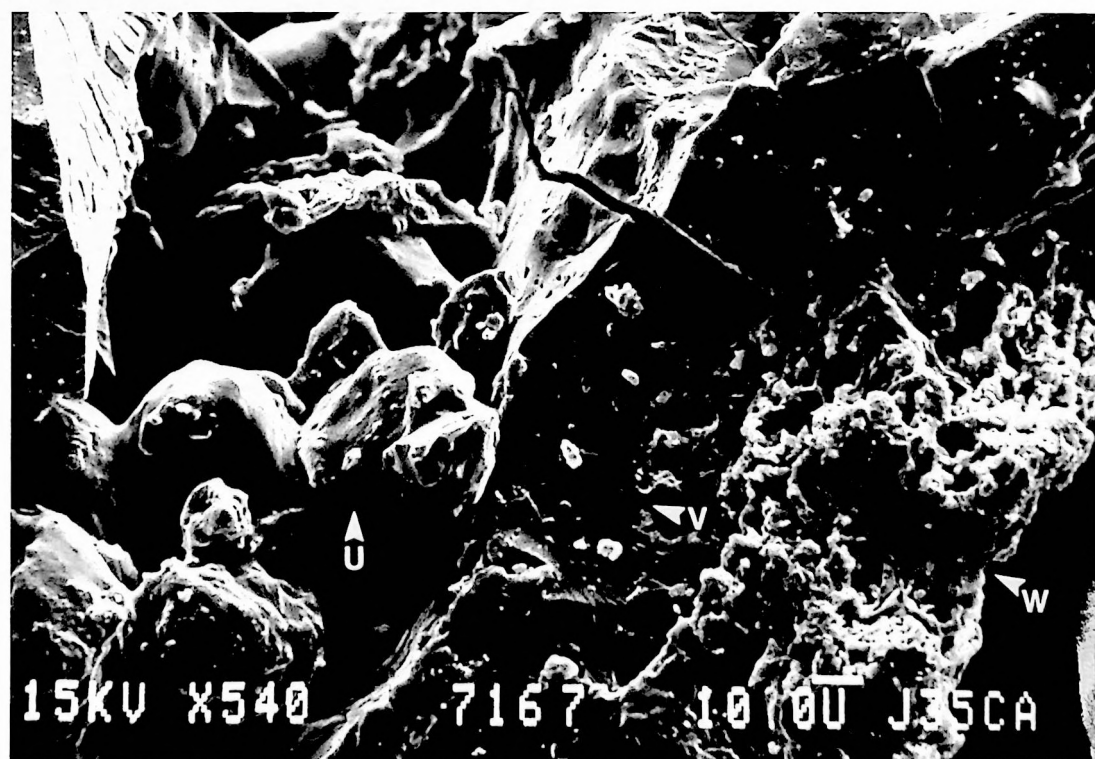
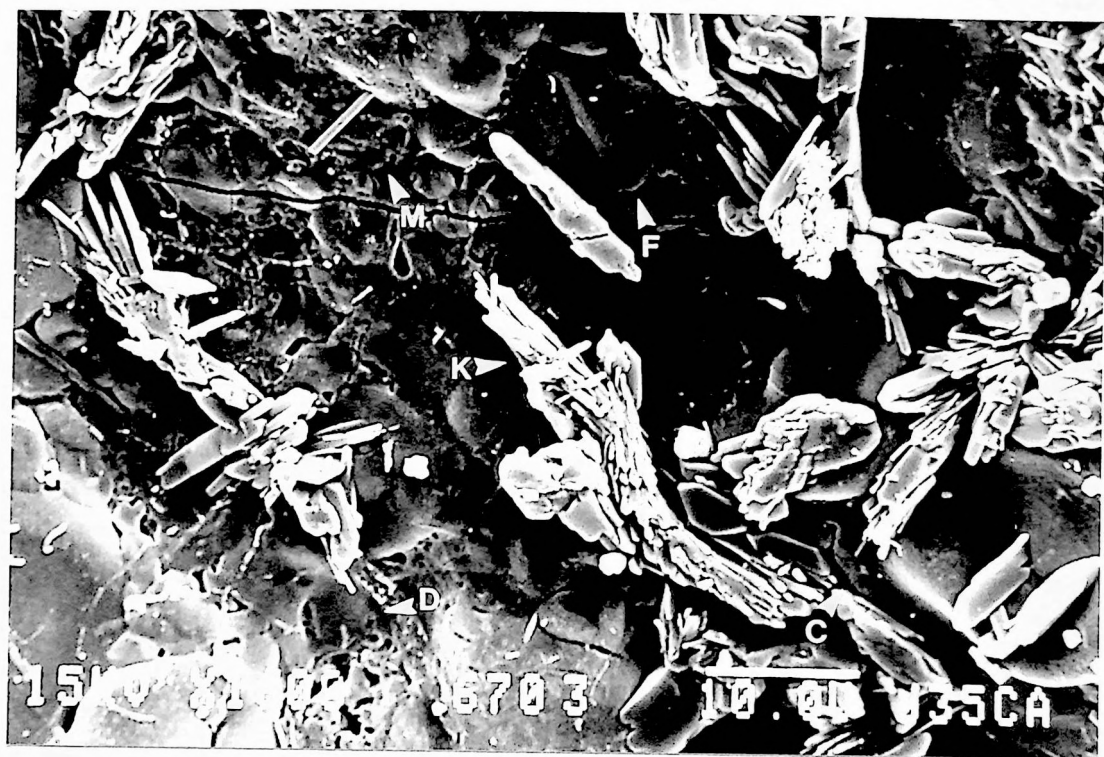


Fig. 6.14: Modern yeast cells. Both micrographs have generously been provided by Nigel Davies, BRFI.

(a) A chain of budding yeast cells. One cell has several bud scars (Y) and a newly forming bud (D).

(b) Enlarged view of budding yeast cells. Bud scars are visible on the central cell (Y).

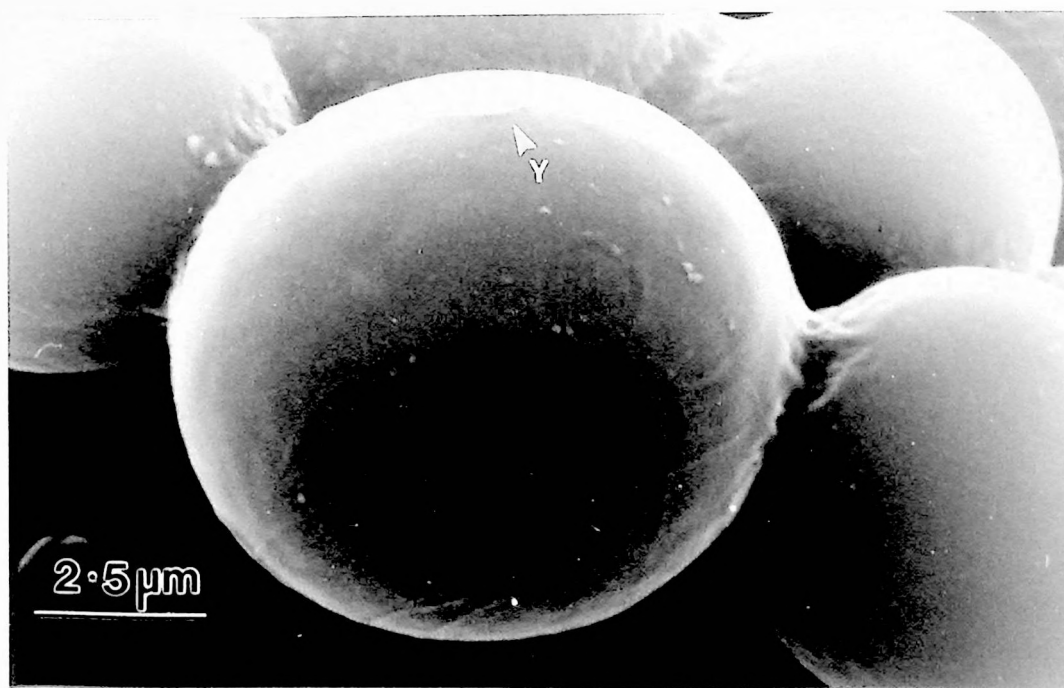
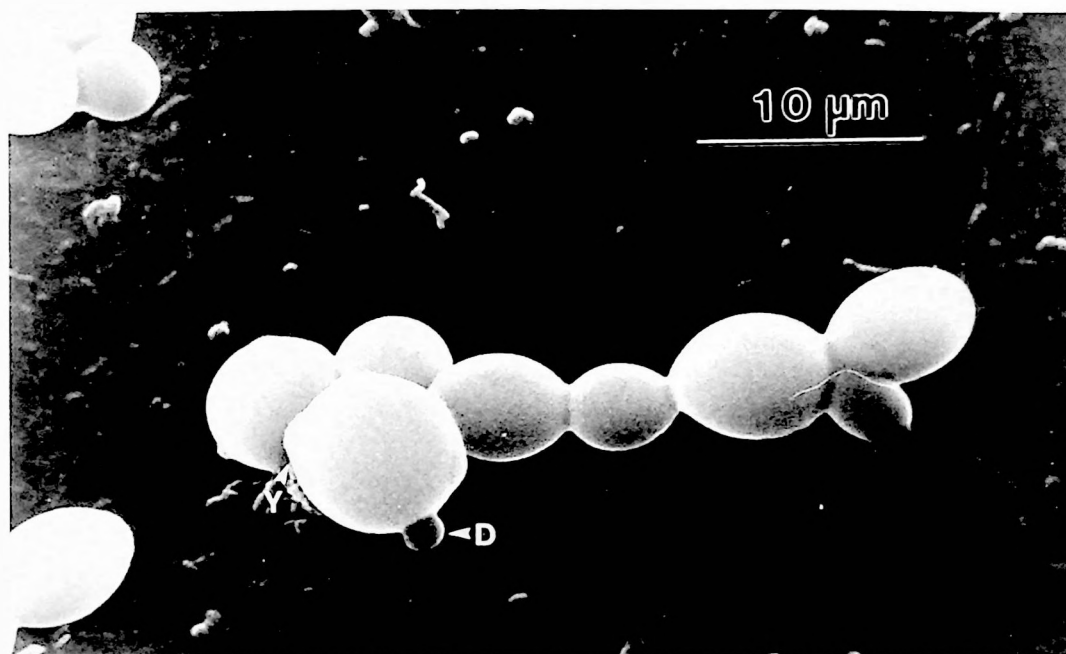


Fig. 6.15: An unmistakable yeast cell in the matrix of loaf 024 (X). It is identified on the basis of its size - about 6.7 μm in length (modern yeast cells range between 4.5 and 21 μm - Berry, 1982: 4), more or less spherical shape, and very clear birth scar (Q) on the right of the cell. What appears to be a small bulge on the left side of the cell (D) is the beginnings of a new cell budding out at the time of desiccation. The yeast cell appears to be an integral part of the bread matrix, but later contamination after this interior piece of crumb was exposed to the air cannot be ruled out completely.

Fig. 6.16: Possible yeast cells in loaf 014. Two possible yeast cells are just above the very centre of the micrograph (V). If yeast cells, they have collapsed somewhat. The upper one, especially, seems to show a bud scar. One reason to doubt the identification is their small size; they are barely 3 μm in length. Also visible in this micrograph are swollen, flattened large starch granules (F) and abundant spicules (R), whose origin is at present unknown.

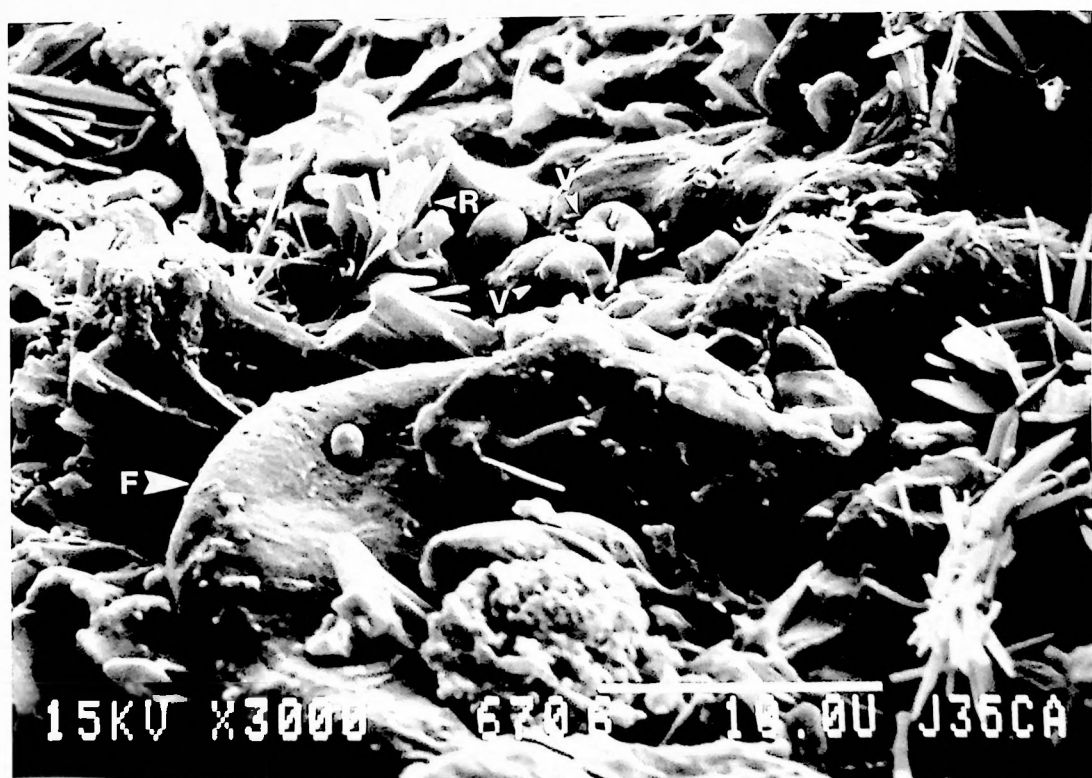
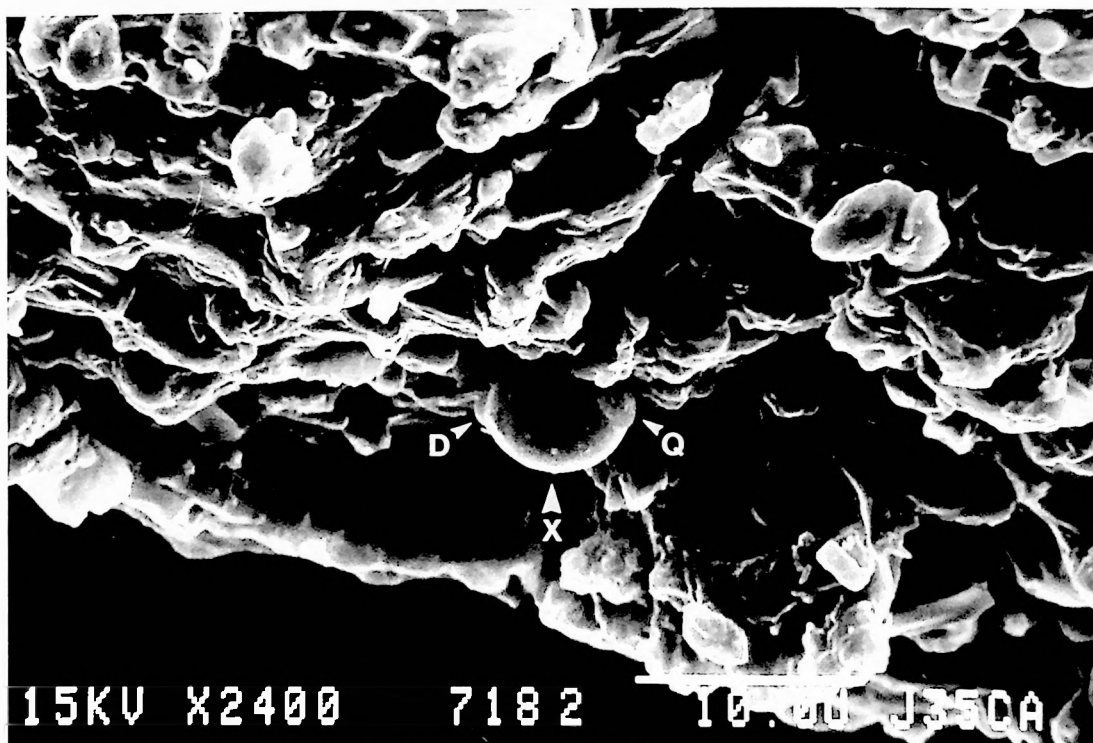


Fig. 6.17: Possible yeast cells in loaf 021. The identification of the objects labelled (V) as yeast is highly uncertain and is not helped by the fact that they appear collapsed and obscured by other material. They could be distorted small starch granules. At approximately 6 μm in length, they are the right size for yeast cells, but their surface texture looks too smooth for yeast.

Fig. 6.18: Possible yeast cells in loaf 029 (Z). They appear to have marks on the left side which might be birth scars, but due to their orientation, these cannot be seen clearly. They are rather small for yeast cells, at about 4 μm and 3.4 μm . Note the irregular small starch granules (Q), and the somewhat blistered, possibly pitted surface, of the large starch granule (T), as well as the gelatinized starch behind (J).

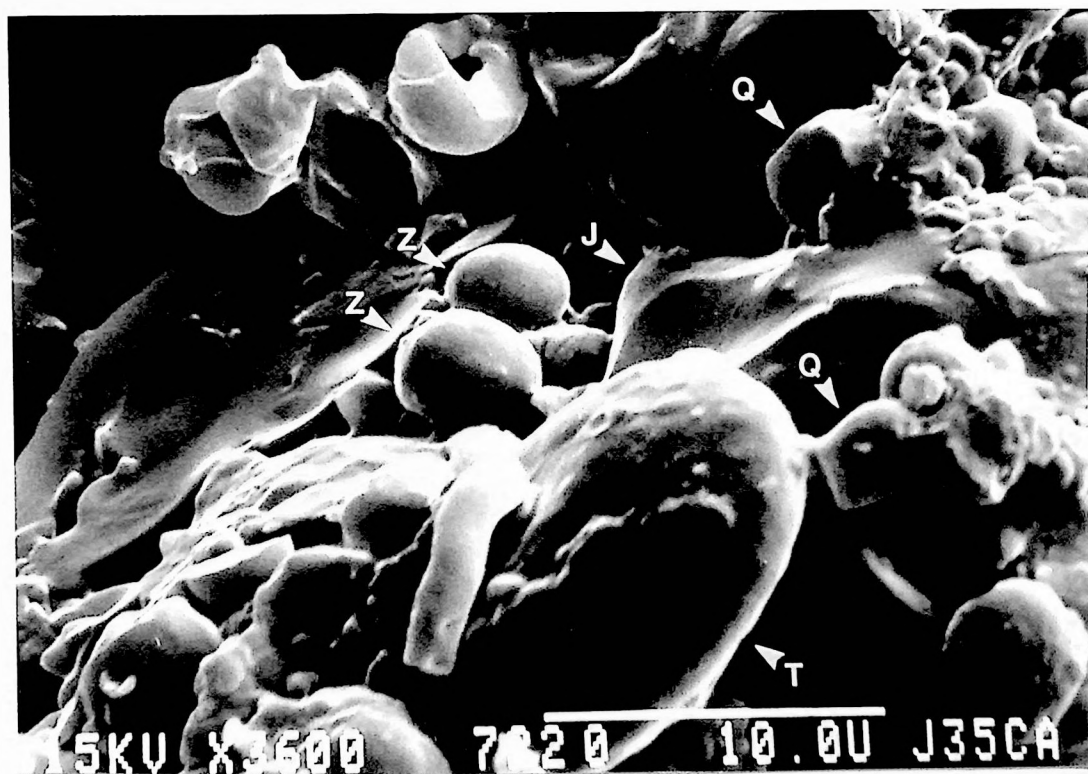
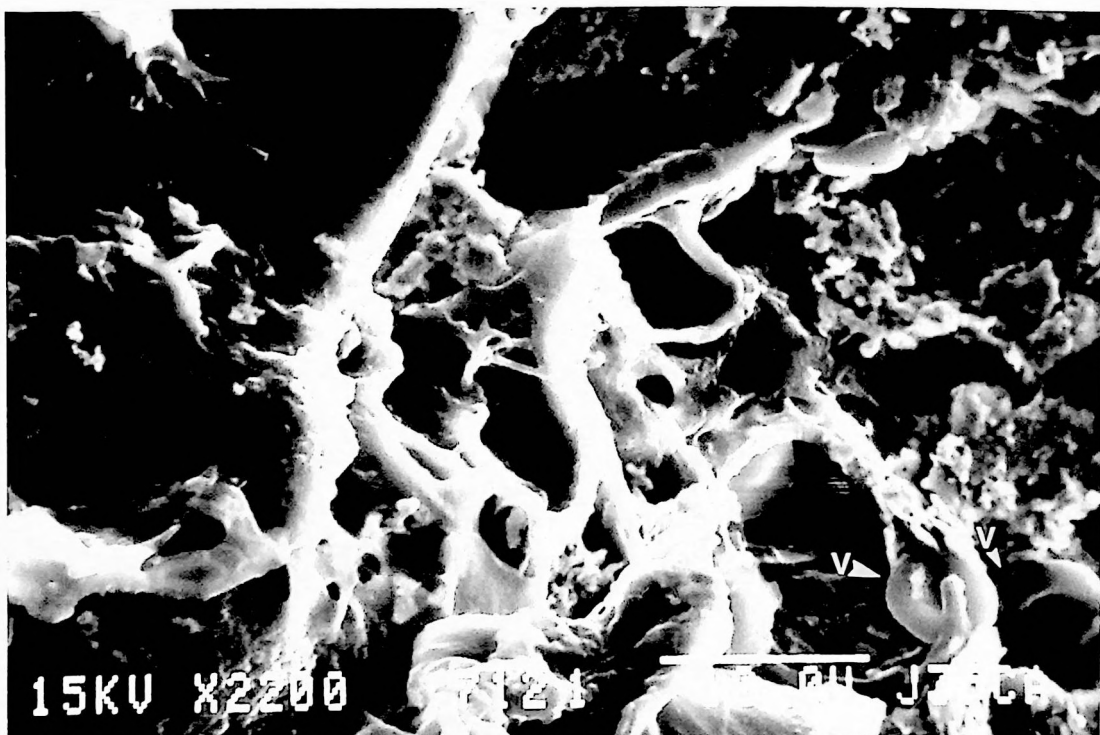


Fig. 6.19: Experimental round oven made from mud brick and mud plaster and lined with clay. The oven had been fired before this photograph was taken, and the liner is dark with soot. Each division on the rod is 25 cm.

Fig. 6.20: Heating the experimental oven in preparation for baking.

Fig. 6.22: Experimental emmer bread baking in the oven. The liner has totally collapsed and fallen away from the oven walls. The lower edge of the loaf is burning, but whole loaf is sticking well to the liner, although it is inclined at a considerable angle.



Fig. 6.21: Raw emmer cakes made from experimentally ground flour (see Fig. 5.41), formed into disks and left while the oven was being heated. Note the thickness of the loaves, the high chaff content, and the cracking, especially around the edges, showing that the dough is very dry.



Fig. 6.23: Experimental emmer loaves after baking.

(a) Top of the loaf. The surface is dry and cracked, and one edge rather badly burnt.

(b) Underside of the loaf. Although the edge is rather badly burnt, the rest of the underside, with its shiny, smoothed texture, does resemble the appearance of many ancient loaves.



Fig. 6.24: A plan of the whole site of Amarna, with the main regions marked. After Baines and Málek, 1984: 123.

Fig. 6.25: An example of the long, narrow, tapered New Kingdom bread mould, from the square oven of the Chapel 556 annexe. Drawing by A. Boyce at one third scale. From Kemp, 1987a: 78.

Fig. 6.27: Two examples of typical ceramic platters from Amarna. Unpublished drawings by A. Boyce, provided by P. Rose.

Fig. 6.24

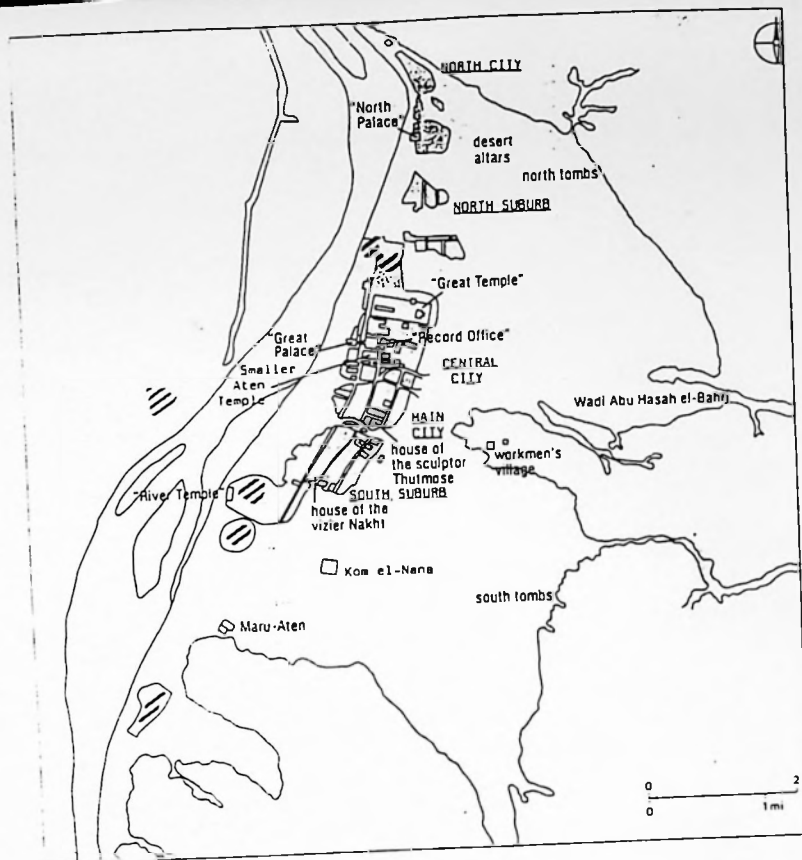


Fig. 6.25

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Fig. 6.27

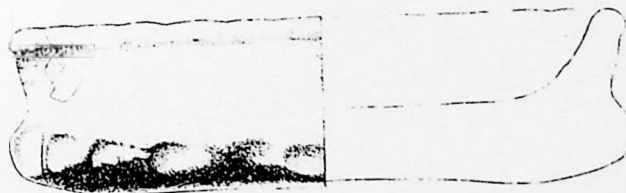
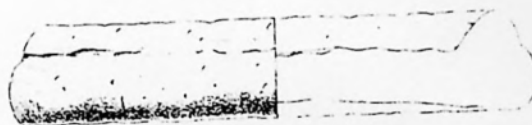


Fig. 6.26: Plan of the Central City and part of the Main City at Amarna, showing sherd survey locations and the buildings mentioned in the text where large quantities of bread moulds were found. From Rose, 1989: 103, Fig. 5.1.

Fig. 6.26

