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## MOLLUSCS AND ECHINODERMS FROM PALAEOLITHIC DEPOSITS IN THE ROCK SHELTER OF KSÂR'AKIL, LEBANON

by

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### INTRODUCTION

The palaeolithic deposits of the rock shelter of Ksâr'Akil in the Antelias valley have been excavated by a group of American Jesuits in the years 1937-1938 and 1947-1948. Recently the fossil bones from these deposits were reported upon by my colleague Hooijer (1961). When he received the material for description it appeared that his samples contained a large collection of molluscan shells and a few spines of echinoderms as well. These are dealt with in the present paper. To the best of my knowledge they are all the remains of molluscs and echinoderms found during the excavation. For further details on the collection and the site I refer to Hooijer's paper, which also contains references to the literature on Ksâr'Akil.

A few shells from the neighbouring site Abri Bergy (cf. Hooijer, 1961, p. 56) are mentioned in my list of Mollusca under nos. 6 and 26.

### MOLLUSCA

Shells of 45 species of Mollusca have been collected in the rock shelter of Ksâr'Akil. They belong to marine, freshwater, and terrestrial molluscs. All the species recorded are still living in the neighbourhood of the locality.

The following is an annotated list of these Mollusca. Unless otherwise stated the data on the bathymetrical distribution of marine species have been borrowed from the list on page 808 seq. of volume 2 of the book by Bucquoy, Dautzenberg, and Dollfus. Information on the distribution of non-marine species was found in Germain's publication of 1921/1922, and in the literature

cited in that paper. Fragments, which are relatively scarce in the material, have been counted for so many specimens as they must at least represent.

## CLASS GASTROPODA

### SUBCLASS PROSOBRANCHIA

1. *Patella caerulea* Linnaeus, 1758; 13 samples containing 29 specimens. This is a littoral marine species. The shells are sometimes damaged, but they are not worn, and therefore the specimens appear to have been collected alive.

2. *Patella lusitanica* Gmelin, 1790; 17 samples containing 61 specimens. Another littoral marine species, the specimens of which also appear to have been collected alive.

*Patella* spec.; 14 samples containing 20 specimens. These specimens cannot be assigned to one of the two species mentioned, either because their shape is not sufficiently typical (in recent specimens the colour is often a great help in separating these two species), or because they are too fragmentary.

3. *Gibbula (Osilinus) turbinata* (Born, 1778); 59 samples containing 339 specimens. This is a littoral marine species. There are many undamaged shells, especially from the levels II-VIII. Other specimens are damaged (in many cases the top is missing), but they nevertheless appear to have been collected alive.

4. *Astraea (Bolma) rugosa* (Linnaeus, 1767); 1 sample of 2 specimens. This marine species lives at depths between 5 and 250 m; Pallary (1938) records it from 25-30 m near Beirut. The specimens are damaged, but they may have been collected alive.

5. *Theodoxus (Neritaea) jordani* (Sowerby, 1836); 3 samples containing 5 specimens. This is a small freshwater species, of which the shell is beautifully coloured when recent. It is an inhabitant of lakes and rivers in Syria and Palestine. I have found no records of this species from the immediate neighbourhood of Ksâr'Akil. The five specimens from this locality show a hole in the last whorl.

6. *Pomatias olivieri* (Charpentier, 1847); 32 samples containing 67 specimens, of which 7 still possess the operculum. This is a terrestrial mollusc occurring at present in the Lebanon from sea-level up to a height of more than 600 m. Most of these specimens are in very good condition. In four of them there is a tiny perforation just in the centre of the operculum. I examined two other specimens of this species from the Abri Bergy.

7. *Melanopsis praemorsa* (Linnaeus, 1758); 3 samples containing 4 specimens. Another freshwater species, occurring throughout the Mediterranean region. It lives in marshes, lakes and rivulets. According to Pallary (1933)

the species of *Melanopsis* need a water temperature of at least 14° C. The specimens appear to have been collected alive.

8. *Cerithium (Vulgocerithium) vulgatum* Bruguière, 1792; 21 samples containing 46 specimens. This is a litoral marine species, which descends to 30 fathoms near Alexandria in Egypt according to Steuer (1939). Most of the specimens appear to have been taken alive, although their shells have been subsequently broken, but some of them are very much worn and must have been picked up on the beach.

9. *Polinices (Neverita) josephinius* (Risso, 1826); 7 samples containing 7 specimens. A litoral marine species, recorded by G. Haas (1951) from 18-90 m off the coast of Palestine, and by Steuer (1939) from 3-22 fathoms near Alexandria in Egypt. The shells are not much worn, but they may have been picked up on the beach. They all show some damage; some of them have a hole in the last whorl.

10. *Phalium (Semicassis) saburon* (Bruguière, 1792); 1 specimen. This marine species occurs at depths from 5 to 160 m. The recorded specimen is a fragment: the outer lip of a shell.

11. *Murex (Truncularia) trunculus* Linnaeus, 1758; 6 samples containing 8 specimens. This marine species lives at depths from 0 to 60 m; Pallary (1938) records it from 25-30 m near Beirut. Some of these specimens appear to have been collected as empty shells on the beach, while others, although more or less damaged, may have been taken alive.

12. *Murex (Murex) brandaris* Linnaeus, 1758; 2 samples containing a fragment and a worn shell. This is a marine species living at depths between 5 and 80 m according to Bucquoy, Dautzenberg, and Dollfus, but G. Haas (1951) records it from 18-135 m off the coast of Palestine.

*Murex* spec.; 2 samples containing 2 ill-preserved specimens.

13. *Columbella rustica* (Linnaeus, 1758); 62 samples containing 416 specimens. This marine species lives at depths from 0 to 20 m according to Bucquoy, Dautzenberg, and Dollfus, but Pallary (1938) records it from 25-30 m near Beirut. Most of these shells show some damage; in 258 specimens there is a hole in the last whorl. The specimens may have been collected alive, or have been picked up on the beach.

14. *Euthria cornea* (Linnaeus, 1758); 3 samples containing 3 damaged specimens. A marine species living at depths from 5 to 60 m.

15. *Pisania maculosa* (Lamarck, 1822); 2 samples containing 2 damaged specimens. A litoral marine species.

16. *Nassarius (Arcularia) gibbosulus* (Linnaeus, 1758); 101 samples containing 700 specimens. A marine species common in the eastern part of the Mediterranean sea. Steuer (1939) records it from a depth of 3 fathoms near

Alexandria in Egypt. Just as is the case with *Columbella rustica* most of these shells are damaged, and in 521 specimens there is a hole in the last whorl. In some cases the shell has been ground off to such an extent that only a ring-shaped piece is left, the central hole being the aperture of the shell. These specimens may have been collected alive or have been picked up on the beach.

17. *Nassarius (Nassarius) mutabilis* (Linnaeus, 1758); 2 samples containing 2 specimens. This marine species lives at depths from 4 to 10 m; Pallary records the var. *minuscule* (Pallary, 1900) from 25-30 m near Beirut. One of these specimens has a hole in the last whorl; the other shows a hole drilled by a naticid (as several specimens of the previously mentioned species do), but for the rest it is undamaged.

18. *Fasciolaria ligniaria* (Linnaeus, 1758); 2 samples containing 2 ill-preserved specimens. A marine species, which Carus (1889-1893) records from a depth of 2 fathoms off Lesina in the Adriatic Sea on the authority of Heller. According to Pallary (1938) specimens from Syria (subsp. *orientalis* Pallary, 1938) are larger and narrower than those from the western Mediterranean. The largest specimen from Ksâr' Akil must have been more than 53 mm long, and about 27 mm wide.

19. *Vexillum (Uromitra) ebenus* (Lamarck, 1811); 2 samples containing 2 specimens. This marine species occurs at depths from 5 to 70 m. Both shells have a hole in the last whorl.

20. *Conus (Puncticulis) mediterraneus* Hwass, 1792; 14 samples containing 16 specimens. A marine species living at depths from 3 to 160 m. Pallary (1938) records it from 25-30 m near Beirut, and G. Haas (1951) from 12.5 to 90 m off the coast of Palestine. The shells appear to have been picked up on the beach. Six of them show a hole at the top, two have a hole in the last whorl.

#### SUBCLASS PULMONATA

21. *Buliminus (Buliminus) labrosus* (Olivier, 1804); 6 samples containing 6 specimens. This is a terrestrial mollusc belonging to the recent fauna of the Lebanon.

22. *Buliminus (Pene) syriacus* (Pfeiffer, 1846); 1 damaged specimen. Another land snail belonging to the recent fauna of the Lebanon.

23. *Buliminus (Pene)* spec.; 1 damaged specimen. This specimen consists of a last whorl only. It is certainly specifically distinct from the previously mentioned species.

24. *Medora (Cristataria) porrecta* (Rossmäessler, 1857); 1 specimen. This is a land mollusc originally described from "Syria". According to Germain

*Clausilia raymondi* Bourguignat, 1863, is a synonym. This species was found in the valley Nahr el Kelb at about 7 km from the mouth of the river. According to Pallary (1933) the species of Clausiliidae occurring in the Lebanon Mountains are each of them restricted to one special valley. The valley of Nahr el Kelb is the first valley to the North of that of Antelias, in which the rock shelter of Ksâr'Akil is situated. The specimen is an entire shell. The identification was checked by Dr. F. E. Loosjes.

25. "*Hyalinia*" *libanica* Naegele & Westerlund, 1890; 13 samples containing 16 specimens. This is a terrestrial snail described after recent specimens from the neighbourhood of Beyrut. Its generic position will be uncertain as long as the anatomy of the species has not been studied. The specimens agree very well with recent shells of this species in the Rijksmuseum van Natuurlijke Historie at Leiden and the British Museum (Natural History) at London. The largest specimen from Ksâr'Akil has a diameter of  $21\frac{1}{2}$  mm.

26. *Sphincterochila cariosa* (Olivier, 1804); 1 specimen. This is a land mollusc belonging to the recent fauna of the Lebanon. I examined another specimen of this species found in the Abri Bergy.

27. *Monacha syriaca* (Ehrenberg, 1831); 23 samples containing 37 specimens. A land snail belonging to the recent fauna of the Lebanon. Germain lumped it with other species in "*Helix (Theba) olivieri*", but it is distinct conchologically as well as anatomically.

28. *Monacha nummus* (Ehrenberg, 1831); 2 samples containing 2 damaged shells. A land snail belonging to the recent fauna of the Lebanon.

29. *Metafruticicola berytensis* (Pfeiffer, 1841); 35 samples containing 68 specimens. A land mollusc occurring in Palestine and the Lebanon. The specimens from Ksâr'Akil are fairly large: 49 of the 68 shells have a largest diameter of 15 mm or more as appears from the following measurements.

Diameter:	15	16	17	18	19	20	21	22 mm
Number of specimens:	4	3	10	9	12	9	1	1

According to Westerlund (1889) the largest diameter varies from 14 to 16 mm. From the figure published by Germain it appears that the type specimen has a diameter of nearly 15 mm, while this author records another specimen of 16 mm, and the Zoological Museum at Amsterdam possesses a specimen of that size from Palestine. Bourguignat (1863), however, mentions larger recent specimens of this species; according to him the largest diameter is 16-20 mm.

30. *Helix pachya* Bourguignat, 1860; 60 samples containing 441 specimens. A terrestrial species belonging to the recent fauna of the Lebanon, where

it occurs from sea-level up to a height of more than 600 m. This species appears to be characterised by its thick shell, the conical shape of its spire, and by the sculpture. Although most specimens from Ksâr'Akil are thick conical shells, both the thickness of the shell and the shape of the spire are subject to variation. In the least conical specimens the breadth is equal to the height. Specimens with a fairly thin shell are connected by transitional forms with typical specimens. The following measurements give an impression of the variation of the shape of the shell in the present material.

Height 55 mm, diameter 45 mm (largest specimen)

Height 51 mm, diameter 37 mm (relatively high specimen)

Height 45 mm, diameter 45 mm (relatively flat specimen)

Most of the shells from Ksâr'Akil are fairly large. The following are the measurements of a sample of 15 specimens chosen at random (from level V, square D5-7).

Height	54	54	48	46	46	46	43	43	43	42	42	41	40	39	38
Diameter	47	46	42	42	40	36	40	39	37	39	37	37	37	37	36

According to the original description by Bourguignat (1860) the height of shells of this species is 30-35 mm, the diameter 28-32 mm; in his var. *elongata* these measurements are 44 and 38 mm respectively. Germain already pointed out that larger recent specimens occur; he gives the following measurements.

	syntypes of Bourguignat		other specimens		var. <i>elongata</i> from Beyrut
Height	31	34	37	56	41
Diameter	28	30½	33	40	36

In the Natural History Museum at London I examined specimens of the following dimensions.

	var. <i>elongata</i> from Hamaur (Lebanon)		typical form from Syria		var. <i>texta</i> Mss. from Lebanon
Height	42	40	41	37½	46
Diameter	34	35	37	35	43

#### CLASS SCAPHOPODA

31. *Dentalium vulgare* (Da Costa, 1778); 7 samples containing 8 specimens. A marine species living at depths from 5 to 80 m. Pallary (1938) records it from 25-30 m near Beyrut, and G. Haas (1951) from 54-55 m off the coast of Palestine.

32. *Dentalium dentalis* Linnaeus, 1758; 8 samples containing 18 specimens. A marine species recorded by Pallary (1938) from a depth of 25-30 m near Beirut, by G. Haas (1951) from 18 to 135 m off the coast of Palestine, and by Steuer (1939) from 1.4 to 110 fathoms near Alexandria, Egypt.

*Dentalium* sp.; 7 samples containing 21 specimens. These specimens are fragments and ill-preserved shells, probably belonging to the two previously mentioned species.

#### CLASS BIVALVIA

33. *Arca (Arca) noae* Linnaeus, 1758; 1 valve. A marine species living at depths from 2 to 35 m according to Bucquoy, Dautzenberg, and Dollfus, and recorded by Pallary (1938) from 20 m off Ruad (Syria), but Steuer (1939) found it at depths from 4 to 28 fathoms near Alexandria, Egypt.

34. *Arca (Barbatia) barbata* Linnaeus, 1758; 1 valve. A marine species occurring at depths from 5 to 30 m; recorded by Pallary (1938) from 25-30 m near Beirut.

35. *Arca (Anadara) diluvii* Lamarck, 1805; 2 samples containing 2 valves, one of which is much worn. A marine species living at depths from 10 to 1000 m; recorded from 18 to 140 m off the coast of Palestine by G. Haas (1951).

36. *Glycymeris violascens* (Lamarck, 1819); 18 samples containing 38 valves. This marine species lives at depths from 5 to 250 m; G. Haas (1951) records it from 12-135 m off the coast of Palestine. Most of these valves are well preserved; the specimens have apparently been collected alive.

37. *Glycymeris* spec.; 42 samples containing 75 specimens. These shells certainly do not belong to *Glycymeris violascens*, but I failed to assign them with certainty to one of the two other large mediterranean species of the genus: *Gl. pilosa* (Linnaeus, 1767) and *Gl. bimaculata* (Poli, 1795). Most of these specimens appear to have been collected alive, but some of them are beach-worn shells.

*Glycymeris* spec.; 45 samples containing 141 specimens. These are fragments and ill-preserved valves unfit for specific identification.

38. *Pinna nobilis* Linnaeus, 1758; 4 samples containing 4 specimens. This is a littoral marine species. The recorded specimens are fragments of shells.

39. *Spondylus gaederopus* Linnaeus, 1758; 3 samples containing 3 specimens. This is a marine species living at depths from 2 to 40 m; Pallary (1938) records it from 25-30 m near Beirut. The specimens are two odd valves and a fragment.

40. *Lima lima* (Linnaeus, 1758); 4 samples containing 4 odd valves and





a fragment, all of them worn. This is a marine species living at depths from 2 to 40 m, and recorded by Pallary (1938) from 25-30 m near Beirut.

41. *Ostrea edulis* Linnaeus, 1758; 3 samples containing 3 specimens. The oyster is recorded from depths varying between 2 and 40 m. The identification of a fragment from level XXI is doubtful.

42. Unionacea, gen. spec.; 6 samples containing 6 specimens. These specimens are remains of freshwater mussels (naiads). Most of them are fragments, but there is one nearly entire valve from level IX (square G<sub>4</sub>, depth 7.39 m), which belongs to *Potomida littoralis* (Lamarck, 1801). According to F. Haas (1940) three subspecies of this species occur in Syria and Palestine. By lack of material for comparison it proved impossible for me to settle the subspecific identity of this single valve.

43. *Cardium (Acanthocardia) tuberculatum* Linnaeus, 1758; 26 samples containing 50 specimens. A marine species living at depths from 0 to 100 m; G. Haas (1951) records it from 18-54 m off the coast of Palestine. Most of these shells are hardly worn; the specimens appear, therefore, to have been collected alive.

44. *Venus verrucosa* Linnaeus, 1758; 1 fragment. A littoral marine species, which descends to 20 m off Ruad (Syria), to 25-30 m near Beirut, both according to Pallary (1938), and to more than 34 fathoms near Alexandria, Egypt, according to Steuer (1939).

45. *Donax (Serrula) trunculus* Linnaeus, 1758; 1 valve. This marine species occurs at depths from 0-45 m; G. Haas (1951) records it from 12-45 m off the coast of Palestine.

#### ECHINODERMATA

Two club-shaped spines of a fossil echinoid, *Balanocidaris glandifera* (Goldfuss, 1829), were found in level XI-XII, square F<sub>5</sub>, depth 9.20-9.75 m, and in level XVIII, square F<sub>5</sub>, depth 11.50-12.00 m respectively. These fossils occur abundantly in Upper Jurassic limestone beds in the Lebanon Mountains. From the description of the geology of the locality by Wright (1951) it does not appear if the presence of these fossils in the deposits of the rock shelter may be due to weathering of the Jurassic limestone cliff overhanging the shelter.

#### GENERAL DISCUSSION

The distribution of the molluscs in 25 of the 36 levels which have been distinguished in the sequence of deposits at Ksâr'Akil is shown in a table 1). No molluscs appear to have been found in the levels XXV, XXVI, and

1) See pp. 94-95.

XXVII, and farther down than level XXVIII. The number of species collected in a certain level is found in the first column, the number of specimens in the second. The number of specimens of each species in each sample is indicated by the percentage of the total number of specimens contained in that sample. When the number of specimens of a species in a sample is less than  $\frac{1}{2}\%$  of the total number of specimens in that sample, this species is indicated by a +. Each valve of a bivalve has been counted as a specimen.

I do not think that the distribution of molluscan remains over the deposits enables us to draw any conclusions as to changes of environment during their deposition. On the contrary it appears that the most common species occur practically throughout the sequence of deposits as far as molluscs are present in them. No boreal species, of which we have evidence that they lived in the Mediterranean during Glacial Stages of the Pleistocene, are present in any of the levels at Ksâr'Akil. Fluctuations in the relative frequency of the species may be partly due to changes in the climate, but changes in the habits of the inhabitants of the rock shelter and slight local changes of environment may also have caused these fluctuations.

Biometrical analysis of recent populations of the two land snails *Metafruticicola berytensis* and *Helix pachya* would be needed to establish whether any value should be attached to the occurrence of so many large specimens of these species. It seems likely that they are indicative of a relatively humid climate.

Probably most of the shells, at least those of all the marine species, were brought to the rock shelter by its human inhabitants. Part of the marine molluscs are litoral species, but some of them must have been collected by fishermen, if my hypothesis that they were collected alive is correct (e.g. *Glycymeris violascens*). Consequently the inhabitants of Ksâr'Akil were either able to go fishing themselves or they had some trade with fishermen. From the scarcity of fish remains in the deposits Hooijer (1961, p. 6) concludes that fish has never been an important source of food at Ksâr'Akil. It is in accordance with this observation that the number of specimens of probable food molluscs from the litoral zone is much higher than that of the specimens which have probably been fished.

As to the freshwater shells, they may have been deposited by the river during occasional inundations. This seems, however, unlikely at least for the specimens of *Theodoxus jordani*, because a hole has been made in their last whorl. The shells of naiads may have been collected by the Ksâr'Akil people for ornamental purposes, as they possess a thick layer of mother of pearl. Part of the landsnails probably were not brought to the locality by man, but lived there or went there for aestivation. The latter supposition seems most probable for the specimens of *Pomatias olivieri* found with the operculum.

The molluscs or their shells apparently have been collected for several purposes. A number of the larger species were probably eaten: *Patella caerulea*, *P. lusitanica*, *Gibbula turbinata*, *Astraea rugosa*, *Cerithium vulgatum*, *Fasciolaria ligniaria*, *Helix pachya*, *Glycymeris violascens*, *Gl. spec.*, *Ostrea edulis*, *Cardium tuberculatum*, *Donax trunculus*<sup>1</sup>). Of most of these the shell was broken in order to take out the animal; of others it could apparently be taken out without doing damage to the shell: *Gibbula turbinata* in the upper levels, *Helix pachya*.

The two species of *Murex* were collected in antiquity in order to use the contents of their hypobranchial gland, the famous purple, for dying purposes. Archaeologists will have to decide whether the same use may already have been made of *Murex* by the inhabitants of the rock shelter of Ksâr'Akil. The specimens of *Murex* may also have been used for food.

Some of the species are too small to serve for food. Their shells have probably been used as ornaments. Among these there are some species of which the recent shells have beautiful colours or colour patterns: *Theodoxus jordani*, *Columbella rustica*, *Pisania maculosa*, *Vexillum ebenus*, *Conus mediterraneus*, while others like *Nassarius gibbosulus* are attractive rather by their shape. In most of these shells a hole was intentionally made in order to put them on strings<sup>2</sup>). Some specimens of *Nassarius gibbosulus* were ground off, apparently in order to make ornaments which could be fastened on clothes. Scaphopods also were used for making strings, and, as has been shown by Garrod (1937, pl. 6 fig. 2, pl. 7), skull-caps. All the scaphopods from Ksâr'Akil were found fairly closely together, viz. in the levels VIII-X, at depths varying between 6.24 and 7.90-8.50 m. The custom of using scaphopods for ornamental purposes may, therefore, have existed just during that period. That the mother of pearl of naiads may have been used for making ornaments has already been touched upon above.

Some beach worn shells may have been used as implements. For instance certain valves of *Glycymeris spec.* and *Spondylus gaederopus*, in which the sharp edges are rounded off by wear, seem fit to have been used as spoons. Finally beautiful little shells may have been collected, especially by children, just because of their beauty.

Archaeologists will have to decide whether the club-shaped spines of *Ba-*

1) According to Pallary (1938) *Donax trunculus* is at present eaten in Syria under the name of "haricot de mer".

2) I wonder if the tiny holes found in some opercula of *Pomatias olivieri* are due to human action. In fact I can offer no satisfactory explanation of the presence of these perforations.

*Ianocidaris glandifera* may have been used as talismans by the inhabitants of Ksâr'Akil. The custom of ascribing curative properties to these fossils was traced back to the 26th Egyptian dynasty, 650 B.C., by Fraas (1878).

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