

RECENT OSTRACODES FROM MARINE SEDIMENTS OF SAFAGA BAY, RED SEA, EGYPT. 3333

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ABSTRACT

This work is the first attempt to throw some light on the ostracodes from the recent marine environment in the Safaga bay along the Red Sea coast, Egypt. Thirty surface bottom sediment samples were collected from the study area, and treated for their Ostracoda content. Identification, taxonomy, occurrence, ecology, and zoogeographic aspects were carried out on the ostracode assemblages. Twenty-three ostracode species belonging to 21 genera, and 13 families are recorded. Three biofacies were determined covering the area under study. A shallow, warm, slightly alkaline, hypersaline, oxidizing marine environment was determined for the living medium of the present ostracode assemblages. Beside the main Indian fauna, some Mediterranean and cosmopolitan faunal elements were recorded.

KEY WORDS Ostracodes – Recent marine sediments – Safaga bay- Red Sea-Egypt.

INTRODUCTION

Along the Red Sea coast of Egypt, the marine ecosystem and geosystem are dynamic having variable bottom sediment types, diverse biologic habitats and localized depositional and transportation processes. They are impacted by many activities, as phosphate mining, oil industry, fishing, recreation, urbanization, tourism, sewage and waste disposal and shipping. Bottom sediments reflect the past and present environmental conditions of a water body. The objectives of the present work are the detailed study of the taxonomy, biofacies, ecological and zoogeographical implications of the ostracode assemblages collected from the recent marine sediments of Safaga Bay on the Red Sea Coast, Egypt. Also, the present investigation may lead to constitute better understanding of the ecology of recent ostracodes.

Several investigations on recent sediments were carried out on the Egyptian Red Sea coast such as Piller and Pervesler, 1989; Piller and Mansour 1990 & 1994; Piller, 1994; Nebelsick, 1992 a & b; Mansour et al., 1997 & 2000; Aref and Madkour 2000; Ziko et al., 2001 and Abd El-Wahab, 2002.

GEOLOGICAL SETTING

The Safaga area is occupied by relatively low hills of sedimentary rocks and is surrounded by mountainous area of igneous and metamorphic rocks. Safaga bay is a shallow water bay with a maximum water depth of 70m, and it is situated on the west coast of the Red Sea on Egyptian territory between $33^{\circ} 56'$ and 34° longitude and between $26^{\circ} 37'$ and $26^{\circ} 52'$ northern latitude (Fig. 1). The bay is bordered by a narrow arid coastal plain on the westwards, and its east and southwards by very steep slope, while the northern border is formed by the prominent peninsula of Ras Abu Soma. The N-S oriented Safaga Island (Gazirat Safaga) equally subdivides the bay into a northern and a southern part. Both parts are distinctly separated by a shoal and connected only by a narrow channel.

Additionally, the prevailing water current from north to south prevents the harbor of Safaga, which is situated in the southern part, from influencing the northern bay. The southern bay is deepest than the northern one. Various bottom facies were observed such as coral reefs, sand bottoms, seagrass bottoms and mud bottoms. The northern bay is characterized by common occurrence of coral reef communities, seagrass beds and pure sand bottoms especially at the base of the steeper slope which is inhabited by coral reefs, while the southern bay is famous with mud bottoms, coral reefs are less abundant and consists mainly of soft one.

CLIMATE AND OCEANOGRAPHIC INFLUENCES

The climate of the Red Sea is largely controlled by the distribution of winds and change in atmospheric pressure over a very wide area. Over the whole year winds from NW to NE predominate. Generally, wind velocity is distinctly higher during the daytime, a phenomenon that can be explained by the higher temperature differences between the stronger heated landmass and sea water. Considerably, the water level changes periodically as a result of thermally driven winds, blowing landward in daytime. Winds also create a mainly NE-SW oriented water motion. This leads to distinct higher waves in the exposed area than in the protected parts and drives longshore current in summer southward. Waves and currents redistribute terrigenous debris brought into the sea either by wadis or NW winds on the tidal flat area (Mansour, 1995).

Because of permanent air and water turbulence, a complete mixing of water column occurs and no stratification is developed inside the water body. This is reflected also by the values of temperature and salinity, which show no significant differences between surface and bottom waters (Piller and Pervesler, 1989). The tide is semidiurnal, maximum peak every 12 h with a mean tidal range of about 0.5m. The water depth in the high level tide from the bottom surface is about 0.90m and water depth in the low tide is about 0.30m.

The rainfall over the Red Sea is extremely small, mostly in the form of short duration winter showers, amounting to some 10 - 15mm/year (Morcos, 1970). A close relationship is observed between air and sea surface temperatures. Water temperature clearly reflects seasonal changes (summer: 28-29^oC, winter: 21-23^oC). In shallow area, higher values were measured due to solar radiation. In June 2001 all oceanographic parameters were measured in Safaga area (Table 1). Water temperature varies from 22 °C to 28.82 °C, salinity from 40.36 to 42.3 ‰, pH values between 7.07 and 8.34 , dissolved oxygen from 6.08 to 7.98 mg/l, total dissolved salts from 39.06 to 39.46 g/l, oxidation reduction potential between 390 and 429 mv, and specific conductivity from 61.5 to 61.73 ms/cm.

MATERIAL AND METHODS

Surface marine sediment samples were collected in summer 2001 for Safaga bay, depth of samples ranges from beach sediments to 34m below (Table 1 & Fig. 1). Thirty samples were collected either by grab sampler in deep water, or by hand at the beach at different distances from the shoreline and along it .

Oceanographic parameters that control the coastal features of the Red Sea, such as salinity, water temperature, pH and dissolved oxygen were determined on a sample of overlying seawater for each sample. Moreover, most of these parameters, especially water temperature (Temp.), pH, salinity (S), total dissolved salts (TDS), specific conductivity (Spc) dissolved oxygen (Do) and oxidation reduction potential (Eh) were measured in the summer 2001 (June) at each sample using Hydrolab Surveyor - 4 Model Instruments and data are summarized in table (1).

The obtained samples are investigated for their Ostracoda content. The bottom sediments are treated by normal washing techniques traditionally used for the extraction of ostracods in the micropaleontological laboratory of the U.S. geological survey and summarized by Sohn (1961) in the treatise (Moore eds., 1961). 100 gm of

the washed residue are inspected and the obtained taxa are counted and the results are introduced in table (2).

OSTRACOD ASSEMBLAGES

The distribution, occurrence and density of the recorded taxa led to the differentiation between three assemblages.

Biofacies I

This biofacies is recorded from the southern bay. It is the more dense and diversified one. This assemblage consists of the following species: *Xestoleberis rhomboidea*, *Xestoleberis rotunda*, *Loxocorniculum ghardaquensis*, *Loxoconcha sp.A*, *Moosella striata*, *Caudites levis*, *Neonsidea schulzi*, *Paranesides sp.*, *Leptocythere rara*, *Alocopocythere reticulata*, *Miocyprideis cf. spinulosa*, *Miocyprideis sp.*, *Tanella gracilis*, *Eucytherura complexa*, *Cytherelloidea sp. A*, *Aglaiocypris triebeli*, *Pontocypris sp. A*, *Thalmania sp.*, *Paracytheridea remanei*, *Cythereis ? rubrimaris*, *Cytherepteron sp.*, and *Cytherella cf. punctata*.

This association is dominated by six species: *Alocopocythere reticulata*, *Miocyprideis sp.*, *Aglaiocypris triebeli*, *Loxocorniculum ghardaquensis*, *Xestoleberis rhomboidea*, *Xestoleberis rotunda* and *Miocyprideis cf. spinulosa*. The former four species are very rare in the northern bay.

Furthermore, four species are restricted to biofacies I and are not recorded in the other associations. These species are *Leptocythere rara*, *Cytherelloidea sp.*, *Thalmania sp.* and *Caudites levis*.

Biofacies II

The biofacies II is localized in the northern bay, it is dominated by ten species: *Neonsidea schulzi*, *Loxocorniculum ghardaquensis*, *Xestoleberis rotunda*, *Loxoconcha ornatovalvae*, *Cythereis ? rubrimaris*, *Alocopocythere reticulata*, *Moosella striata.*, *Paranesidea sp.* and *Xestoleberis rhomboidea*. The following eight species are also present but with rare occurrences: *Cytherella cf. punctata*, *Cytherepteron sp.*, *Aglaiocypris triebeli*, *Tanella gracilis*, *Miocyprideis sp.*, *Paracytheridea remanei*, *Miocyprideis cf. spinulosa* and *Eucytherura complexa*.

Biofacies III

This biofacies is restricted to the channel connecting the two bays and bordered seaward by the Safaga Island. The community is generally poor and less

diversified. The density of the recorded species are don't exceed 4 carapaces, nine species are recorded by 2-4 carapaces: *Xestoleberis rhomboidea*, *Loxoconcha sp.A*, *Cythereis ?rubrimaris* , *Neonesidea schulzi*, *Paranesidea sp.*, *Alocopocythere reticulata*, *Miocyprideis cf. spinulosa* and *Agelaiocypris triebeli*.

There are also five species each represented by only one carapace: *Xestoleberis rhamboidea*, *Loxocorniculum ghardaquensis*, *Moosella striata*, *Paracytheridea remanei* and *Cytheropteron sp.*

ZOOGEOGRAPHY

Of the 23 Ostracoda species recognized from the Safaga Bay, the following 14 species are known to occur in the Persian Gulf, Abu Dhabi Lagoon: *Neonesidea schulzi* (Hartmann); *Paranesidea sp.* Bate; *Agelaiocypris triebeli* (Hartmann); *Cytherella cf. punctata* Brady, *Pontocypris sp.B* Bate, *Alocopocythere reticulata* (Hartmann); *Xestoleberis rhomboidea* Hartmann; *Loxoconcha sp.A* Bate ; *Cytherelloidea sp. A* Bate; *Carinocythereis cf. hamata* (Kingma); *Moosella striata* Hartmann; *Xestoleberis rotunda* Hartmann and *Thalmannia sp.* Bate. Whether these species migrated from the Red Sea to the Persian Gulf or vice versa is not know. It is more probable, of course, that the species entered both regions from the Indian Ocean independently (Bate 1970). Moreover, Bate (op. cit) noticed that some species common to the Persian Gulf and the Red Sea are also present in East Africa (off Bagamoyo, Tanzania). Several elements of Red Sea ostracodes are also related to, if not actually conspecific with, Cenozoic species described by Kingma (1948) from Indonesia; e.g.: *Tanella gracilis* Kingma from Safaga Bay is identical to *Tanella gracilis* Kingma, described from the Lower and Upper Pliocene of Sumatra and Java respectively. *Carinocythereis cf. hamata* (Kingma) present in Safaga Bay appears to be closely related to *Cythereis hamata* Kingma, recorded from the Lower Pliocene of Sumatra. *Cytherella cf. punctata* Brady, is close to *Cytherella punctata* Brady, described from the Lower Pliocene to Pleistocene of eastern Java.

A number of Safaga Bay ostracodes show affinities to Mediterranean or even cosmopolitan species: these species include *Leptocythere rara* (Mueller), *Miocyprideis cf spinulosa* (Brady), *Eucytherura complexa* (Brady), and *Tanella gracilis* Kingma . The presence of the Mediterranean fauna may be attributed to dispersal and migration. This may take place through passive migration, interesting

case in this category is that of *Potamocypris humilis* cited by Green (1961). This South African species is also found in rock pools on the south coast of Finland and Greenland, this is explained by the fact that both land masses lie along the migration route of the Arctic and Common Terns which overwinter in South Africa and suggests that *P. humilis* or its eggs may be carried by these birds (Neale 1964). A similar mechanism can be proposed for the study area. Several species of the European birds migrate to the Red Sea coast where they overwinter passing across the Mediterranean Sea. Moreover, ships may contribute in this context as the southern Safaga Bay is used as a harbour. Great number of ships move between Red Sea and Mediterranean Sea through the Suez Canal. According to Teeter(1973) man may inadvertently assist interoceanic dispersal through the Suez and Panama Canals by the use of water ballast during ship passage .The floating marine plants also play an important role and serve as another tool in passive migration .

TAXONOMIC DESCRIPTION

The present taxonomic work lead to the identification of twenty three species belonging to twenty one genera and fourteen families. Occurrence and ecology are given for each identified species. Table (2) shows the taxonomic list, the total numbers of the studied species, percentage and their occurrence.

Order: Podocopida Müller, 1894.

Suborder: Podocopina Sars, 1866.

Superfamily: Bairdiacea Sars, 1888.

Family: Bairdiidae Sars, 1888.

Genus: *Paranesidea* Maddocks, 1969.

Paranesidea sp Bate.

(Pl.1 , Fig. 1).

1970 *Paranesidea* sp.- Bate, P 246, Pl. 1, Fig. 1j.

Occurrence: The largest population of this species was obtained from samples no. 27, 24 and 6 (11, 7 and 6 carapaces respectively). It constitutes 2.893% of the studied ostracodes taxa.

Ecology: It is distributed in bottom sediments from sand to sandy silt at depths (17-33.5m). The oceanographic parameters are as follows: salinity ranges from 41.38 to 42.30‰; pH ranges from 7.07-8.18 and Eh from 392-401.

Zoogeography: Indian Ocean and Persian Gulf (Bate,1970).

Genus: *Neonesidea* Maddocks, 1969

Neonesidea schulzi (Hartmann)

(Pl. 1 , Fig. 2)

1964 *Triebelina schulzi* n.sp. Hartmann,p.44,pl.4,5,figs.14-22 .

1970 *Neonesidea schulzi* (Hartmann) – Bate, P. 246, Pl. 1, Fig. 1i.

Occurrence: This species attains its highest occurrence in samples no. 27 and 20 (7 & 6 carapaces respectively). It represents 2.81% of the total ostracodes taxa.

Ecology: This cosmopolitan species occurs in the northern bay sandy silt sediments at depths (25.4 - 33.5m), average value of ecological conditions are : salinity (41.51‰); pH (7.13) and Eh is (391).

Zoogeography: Indian Ocean and Persian Gulf (Bate,1970) .

Superfamily: Cypridacea Baird, 1845

Family: Paracyprididae Sars, 1923

Genus: *Agelaiocypris* Sylvester-Bradly, 1946

Agelaiocypris triebeli (Hartmann)

(Pl. 1 , Fig. 3).

1964 *Ghardaglaia triebeli* n. sp. Hartmann,p.41,pl.6-9,figs.23-40.

1970 *Agelaiocypris triebeli* (Hartmann) – Bate, P. 246, Pl. 1, Fig. 1w.

Occurrence: This species is widely distributed in the southern bay. The highest population is recorded from samples no. 1, 3 and 12 (36, 22 & 21 carapaces respectively). It constitutes 8.66% of the studied ostracodes species.

Ecology: It is recorded at depths (zero - 34m) from sand to mud bottom sediments. oceanographic parameters : salinity ranges from 40.96 to 41.36 ‰; pH have average value of 8.24 and Eh value ranges from 394 to 421.

Zoogeography: Indian Ocean and Persian Gulf (Bate,1970).

Family: Pontocyprididae Müller, 1894

Genus: *Pontocypris* Sars, 1866

Pontocypris sp. B Bate

(Pl. 1 , Fig. 4)

1970 *Pontocypris* sp.B-Bate,p.264,pl.1,fig.1h.

Occurrence: Rare specimens of this species were found in the southern bay from samples no. 1 and 3 (3 & 4 carapaces respectively). It represents 1.29% of the total ostracod fauna.

Ecology: This species was distributed in very shallow water muddy sand sediments at depth ranging from 5.3 to 10m. Ecological factors are as follows : salinity varies between 40.96 and 42.60 ‰; pH ranges from 6.88 to 8.21 and Eh varying from 421 and 390.

Zoogeography: Indian Ocean and Persian Gulf (Bate,1970).

Superfamily: Cytheracea Baird, 1850

Family: Leptocytheridae Hanai, 1957

Genus: *Leptocythere* Sars, 1927

Leptocythere rara (G.W. Müller)

(Pl. 1 , Fig. 5)

1894 *Leptocythere rara* n. - G. W. Müller, 1894, P. 355, T. 29, FF. 12 & 14.

1974 *Leptocythere rara* (G. W. Müller, 1894) - Ruggieri, P. 432, Fig. 5.

Occurrence: Few specimens were recorded from the southern bay in the samples no. 1 and 7 (3 & 11 carapaces respectively). It represents 1.06% of the total ostracod species.

Ecology: Dense population is found at depth 20m where its frequency increases in the muddy sand. Oceanographic parameters have average values of : salinity (41.34 ‰); pH (8.21) and Eh (400).

Zoogeography: Mediterranean Sea (Ruggieri, 1974).

Genus: *Tanella* Kingma, 1948

Tanella gracilis Kingma

(Pl. 1 , Fig. 6)

1973 *Tanella gracilis* Kingma -Teeter, P. 51, Fig. 2 i-p.

Occurrence: Rare specimens of this species were recorded from samples no. 1, 19 and 20 (1, 1 & 2 carapace). It represents 0.30% of the total ostracod taxa.

Ecology: The samples no.1 & 19 is beach samples while sample no. 20 is collected at a depth of 25.4m from sand to sandy silt bottom facies. Oceanographic parameters: average value of salinity is 41.5 ‰; pH (7.2) and Eh (391).

Zoogeography: Cosmopolitan (Teeter,1973).

Order: Podocopida Müller, 1894

Suborder: Podocopina Sars, 1866

Superfamily: Cytheracea Baird, 1850
Family: Hemicytheridae Puri, 1953
Subfamily: Orionininae Puri, 1974
Genus: *Caudites* Coryell & Fields, 1937

Caudites levis Hartmann

(Pl.1 , Fig.7)

1964 *Caudites levis* n. sp. Hartmann, P. 117, Pl.55, Fig. 311-316.

Occurrence: This species is rare and only recorded in the sample no 1 (two carapaces). It represents 0.15% of the total ostracod species.

Ecology: It is recorded from the beach sediments of the southern bay.

Zoogeography: Red Sea (Hartmann,1964).

Family: Campylocytheridae Puri, 1960

Genus: *Alocopocythere* Siddiqui, 1971

Alocopocythere reticulata (Hartmann)

(Pl. 1 , Fig. 8)

1964 *Bradleya reticulata* n.sp.Hartmann,p.108,pl.46,fig.269;pl.47-49,figs.274-288 .

1970 *Alocopocythere reticulata* (Hartmann) – Bate, P. 246, Pl. 1, Fig. 2PP.

Occurrence: This species is widely distributed in the southern bay and the more dense population is recorded from samples no. 7 and 15 (44 & 19 carapaces respectively). It constitutes 12.54% of the studied ostracode species.

Ecology: Exceptional dense population of this species is recorded from sample no. 7 in muddy sand sediment at water depths (25.7 - 26.9m). Average value of salinity (41.36 ‰); pH (8.19) and Eh (398) .

Zoogeography: Indian Ocean and Persian Gulf (Bate,1970).

Family: Cytherideidae Sars, 1925

Subfamily: Cytherideinae Sars, 1925

Genus: *Miocyprideis* Kollmann, 1960

Miocyprideis cf. spinulosa (G. S. Brady)

(Pl.1 , Fig. 9)

1868 *Cytheridea spinulosa* n. sp. G. S. Brady, P. 182-183, Pl. 8, Fig. 1-6.

1880 *Cytheridea spinulosa* G. S. Brady, P. 112, Pl. 33, Fig. 6a-d.

1960 *Miocyprideis spinulosa* (Brady)-Kollmann, P.178, Pl.18, Figs.12-13, Pl. 19, Fig.16.

1971 *Miocyprideis cf. spinulosa* (G. S. Brady)-Gramann,P.124,Pl.15,Figs.8-10.

Occurrence: This cosmopolitan species was found in the southern bay from the samples no. 9, 12 and 7 (17, 14 & 12 carapaces respectively). It represents 6.23% of the total ostracod species.

Ecology: This species is recorded from muddy sand facies at depth averaging 25.7m. Oceanographic parameters : salinity; pH and Eh are 41.37 ‰; 8.24 and 397 respectively.

Zoogeography:Cosmopolitan (Kollmann,1960 ; Gramann,1971).

Miocyprideis sp.

(Pl.1 , Fig. 10)

Description: Carapace of medium size, about 0.7mm length. Subrectangular in lateral view, both ends well rounded. Dorsal margin nearly straight, ventral outline slightly convex. Anterior and posterior margins very weakly denticulated. Left valve slightly larger than right valve and overlaps it ventrally, surface pitted.

Internal features : Not accessible.

Occurrence: Few numbers of the species are found in the southern bay from the samples no. 7, 9, 11 and 12 (3, 5, 7 & 9 carapaces respectively). It constitutes 2.13% of the studied ostracodes species.

Ecology: It is recorded from muddy sand bottom sediments at depth of about 25.7m. The value of salinity (41.39‰); pH (8.27) and Eh (397).

Zoogeography: Red Sea.

Family: Cytheruridae Müller, 1894

Subfamily: Cytherurinae Müller, 1894

Genus: *Eucytherura* Müller, 1894

Eucytherura complexa (Brady)

1985 *Eucytherura complexa* (Brady)–Guillaume et al., P. 352, Pl. 104, Figs. 5-6.

Occurrence: This species is rare and its occurrence didn't exceed two carapaces in any samples (e. g. sample no. 2, 13 and 20). It represents 0.99% of the total ostracod taxa.

Ecology: It is found in bottom sediments from sand to sandy silt at depths (2 - 25.4m). The measured Ecological factors are : salinity ranges from 40.46 to 41.50 ‰; pH from 7.2 to 8.22 and Eh varies from 391 to 429.

Zoogeography: **Mediterranean** Sea (Guillaume et al.1985).

Subfamily: Cytheropterinae Hanai, 1957

Genus: *Cytherepteron* Sars, 1866

Cytherepteron sp.

Description: **Carapace** small to medium size, inflated with ventral swelling. Caudal process pronounced and acuminate. Lateral view oval with two subcentral to posteroventral, tapering wings.

Internal Features: Not accessible.

Occurrence: Few **specimens** of this species were recorded in the studied area. The highest population (only two carapaces) is recorded from samples no. 12, 13 and 16. It constitutes 1.06% of the studied ostracode species.

Ecology: This species is found in the very fine sand to muddy sand bottom sediments at a depth range of 7-34m, while salinity (41.36 – 41.51‰); pH (8.08-8.32) and Eh (394 - 406).

Zoogeography: Red Sea.

Family: Cytheridea Baird, 1850

Subfamily: Loxoconchinae Sars, 1825

Genus: *Loxoconcha* Sars, 1866

Loxoconcha sp. A Bate

(Pl. 1 , Figs.11,12)

1970 *Loxoconcha* sp.A Bate, P. 246, Pl. 1, Fig. 1 , 1 .

Occurrence: This **species** is widely distributed in the studied area, the highest population of this species is recorded from samples no. 20 and 6 (29 & 18 carapaces respectively). It represents 7.22% of the total ostracod taxa.

Ecology: This species occurs commonly at depths ranges from 17 to 25.4m in the bottom facies varying from sandy silt to muddy sand. Oceanographic parameters: salinity between 41.38 and 41.50‰; pH from 7.20 to 8.18 and Eh ranges from 391 to 401.

Zoogeography: Indian Ocean and Persian Gulf (Bate, 1970).

Genus: *Loxocorniculum* Benson and Coleman, 1963

Loxocorniculum ghardaquensis (Hartmann)

(Pl. 1 , Fig. 13)

1964 *Loxoconcha ghardaquensis* n.sp.Hartmann,p.52,pl.15,figs.67-72;pl.16,figs.73-76;pl.17,figs.77-79;pl.18,figs.80-82.

1970 *Loxocorniculum ghardaquensis* (Hartmann) – Bate, P. 254.

Occurrence: Moderate numbers of this widely distributed species occurs in the southern bay while rare numbers were found in the northern bay. The highest population of this species was recorded from samples no. 13, 2 and 1 (19, 14 & 11 carapaces respectively). It constitutes 5.85% of the studied ostracod species.

Ecology: It occurs in very shallow water at depths between (2 - 7m) and increases in the very fine sand. Ecological values : salinity ranges from 40.46 to 41.36 ‰; pH varies between 8.08 and 8.22, and Eh from 406 to 429.

Zoogeography: Red Sea (Hartmann,1964).

Family: Trachyleberididae Sylvester-Bradley, 1948

Subfamily: Trachyleberidinae Sylvester-Bradley, 1948

Genus: *Carinocythereis* Ruggieri, 1956

Carinocythereis cf. *hamata* (Kingma)

(Pl.1 , Fig.15)

1970 *Carinocythereis* cf. **hamata** (Kingma)-Bate, P. 246, Pl. 1, Fig. 1y.

Occurrence: This species is only recorded in the channel connecting between southern and northern bays from sample no.18 (4 carapaces). It constitutes 0.30% of the studied ostracod species.

Ecology: It is found in muddy sand sediments at a depth of 16.5m. The salinity; pH and Eh are 41‰; 8.13 and 393 respectively.

Zoogeography :Indian Ocean and Persian Gulf (Bate,1970).

Carinocythereis rubrimaris(Hartmann)

(Pl. 1 , Fig. 14)

1964 *Cythereis* ? *rubrimaris* n.sp.Hartmann,p.115,pl.54,figs.306-310;pl.56,figs.317.

Occurrence: Moderate numbers of this species were found in the studied area and the highest population were recorded in the southern bay from samples no. 2 and 7 (21 & 8 carapaces respectively). It represents 5.40% of the total ostracod taxa.

Ecology: The oceanographic parameters of this species are: salinity (40.46 - 41.34‰); pH (8.22); Eh (400 – 429) and its habitat varies from sand to muddy sand sediments at depths of about 25.7m.

Zoogeography: Red Sea (Hartmann,1964).

Genus: *Moosella* Hartmann, 1964

Moosella striata Hartmann

(Pl. 1 , Fig. 16)

1964 *Moosella striata* n. sp. Hartmann, pl.46, figs.270-273; pl.50-51, figs.289-297.

Occurrence: This species is found in moderate numbers from the studied area, the highest population is recorded from samples no. 2, 12, 13 and 25 (20, 17, 10 & 10 carapaces respectively). It represents 8.74% of the total ostracod taxa.

Ecology: It is common in the bottom facies that varies from sand to mud at depths between 2-34m; the average values of the physical conditions are salinity (41.32‰); pH (7.99) and Eh (405).

Zoogeography: Red Sea (Hartmann, 1964).

Genus: *Thalmannia* Le Roy, 1939

Type species: *Thalmannia sumatraensis* Howe, 1951

Thalmannia sp. Bate

1970 *Thalmannia* sp. Bate, P. 246, Pl. 1, Fig. 2x.

Occurrence: This species is generally rare and is represented by only one carapace from each of the samples no. 6 and 7 in the southern bay. It constitutes 0.30% of the studied ostracodes species.

Ecology: It is found in muddy sand sediment at depths between 17-20m and the ecological parameters are: salinity 41.36‰; pH and Eh 8.19 and 400.

Zoogeography: Persian Gulf (Bate, 1970).

Family: Paracytherideidae Puri, 1957

Subfamily: Paracytherideinae Puri, 1957

Genus: *Paracytheridea* G. W. Müller, 1894

Paracytheridea remanei Hartmann

1964 *Paracytheridea remanei* Hartmann, p.65, pl.23, figs.114-120; pl.24, figs.121-124.

Occurrence: Rare specimens of this species were found in the studied area from samples no. 18, and 19 (one carapace each) and sample no. 16 (two carapace). It represents 0.30% of the total ostracod taxa.

Ecology: It is recorded rarely in muddy sand at depths between (0 – 28.8m), the average values of physical parameters are: salinity (41.25‰); pH (8.23) and Eh (393)

Zoogeography: Red Sea (Hartmann, 1964).

Family: Xestoleberididae Sars, 1928

Subfamily: Xestoleberidinae G. O. Sars, 1928

Genus: *Xestoleberis* G. O. Sars, 1866

Xestoleberis rhomboidea Hartmann

(Pl.1, Fig. 17)

1964 *Xestoleberis rhomboidea* n.sp. Hartmann, p.75,pl.32,33,figs.177-186 .

1970 *Xestoleberis rhomboidea* Hartmann-Bate,p.246,pl.1,fig.1,b; pl.2,fig.1,2 b.

Occurrence: This species is one of the most common species and nearly present in all samples The highest population is found in samples no. 12 and 20 (62 & 33 carapaces). It constitutes 20.97% of the studied ostracod species.

Ecology: This species represent the most abundant species of genus *Xestoleberis* and occurs commonly in bottom facies from sandy gravel to mud at depths (0 - 34m); The ecological parameters are : salinity ranges from 40.36-42.30‰; pH varies between 7.07 – 8.34; Eh ranges from 391 to 401.

Zoogeography: Indian Ocean,Red Sea and Persian Gulf (Hartmann,1964 ;Bate,1970)

Xestoleberis rotunda Hartmann

(Pl. 1, Fig. 18)

1964 *Xestoleberis rotunda* n.sp. Hartmann,p.81,pl.24,figs.162-163; pl.29,figs.156-161; pl.28,figs.154,155 .

1970 *Xestoleberis rotunda* Hartmann-Bate, P. 246, Pl. 1, Fig. 1c.

Occurrence: This is a widely distributed species, and the more dense population is recorded from samples no. 12, 7 and 3 (20, 13 & 13 carapaces respectively) which represents 7.83% of the total ostracod taxa.

Ecology: This species occurs commonly in fine sand to muddy sand facies at water depths (5.3-34m). Oceanographic parameters values are as follows : salinity from 40.96 to 41.50‰ ; pH from 7.20 to 8.21 and Eh value between 394 and 421.

Zoogeography: Indian Ocean, Red Sea and Persian Gulf (Hartmann,1964 ;Bate,1970)

Suborder: Platycopina Sars, 1866

Family: Cytherellidae Sars, 1866

Genus: *Cytherella* Jones, 1849

Cytherella cf. punctata Brady

(Pl. 1 , Fig.19)

1970 *Cytherella cf. punctata* Brady – Bate, P. 246, Pl. 1, Fig. 1u.

Occurrence: This species is represented by few carapaces in samples no. 7 and 12 (8 & 9 carapaces respectively). It constitutes 2.81% of the studied ostracodes species.

Ecology: It is found in muddy sand at depths between 20 – 33.4m. The average values of salinity; pH and Eh are 41.35‰; 8.24 ; and 403 respectively.

Zoogeography: Cosmopolitan (Bate,1970).

Genus: *Cytherelloidea* Alexander, 1929

Cytherelloidea sp. A Bate

(Pl. 1 , Fig. 20)

1970 *Cytherelloidea* sp. A Bate, P. 246, Pl. 1, Fig. 1s.

Occurrence: This species was represented from southern bay by only one carapace in samples no. 3 and 4. It is found rarely in muddy sand facies at shallow depths (5.3 – 10m). It represents 0.15% of the total ostracod taxa.

Ecology: It is found in muddy sand facies at shallow depths (5.3-10) .The ecological parameters are as follows: Salinity (40.96 – 41.13‰); pH (8.21 – 8.23) and Eh (413 – 421).

Zoogeography: Red sea and Persian Gulf (Bate,1970).

ECOLOGICAL IMPLICATIONS

The analysis of the ecological parameters controlling the ostracodes distribution is based on the study of their occurrences and the measured parameters. According to physical data, the average temperature of sea water during the collection of the studied samples in Safaga bay was between 24-22 °C. The water salinity of the investigated area is high with an average value of 40.08‰. Both pH and Eh data show that the Safaga bay is slightly alkaline, where pH ranges from 7.07 to 8.34 since the pH value is affected greatly by the photosynthetic activity of the flora, the water temperature and the amount of organic constituents in sea water, while the Eh indicate that the conditions of the sea water in the area under study are oxidizing and ranging between 390 – 429mv. Dissolved oxygen is affected by several factors such as: the temperature, the amount of organic matter, respiration of animals and plants and the photosynthetic activities in the marine ecosystem (Doaa, 1993). Dissolved oxygen in the studied area varies from 6.08 to 7.98 mg/L. Table (1) shows low values of Do in the southern bay compared to the northern bay. This may be due to the presence of algae and seagrass beds in the southern bay. Specific conductivity fluctuate around 61 ms/cm in all studied samples. Generally, the ecological data indicate that Savage Bay is a shallow, warm, slightly alkaline , hypersaline, and oxidizing marine environment .

SUMMARY AND CONCLUSIONS

The main results of this work can be summarized as follows:

- 1- The work is the first trial to study the recent ostracodes of the recent marine sediments in Safaga Bay.
- 2- Twenty-three species belonging to 21 genera, 14 families and 2 suborders are recorded, systematically studied and scanned .
- 3- Within the studied area three biofacies were distinguished The highest community of ostracod taxa are recorded in the southern Safaga Bay, which represent biofacies I. The poorer one was recorded from the chanell connecting the northern and southern bays .
- 4- The measured ecological parameters indicate that Safaga Bay is shallow marine , warm, slightly alkaline ,hypersaline and oxidizing environment .
- 5- Beside the main Indian fauna, some Mediterranean and cosmopolitan faunal elements are noticed, this is attributed to passive migration.

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Table 1. Oceanographic parameters measured in June 2001 at different localities of Safaga Bay.

Sample No.	Depth in meter	Temp. °C	Bottom Facies	Salinity ‰	Do mg/L	pH	TDS g/L	Eh mv	SPC Ms/cm
1	beach	-	Sandy Gravel	-	-	-	-	-	-
2	2.0	25.75	Sand	40.46	6.90	8.22	38.66	429	60.39
3	5.3	25.83	Fine sand	40.96	6.23	8.21	39.06	421	61.69
4	10	28.78	Muddy sand	41.13	6.45	8.23	39.23	413	61.22
5	15	25.78	Muddy sand	41.21	6.71	8.28	39.29	407	61.38
6	17	25.75	Muddy sand	41.38	6.55	8.18	39.32	401	61.44
7	20	25.71	Muddy sand	41.34	6.50	8.21	39.38	400	61.49
8	24	25.71	Muddy sand	41.35	6.50	8.22	39.39	401	61.50
9	28	25.69	Muddy sand	41.40	6.61	8.25	39.41	394	61.56
10	27	25.79	Muddy sand	41.45	6.33	8.34	39.45	394	61.66
11	30	25.75	Mud	41.47	6.08	8.34	39.46	394	61.67
12	34	25.69	Mud	41.36	6.56	8.28	39.42	394	61.54
13	7.0	26.10	V. F. Sand	41.36	6.29	8.08	39.41	406	61.55
14	14	25.90	Muddy sand	41.38	6.36	8.17	39.40	397	61.56
15	30	26.90	Mud	41.38	6.36	8.17	39.41	397	61.56
16	16	28.82	Muddy sand	41.51	6.27	8.32	39.41	394	61.73
17	34	25.69	Mud	41.40	6.61	8.25	39.41	394	61.56
18	16.5	23.00	Muddy sand	41.00	6.56	8.13	39.39	393	61.65
19	beach	-	Gravelly sand	-	-	-	-	-	-
20	25.4	27.50	Sandy Silty	41.50	7.55	7.20	39.38	391	61.66
21	27.2	27.50	Sandy Silty	41.60	7.24	7.10	39.39	392	61.44
22	29.2	22.20	Sandy Silty	41.78	7.11	7.27	39.38	392	61.54
23	26.5	23.50	F. Sand	41.91	7.68	7.40	39.29	393	61.65
24	15.5	22.00	Sand	42.30	7.12	8.05	39.37	394	61.70
25	26.4	23.5	F. Sand	42.11	7.84	7.41	39.38	391	61.64
26	30.7	22.40	Sandy Silty	41.89	7.71	6.88	39.39	390	61.66
27	33.5	22.00	Sandy Silty	41.53	7.64	7.07	39.37	392	61.61
28	21.7	23.00	F. Sand	42.30	7.55	8.10	39.35	394	61.56
29	15.5	23.00	Sandy Silty	42.30	7.12	8.13	39.37	393	61.54
30	33.4	23.00	Silt	41.65	7.98	7.55	39.39	393	61.66
Min.		22.00		40.36	6.08	7.07	39.06	390	61.50
Max.		28.82		42.30	7.98	8.34	39.46	429	61.73
Aver.		24.22		40.08	6.63	7.66	37.98	384.3	59.41

Explanation of plate 1

- Fig.1 :*Paranesidea* sp. Bate,1970 ;LVC, sample no.18 .
Fig.2 :*Neonesidea schulzi* (Hartmann,1964); LVC ,sample no.16 .
Fig.3 :*Aglaiocypris triebeli*(Hartmann,1964) ; LVC ,sample no.12 .
Fig.4 :*Pontocypris* sp. B Bate,1970; LVC ,sample no. 3 .
Fig.5 :*Leptocythere rara* (Mueller,1894) ,LVC ,sample no. 7 .
Fig.6 :*Tanella gracilis* Kingma,1948 ; LVC, sample no.19.
Fig.7 :*Caudites levis* Hartmann,1964 ; LVC , sample no. 1 .
Fig.8 : *Alocopocythere reticulata* (Hartmann,1964) ;RVC ,sample no.7
Fig.9 :*Miocyprideis cf spinolusa* (Brady,1868) ;RVC ,sample no. 9
Fig.10 :*Miocyprideis* sp. ;RVC, sample no. 9
Fig.11 :*Loxoconcha sp.A* Bate,1970 ;LVC ,sample no. 6 .
Fig.12 :*Loxoconcha sp.A* Bate,1970;IRVC ,sample no.6 .
Fig.13 :*Loxocorniculum ghardaquensis* (Hartmann,1964) ;LVC ,sample no.13 .
Fig.14 :*Carinocythereis rubrimaris* (Hartmann,1964) ;RVC ,sample no.7 .
Fig.15 :*Carinocythereis cf. hamata* (Kingma,1948) ;RVC, sample no.18 .
Fig.16 :*Moosella striata* Hartmann,1964 ;RVC; sample no.2 .
Fig.17 :*Xestoleberis rhomboidea* (Hartmann,1964) ; RVC ,sample no. 12 .
Fig.18 :*Xestoleberis rotunda* Hartmann,1964 ;LVC ,sample no 7.
Fig.19 :*Cytherella cf. punctata* Brady,1868 ;LVC, sample no. 7 .
Fig.20 : *Cytherelloidea* sp.A Bate,1970 ;RVC ,sample no. 3 .

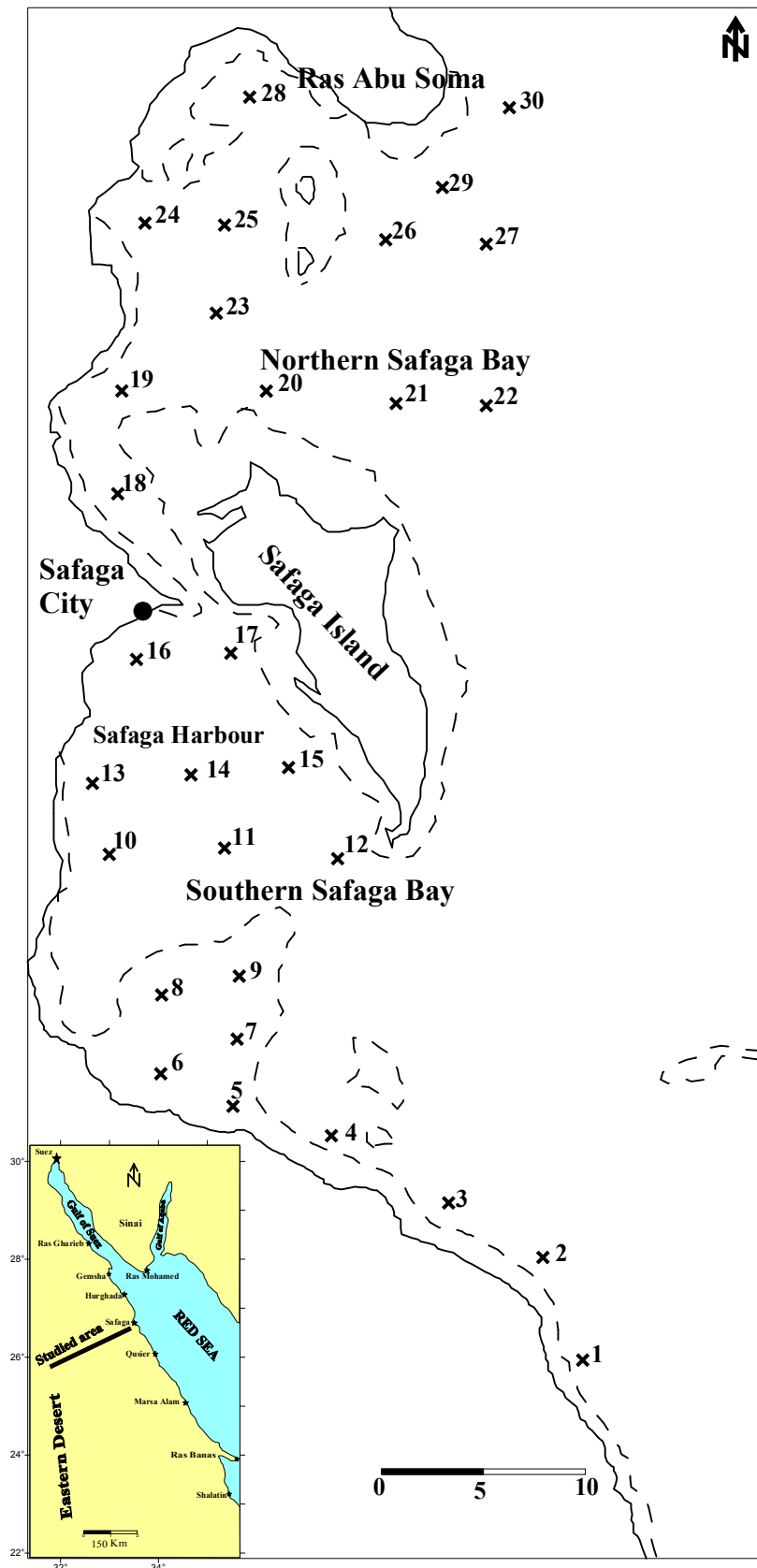


Fig. (1). Location map.



Fig. (2). The studied ostracodes samples have been collected from loose sediments at northern Safaga bay.



Fig. (3). The studied ostracodes samples have been collected from loose sediments at southern Safaga bay.