Chapter 24: The Mollusca

by

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§ 24.1 Introduction

Marine, land and freshwater molluscs may occur in archaeological deposits for a variety of reasons. The site may represent part of their natural habitat, in which case they occur naturally without the agency of man, or they may have been introduced by man or, more rarely, by animals. Introductions may have been accidental, in cases where molluscs were introduced together with some other commodity such as vegetation or sand, or they may have been deliberately introduced for various reasons. Molluscs are known to have been used in the past as food and their shells as tools, utensils, ornaments and 'ritual objects'; or the shells may have been collected from a neighbouring beach out of passing interest and then simply discarded.

By studying the species composition of samples according to context, the relative frequency of the different species represented and the condition of the shells themselves (for example, whether marine shells are beachworn or 'fresh' and therefore were probably collected alive), it can be possible to suggest reasons for the presence of molluscs at an archaeological site. Similarly, a study of shell samples according to period of occupation can sometimes reveal changes in molluscan utilisation with time. The land and freshwater shells which occur naturally can provide environmental information. The molluscan samples from Kissonerga were studied with these precepts in mind.

A total of 1394 molluscan and crab claw samples (M100-M1461 plus 32 unnumbered samples) was logged from Kissonerga, of which 309 were not available for analysis and 85 land snail flotation samples were received but not examined. The remaining 999 samples were examined with regard to species composition, estimated minimum number of individuals and shell condition. Although each bivalve must originally have been represented by two valves, these occurred singly or in unequal pairs and so each valve was counted as one individual. Each sample was correlated with its unit number, which provided information on its context, status and chronological period.

Most of the samples were collected by hand during excavation but some are the result of dry sieving and sieving flotation residues, using a 1.5 mm mesh sieve and a 0.66 mm or a 1.5 mm mesh sieve, respectively. Sieving and, especially, flotation can produce large numbers of small shells, mostly land snails, and introduce a marked bias into the sampling. The examination of 82 flotation samples from a range of different contexts revealed a fairly standard land snail composition according to context, and on this basis it was decided not to examine all the flotation samples available: the amount of further information that might be expected was outweighed by the time that would be required to analyse all the samples.

Not all the shells recovered from the excavations at Kissonerga are considered in this report: shell artefacts, and tusk shell or dentalia (*Dentalium* spp.) beads and a toilet shell (*Mactra corallina* = *M. stultorum*) from graves are dealt with in § 8.2, 8.3 and 16.1; *Preliminary* 14). The shells from the Ceremonial Area at Kissonerga have also been described separately (*LAP* II.2, 75-84).

§ 24.2 The marine species

Many of the marine shells are very fragmentary and some are heavily worn and/or encrusted with hard deposits. Nevertheless, most have been identified at least to generic level and many of the unidentifiable specimens are beachrolled fragments or worn juveniles. The samples yielded 49 species of marine Gastropoda, 21 species of Bivalvia, three species of Scaphopoda or dentalia, and one species of Cephalopoda. The marine species are listed in Table 24.1, which gives their estimated minimum number and relative frequency at Kissonerga, based on the 999 samples examined, together with the relative percentages of 'fresh' and 'worn' shells for the more frequent (18+ individuals) species. It must be stressed that the distinction between 'fresh' or live-collected shells and 'worn' or beachrolled empty shells is somewhat arbitrary, since one condition grades into the other and some 'fresh' shells can be picked up empty from the beach whereas others attain a 'worn' appearance during life. Shells can also become 'worn' or abraded in disturbed deposits and ploughsoil. Similarly, an examination of the broken edges of shells can indicate whether they were collected as broken fragments (edges abraded) or were collected intact and later broken on the site (edges not abraded).

The marine shells from Kissonerga are characterised by the large number of species represented (74) and the low number of individuals of any one species.

Table 24.1. Marine Mollusca

Species	*No.*[1]	*Total (%)*	*'Fresh' (%)*	*'Worn' (%)*
GASTROPODA				
Arcularia gibbosula (Linnaeus)	2	0.09		
Astraea rugosa (Linnaeus)	35	1.64	0	100.00
Calliostoma conulus (Linnaeus)	1	0.05		
Cerithium rupestre Risso	5	0.23		
Cerithium vulgatum Bruguière	37	1.73	7.70	92.30
Charonia nodifera (Lamarck) }	102	4.77	59.80	40.20
Charonia variegata (Lamarck) }				
Clanculus corallinus (Gmelin)	1	0.05		
Columbella rustica (Linnaeus)	195	9.12	8.21	91.79
Conus mediterraneus Hwass	61	2.85	11.48	88.52
Cymatium parthenopeum (Von Salis)	3	0.14		
Cypraea lacrimalis Monterosato }	13	0.61	40.91	59.09
Cypraea spurca Linnaeus }				
Diodora gibberula (Lamarck)	1	0.05		
Euthria cornea (Linnaeus)	2	0.09		
Fasciolaria tarentina Lamarck	5	0.23		
Galeodea echinophora (Linnaeus)	2	0.09		
Galeodea rugosa (Linnaeus)	1	0.05		
Gibbula cineraria (Linnaeus)	13	0.61 }		
Gibbula divaricata (Linnaeus)	3	0.14 }	33.33	66.67
Gibbula sp.	19	0.89 }		
Haliotis lamellosa Lamarck	2	0.09		
Haliotis tuberculata Linnaeus	2	0.09		
Littorina neritoides (Linnaeus)	7	0.33		
Luria lurida (Linnaeus)	14	0.65	[2]	[2]
Mitra cf. *cornicula* Linnaeus	3	0.14		
Mitrella scripta (Linnaeus)	14	0.65		
Monodonta articulata Lamarck }	499	23.34	99.60	0.40
Monodonta turbinata (Born) }				
Murex brandaris Linnaeus	68	3.18	100.0	0
Muricopsis cristata (Linnaeus)	10	0.47		
Nassarius incrassatus (Ström)	9	0.42		
Natica hebraea Montagu	1	0.05		
Nerita sp.	1	0.05		
Ocenebra cf. *aciculata* (Lamarck)	2	0.09		
Patella caerulea Linnaeus }				
Patella aspera Lamarck }	534	24.98	97.94	2.06
Patella rustica Linnaeus }				
Phalium granulatum (Gmelin) }	41	1.92	17.07	82.93
Phalium saburon (Bruguière) }				
Pisania maculosa (Lamarck)	19	0.89	43.75	56.25
Rissoa cf. *ventricosa* (Desmarest)	1	0.05		
Thais haemastoma Lamarck	26	1.22	26.92	73.08
Tonna galea (Linnaeus)	9	0.42		
Tricolia pullus (Linnaeus)	1	0.05		
Truncularioposis trunculus (Linnaeus)	52	2.43	5.77	94.23
Turritella communis Risso	2	0.09		
Turritella triplicata (Brocchi)	9	0.42		
Vermetus gigas Bivone	4	0.19		
Unidentified Gastropoda	67	3.13		
Total Gastropoda	1898			
BIVALVIA				
Acanthocardia echinata (Linnaeus)	2	0.09		
Acanthocardia tuberculata (Linnaeus)	7	0.33		
Anomia ephippium Linnaeus	1	0.05		
Arca barbata Linnaeus	18	0.84 }		
Arca tetragona Poli	2	0.09 }	15.79	84.21
Arca sp.	1	0.05 }		
Callista chione Linnaeus	20	0.94	15.00	85.00
Cardita sulcata Bruguière	4	0.19		
Cardita trapezia (Linnaeus)	1	0.05		
Gaederopus gaederopus (Linnaeus)	6	0.28		
Glycymeris glycymeris Linnaeus	39 }			
Glycymeris violascens Lamarck	30 }	4.21	6.67	93.33
Glycymeris sp.	21 }			
Loripes lacteus (Lamarck)	18	0.84	12.50	87.50
Mactra corallina (Linnaeus)	1	0.05		
Ostraea edulis Linnaeus	2	0.09		
Pecten jacobaeus Linnaeus	1	0.05		
Pinna nobilis Linnaeus	5	0.23		
Spisula sp.	1	0.05		
Venerupis decussata (Linnaeus)	2	0.09		
Venus striatula (Da Costa)	2	0.09		
Unidentified Bivalvia	10	0.47		
Total Bivalvia	94			
SCAPHOPODA				
Dentalium inaequicostatum Dautzenberg	10 }			
Dentalium rectum Gmelin	8 }	2.10	6.67	93.33
Dentalium vulgare Da Costa	27 }			
Total Scaphopoda	45			
CEPHALOPODA				
Sepia officinalis Linnaeus	1	0.05		
Total Mollusca	2,138	100.00		

Notes:
[1] Estimated minimum number of individuals.
[2] Data combined with *Cypraea* spp.

Large deposits of molluscan remains are absent and most species occur singly or in very low numbers in any one sample.

Some of the congeneric species represented are very similar in size, appearance and habitat, and for the purpose of this analysis these species have been considered together under the genus: it is thought unlikely that the inhabitants of Kissonerga were concerned with minor taxonomic differences. These generic groupings include the gastropods *Charonia* spp. (two species), *Galeodea* spp. (two species), *Gibbula* spp. (three species), *Haliotis* spp. (two species), *Monodonta* spp. (two species), *Patella* spp. (three species) and *Turritella* spp. (two species), the bivalves *Glycymeris* spp. (three species) and the dentalia *Dentalium* spp. (three species). Similarly, the three species of cowry are considered together although two separate genera are represented. The two species of *Cerithium*, however, are very different in size and are considered separately. Nevertheless, even with these groupings, most of the species/genera are present in frequencies of less than 1.0% of the total marine molluscan assemblage (see Table 24.1).

The most frequent marine molluscs are limpets (*Patella* spp.) and topshells (*Monodonta* spp.), representing 24.98% and 23.34% of the total assemblage respectively. *Patella caerulea* is the commonest limpet, followed by *P. rustica* and the infrequent *P. aspera*: many of the fragments could not be identified as to species and they are considered together. Of the topshells, *Monodonta turbinata* greatly outnumbers its congeneric *M. articulata* but again small fragments were difficult to identify to species. In terms of numbers of individuals, these shells together comprise half (48.32%) of all the marine shells recovered from Kissonerga. The next most frequent species is the dove shell *Columbella rustica* (9.12%), followed by the trumpet shells *Charonia* spp. (4.77%) and dog cockles *Glycymeris* spp. (4.21%).

High frequency of occurrence can indicate that a species was used for food and this is substantiated for limpets and topshells as nearly all (97.94% and 99.60% respectively) of the shells had been collected fresh/alive. In addition, most of the limpet shells had been chipped at the edge where they were prised off the rocks and most of the topshells had been smashed at the site to extract the meat, although the smaller (juvenile) shells were left intact and these animals may have been discarded. From 1-5 topshells occurred in 266 samples, giving an average number of 1.63/sample. An unusually large assemblage of 99 topshells, mostly intact juveniles, was recovered from Unit 1015 in the Ceremonial Area and this was interpreted as a token offering of shells too small for normal consumption (*LAP* II.2, 75-84). A group of 13 intact juveniles was also recovered from a pit fill elsewhere on the site. Limpets occurred in batches of 1-13 in 274 samples, with an average number of 1.95/sample. Although limpets and topshells represent such a large proportion of the shells from the site, in terms of quantity of food they represent very little. Davidson (1972) states today limpets are eaten raw in the Mediterranean: if shellfish were eaten raw in the past, perhaps most were consumed on the beach and the shells in the samples may represent only a small proportion of the total. Not all the topshells and limpets represent food remains: a few were collected as beach specimens and one large *M. articulata* had a worm tube inside the aperture.

Trumpet shells and dog cockles are edible (Davidson 1972), but the condition of the shells does not support the possibility that they were used as food at Kissonerga. A large proportion of the trumpet shells was collected in a worn or beachrolled condition and almost all the dog cockles (93.33%) were beach specimens. Table 24.1 shows that the next three most frequent bivalves (*Arca* spp., *Callista chione* and *Loripes lacteus*) were also mostly collected as dead shells from the beach, rather than as food, and this is confirmed by the presence of deliberately holed examples of all four bivalves, which appear to have been used as beads or pendants (see § 24.6 below). The condition and also the low frequency of bivalves would seem to preclude their use as food at Kissonerga. Similarly, the high proportion (93.33%) of worn dentalia shells indicates their use as ornaments.

The condition of the gastropod shells also indicates that most were collected as beach specimens for non-food purposes. The main exception, apart from limpets and topshells, is the murex *Murex brandaris*: although occurring at a relatively low frequency (3.18%), all the shells were fresh and had been crushed to remove the meat. This can be compared with another murex, *Trunculariopsis trunculus*, which occurs at a similar frequency (2.43%) and is a similar size to *M. brandaris* and yet was mostly collected as dead shells. Some of these shells had been holed for suspension and this example shows a clear distinction between species differentially selected as food and as ornaments.

Not all the differences between the proportion of fresh and worn shells are so clear: in the case of *Charonia* spp., where it is known that the shells were highly prized for ritual purposes (Reese 1990; *LAP* II.2, 75-84), the relatively high proportion of shells in good condition could reflect that live animals were collected for the condition of their shells, rather than as food items. The large number of shells recorded (102) may overemphasise the frequency of *Charonia* spp. These large shells are represented mostly by small fragments and it is possible that a single specimen may have become distributed over more than one context.

Table 24.2. Size of the marine shells

Species	*Number measured*	*Range (mm)*	*Mean (mm)*	*Max.*[1] *(mm)*
Cerithium vulgatum	9	7.7-50.9	17.41	60.0
Columbella rustica	19	3.7-16.8	12.6	20.0
Conus mediterraneus	37	3.4-51.1	14.87	50.0
Cymatium parthenopeum	1	-	76.2	100.0
Cypraea lacrimalis	2	21.9-24.0	22.95	50.0
Fasciolaria tarentina	1	-	50.0	50.0
Luria lurida	4	20.4-37.0	31.98	
Natica hebraea	1	-	34.5	
Patella spp.	118	6.8-48.7	26.14	45.0
Phalium granulatum	1	-	70.0	111.0[2]
Phalium saburon	2	53.0-56.0	54.5	60.0[2]
Thais haemastoma	11	23.8-70.0	49.41	80.0
Trunculariopsis trunculus	12	32.0-60.0	43.51	70.0
Arca barbata[3]	6	25.0-55.0	39.93	50.0
Gaederopus gaederopus[3]	3	32.6-98.0	61.5	100.0
Glycymeris spp.[3]	47	5.0-90.0	23.87	80.0
Loripes lacteus[3]	11	11.9-22.0	16.99	25.0

Notes:
[1] After Campbell (1982) except for *Phalium* spp.
[2] After Reese (1989).
[3] The longest dimension of bivalve shells was recorded.

Most of the shells examined are fragmentary but intact specimens were measured and compared with the maximum size given for the species in the area today (Table 24.2). Although smaller specimens may be less likely to get broken, giving a bias towards juveniles, some large shells are present which in some cases (*Patella caerulea, Glycymeris glycymeris, Arca barbata*) reach or exceed the present maxima. However, the mean size of the limpets (*Patella* spp.) is far below the maximum at only 26.14 mm, showing that large numbers of small shells had been taken. This suggests the over-exploitation of the local limpet population for food and that individuals were being collected before

Table 24.3. Non-molluscan invertebrates

Phylum / *Species*	*Frequency*	*Comments*
Porifera		
Cliona celata (Grant)	Common	Parasitic on many shells, especially *Charonia* spp.
Coelenterata		
Dendrophyllia ramea (Linnaeus)	1	
Caryophyllia smithii Stokes and Broderip	5	Three attached to a single valve of *Gaederopus*
Annelida		
Spirorbis pagenstecheri Quatrefages	Common }	Coiled tubes attached
Spirorbis borealis Daudin	Occasional }	to shells
Hydroides norvegica (Grunnerus)	1	Mass of tubes
Arthropoda		
Cancer pagurus Linnaeus }		
Carcinus mediterraneus Czerniavsky }	113	Mostly claws
Eriphia spp. }		
Homarus gammarus (Linnaeus)	1	Single claw
Parapenaeus longirostris (Lucas)	4	Rostra
Echinodermata		
Paracentrotus lividus (Lamarck)	3	Fragments of test and spines

they had time to reach full size (unless the smaller individuals were easier to collect and/or were considered more palatable). The relatively small size of non-food species indicates that the shells were valued regardless of size.

Some fossil molluscs were also found in the samples: two fossil oysters (cf. *Ostrea* sp.) and the internal casts of three unidentified marine gastropods, which may have been collected as curiosities from nearby Pleistocene deposits. Another fossil was provisionally identified as a belemnite guard. All the fossils came from general and fill deposits and do not seem to have been accorded special significance.

In addition to molluscs, the samples contained the remains of several other marine invertebrate groups, which are listed in Table 24.3. A large proportion of *Charonia* and some other shells had been damaged by the boring sponge *Cliona celata*, which penetrates the surface through minute holes and eventually erodes the central layer of the shell into a honeycomb which is exposed when the delicate, largely unsupported, outer layer is damaged. Some of the shells carried the coiled tubes of the annelid worms *Spirorbis* spp. and these are indicative of dead-collected shells when they occur on the inner surface. The largest number of non-molluscan invertebrate remains were of decapod Crustacea: all the species present are edible and probably represent food remains although, as with limpets and topshells, very few actual meals are represented.

§ 24.3 Land and freshwater species

Table 24.4 shows the land snails from Kissonerga arranged according to family, with some indication of their relative frequency. Hundreds of small land snails were present in some of the flotation samples and the preservation of land snails was generally good. However, many of these have proved difficult to identify in the absence of published information; in some cases only provisional identifications have been possible (these are indicated by a question mark in Table 24.4)

Table 24.4. Land snails

Family / *Species*	*Number*	*Total %*
Orculidae		
?*Orcula* sp.	22	0.12
Enidae		
Chondrula cf. *tridens* (Müller)	1,014	5.55
Zebrina detrita (Müller)	4	0.02
Zonitidae		
Vitrea cf. *cyprina* Westerlund	17	0.09
?*Aegopinella* sp.	2	0.01
Ferussaciidae		
Cecilioides cf. *petitianus* (Benoit) }		
?*Caecilianella aegyptiaca* Pallary }	5,371	29.39
Calaxis unidentata Jicheli }		
Subulinidae		
Rumina decollata Linnaeus	4	0.02
Helicidae		
Caracollina lenticula (Férussac)	11	0.06
Candidula cf. *cyparissias* }	7,518	41.14
?*Xerophila cretica* }		
Helicella cf. *obvia* (Menke)	84	0.46
Cochlicella acuta (Müller)	1	0.01
Monacha syriaca Ehrenberg	2,873	15.72
Levantina sp.	1	0.01
Eobania vermiculata (Müller)	36	0.20
Helix cf. *cincta* Müller	1,315	7.20
Helix aspersa Müller	1	0.01
Total	18,274	100.01

although all have been identified to family level. As with the marine shells, closely similar and related species have been grouped together, namely the subterranean Ferussaciidae and the small Helicidae, *Candidula* cf. *cyparissias*, ? *Xerophila cretica* and possibly some other species which have not been identified.

The most frequent species are the small Helicidae (41.14%), followed by the Ferussaciidae (29.39%) and the middle-sized helicid *Monacha syriaca* (15.72%). The maximum numbers of these recorded from single samples are 500, 464 and 105 respectively, and where such large numbers occur a considerable proportion consists of juveniles, suggesting that thriving populations of these snails were living *in situ* in the particular context represented by the sample. As with these species, it is probable that all the land snails were living naturally at the site and as such they may be environmental indicators (see § 24.7 below). The larger species, especially *Helix* cf. *cincta* which is the fourth most frequent at 7.20%, may have been eaten but they could have entered the site naturally. Reese (1978) thinks that *H. cincta* was eaten at Cape Andreas-Kastros and Sotira-Kamminoudhia, and if this was the case at Kissonerga the 1315 shells recorded represent considerably more meat than the limpet and topshell remains.

Table 24.5. Freshwater and brackish water Mollusca

Class: *Subclass* *Species*	*No.*	*Total %*
Gastropoda:		
Prosobranchia		
Melanopsis praemorsa (Linnaeus) F	2,803	79.68
Melanoides tuberculata (Müller) F	191	5.43
Truncatella subcylindrica (Linnaeus) B	376	10.69
Hydrobia ventrosa (Montagu) B	1	0.03
Bithynia cf. *leachii* (Sheppard) F	61	1.73
Pulmonata		
Ovatella myosotis (Draparnaud) B	36	1.02
Oxyloma pfeifferi (Rossmässler) F	33	0.94
Lymnaea truncatula (Müller) F	12	0.34
Ancylastrum fluviatile (Müller) F	1	0.03
Bivalvia:		
Pisidium sp. F	4	0.11
Total	3,518	100.00

Notes:
F = freshwater species; B = brackish water species.

Ten species of freshwater and brackish water molluscs were recovered from the Kissonerga samples (Table 24.5): these attest not only to the presence of a permanent water source during the periods of occupation, but also to the presence of aquatic and waterside vegetation at the site. The freshwater prosobranch *Melanopsis praemorsa* (2803) is particularly frequent, comprising 79.68% of the freshwater and brackish water assemblage and ranking with the land snail *Monacha syriaca* (2873) as the third most frequent mollusc from the Kissonerga samples. The presence of this species and its relatively large size (up to approx. 20 mm) are difficult to explain as the result of casual introduction with, for example, drinking water. The similar but delicately sculptured *Melanoides tuberculata*, which shares the same habitat, is the third most frequent (5.43%) mollusc in this category. The second most frequent species, the tiny brackish water snail *Truncatella subcylindrica* at 10.69%, was probably introduced into the site on vegetation. The remaining species occur in relatively low numbers and may be considered adventitious. All the *Bithynia* cf. *leachii* are tiny juveniles and only juveniles of *Oxyloma pfeifferi* and *Lymnaea truncatula* are represented, suggesting that these shells were accidentally introduced along with some other commodity, perhaps aquatic vegetation. *Ovatella myosotis* and *Hydrobia ventrosa* are estuarine species and often share the same habitat as *T. subcylindrica*: they may have been introduced along with it.

§ 24.4 Contextual analysis

The context in which shells occur could be relevant to the interpretation of their significance within the site. For example, shells found predominantly in graves could have been offerings, shells found in fill deposits could represent discarded rubbish, and shells found in pits could be offerings or rubbish, depending on the nature of the pit fill.

Shells were not evenly distributed within all the classes of context at Kissonerga: some classes yielded no shell samples at all, whereas others provided many samples. The distribution of molluscan samples according to context type at Kissonerga is shown in Table 24.6. No shell samples were obtained from gullies (context class 15), rooms (class 19), skirting (class 20) or cadastral plots (class 21).

Table 24.6. Distribution of molluscan samples by context

Context type	*Class nos.*	*No. of samples*
Extramural (habitation levels ± refuse)	1	300
Surfaces and floors (paved and unpaved)	2-3	45
Intramural (includes hearths, etc)	4-7, 11-12, 24-26	41
Pits	10	169
Graves	8	79
Fill	17	261
Other (postholes, etc.)	9, 13-14, 18, 23	42
Disturbed and unknown	0, 16, 22, unnumbered	62
Total		999

The marine species occurring at frequencies greater than 1.0% (see Table 24.1) were analysed according to context by plotting the number of samples in which each species or species group occurred according to context class (Table 24.7). Because of the overall pre-

Table 24.7. Occurrence of marine Mollusca by context[1]

	Number (%) of samples with spp. by context							
Species	*Extramural*	*Surfaces*	*Intramural*	*Pits*	*Graves*	*Fill*	*Other*	*Disturbed*
Astraea rugosa	7 (20.00)	3 (8.57)	3 (8.57)	5 (14.29)	5 (14.29)	8 (22.86)	2 (5.71)	2 (5.71)
Cerithium vulgatum	7 (20.00)	2 (5.71)	0 (0)	6 (17.14)	3 (8.57)	15 (42.86)	1 (2.86)	1 (2.86)
Charonia spp.	43 (43.43)	2 (2.02)	4 (4.04)	13 (13.13)	1 (1.01)	24 (24.24)	2 (2.02)	10 (10.10)
Columbella rustica	22 (17.32)	6 (4.72)	6 (4.72)	27 (21.26)	20 (15.75)	37 (29.13)	6 (4.72)	3 (2.36)
Conus mediterraneus	19 (35.85)	3 (5.66)	1 (1.89)	10 (18.87)	7 (13.21)	11 (20.75)	1 (1.89)	1 (1.89)
Cypraeidae	11 (45.83)	0 (0)	0 (0)	6 (25.00)	1 (4.17)	3 (12.50)	1 (4.17)	2 (8.33)
Gibbula spp.	8 (27.59)	0 (0)	0 (0)	3 (10.34)	6 (20.69)	12 (41.38)	0 (0)	0 (0)
Monodonta spp.	73 (27.04)	14 (5.19)	12 (4.44)	54 (20.00)	35 (12.96)	58 (21.48)	8 (2.96)	16 (5.93)
Murex brandaris	15 (25.86)	3 (5.17)	1 (1.72)	11 (18.97)	6 (10.34)	21 (36.21)	1 (1.72)	0 (0)
Patella spp.	64 (23.36)	18 (6.57)	12 (4.38)	67 (24.45)	38 (13.87)	54 (19.71)	12 (4.38)	9 (3.28)
Phalium spp.	17 (41.46)	0 (0)	1 (2.44)	3 (7.32)	3 (7.32)	10 (24.39)	2 (4.88)	5 (12.20)
Thais haemastoma	10 (45.45)	0 (0)	0 (0)	1 (4.55)	3 (13.64)	6 (27.27)	0 (0)	2 (9.09)
Truncularioopsis trunc.	15 (30.61)	2 (4.08)	2 (4.08)	7 (14.29)	1 (2.04)	16 (32.65)	2 (4.08)	4 (8.16)
Glycymeris spp.	29 (37.66)	3 (3.90)	2 (2.60)	8 (10.39)	2 (2.60)	23 (29.87)	3 (3.90)	7 (9.09)
Dentalium spp.	10 (27.03)	0 (0)	1 (2.70)	3 (8.11)	0 (0)	20 (54.05)	0 (0)	3 (8.11)

Note:
[1] Species occurring at a frequency of >1.0% of the total marine molluscan assemblage.

Table 24.8. Occurrence of the most frequent land and freshwater Mollusca by context

A.	*Number (%) of samples with species*					
Species	*Extramural*	*Surfaces*	*Pits*	*Graves*	*Fill*	*Other*
Small Helicidae[1]	123 (25.57)	10 (2.08)	63 (13.10)	89 (18.50)	139 (28.90)	57 (11.85)
Ferussaciidae[2]	50 (19.69)	7 (2.76)	44 (17.32)	49 (19.29)	77 (30.31)	27 (10.63)
Melanopsis praemorsa[3]	24 (24.00)	2 (2.00)	7 (7.00)	23 (23.00)	37 (37.00)	7 (7.00)

B.	*Range (mm), mean (mm) and (number) of shells in sieved samples by context*[4]				
Species	*Extramural*	*Surfaces*	*Pits*	*Graves*	*Fill*
Small Helicidae[1]	1-7	0-28	3-440	0-422	1-62
	4.00	12.63	92.10	59.00	11.20
	(n=4)	(n=8)	(n=20)	(n=20)	(n=20)
Ferussaciidae[2]	0-9	0-21	0-464	0-390	0-89
	3.75	7.00	69.75	42.75	12.15
	(n=4)	(n=8)	(n=20)	(n=20)	(n=20)
Melanopsis praemorsa[3]	0-7	0-19	0-28	0-92	0-17
	4.50	8.13	11.8	10.75	5.15
	(n=4)	(n=8)	(n=20)	(n=20)	(n=20)

Notes:
[1] *Candidula* cf. *cyparissias* and ?*Xerophila cretica*.
[2] *Cecilioides* cf. *petitianus*, ?*Caecilianella aegyptiaca* and *Calaxis unidentata*.
[3] Based on 100 samples.
[4] Vertical columns refer to the same random group of samples.

dominance of samples from extramural, fill and pit contexts, the results of this analysis show the same relative peaks and troughs for all the species considered. However, a pattern does emerge. Species, which from frequency and shell condition are considered to have been used as food (*Monodonta, Murex, Patella*), appear relatively less frequently in extramural contexts and more frequently in pit and grave contexts than species which appear to have been used as ornaments (e.g. *Phalium, Thais, Truncularioopsis*). This can only be a generalisation: *Astraea rugosa*, for example, the operculum of which has been used as a gem stone throughout antiquity and to the present day, shows a distribution pattern similar to that of the food species. However, the contextual distribution of crab claws closely follows that of edible molluscs: extramural - 27.08%; surfaces - 5.21%; intramural - 0%; pits - 27.08%; graves - 8.33%; fill - 29.17%; other - 1.04%; and disturbed - 2.08%.

Because each species tends to occur singly or in very low numbers in any one sample, Table 24.7 probably gives a fairly accurate indication of their overall frequency according to context. Because the shells of any one species do not occur together in quantity, there were no specific caches or deposits of shells and the contextual analysis suggests that the marine molluscs at Kissonerga form part of the general background detritus distributed throughout the site. The higher frequency of food species in pits and graves could reflect their use as offerings: the only large assemblage of topshells (99 shells) came from pit 1015. Other pits could have been used for rubbish. However, both limpets and topshells occur in a wide range of contexts and almost always with other non-food species. They form part of the general site rubbish and as such some may have entered pits and graves. It is possible that most of the edible shell refuse went into separate middens away from the site.

An analysis of the most frequently occurring land and freshwater snails according to context shows a similar pattern (Table 24.8A). Most samples containing these species are from general extramural deposits, pits and graves, and fill. Unlike the marine shells (with the exception of *Gibbula* spp. and *Thais haemastoma*, although too few examples of these species were found to substantiate any conclusion), more samples come from graves than from pits. However, whereas the marine shells tend to occur singly or in low numbers, in some of the samples the small land snails occur in quantity (Table 24.8B). In a random sample of 20 samples each from pits and graves, there is great variation in the number of shells present per sample, but overall the mean for small Helicidae occurring in pits is 92.10 and in graves it is 59.0. Corresponding figures for Ferussaciidae and the freshwater snail *Melanopsis praemorsa* are 69.75 and 42.75, and 11.8 and 10.75 respectively. The data presented in Tables 24.8A and B therefore show that small land snails are overwhelmingly predominant in pits, followed by graves with approximately two-thirds the number of individuals. This extreme pattern was not shown by *Melanopsis*, despite an increased incidence of this species in pits and graves. The presence of tiny juveniles shows that land snail colonies were living and thriving in these contexts, whereas the freshwater shells must have entered them by other means.

The wide variation in numbers of small land snails in pits and graves could reflect the quantity of sieved deposit; it could also reflect how effectively or how quickly the pits and graves were sealed after construction. Some graves were covered with capstones and left as voids, such as Gr. 563 (Peltenburg 1992). This Type 2 grave yielded 429 small Helicidae and 285 Ferussaciidae, which attest to its 'open' state. T. 550 yielded even more (468 small Helicidae and 561 Ferussaciidae) although other tombs (T. 515 and 561) apparently contained very few. Overall, Type 2 graves appeared to support the largest populations of these small land snails.

The species of molluscs occurring together within a single sample can sometimes provide information about the nature of a particular assemblage as, for example, when food species occur together they could represent midden debris. Because of the low frequency of occurrence of marine shells very few special assemblages were apparent among the Kissonerga samples. Examples include the shells from Sample M684, which includes an unusually large number of the food species *Monodonta* spp. (13) and *Murex brandaris* (7) together in a fill deposit and which may represent the remains of a meal, and Sample M738 from a stone setting which contained one example each of four species of bivalves, three of which had been deliberately holed by grinding and the fourth was a species of which holed examples had been found elsewhere on the site: this assemblage appears to represent a small collection of ornamental shells used as pendants or beads. No particular association between the food species *Monodonta* spp. and *Patella* spp. could be demonstrated.

§ 24.5 Chronological analysis

Any possible changes in the utilisation of molluscs over time were investigated by determining the frequency pattern of species according to period of occupation. Tables 24.9 and 24.10 show the numbers and percentage occurrence of those marine and freshwater/brackish water species, respectively, with an overall frequency of more than 1.0% according to site period, including only those shells for which a definite time period has been determined.

No shells were recorded from the Neolithic periods (Periods 1A and 1B) and relatively few from the EChal (Period 2). For the marine species in general, their presence on the site increased during the MChal (Periods 3A and 3B) to reach a peak during the LChal (Period 4), after which numbers declined rapidly. The food species, limpets (*Patella* spp.) and topshells (*Monodonta* spp.), show a similar pattern of frequency according to time period, occurring at 8.70% and 6.83% respectively in Period 2, increasing to 17.39% and 17.49% respectively in Period 3A and 29.67% and 35.25% respectively in Period 3B, to peak at 41.18% and 36.34% respectively in Period 4. This pattern is followed by the third food mollusc, *Murex brandaris*, although this species was relatively more frequent during Period 2, suggesting that its exploitation may have begun earlier and that it was perhaps largely replaced by the more easily collected, but probably less palatable, limpets and topshells.

The frequency of the ornamental species peaked more strongly during Period 4, for example reaching 45.0% and 58.54% respectively for *Thais haemastoma* and *Truncularіopsis trunculus* and a marked 91.18% for *Phalium* spp. There is no obvious distinction in frequency pattern according to time period between these ornamental species and those shells to which ritual or special significance has been attached (*LAP* II.2, 75-84): for example, *Charonia* spp. peaked in Period 4 at 64.94%, *Columbella rustica* at 73.84% and *Dentalium* spp. at 81.58%.

Table 24.9. Frequency of the more common marine Mollusca by period [1]

	Number (%) of shells by Period[2]				
Species	*2*	*3A*	*3B*	*4*	*5*
Astraea rugosa	0	3 (10.00)	11 (36.67)	16 (53.33)	0
Cerithium vulgatum	1 (3.13)	7 (21.88)	8 (25.00)	14 (43.75)	2 (6.25)
Charonia spp.	1 (1.30)	12 (15.58)	12 (15.58)	50 (64.94)	2 (2.60)
Columbella rustica	7 (4.07)	11 (6.40)	24 (13.95)	127 (73.84)	3 (1.74)
Conus mediterraneus	1 (1.82)	5 (9.09)	5 (9.09)	42 (76.36)	2 (3.64)
Cypraeidae	0	7 (31.82)	1 (4.55)	11 (50.00)	3 (13.64)
Gibbula spp.	2 (5.13)	4 (10.26)	6 (15.38)	27 (69.23)	0
Monodonta spp.	25 (6.83)	64 (17.49)	129 (35.25)	133 (36.34)	15 (4.10)
Murex brandaris	18 (30.00)	8 (13.33)	16 (26.67)	17 (28.33)	1 (1.67)
Patella spp.	34 (8.70)	68 (17.39)	116 (29.67)	161 (41.18)	12 (3.07)
Phalium spp.	0	2 (5.88)	1 (2.94)	31 (91.18)	0
Thais haemastoma	3 (15.00)	2 (10.00)	3 (15.00)	9 (45.00)	3 (15.00)
Trunculariopsis tr.	0	4 (9.76)	10 (24.39)	24 (58.54)	3 (7.32)
Glycymeris spp.	1 (1.25)	7 (8.75)	12 (15.00)	55 (68.75)	5 (6.25)
Dentalium spp.	1 (2.63)	1 (2.63)	3 (7.89)	31 (81.58)	2 (5.26)

Notes:
[1] Species occurring at a frequency of >1.0% of the total marine molluscan assemblage.
[2] No shells were represented from Neolithic Periods 1A and 1B.

Table 24.10. Frequency of the more common freshwater and brackish water Mollusca by period [1]

	Number (%) of shells by Period[2]				
Species	*2*	*3A*	*3B*	*4*	*5*
Freshwater:					
Melanopsis praemorsa[3]	2 (0.45)	3 (0.68)	124 (27.99)	313 (70.65)	1 (0.23)
Melanoides tuberculata	3 (2.16)	57 (41.00)	56 (40.29)	23 (16.55)	0
Bithynia cf. *leachii*	0	19 (33.93)	30 (53.57)	5 (8.93)	2 (3.57)
Brackish water:					
Truncatella subcyl.	0	31 (8.45)	74 (20.16)	262(71.39)	0
Ovatella myosotis	0	11 (35.48)	19 (61.29)	1 (3.23)	0

Notes:
[1] Species occurring at a frequency of >1.0% of the total marine molluscan assemblage.
[2] No shells were represented from Neolithic Periods 1A and 1B.
[3] From 150 samples.

Among the freshwater and brackish water species, which were introduced into the site neither as food nor as ornaments, the frequency of *Melanopsis praemorsa* and *Truncatella subcylindrica* increases markedly during Period 4, suggesting that whatever agency or activity brought them to the site also increased during this period. In contrast, the frequency of *Melanoides tuberculata*, *Bithynia* cf. *leachii* and *Ovatella myosotis* reached a peak during Periods 3A and 3B, unlike any of the marine species. The agencies and/or activities bringing these species to the site would therefore appear to be different from those affecting *Melanopsis* and *Truncatella*.

The chronological analysis therefore suggests a steady increase in the exploitation of topshells and, especially, limpets from Periods 2 to 4 and a rapid decline thereafter. It is possible that as the population at Kissonerga increased, these more readily available species supplemented and largely replaced *Murex brandaris*, which reached its peak frequency in Period 2, as a marine food resource. The use of ornamental species and shells with special or 'ritual' significance, such as dentalia, also increased more sharply during Period 4, Unlike the marine species, some of the freshwater and brackish water species reached peak frequency during Period 3, suggesting a change in the relative importance of the agencies or activities responsible for their introduction after this period.

The land snails were not analysed according to period, since their occurrence at Kissonerga is not directly attributable to human agency.

§ 24.6 Utilisation of molluscs

The marine, freshwater and brackish water species at Kissonerga were introduced into the site through conscious or unconscious human activity. Their presence can be attributed to one or more of the following categories: as food, as tools or utensils, as ornaments and 'ritual objects', as casual but deliberate introductions (e.g. as toys or curios), or as accidental introductions.

§ 24.6.1 Food species

The frequency and shell condition of *Monodonta* spp., *Patella* spp. and *Murex brandaris* single these species out as a food resource, together with the remains of Crustacea including several species of crabs, a lobster and at least one species of prawn. Ormers (*Haliotis* spp.) and tun shells (*Tonna galea*) were also collected 'fresh' and may have been eaten, but very few individuals are represented (four and nine, respectively). Fragments of the internal shell of the cuttlefish *Sepia officinalis* may represent food: although only one example was recovered, these shells are fragile and do not preserve well. The only species of bivalves represented by 'fresh' shells occur in extremely low numbers: the scallop *Pecten jacobaeus* (1), the fan mussel *Pinna nobilis* (5), the oyster *Ostraea edulis* (2) and the spiny cockles *Acanthocardia* spp. (9) may represent food species. The shells of other species of marine molluscs which are known to have been eaten at other periods and places within the eastern Mediterranean occur only in a beachworn condition showing that the live animals were not collected, for example the bivalve *Callista chione*. It is possible that the large land snail *Helix* cf. *cincta* was eaten.

§ 24.6.2 Shells as tools and utensils

Very few of the shells from Kissonerga show signs of having had a purely practical function. Two *Charonia variegata* (= *C. sequenzae*) (KM 5068 and KM 5069) may have been used as trumpets and this species was highly prized as a ritual object (*LAP* II.2, 75-84). The edge of part of a spire of *C. variegata* (KM 5070) and part of a body whorl of the same species (KM 5071) show evidence of cutting and grinding and these shells may have been used as spoons or scoops. A fragment of a large valve of *Glycymeris glycymeris* (KM 5082) shows an unusual wear pattern, in that the edge appears to have been artificially chipped or flaked, either through use or to form a sharp cutting edge: this may also have been used as a scoop or tool. The use of the single *Mactra corallina* valve as a cosmetic container has been described elsewhere (*Preliminary* 14).

§ 24.6.3 Shells as ornaments and 'ritual' objects

Shells may be collected and utilised as personal ornaments and/or venerated as ritual or symbolic objects: these two functions may overlap or be one and the same. A spire of a juvenile *Charonia variegata* (KM 5072), in excellent condition but missing the body whorl, has a neat round 5.0 mm diameter hole in the otherwise intact penultimate whorl: a cord threaded through the hole and passed out through the siphonal canal would suspend this shell vertically, spire downwards, as a pendant. Despite the ritual associations of *Charonia* at Kissonerga, the random distribution of fragments suggests that broken shells were discarded to form part of the general site detritus.

Of particular interest were two virtually intact specimens of *Charonia variegata* found against the wall in the Pithos House (B 3) where they would have been hidden behind the stacked vessels. One of these is a juvenile, 162 mm high, originally in excellent condition, which has been burned and crushed *in situ*. The tip of the apex is missing but the shell is imperforate. The other specimen is larger and was probably about 200 mm high when complete. The first three apical whorls have been broken off but the hole is jagged and irregular and this does not appear to have been a trumpet shell. It is in good condition, despite some sponge-pitting. Neither shell shows any evidence of working, neither do they appear to have been used as containers. Because of their susceptibility to attack by the boring sponge *Cliona celata*, good specimens of *Charonia* had rarity value. That two such specimens should be found together in the storage context of B 3 is unusual. Two possible explanations are offered: that the shells were used as measures or ladles to impart a special or 'sacred' quality to goods being distributed; or that they had been hidden in this building for some unknown reason. Two other specimens, one burned and crushed and the other consisting of two burned fragments only, were associated with specific storage vessels in this building.

Many shells were collected in a beachworn condition but relatively few show signs of utilisation as personal ornaments. Nine (17.31%) specimens of the murex *Truncalariopsis trunculus* have irregular holes punched in the back of the body whorl. These holes could have been the result of natural damage but they occur in the same place on all the shells and in one case (KM 5080) the edges of the hole are smooth and shiny, suggesting that a cord may have been threaded through it and the shell used as a pendant. Nine other shells of this species are represented by beachworn 'apertural rings' only, which could have been strung or suspended in some way. Suárez Díez (1989) illustrates similar apertural rings of Mexican species and describes these as 'pendants'. Four beachrolled columellar fragments could also be attributed to *Truncalariopsis*, and it is possible that some of the unidentified gastropods also belong in this category: they may have been collected for their spiral shape, which may or may not have had special significance. In contrast, the rather similar rock shell *Thais haemastoma* does not appear to have been used as an ornament: none are holed, there is only one 'apertural ring' and relatively more of the shells were collected in a good or 'fresh' condition (see Table 24.1). The significance of this species at Kissonerga is unclear: with *Murex brandaris* and *Truncalariopsis brunculus*, it is a source of the famous Tyrian purple dye but there is no evidence that shells were exploited for this substance as early as the Chalcolithic, neither do the shells show the characteristic damage caused to extract the gland containing the dye (Reese 1987).

Arcularia gibbosula were holed for stringing as beads at other Cypriot sites (Reese, 1985, Ridout in Peltenburg 1982, 93-5, 437-52): two worn and fragmentary examples were recovered from Kissonerga but it was not possible to ascertain whether they had been used as beads.

The star shell *Astraea rugosa* has a thick decorative operculum, in shape and size rather like a cabochon-cut gemstone, which has been used as an ornament by many cultures. Of the 35 examples of this species at Kissonerga, 22 (62.86%) are opercula which range in size from 3.3-16.0 mm (mean 9.42 mm). The remaining examples are worn or very worn shell fragments of uncertain significance but include three spiral columellae.

Helmet or bonnet shells (*Phalium* spp.) are well represented at Kissonerga, being the seventh most frequent marine gastropod with 41 examples. Most are the Mediterranean subspecies *Phalium granulatum undulatum* but at least two are the smaller *P. saburon*. Eleven examples are represented just by the strongly ridged outer lip, some fresh and some beachworn, and of these six show clear signs of having been deliberately cut or otherwise removed from the parent shell. Reese (1989) presents a catalogue of *Phalium* lips from Near Eastern and Mediterranean archaeological sites, where they occur from the Neolithic through to the Iron Age. Several examples have been previously recorded from Cyprus, including two from EBA Sotira-Kamminoudhia. The Kissonerga lips are attributed to the MChal to LChal. Reese (1989) interprets these as personal ornaments or offerings in graves or sanctuaries but all the Kissonerga examples came from general or fill deposits. None of them are pierced and Reese (1989) suggests that they were tied to strings and used as ornaments.

One beachworn shell of *Phalium granulatum* (KM 5078) has the outer lip cleanly removed flush with the surface of the body whorl. The outer margin of the callus or columellar shield and the siphonal canal opening of this specimen had been worn or ground down flat. Two of the shells appear to have been deliberately holed for use as pendants. One is a complete, slightly worn shell of *P. saburon* (KM 5076), 56.0 mm high, which has a rough hole in the back of the body whorl; the flared part of the outer lip appears to have been removed or cut off flush with the surface of the body whorl. The other is a worn specimen of *P. saburon* (KM 5077), 53.0 mm high, with a hole in the body whorl which shows possible signs of wear through suspension: the lip of this specimen was left intact. One intact shell of *P. granulatum* was recovered in excellent 'fresh' condition, but most of the remaining examples are worn and fragmentary.

Cowry shells have a world-wide association with sexual symbolism (Reese 1978), the inrolled curved lips and the slit-like aperture having a fanciful resemblance to the female genitalia. Three species (*Cypraea lacrimalis*, *C. spurca* and *Luria lurida*) and 27 examples were recovered at Kissonerga, with a high proportion of the shells (40.91%) in good or 'fresh' condition. Most are fragmentary but none appear to have been worked or show signs of wear. One is represented by a beachrolled lip which may have been used in the same way as a *Phalium* lip. A relatively high proportion of cowries came from graves (Table 24.7), where they may have been offerings.

Cowries introduce a whole range of gastropods which seem to have been collected at Kissonerga because of their slit-like apertures and possible sexual connotations: these include the cone shell *Conus mediterraneus*, the dove shell *Columbella rustica* and several similar species. At 61 shells, *Conus mediterraneus* is the fifth most frequent marine gastropod: most of the shells had been collected as beachworn specimens and intact examples range in size from a tiny 3.4 mm to 51.1 mm, which is about the maximum for this species, with a mean of 14.97 mm showing that most are juveniles. None show signs of working or artificial wear, although four are represented by beachworn 'conus top beads' which are round apical fragments with a naturally worn hole in the centre which would have permitted them to have been strung (Reese 1978).

Columbella rustica is the third most frequent marine gastropod at 195 shells, and the most frequent non-food species. The distinctive long, slightly curved and inrolled outer lip resembles those of cowries. This is a small species, intact specimens ranging in size from 3.7-16.8 mm (mean 12.32 mm); most are represented by lip fragments only. Nearly all (91.79%) are beachworn specimens. Eight had been holed, perhaps naturally, and these include one unusually coloured shell, white with a purple tip instead of the usual mottled red, which must have had rarity value. Two of the holed shells show evidence of artificial wear: one beachworn shell (KM 5079), 12.9 mm high, has a small hole in the body whorl and the base of the outer lip and siphonal canal are worn, suggesting that a suspension cord may have been threaded through the hole and shell aperture; another fine specimen (KM 5081) has a hole of 4.5 x 3.0 mm at the back of the body whorl which shows wear and abrading with a slight bevelling of the edge closest to the spire. Reese (1978) quotes Biggs (1963) as stating that this species is possibly worn today by Greek women as a necklace and love charm. *Columbella* occurred in groups of 1-14 and the largest group came from a grave: this may imply a ritual significance for this small shell, although its wide contextual distribution suggests that it may have been more a personal amulet than a special offering. The less frequent *Pisania maculosa*, *Mitrella scripta*, *Muricopsis cristata* and *Mitra* cf. *cornicula* may have performed a similar function: the size and fusiform shape of these shells resembles that of *Columbella rustica* although, with the exception of *Mitra*, the apertures of these species are not particularly slit-like.

Whereas these species may represent the female sex, it has been suggested (Peltenburg 1992) that the elongated and slightly curved tusk shells or dentalia (*Dentalium* spp.) may represent the male sex. Dentalia shells occurred predominantly in graves and are described in § 4.4, 8.3 and 16.1; 45 examples were recovered from the molluscan samples, mainly (54.05%) from fill deposits. The shells vary in length from 4.2-38.9 mm (mean 15.20 mm). The hole running through 11 (24.44%) of these is too fine (< 1.0 mm diam.) to have permitted the shell to have been strung as a bead and these are considered to be the cut-off end fragments of larger shells and to represent the debitage or debris from bead-making. The ends of at least two dentalia shells show signs of cutting.

It is just possible that long-spired gastropods of no obvious function at Kissonerga may also have represented the male sex, in particular the tower shells *Turritella* spp. and the ceriths *Cerithium* spp. *Cerithium vulgatum* is the eighth most frequent marine gastropod with 37 individuals and represents 1.73% of the total marine assemblage. This is an edible species but the shells from Kissonerga are almost all (92.30%) beach-worn specimens: one had been predated on by another gastropod, *Natica* sp., and another shows an internal worm tube. Intact shells range from a tiny 5.2 mm to a magnificent 50.9 mm, with a mean of 17.41 mm. Apart from the *Natica*-bored specimen, none are holed.

Most of the bivalves are represented by beachworn specimens and a number of these had been deliberately ground at the umbo to form a hole for suspension. The ground surface is always flat and marked by fine parallel striations, as if the shell had been rubbed backwards and forwards against a stone. Shells holed in this way include ten *Glycymeris* spp., two *Callista chione*, two *Arca barbata*, three *Loripes lacteus*, one *Venus striatula* and one *Acanthocardia tuberculata*. Although the smooth round shells of *Glycymeris* spp. appear to have been preferred, any suitable bivalve shell seems to have been used in this way. However, in one *Glycymeris* the ground umbo is not perforated and in another the hole appears too small (< 1.0 mm diam.) to have permitted threading, as if these two shells were discarded before the grinding was completed. The ground shells tend to be rather small (range 14.3-35.2 mm, mean 21.96 mm) and the ground holes themselves are small at about 1.5 mm in diameter. In addition to the ten *Glycymeris* with ground umbones, one shell (KM 5084) has an irregular hole in the umbo which appears to have been deliberately knocked out, perhaps with a sharp stone (the edges are fresh and rough), two had been neatly holed near the umbo by the gastropod predator *Natica* sp. and three appear to have been naturally or accidentally holed, giving a total of 16 (17.78%) perforated/ground shells. Some of these show evidence of use: a slightly worn valve of *G. violascens* (KM 5089), 30.8 mm high, has a ground and holed umbo and a slightly asymmetrical hinge plate which could have resulted from wear caused by suspension from a cord, and a ground and holed juvenile valve of *G. glycymeris* (KM 5090), 17.8 mm high, has a similar wear pattern. One of the naturally holed *G. glycymeris* is unusually large at 90.0 mm high, exceeding Campbell's (1982) maximum for this species by 10.0 mm, but this specimen shows no signs of artificial wear from suspension. *Glycymeris* shells of all sizes, from a tiny 5.0 mm to the giant 90.0 mm (mean 23.87 mm), were collected and some of these are considerably beach-worn, damaged by the parasitic sponge *Cliona celata*, or disfigured by worm tubes. It therefore seems probable that *Glycymeris* shells had a special 'ritual' or symbolic significance and were prized regardless of condition. Although most of the shells (61.11%, 55/90) were found in general deposits and fill, the maximum number occurring together was five, all unground juveniles, from a grave fill and these may represent an offering.

The hinge plates of a juvenile holed *Callista chione*, a juvenile holed *Venus striatula* and, especially, a relatively large (46.2 mm) holed valve of *Arca barbata* also show uneven wear on the hinge plate resulting from suspension. The asymmetrical valves of *Arca*, which have the umbo in the anterior half, would seem to be unlikely candidates for pendants as they hang unevenly and this is reflected in the extent of wear on the hinge plate.

§ 24.6.4 Casual introductions

Some of the shells appear to have been collected for no other reason than as aesthetic objects and curios. These all occur in low numbers, show no signs of artificial wear and no special contextual significance. An almost perfect *Cymatium parthenopeum*, 76.2 mm high, probably falls into this category (although one of the three shells of this species has a natural hole in the body whorl), as do the occasional and relatively large shells of *Euthria cornea, Fasciolaria tarentina, Galeodea* spp. and *Natica hebraea*. The four examples of the giant worm shell *Vermetus gigas* are natural curios. Among the bivalves, three specimens of the thorny oyster *Gaederopus gaederopus* include a very large and very worn shell 98.0 mm long, which approached the maximum for this species at 100.0 mm. Thorny oysters are prized by many cultures for their colour, appearance and rarity value (Suárez Díez 1989).

§ 24.6.5 Accidental introductions

A number of species do not fit readily into any of the above categories. These tend to be small to medium sized species that show no signs of utilisation. It is perhaps no coincidence that these are all common intertidal or shallow water species and it seems probable that they were introduced into the site at Kissonerga along with some other product from the beach: sand or gravel, perhaps, but most probably the seaweed that may have been used in house construction. Most of these species occur singly or in low numbers (see Table 24.1): the topshells *Calliostoma conulus* and *Clanculus corallinus*, the slit limpet *Diodora gibberula*, the nerite *Nerita* sp., *Rissoa* cf. *ventricosa*, the pheasant shell *Tricolia pullus*, *Ocenebra* cf. *aciculata*, the small periwinkle *Littorina neritoides* and the netted dog whelk *Nassarius incrassatus* are all common shore-living gastropods. Only the small topshells *Gibbula* spp. occur in significant numbers (35 shells, representing 1.64% of the marine molluscan assemblage). It may be significant that a relatively large proportion (33.33%) of these seaweed-living species are 'fresh' and a similar proportion (28.57%) are small juveniles, suggesting the presence of living colonies of these species among seaweed collected, perhaps, for house construction at Kissonerga.

Several species of off-shore bivalves which occur in low numbers could represent beach specimens collected among seaweed: *Anomia ephippium*, *Cardita* spp., *Spisula* sp., *Venerupis decussata* and *Ostrea edulis*.

All the freshwater and brackish water molluscs occurring at Kissonerga (Table 24.5) are thought to represent accidental introductions, perhaps with aquatic and estuarine vegetation or with drinking water.

§ 24.7 Environmental considerations

All the marine molluscs represented at Kissonerga are Mediterranean species and could have been obtained locally. Their habitats range from rocky shores to offshore sandy and muddy substrates down to quite deep water. Despite the international contacts established by Kissonerga during the LChal (Period 4), there are no imported or exotic shells.

The freshwater and brackish water species attest to the presence of a nearby permanent water course, the Skotinis stream. The gill-breathing prosobranch gastropods, *Melanopsis praemorsa*, *Melanoides tuberculata* and *Bithynia* cf. *leachii*, and the bivalve *Pisidium* sp. require well-oxygenated water; in addition, *Melanopsis* and *Bithynia* are hard-water species that prefer rivers and streams that have flowed through chalk or limestone. The pulmonate freshwater limpet *Ancylastrum fluviatile* also requires flowing water and together these freshwater species are indicative of permanent running water rather than seasonal streams and stagnant pools. In contrast, the pulmonates *Lymnaea truncatula* and *Oxyloma pfeifferi* are amphibious in habit, living among vegetation in damp marshy locations. The Skotinis stream must therefore have supported marshy riverside vegetation and these species may have been introduced into the site among rushes or reeds.

The large numbers of *Melanopsis praemorsa* recovered from Kissonerga and from most contexts (Table 24.8) are a puzzling feature. The shells range in size from tiny juveniles of 3.2 mm to adults up to 19.2 mm, showing the presence of thriving populations in the stream. Although some of the shells are holed, this appears to be the result of natural damage and there is no evidence to suggest that they were used as beads at Kissonerga. Their strong presence in extramural (24.0%) and fill (37.0%) deposits suggests that they form part of the general background detritus at the site, although their high frequency in graves (23.0%) suggests a possible introduction with libations of water. Some of the graves at Lemba had circular openings, presumably for this function. They could have been introduced with flood water: Peltenburg (1992) refers to 'settling by water action' in Gr. 563. In the absence of flooding, introduction along with drinking water would seem the most likely explanation for the presence of this species, although it might be thought that at least the larger shells, which reach nearly 20.0 mm in size, would have been removed at source.

The rather similar *Melanoides tuberculata* shows a different distribution pattern according to context: proportions in extramural deposits and surfaces are similar to those of *Melanopsis* (26.04% and 24.0%, and 4.14% and 2.0%, respectively). However, there is a discrepancy with regard to pits, graves and fill deposits: 36.69% of *Melanoides* occurred in pits, compared to 7.0% of *Melanopsis*; 12.43% of *Melanoides* occurred in graves compared to 23.0% of *Melanopsis*; and only 13.61% occurred in fill compared to 37.0% of *Melanopsis*. This suggests that *Melanoides* was introduced into the site in a different way from *Melanopsis*, perhaps among vegetation rather than with drinking water. The peak occurrence (81.29%) of *Melanoides* during Periods 3A-3B, compared to a peak for *Melanopsis* (70.65%) during Period 4, when grave-orientated rituals (and possibly libations) may have been more frequent, may help to explain the discrepancy. The spatial and temporal distribution of *Bithynia* cf. *leachii*, all of which are juveniles possibly introduced on aquatic vegetation, agree with those of *Melanoides*: 21.82% for extramural deposits, 12.73% for surfaces, 40.0% for pits, 7.27% for graves and 7.27% for fill deposits, with 87.5% occurring during Periods 3A-3B.

The spatial distribution of the brackish water species *Truncatella subcylindrica* and *Ovatella myosotis* also differ. Most *Truncatella* occur in graves (42.39%) with 21.74% in pits and 32.34% in fill. The equivalent figures for *Ovatella* are 5.56% (graves), 52.78% (pits) and 25.0% (fill). Both are small species and were probably introduced among vegetation. Of the two, *Ovatella* is more strongly brackish in requirements whereas *Truncatella* can also occur among weeds on the shore. The discrepancy in distribution according to context may therefore reflect the introduction of two different types of vegetation although it is uncertain what this could be, especially with regard to the graves. Neither species has a general 'background' distribution in different contexts at Kissonerga, which supports the suggestion that they were associated with particular commodities.

The land snails (Table 24.4) are thought to have occurred naturally at Kissonerga and therefore their habitat preferences will reflect the environmental conditions prevailing in or close to the site. Many of the species are indicative of a dry open habitat: *Chrondrula* cf. *tridens*, *Zebrina detrita*, *Rumina decollata* and the smaller Helicidae, namely *Candidula* cf. *cyparissias*, ?*Xerophila cretica*, *Helicella* cf. *obvia* and *Monacha syriaca*. *Cochlicella acuta* is characteristic of open maritime habitats. *Levantina* sp. and *Helix* cf. *cincta* among the larger Helicidae also indicate a dry open habitat, but *Eobania vermiculata* and *Helix aspersa* are synanthropic species, thriving in man-made habitats such as gardens and vineyards.

A brief survey of present-day land snails in the Kissonerga area, made by the author in September 1990, showed the last two species to be common whereas *Helix* cf. *cincta*, so frequent in the archaeological deposits at Kissonerga, was not in evidence. The single example of *H. aspersa* and the 36 *Eobania* from the excavations are primarily from general (50%) and disturbed (25%) deposits and many retain traces of their original colouring, unlike *H.* cf. *cincta*, suggesting that they may be relatively more recent. In some *Eobania*, traces of the delicate periostracum and epiphragm (papery coverings to the shell and, in time of drought, aperture respectively) are still present. It is therefore suggested that these synanthropic species were introduced by man into Cyprus, possibly after the main period of occupation at Kissonerga, and have since replaced *H.* cf. *cincta* as the dominant large helicid snail.

Not all the land snails indicate a dry open environment: the Zonitidae *Vitrea* cf. *cyprina* and ?*Aegopinella* sp. require a moist habitat, and ?*Orcula* sp. also prefers moist shady places. This group of species could have been derived from the fringes of the riverside vegetation (or irrigated farm plots) which is indicated by the presence of the freshwater *Oxyloma pfeifferi* and *Lymnaea truncatula*. *Lymnaea truncatula* is the intermediate host of the liver fluke *Fasciola hepatica* which affects domestic animals, especially sheep, and occasionally man. The presence of this snail at Kissonerga raises the possibility that the parasite may have been present also.

The large numbers of small Helicidae and the subterranean Ferussaciidae occurring in pits and graves (Table 24.8) has been discussed elsewhere (*LAP* II.2, 75-84). Thriving populations of *Candidula* cf. *cyparissias* and ?*Xerophila cretica* and of the three Ferussaciidae species (*Caecilianella aegyptiaca*, ?*Caecilioides* cf. petitianus and *Calaxis unidentata*) were found in both contexts, with large numbers of juveniles showing that reproduction was taking place *in situ*. The Helicidae probably entered these contexts seeking shelter but they are not subterranean in habit and their presence shows that the pits and graves in which they occur must have retained some connection with the surface for at least some time after their construction. *Caracollina lenticula* is another small helicid which was occasionally found in pits and graves; this species prefers sheltered places and is often found among human habitation. The biology of the blind and subterranean Ferussaciidae is little known but they appear to have a predilection for graveyards (Step 1945) and are probably scavengers, feeding on the organic matter present in both pits and graves.

§ 24.8 Summary and conclusions

The Mollusca recovered from the excavations at Kissonerga are characterised by high diversity (103 species) but relatively low numbers of individuals, with the exception of some land and freshwater snails.

The marine species fall into several categories according to utilisation: food species (mainly limpets and topshells) with freshly broken, live-collected shells which are distributed over a wide area and a large number of contexts as 'background rubbish'; shells used as tools or utensils, which are rare at Kissonerga; ornamental species such as *Phalium* spp., *Truncularíopsis trunculus* and *Glycymeris* spp. which had been holed for suspension and which occur in various contexts; species with a special or 'ritual' significance, such as *Charonia* spp. and the 'sex symbols' *Columbella rustica* and others, which occur in relatively large numbers and in all conditions (both 'fresh' and 'worn') and more frequently in pits and graves; various relatively large and usually beachworn specimens which occur in low numbers in all contexts and were probably picked up as curios; and small shore-dwelling species such as *Gibbula* spp. which were probably introduced along with seaweed. Food species do not occur in sufficient quantities to show that marine molluscs played a significant part in the economy: however, the existence of middens away from the site and/or the possibility that raw shellfish were consumed on the beach cannot be excluded.

There is little evidence for any major changes in the utilisation of Mollusca at Kissonerga over much of its long period of occupation, although no shells were associated with the Neolithic Periods 1A and 1B and most of the samples date to the LChal (Period 4). For example, most of the limpets and topshells date to the late MChal and LChal (Periods 3B and 4) but these shells are also represented in earlier periods and the small size of the limpets suggests that the local limpet population may have been exploited for a long time. The 'ritual' *Charonia* spp. and the 'sex symbol' *Columbella rustica* were present from the EChal (Period 2). Perforated bivalves were also present in samples from Periods 2 to 4, showing that the use of these shells as ornaments remained fashionable for a long period of time, whereas almost all (91.18%) of the *Phalium* ornaments came from LChal Period 4.

The large land snail *Helix* cf. *cincta* may have been eaten and if so the large numbers of shells found at Kissonerga show that snails could have formed an important, if minor, component of the economy. The land and freshwater species are useful environmental indicators and suggest a dry open habitat but with a permanent running water supply in the form of the Skotinis stream, with adjacent marsh or reed beds and other riverside vegetation. Freshwater, brackish water and marsh species may indicate the use of aquatic and riverside vegetation at Kissonerga. Finally, large concentrations of small surface-dwelling land snails in pits and graves suggest that these features remained in open contact with the surface for some time after their construction.

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