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Molluscs of the Great Bitter Lake, Suez Canal, Egypt, collected by C. Beets in 1950

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A list of shells dredged in the Great Bitter Lake in 1950, by Dr. C. Beets is given. The rare species *Pauliella miliacea* (Issel, 1869) (Kelliellidae, Bivalvia) is figured.

Key words: Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, Great Bitter Lake, Suez Canal, Egypt.

In 1950, Dr. C. Beets spent a three-weeks holiday dredging in the Great Bitter Lake, Egypt. The dredged material, collected during that time was donated to the Rijksmuseum van Natuurlijke Historie (N.N.M., Leiden), but never sorted and named, except for the Crustacea Decapoda (Holthuis, 1956). In these notes of Holthuis (page 311), Dr. A.C. van Bruggen identified the following ten gastropod shells: *Trochus erythraeus* (Brocchi, 1821), *Cleopatra bulimoides* (Olivier,1804)*, *Melanoides tuberculata* (Müller, 1774), *Cerithium clypeomorus* (Jousseaume, 1888)*, *C. rueppelli* Philippi, 1848*, *C. scabridum* Philippi, 1848, *Pirenella conica* (Blainville, 1826) [= *Potamides conicus* (Blainville,1826)], *Fusus marmoratus* Philippi, 1846, [= *Fusinus polygonoides* (Lamarck,1822)], *Murex anguliferus* Lamarck, 1822, [= *Chicoreus virgineus* (Röding, 1798)] and *Murex tribulus* Linné, 1758 [= *Murex forskoehlii* Röding, 1798], all inhabited by the hermite crab *Diogenes pugilator* (Roux, 1829). We did not encounter the species marked with *. The names between [ ] are used in our article.

In 1953, Beets published a report on this dredging operation in which all stations visited in the Great Bitter Lake were listed, together with the local habitat and a map of the Great Bitter Lake. We gratefully made use of the map and the data given by Dr. Beets in his report. Although much material was live collected, we did not find any remains of the animals after more than 40 years.

Dr. Cornelis Beets died on 28 July 1995. An obituary with a list of his publications and his newly described species, written by Winkler Prins, can be found in Basteria, (1996).

For the systematics we mainly used Vaught (1989). 'R' behind a name indicates an original Red Sea species, 'M' behind a name an original Mediterranean species, 'F' behind a name means a freshwater species, washed in by streams debouching into the Great Bitter Lake.

POLYPLACOPHORA

Acanthochitonidae

Acanthochitona penicillata (Deshayes, 1863) R

Strack, 1993: 23-25, pl. 5 fig. 6.
Sta. 1.

GASTROPODA

Fissurellidae

Diodora imbricata (Sowerby, 1862) R

Bouchet & Danrigal, 1982: 15, fig. 50; Christiaens, 1987: 28-30, figs. 24-26, 47, 51.
Sta. 13.

Note. — A specimen from the Great Bitter Lake, Sta. 18, leg. Beets, (NNM) was figured by Christiaans, 1987: figs. 24-25.

Diodora ruppellii, (Sowerby, 1834) R

Sharabati, 1984: pl. 2 figs. 6-7
Sta. 5, 7, 8, 9, 13, 24.

Lottiidae

Patelloida rolani Christiaens, 1987 R

Christiaens, 1987: 21-22, figs. 4-7, 54-55.
Sta. 1, 5, 6, 8, 27, 36.

Trochidae

Clanculus tonnerrei (G.& H. Nevill, 1874) R

Dance, 1995: No. 35.
Sta. 1, 3, 5, 6, 13, 14, 27, 36, 37, 40.

Note. – Herbert (1996) has shown that this species should be called C. *tonnerrei.* The species *C. gennesi* H. Fischer, 1901, and others are synonyms.

Trochus erithreus Brocchi, 1821 R

Sharabati, 1984: pl. 3 fig. 2; Dance, 1995: No. 38
Sta. 1, 3, 5, 6, 13, 14, 24, 27, 36, 37, 45.

Ethminolia hemprichi (Issel, 1869) R

Bouchet & Danrigal, 1982: 13, fig. 22.
Sta. 1, 3, 4, 7, 19, 32, 36, 40.

Pseudominolia nedyma (Melvill, 1897) R

Dance, 1995: No. 55.
Sta. 3, 5, 6, 8, 9, 13, 14, 17, 19, 24, 26.

Pagodatrochus variabilis (H. Adams, 1873) R

Dance, 1995: No. 52.
Sta. 1, 3, 5, 6, 13, 14, 19, 27, 36, 37, 40.

Perrinia stellata (A. Adams, 1864) R

Dance, 1995: No. 28.
Sta. 1, 3, 5, 6, 13, 14, 18, 23, 24, 25, 27, 36, 37, 40.

Stomatella modesta H.& A. Adams, 1864 R

Bouchet & Danrigal, 1982: 13, fig. 48.
Sta. 1.

Note. — *Stomatella doriae* Issel, 1869, and *S. scitula* H. Adams, 1872, are junior synonyms of *S. modesta*. The type (BMNH 1968.136, one broken syntype of three left) of *S. modesta* was seen by the second author in 1996.

Neritidae
Theodoxus niloticus (Reeve, 1856) F

Schütt, 1986: 170, text fig.
Sta. 1, 6, 27, 36, 40.

Hydrobiidae
Ventrosia ventrosa (Montagu, 1803) M

d'Angelo & Gargiullo, 1978: 96; Fretter & Graham, 1978: 125-126, fig. 114.
Sta. 14, 24, 27, 36.

Rissoidae
Rissoa labiosa (Montagu, 1803) M

Verduin, 1982: 158 figs. 36-37, 39-40.
Sta. 13.

Pusillina radiata (Philippi, 1836) M

Verduin, 1976: 34-38, pl.1 figs. 4-7; pl. 2 figs. 1-4; pl. 3. figs. 1-3.
Sta. 5, 6, 9, 13, 24, 27, 36, 40.

Lucidestea pallaryi (Hornung & Mermod, 1927) R

Hornung & Mermod, 1927: 367-368, fig. 3.
Sta. 3, 5, 6, 8, 9, 16, 24.

Onoba delicata (Philippi, 1849) R

Moazzo, 1939: 186, fig. 17.
Sta. 6, 13.

Rissoina bertholleti Issel, 1869 R

Bouchet & Danrigal, 1982: 12, fig. 38.
Sta. 5.

Vitrinellidae
Moerchiella cf moreleti (Fischer, 1877) R

Dance, 1995: No. 65.
Sta. 14.

Thiaridae
Melanoides tuberculata (Müller, 1774) F

Schütt, 1986: 171, text fig.
Sta. 1, 6, 24, 27, 36, 37, 40.

Cerithiidae
Cerithium scabridum Philippi, 1848 R

Dance, 1995: No. 162.
Sta. 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 19, 23, 24, 25, 26, 27, 28, 32, 34, 35, 36, 37, 38, 39, 40, 44, 45, 46, and one beach sample just below low waterline W. of Sta.7.

Dialidae
Diala semistriata (Philippi, 1849) R

Dance, 1995: No. 176.
Sta. 1, 3, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 18, 23, 24, 25, 26, 27, 29, 32, 33, 35, 36, 37, 40, 44.

Scaliolidae
Scaliola elata (Semper in Issel, 1869) R

Bouchet & Danrigal, 1982: 13, fig. 84.
Sta. 9.

Finella pupoides (A. Adams, 1860) R

Dance, 1995: No. 183; Buzzurro & Greppi, 1996: 11, fig. 2.
Sta. 3, 5, 6, 8, 9, 13, 14, 15, 16, 18, 23, 24, 25, 26, 27, 29, 33, 36.

Cerithidium cerithinum (Philippi, 1849) R

Moazzo, 1939: 189, fig. 19.
Sta. 3, 5, 6, 8, 9, 13, 14, 15, 18, 23, 24, 25, 26, 29, 33, 36, 40.

Potamididae
Potamides conicus (Blainville, 1826) R-M

Dance, 1995: No. 185.
Sta. 1, 3, 5, 6, 7, 8, 9, 11, 13, 14, 15, 16, 17, 23, 24, 25, 26, 27, 28, 29, 35, 36, 37, 40.

Eulimidae M?-R?
Eulima spec.

Sta. 5, 8.

Muricidae
Murex forskoehlii Röding , 1798 R

Dance, 1995: No. 464.
Sta. 1, 5, 6, 7, 8, 9, 11, 13, 17, 19, 23, 24, 25, 26, 27, 29, 33, 34, 35, 36, 37, 40.

Chicoreus ramosus (Linné, 1758) R

Dance, 1995: No. 456; Sharabati, 1984: pl. 18 fig.9.
Sta. 6, 40.

Chicoreus virgineus (Röding, 1798) R

Sharabati, 1984: pl. 18 fig. 6.
Sta. 17.

Nassariidae
Nassarius pauperus (Gould, 1850) R

Dance, 1995: No. 547.
Sta. 1, 5, 7.

Fasciolariidae
Fusinus polygonoides (Lamarck, 1822) R

Sharabati, 1984: pl. 23 fig. 8.
Sta. 1, 3, 4, 5, 6, 7, 8, 13, 14, 24, 25, 27, 36, 37.

Columbellidae
Zafra savignyi (Moazzo, 1939) R

Moazzo, 1939: 154-155, fig. 14.
Sta. 5.

Note. — The real species, not one of the other *Zafra* species reported from the Meditteranean (Buzzurro & Greppi, 1996: 15-16 figs.13-14).

Olividae
Ancilla lineolata (A. Adams, 1853) R

Sharabati, 1984: pl. 24 fig. 4.
Sta. 1, 3, 5, 6, 7, 8, 9, 13, 27, 35.

Cystiscidae
Gibberula savignyi (Issel, 1869) R

Bouchet & Danrigal, 1982: 15, fig. 88.
Sta. 3, 5, 8, 9, 35.

Turridae
Eucithara spec. R

Sta. 5, 6, 13.

Pseudoraphitoma iodolabiata (Hornung & Mermod, 1928) R

Hornung & Mermod, 1928: 112-113, fig.2.
Sta. 5, 6, 8, 13, 24.

Pseudoraphitoma spec. R

Sta. 5, 6, 8, 13, 24.

Pyramidellidae

About 15 species recognized, which will be dealt with elsewhere by Dr. J.J. van Aartsen.

Scaphandridae
Cylichna villiersi (Audouin, 1826) R

Bouchet & Danrigal, 1982: 16, fig. 53.
Sta. 8, 9.

Cylichna girardi (Audouin, 1826) R

Bouchet & Danrigal, 1982: 13, fig. 52; Buzzurro & Greppi, 1996: 18, fig. 18.
Sta. 5, 6, 8, 9, 13, 24, 36, 37, 40.

Haminoeidae
Atys cylindrica (Helbling, 1779) R

Dance, 1995: No. 825; Sharabati, 1984: pl. 34 fig. 9.
Sta. 5, 9.

Atys ehrenbergi (Issel, 1869) R

Issel, 1869: 281-282, pl. 4 fig. 6.
Sta. 5.

Diniatys dentifera (A. Adams in Sowerby, 1850) R

Habe, 1952: 141, pl. 20 figs. 11-12.
Sta. 3, 5, 6, 8, 13, 24, 27, 36.

Liloa curta (A. Adams in Sowerby, 1850) R

Habe, 1952: 151, pl. 21 fig. 19.
Sta. 3, 5, 6, 8, 9, 13, 16, 35.

Retusidae
Retusa fourierii (Audouin, 1826) R

Bouchet & Danrigal, 1982: 13, fig. 54.
Sta. 5, 6, 8, 9, 13, 14, 24.

Planorbidae
Gyraulus ehrenbergi (Beck, 1837) F

Schütt, 1986: 174, text fig.
Sta. 1.

Bulinidae
Bulinus truncatus (Audouin, 1826) F

Bouchet & Danrigal, 1982: 16, fig. 29; Schütt, 1986: 175, text fig.
Sta. 1.

BIVALVIA

Noetiidae
Striarca erythraea (Issel, 1869) R

Oliver, 1992: 3, pl. 4 fig. 3.
Sta. 3, 5, 6, 8, 9, 13, 14, 17, 23, 24, 37.

Mytilidae
Brachidontes pharaonis (P. Fischer, 1870) R

Oliver, 1992: 48, pl. 5 fig. 2.
Sta. 1, 4, 5, 6, 7, 8, 9, 13, 14, 17, 19, 24, 32, 35, 36, 37, 39, 44, 45.

Note. — This species is better known as *Brachidontis variabilis* (Krauss, 1848). Unfortunately *B. variabilis* (Krauss, 1848) is preoccupied and *Mytilis pharaonis* P. Fischer, 1870 seems to be the next available name.

Modiolus ligneus (Reeve, 1858) R

Oliver, 1992: 53, pl. 6 fig. 4.
Sta. 5, 6, 8, 12, 14, 19, 36, 37, 45.

Gregariella ehrenbergi (Issel, 1869) R

Oliver, 1992: 51, pl. 5 fig. 8.
Sta. 1, 5, 6, 12, 13, 14, 15, 16, 19, 21, 27, 37, 43, 46.

Note. — According to the figures given by Issel, 1869 (pl. 1 fig. 12), his *Crenella ehrenbergi* represents this *Gregariella* species.

Musculus coenobita (Vaillant, 1865) R

Oliver, 1992: 50, pl. 5 fig. 5.
Sta. 5, 6, 7, 10, 12, 13, 14, 15, 16, 18, 19, 25, 27, 28, 33, 34, 35, 36, 37, 39, 44, 45, 46.

Musculus viridulus (H. Adams, 1871) R

Oliver, 1992: 50, pl.5 fig. 7.
Sta. 5, 6, 7, 13, 14, 19, 31, 32, 33, 35, 36, 44, 45, 46.

Musculista senhousia (Benson in Cantor, 1842) R

Oliver, 1992: 51, pl. 5 fig. 9; Hoenselaar & Hoenselaar, 1989: 73-76 figs. 2-3, 6-9
Sta. 31, 37, 44, 45.

Note. — Hoenselaar & Hoenselaar, 1989, figured the types of *Modiola arcuatula* Hanley, 1844, and *Modiola senhousia* Benson in Cantor, 1842. The material and the figure of *Arcuatula arcuatula* given by Oliver, are conform *Musculista senhousia*, not to *Arcuatula arcuatula* .

Solamen vaillanti (Issel, 1869) R

Oliver, 1992: 46 fig. 20 [in our opinion fig. 19 in error].
Sta. 3, 5, 6, 9, 14, 15, 18, 19, 35, 36, 44, 46.

Pteriidae

Pinctada vulgaris (Schumacher, 1817) R

Oliver, 1992: 63, pl. 9 fig. 10.
Sta. 1, 7, 21, 26, 35.

Note. — According to Lamy (1929: 114) *Pinctada vulgaris* Schumacher, 1817) is the Indo-Pacific species while *Pinctada radiata* Leach, 1814, referes to the Caribbean species.

Malleidae
Malleus regula (Forsskål, 1775) R

Oliver, 1992: 65, pl. 10 fig. 3.
Sta. 7, 26, 33, 34, 39, 43.

Limidae
Limaria fragilis (Gmelin, 1791) R

Oliver, 1992: 84, pl. 14 fig. 7.
Sta. 27.

Lucinidae
Pillucina fischeriana (Issel, 1869) R

Oliver, 1992: 98, pl. 20 fig. 4.
Sta. 1, 2, 3, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 19, 24, 25, 26, 27, 28, 31, 32, 33, 35, 36, 37, 38, 39, 44, 45, 46.

Ungulinidae
Diplodonta globosa (Forsskål, 1775) R

Oliver, 1992: 101, pl. 21 fig. 1.
Sta. 18.

Diplodonta subrotundata Issel, 1869 R

Oliver, 1992: 102, pl. 21 fig. 2.
Sta. 1, 4, 6, 7, 21, 26, 27, 31, 32, 40, 42, 46.

Diplodonta spec. R

Oliver, 1992: 102, pl. 21 fig. 4.
Sta. 5, 8, 9, 10, 14, 18, 19, 24, 25, 26, 28, 29.

Note. — This species, as well as the other two, belongs to *Diplodonta (Diplodonta)* as defined by Kilburn, 1996. It is closely related or identical with *Diplodonta raveyensis* Sturany, 1899.

Montacutidae
Mysella spec. R

Sta. 5.

Note. — This species seems to be close to or identical with *Montacuta viaderi* Ray, 1952, described from Mauritius.

Chamidae
Chama asperella Lamarck, 1819 R

Oliver, 1992: 106, pl. 26 figs. 5-7.
Sta. 5, 6, 8, 13.

Kelliellidae
Pauliella miliacea (Issel, 1869) R (figs. 1-6)

Kellia miliacea Issel, 1869: 87, pl. 1 fig.11.
Gouldia minima Montagu, var. *triangularis* ? Montagu; Moazzo, 1939: 90, fig. 4.
Microcirce sp.; Zuschin & Hohenegger, 1998: pl. 56, figs. 4-5.
Sta. 1, 3, 5, 8, 9, 10, 12, 13, 14, 15, 16, 18, 20, 24, 25, 26, 29, 35, 36.

Note. — This species is very common in the Great Bitter Lake. Despite this fact, it is only reported twice in the literature, being omitted by Oliver, 1992. *Pauliella* Munier-Chalmas, 1895, was described from St. Paul Island, Indian Ocean and seems to fit this species well.

Cardiidae
Parvicardium sueziense (Issel, 1869) R

Oliver, 1992: 125, pl. 21 fig. 7.
Sta. 6.

Afrocardium richardi (Audouin, 1826) R

Oliver, 1992: 122, pl. 21 fig. 8.
Sta. 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 18, 19, 24, 25, 26, 29, 32, 33, 34, 35, 36, 39, 40, 43, 45, 46.

Fulvia fragilis (Forsskål in Niebuhr, 1775) R

Oliver, 1992: 123, pl. 22 fig. 8.
Sta. 6, 8, 11, 13, 25, 33, 35, 38, 44.

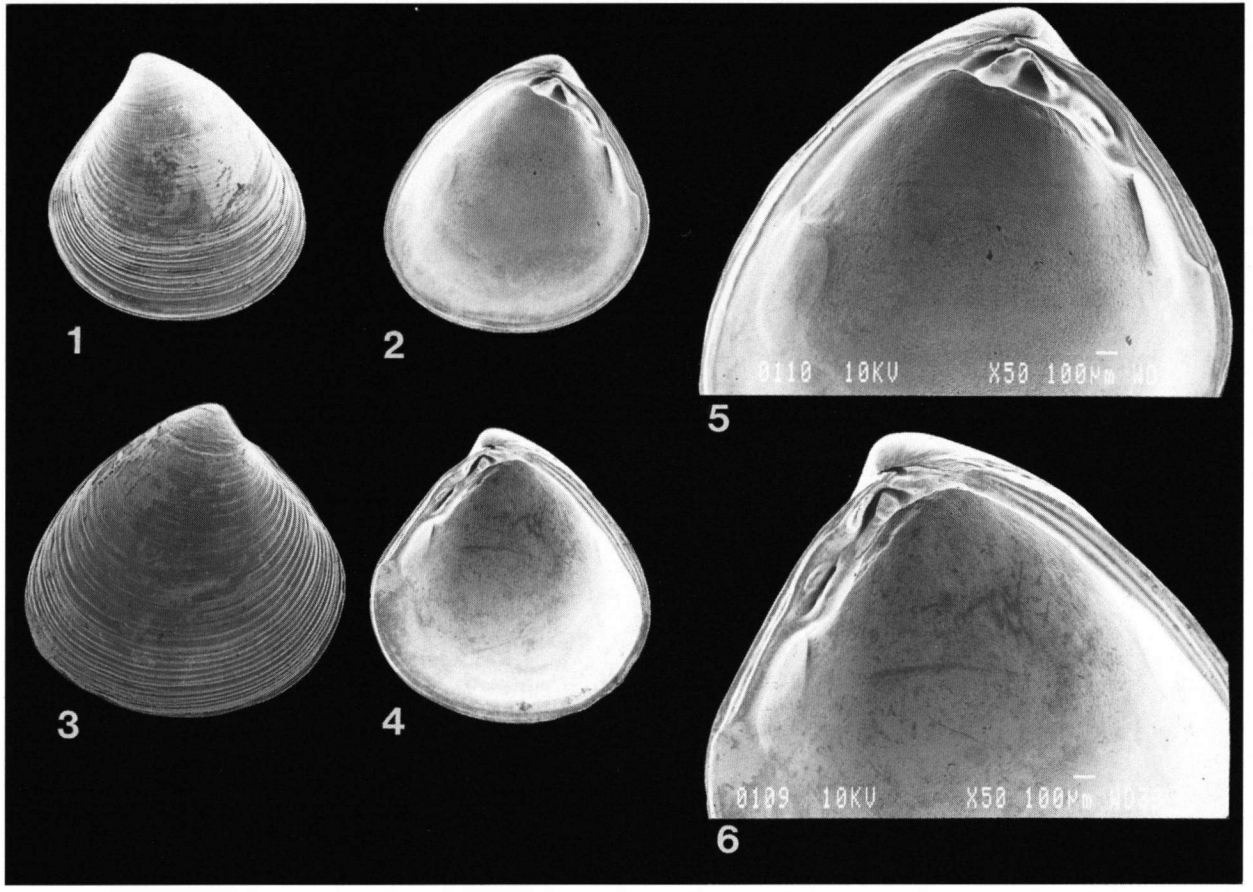
Note. — Vidal (1994: 102-103) has shown that this species has to be called *Fulvia fragilis* (Forsskål in Niebuhr, 1775).

Cerastoderma glaucum (Poiret, 1789) M

Oliver, 1992: 123, pl. 22 fig. 10.
Sta. 1, 4, 6, 7, 21, 23, 40.

Mactridae
Mactra olorina Philippi, 1846 R

Oliver, 1992: 131, pl. 27 fig. 1.
Sta. 1, 2, 4, 7, 8, 16, 21, 26, 28, 31, 38, 42, and one beach sample W. of Sta. 7.



Figs. 1-6. *Pauliella miliacea* (Issel, 1869), Great Bitter Lake, (NNM). 1, outside left valve, width 2.32 mm, length 2.45 mm; 2, inside left valve, width 2.35 mm, length 2.52 mm; 3, outside right valve, width 2.85 mm, length 2.76 mm; 4, inside right valve, width 2.53 mm, length 2.62 mm; 5, enlarged hinge of fig. 2; 6, enlarged hinge of fig. 4.

Mesodesmatidae
Paphies striata (Gmelin, 1791) R

Oliver, 1992: 134, pl. 28 fig. 5.
Sta. 42.

Note. — *Paphies glabrata* (Gmelin, 1791) is a synonym.

Tellinidae
Tellina isseli H. Adams, 1871 R

Oliver, 1992: 151, pl. 30 fig. 2.
Sta. 5, 6, 13, 14, 18, 19, 24, 28, 36, 45.

Loxoglypta rhomboides (Quoy & Gaimard, 1835) R

Oliver, 1992: 159, pl. 35 fig. 3.
Sta. 5, 6, 10, 14, 15, 18, 19, 25, 26, 28, 29, 33, 35, 39, 44, 45.

Psammotreta praerupta (Salisbury, 1934) R

Oliver, 1992: 157, pl. 37 fig. 4.
Sta. 8, 25.

Tellina spec. R

Sta. 8, 10, 14, 15, 16, 18, 19, 25, 26, 28, 29, 35, 39, 44.

Psammobiidae
Soletellina ruppelliana Reeve, 1857 R

Oliver, 1992: 164, pl. 36 fig. 3.
Sta.1.

Gari pallida (Deshayes, 1855) R

Oliver, 1992: 162, pl. 36 fig. 7.
Sta. 26.

Note. — Willan (1993: 19) has shown that this species should be called *Gari pallida* (Deshayes, 1855); *Psammobia weinkauffi* Crosse, 1864 is a synonym.

Semelidae
Semele fragillima (Issel, 1869) R

Oliver, 1992: 167, pl. 30 fig. 6.
Sta. 19, 44.

Leptomyaria spec. R

Zuschin & Hohenegger, 1998: pl. 56 figs. 6,9.
Sta. 5, 8, 9.

Ervilia bisculpta Gould, 1861 R

Oliver, 1992: 168, pl. 31 fig. 4.
Sta. 8, 9, 13, 16, 27.

Note. — *Ervilia scaliola* Issel, 1869, is a synonym.

Donacidae
Donax trunculus Linné, 1758 M

Oliver, 1992: 159, pl. 32 fig. 9.
Sta. 1.

Corbiculidae
Corbicula fluviatilis (Müller, 1774) F

Schütt, 1986: 179, text fig.
Sta. 1.

Solecurtidae
Azorinus chamasolen (Da Costa, 1778) M

Poppe & Goto, 1993: 117, pl. 18 fig. 15.
Sta. 28.

Veneridae
Circe rugifera (Lamarck, 1818) R

Oliver, 1992: 181, pl. 39 fig. 2.
Sta. 5, 6, 7, 19, 21, 26, 31, 33, 35, 36, 40, 42, 44, 46.

Note. — This species was named *Venus corrugata* Dillwyn, 1817, however, this name was preoccupied by *Venus corrugata* Gmelin, 1791, a *Venerupis* species.

Circe scripta (Linné, 1758) R

Oliver, 1992: 181, pl. 39 fig. 1.
Sta. 8, 10, 14, 15, 18, 19, 26, 29, 31, 33, 35, 37, 39.

Gafrarium pectinatum (Linné,1758) R

Oliver, 1992: 182, pl. 39 fig. 6.
Sta. 1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 19, 21, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 39, 42, 43, 44, 45, 46.

Timoclea roemeriana (Issel, 1869) R

Oliver, 1992: 192, pl. 38 fig. 10.
Sta. 3, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16,17, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 38, 39, 43, 44, 45, 46

Callista florida (Lamarck, 1818) R

Oliver, 1992: 187, pl. 40 fig. 7.
Sta. 5, 7, 10, 13, 14, 21, 25, 27, 28, 31, 32, 33, 35, 39, 42, 46.

Tapes deshayesii (Hanley, 1844) R

Oliver, 1992: 189, pl. 43 fig. 3.
Sta. 4, 5.

Paphia aurea (Gmelin, 1791) M

Poppe & Goto, 1993: 123, pl. 22 fig. 4.
Sta. 1, 3, 4, 10, 44.

Paphia rhomboides (Pennant, 1777) M

Poppe & Goto, 1993: 124, pl. 22 fig. 5.
Sta. 10, 36.

Dosinia erythraea Römer, 1860 R

Oliver, 1992: 187, pl. 42 fig. 3.
Sta. 1, 7, 21, 31, 33, 42.

Petricolidae
Petricola hemprichii Issel, 1869 R

Oliver, 1992: 193, pl. 44 fig. 6.
Sta. 4.

Gastrochaenidae
Gastrochaena cymbium Spengler, 1783 R

Oliver, 1992: 200, pl. 45 fig. 6.
Sta. 5, 8, 9, 10, 11, 14, 23, 24.

Laternulidae
Laternula anatina (Linné, 1758) R

Oliver, 1992: 200, pl. 45 fig. 6.
Sta. 4, 10.

SCAPHOPODA

Dentaliidae

Dentalium panormum Chenu, 1843 M

Parenzan, 1970: 229, pl. 39 fig. 944.
Sta. 35.

Dentalium spec. R

Sta. 17.

Fustiariidae

Fustiaria rubescens (Deshayes, 1825) M

Parenzan, 1970: 230, pl. 39 fig. 949.
Sta. 33, 35, 44.

CONCLUSIONS

Before the opening of the Suez Canal in 1869, the Bitter Lakes were in contact with the Red Sea. A fauna of Red Sea species could be expected to occur here before 1869. After the opening of the Suez Canal, Red Sea species might migrate through the Suez Canal into the Mediterranean; this is known as Lessepsian migration. Also the opposite might occur, Mediterranean species could migrate through the Suez Canal into the Bitter Lakes and onwards into the Red Sea (anti-Lessepsian migration).The water flow is mainly from the Red Sea towards the Mediterranean (Barash & Danin, 1987: 93-94), so larval stages of molluscs are also mainly directed towards the Mediterranean. Indeed, there are many more Red Sea species known to live in the Mediterranean than Mediterranean species are known to live in the Red Sea. Also, Red Sea species are able to adapt themselves more easily to their new environment than Mediterranean species are able to adapt to the Red Sea environment.

One should not be confused by certain exotic species now occurring in the Mediterranean but not of Red Sea origin. These are probably transported by human activities (ships, oyster culture). Examples of this group are *Strombus persicus* Swainson, 1821, *Scapharca cornea* (Reeve, 1843) (sensu D'Angelo & Gargiullo, 1978), *Thais lacera* (Born, 1778) (see Mienis, 1994) and *Rapana venosa* (Valenciennes, 1846).

A total of 97 species of Mollusca were found in the material dredged in the Great Bitter Lake by Dr. Beets, without the Pyramidellidae species which will be dealt with elsewhere by Dr. J. J. van Aartsen.

Five species are freshwater species, and were probably washed into the Great Bitter Lake by freshwater streams during wet periods. These freshwater species are well known from the Nile River delta system.

Eighty-one species encountered are Red Sea species, mostly species living in or on sandy or muddy substratum covered with seagrasses. Because no coral growth appears in the Great Bitter Lake, no coral-dependent species of molluscs were encountered. Some of the species found are generally known but also some species were found which are quite rare in the Red Sea. The finding of *Pauliella miliacea* , which was only twice reported after its description, is a good result of the dredgings of Dr. Beets.

Apparently ten species of Mediterranean molluscs were able to invade the Great Bitter Lake until 1950. These are the bivalves *Cerastoderma glaucum, Donax trunculus, Azorinus chamasolen, Paphia aurea* and *Paphia rhomboides.* From the gastropods only three small species were found, all belonging to the Rissoidae, *Ventrosia ventrosa, Rissoa labiosa* and *Pusillina radiata.* Two Mediterranean scaphopods were found, *Dentalium panormum* and *Fustiaria rubescens.* Of these ten, only *Cerastoderma glaucum, Paphia aurea, Paphia rhomboides, Ventrosia ventrosa, Pusillina radiata, Dentalium panormum* and *Fustiaria rubescens* were found alive (or have been living) in the Great Bitter Lake. The others are probably incidental specimens transported by human activity or are specimens that were not able to establish a living population.

In 1987 Barash & Danin published an article which listed the known anti-Lessepsian species of molluscs. They listed 18 "true" anti-Lessepsian migrants and 70 doubtful migrant species, the latter often recorded from outside the Red Sea region. Of the listed 18 species of "true" anti-Lessepsian migrants only *Cerastoderma glaucum* was also found to occur in the material here reported. Apart from *Potamides conicus*, the other 16 species listed are probably only incidental specimens or erroneous determinations. We do not know of any species of Mediteranean mollusc to be reported to really live in the Red Sea outside of the Suez Canal system.

One species has to be mentioned in particular, *Potamides conicus.* It is a species originally living in the NW. Indian Ocean, Red Sea, southern Arabia, Persian Gulf. It was known to live in the Mediterranean before the opening of the Suez Canal (Dautzenberg, 1929: 490). We do not know of fossil records of this species from the Mediterranean area but there are several reports of fossils (Pleistocene) from the Red Sea area.

The Suez isthmus was not always closed before the Suez Canal was definitely opened by human effort in 1869. We assume that *Potamides conicus,* the only Red Sea species able to live in hypersaline water, was able to cross the bridge between the Red Sea and the Mediterranean during an earlier geological period when there were alternating connections of the Bitter Lakes with either the Red Sea or the Mediterranean. Also the opposite occurred, some Mediterranean species, e.g. *Cerastoderma glaucum,* were able to enter the Red Sea area in former geological time. Although these species are now extinct in the Gulf of Suez, their fossil shells can be found as far as Suez [Issel, 1869: 21, 23, 245-303].

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