Environmental Applications of Marine Ostracoda in the Faw town south of Iraq

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Abstract

In this paper, we present surface and subsurface sample from 50 cm by using grab instrument to 21 m by diver variations of Ostracoda assemblage from 15 samples 5 shallow whereas 10 subsurface along Arabian gulf at Faw (Kaser Al- muge) in the Basrah city south of Iraq, Surface and subsurface sediments variation in Ostracoda assemblage. Totally 15 sample were sorted under the binocular microscope Fifty-one species of the Ostracoda taxa belonging to 21 genera, 4 subfamilies, 17 families, 8 super families and 4 suborders have been identified. The variation of Ostracoda with depth revealed the abundant occurrence of *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* in the all samples are predominant while the rest genus and species it is available in varying percentage. The predominant genera of the surface sample indicating to tidal and marine environments with low saline and mud flat condition while the other genus and species in the all sample are an indicating to marine environment, high saline conditions, in addition that environments change and sea level change. Earlier work on Ostracoda along al-faw beach has been carried out by sampling surface and subsurface sediments from marine shelf and upper slope for understanding recent Ostracoda assemblages and Systematics. The grain size analysis and organic matter also are determined.

Keywords: Ostracoda assemblage, Al Faw beach, Kaser Al-muge, Grain size and Organic matter, South of Iraq, Marine Environments

Introduction

(Kaser al-amuge) in al-faw beach in south of Iraq are one of the most important study area, geographical units and form a complex ecological system. Therefore, paleontological and sedimentary studies are an important study in determining sedimentary environments based on specific types of invertebrate fossils (Ostracoda). Ostracoda has received great an importance in determining environments in different geological ages, including the modern era , is an important class of crustaceans in the phylum Arthropoda, and is characterized by a bivalve carapace, a laterally compressed body, and two right and left valves that are connected to each other in the dorsal region is by the joint line, and the Ostracoda has a long geological range, as it was found in sediments ranging in age from the Upper Cambrian to the modern era (Al- Mashlab and Mohammed ,2012;Al-Ali et al., 2020; Al-Shawi et al., 2019). Ostracoda are found in almost all mixed aquatic environments (marine, brackish, fresh) and are characterized by their large numbers. Few of them live on the surface of the water and others spread throughout the water column. A large number of their species are benthic and their spread is affected by salinity, temperature, substrate texture and depth. Ostracoda are of great importance in stratigraphic comparison and identification of the ancient environment and ancient geography. They have also been used as an important tool in oil exploration and in environmental pollution studies (Al-Hilli, 1977). During the late Holocene, the flood plain sediments of South Iraq were greatly influenced by irrigation artificial marine environments and were generally contaminated with reworked sands and silts, which were transported by irrigation water (Al- Mashlab and Mohammed ,2012). The sediments area composed of sand, silt and clay where the silt percentage is dominant, and the size of sand is very fine. There is a characteristic gray dark thin layer of silty clay at a depth between 16-17 m, indicating the disappearance of fossils, this was represented by a pyritization and this layer may represent the upper-part of Al-Hammar formation (Sabah, 2010).

Study Area

Choice of the area and the purpose of study of Al- Faw (Kaser Al-muge) for Ostracoda studies for the following resean, the essential facilities such as motor launch, mud grab, water sampler, etc for collection the sampler, so far the ecological studies of Ostracoda fauna from the Al- Faw (Kaser Al-muge) area have not been undertaken whereas the purpose of the study is the Ostracoda fauna of Al- Faw (Kaser Al-muge) to determine the distribution Ostracoda assemblage and to attempt their distribution with observed environment and evaluate the ecology of the widespread and abundant Ostracoda taxa.

The study area is investigation in south of Iraq, Al- Faw (Kaser Al-muge). Fig (1,2 and 3) and Table (1) by using UTM GIS (Universal Transverse Mercater). The systematics of Recent Ostracoda fauna depending on the sediment sample and this work include many stations in the Basrah city, Al- Faw (Kaser Al-muge), 5 surface by crab at 50 cm and 10 subsurface (Down sample sediment) by diver at 21m. The study area lies in the south of the Mesopotamia (Tectonically). It is one of the important areas for geological studies, which is represents the largest water in Iraq.

Fig. (1): Location of the study area in south of Iraq, Basrah, Al-Faw beach. Eastern breakwater, western breakwater and inner basin.

Table (1): Location of the study area (TP 01 to TP 06) in the (Al- Faw-Kaser Al-muge)

Name (Tern Point)	X (Longitude)	Y(Latitude)
TP 01	253379.8024	3308055.293
TP 02	251364.341	3310736.183
TP 03	240570.6423	3319262.927
TP 04	233964.1125	3323563.385
TP 05	222545.9978	3326135.924
TP 06	206223.3991	3327520.188

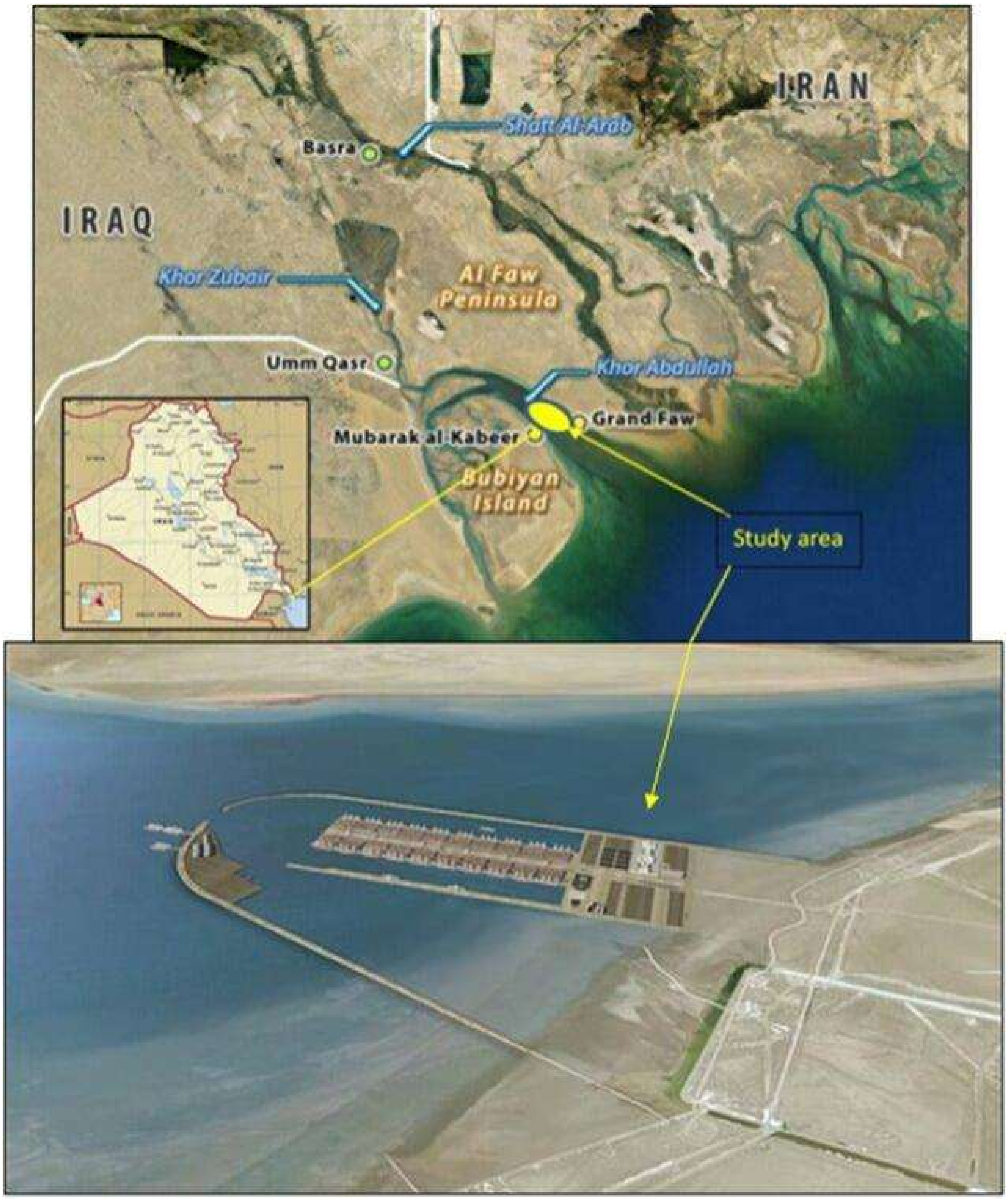

Fig. (2): Location of the study area in south of Iraq, Basrah, Al-Faw beach. Eastern breakwater, western breakwater and inner basin.

Methodology (Materials and Methods)

A total 15 sediment samples were collected for two different location surface and subsurface in June 2024 the coastal and marine environments of the study area along al-faw coastal in Basrah (kaser al-muge), South of Iraq. The surface sediments sample by author herself taking necessary precautions, making use of samples collected at depth 50 cm Petern grap (Betjeman, 1969), and the down-sample or subsurface by the diver is collected sediment samples in depth 21 m. Extreme care was taken to retrieve the sediment sample from sites that are not presently affected by the modern-day tidal processes. All the sediments samples collected from study area were brought to the laboratory and recorded the details such as colour, nature of the sediment, associated materials like shell fragments of the gastropoda, pelecypoda, wood piece, coal fragment etc. A part from sample location, depth and environment were also noted before taking up for analysis. Cutting and weighed by the balance, and we took from all the samples 50 grams. The sample was thoroughly washed and air dried. Sodium hexamet phosphate solution of 0.025 normally was used to disintegrate the flocculated clay particles and dissolved any minor salt that might have been looked up in between the finer grains (Shepared and Moore, 1955; Barnes,1959 and Jayraju, 1993). For extracting Ostracoda, the fossils samples were washed through an ASTM 230 mesh sieve (opening 0.063 mm) to remove the finer (silt and clay -Mud) particles for examination under the stereo binocular microscope. The residue which included sand and fossils were put in ceramic eyelid and dried in an oven at 50°C to 60°C. Benthic Ostracoda specimens were picked and then separated from the residue under binocular microscope by using 0.001mm Winder and Newton sable hairbrush. The Ostracoda were spread carefully were transferred to a single and 24-chamberd card board micro faunal slide and thus dully indexed on one slide of the slide. The typical of species picked out from the slide are kept in multichambered slide to prepare slide. From these, every species is identified and selected by binocular microscope and to generic and species in the level TP 01, TP 02, TP 03, TP 04, TP 05 and TP 06 were processed for Ostracoda study (Fig. 3 and Table (1)). The species were identified and arranged according to the classification proposed by (Moore and Pitrat, 1961 and Harthman and Puri, 1974). All species have been housed in the Paleontology Laboratory, Department of Geology, College of Science, Basrah University.

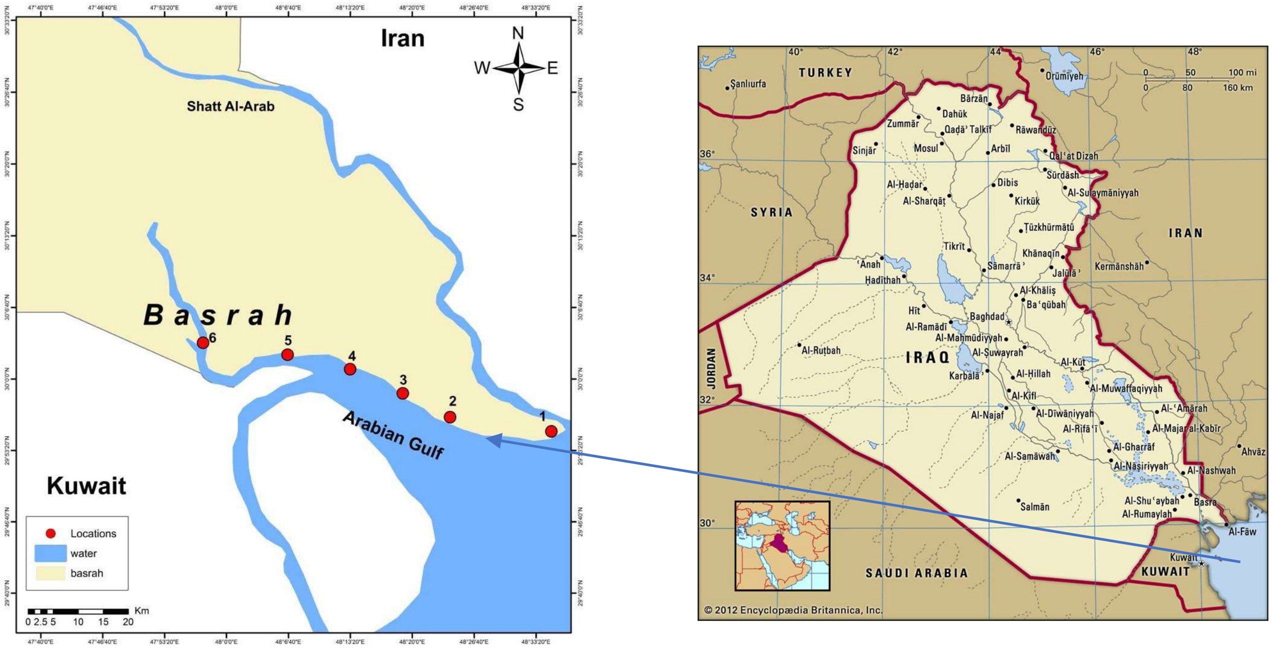

Fig. (3): Location of the study area in south of Iraq ,Basrah, Al-Faw beach, the six sites (TP 01 to TP 06)

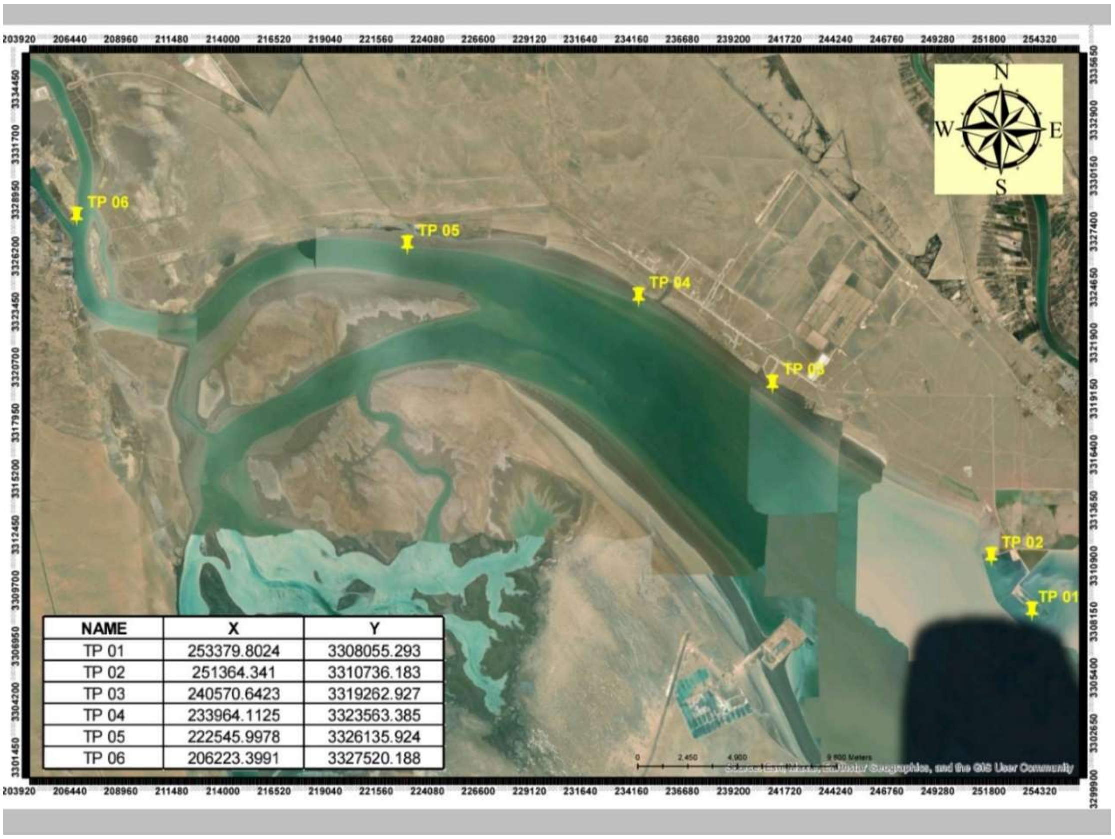

Fig. (4): Location of the study area in south of Iraq ,Basrah, Al-Faw beach, the sediment samples (TP 01 to TP 06)

Results

1.Grain size analysis

Sand-silt-clay ratio estimation:

The off-shore shallow water sediments are, in general, composite types consisting of particles of sizes ranging from sand to clay with their different combinations. In order to find out the percentages of sand, silt, and clay, first, each sample was completely dried in a hot-air oven to eliminate the moisture content. Then, a suitable quantity of each sample was dispersed overnight with a 0.025 N sodium hexametaphosphate solution for disaggregation. The material thus disaggregated was washed through a 230 ASTM sieve mesh (opening = 0.063) made of phosphor-bronze wire mesh until clear water passed through, taking care that the washings did not exceed 1000 cc. The material retained on the sieve was dried and weighed to obtain the weight of the material coarser than 1/16 mm, i.e., sand the fine material (silt and clay) in the washings was analyzed by the pipette method in accordance with the procedure adopted by (Krumbein and Pettijohn, 1938). The suspension passing through the sieve was collected in a 1-liter graduated measuring jar. If the suspension collected in the jar, after complete washing, is less than 1000 cc, the already prepared sodium-hexametaphosphate solution was added to make it up to 1000 cc. The suspension in the measuring jar was well agitated using a stirring device in order to have a uniform distribution of the particles in the suspension. As soon as the agitation stopped, the time was noted. Exactly after 2 hours and 3 minutes, a 20-cc pipette was slowly inserted up to a depth of 10 cm into the solution, and the sample was withdrawn from the place with uniform suction. The pipetted-out sample was transferred to a 50-cc beaker and dried in an oven. Care was taken to prevent boiling and splitting. After complete drying, the weight of the residue was found out. The respective weights of sand, silt, and clay were converted into weight percentages and plotted on a trilinear diagram. (Trefethen's, 1950) textural nomenclature has been used to describe the sediments in the present study. The percentage distribution of sand, silt and clay proportions of the sediments for surface and subsurface sample are plotted on the triangular by (Folk, 1974) (Fig. 5). From the plot sediments have been classified for each region in the coastal and marine environments, the percentage sediment texture is given below. Table (2) show the percentages of sediment components of clay, silt and sand for al- faw beach. The results clearly indicate that the sediments are mainly composed of silt for regions. We also note the presence of a difference in the percentage of sediment components of clay and sand. The sand percentage was low in areas, ranging in al faw beach (eastren kaser al-muge) between 8-39, with the highest value recorded at a depth of sample station 5 and the lowest value at a depth of station 9. In (western kaser al-muge), its clay ranged between 14-25 percentage, with the highest value recorded at a depth of station 4, and the lowest value recorded at station 12.

Table (2): Results of volumetric analysis using the Pipette method according to (Folk, 1974) and percentages of sediment components of clay, silt and sand in (kaser al-muge)

No.	Sample name	Sand%	Silt%	Clay%	Particle Size Distribution Classification
1	1	20	61	19	slightly clayey sandy silt
2	2	25	56	19	Slightly clayey sandy silt
3	3	23	59	18	slightly clayey sandy silt
4	4	12	63	25	slightly sandy clayey silt
5	5	39	44	17	slightly clayey sandy silt
6	15	13	66	21	slightly sandy clayey silt

7	6	21	62	17	slightly clayey sandy silt
8	7	18	67	15	slightly sandy slightly clayey silt
9	8	8	70	22	slightly sandy clayey silt
10	12	14	62	24	slightly sandy clayey silt
11	10	14	65	21	slightly sandy clayey silt
12	11	25	61	14	slightly clayey sandy silt
13	13	11	64	25	slightly sandy clayey silt

14	14	16	62	22	slightly sandy clayey silt
15	9	17	68	15	slightly sandy slightly clayey silt

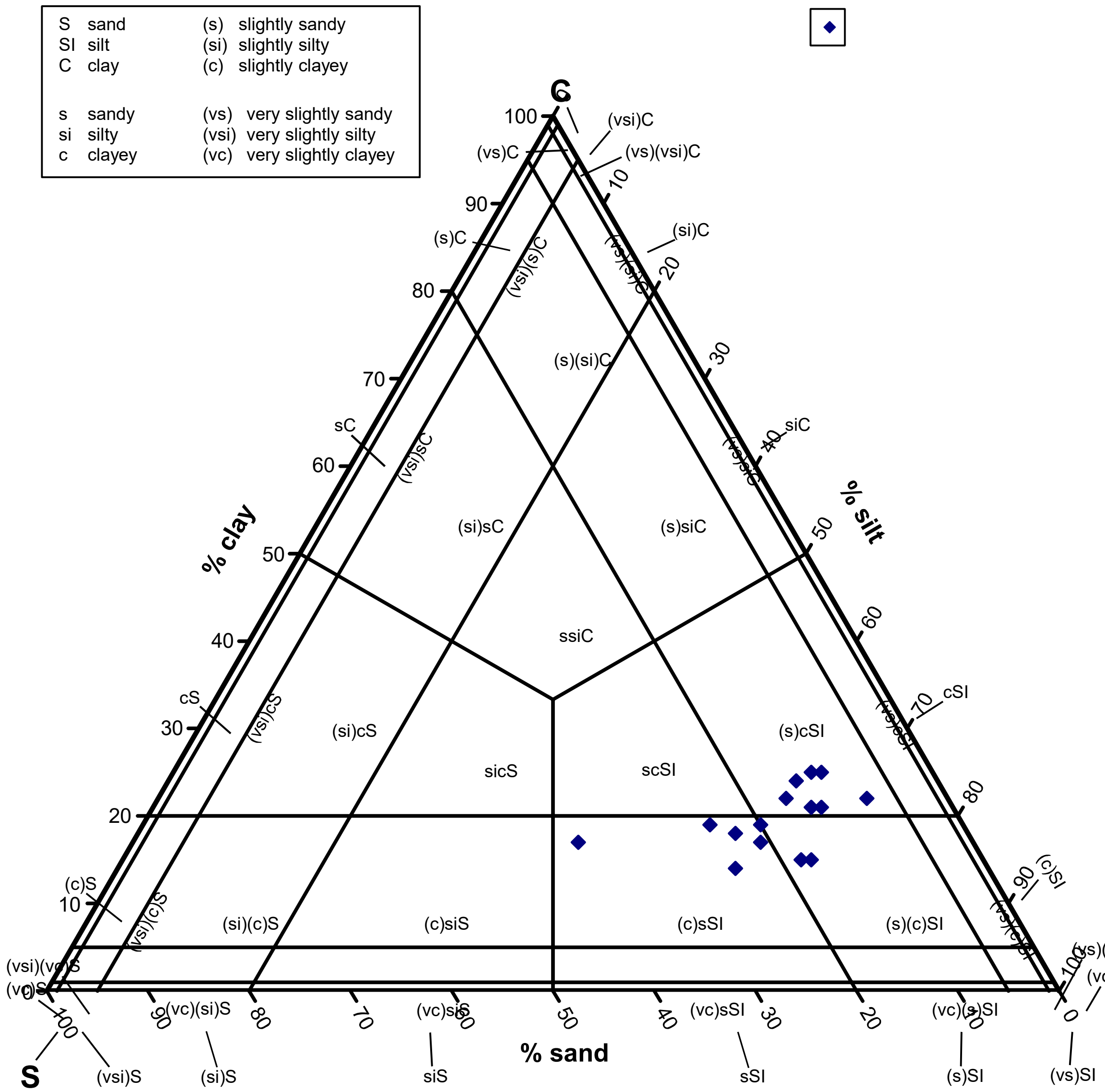

Fig. (5): Grain size analysis in study area according to Folk (1974).

2.Organic matter

The term organic matter refers to the decomposable matter accumulated in a sediment through organic activity and excludes shells and other hard skeletal parts originated from organisms, most of organic matter in coastal sediments is derived from benthic material which has been trapped between finer particles of the inorganic sediments. The organic matter in the sediment has been by ignition (Davies, 1974). The recorded are tabulated below. The OM values in study area ranged between 1.42-1.60 in the surface sample, while in the down sample is ranged 1.56-3.21. The only method available for directly determining organic matter is in which the sediment organic matter is oxidized by a concentrated solution of hydrogen peroxide, the resulting loss is taken as a measure of organic matter. However, the organic matter is usually calculated from the organic carbon content. This can be determined with considerable accuracy by dry combustion methods, wet combustion methods, and titrimetric methods. The dry combustion methods are too expensive and do not distinguish between different forms of carbon, such as coal, charcoal, graphite, etc. The wet combustion methods are too time-consuming (Kumar, 1988).

Table (3): percentage of organic carbon OM

Surface	Deep
1.45	2.68
1.60	2.78
1.53	3.01
1.52	2.08
1.42	2.67
	1.89
	2.32
	3.21
	1.56
	2.38

Identification of Ostracoda

The Ostracoda identified in the present study under Suborder Podocopina. The benthic Ostracoda are the most dominant group is Suborder Podocopina represented with 21 genera, 26 species, 4 sub family, 17 family, 8 super family are abundance and occurs since the early Holocene period, Sediment sample variation of Ostracoda with depth revealed the abundant occurrence of *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* with varying TP 01, TP 02 and TP 03 indicating high saline conditions. However, in sample the occurrence of *Cypreidis and Tanella* are an indicated marine environment with low saline and mud flat conditions. Four benthic Ostracoda species *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* were found in all the samples. The benthic Ostracoda have been abundant in four samples and these are:

TP 01: *Cypreidis, Tanella, Actinocythereis, Neocytheromorpha, Parakrithe and Candona neglecta*

TP 02: *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha, Xestoleberis variegata and Miocyprideis sp.1*

TP 03: *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha, Keijia Demiss and Kalingell*

TP 04: *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha, ALocopocyt-here reticulate and* Neocyprides sp.

TP 05: *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha, Calliostoma coppingeri and Lankacythere coralloide*

TP 06: *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha, Dohukia fossulat and Heterocypris giesbrechtii*

Discussion

The most an important characteristic of Ostracoda is their sensitivity to environment change. Our knowledge of modern species indicates that many species have-well-defined ecological range, and therefore changes in fossils assemblage through reflect changing environmental conditions, which can be reconstructed if ecological tolerances of the species are known (Haslett, 2002). The varitions in salainity determine the composition and diversity of the Ostracoda and there are well-defined assemblages, each dominated by just four species *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* (Boomer and Eisenhauer, 2002). There are some species that prefer muddy substrate, some that sandy substrate. In some environment, Ostracoda assemblage are dominant by single taxon. The study characterized by high abundance of Ostracoda communities which showed great diversity, widespread and an indicates that the organisms are sensitive to environments change (Hemidawi, 2020). The presence of certain Ostracoda communizes in a particular region reflect the type of environment, in which these communities and their significant environment impact have lived in the size, shape and ornamentation of Ostracoda shells. So, the study of Ostracoda tax gives clues to the environments (Alkaabi, 2001). Ostracoda communities are environmentally controlled by factors such as temperature, water depth, sediment nature, volumetric gradient and availability nutrients that reflect the direct impact of the environment. The high abundance of Ostracoda in the study area which showed largely varied sizes and shapes that indicates the original environment of Ostracoda which not transferred from another region. The important species in the study are *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* which have been shown the availability of this species in marine and brackish environments (Morkhoven, 1962 and 1963). The pertinent of *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* in all the samples suggest their wide range of tolerance to the observed environmental parameters (Mohammed, 2006). The genera of *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* and the specially the species *Tanella gracilis* is widely distributed in the Indo-Pacific and Atlantic including the Caribbean and also in my study area. Th wide geographic distribution of this cosmopolitan species in primary through passive by ships (Witte, 1993), (Zhao and Whatley, 1989) found this species to occure very widely thought the faw coastal. In the present study, the organic matter of the sediments and the nature of the substrate reflect the abundance of Ostracoda in them, an effort has been made to determine the same in all the sediment samples collected off Faw Coastal (kasar al-muge). The ultimate source of organic matter incorporated in the sediments It is some form of plant life thriving on the surface waters of the sea, on land, or both. In marine water sediments, the organic matter is to a great extent related to the plant material of terrigenous origin, while for the ocean as a whole, it is the benthonic photosynthetic organisms, which are the main source of organic matter. In both cases, the amount of organic matter in sediments depends upon the rate of deposition of organic matter and an abundant supply of organic matter. The above table shows that the organic matter is gradually increasing and reaches the highest average values (1.42-3.21) in both (surface and down surface). From the table, it is found that organic matter content increases as the sediment becomes finer and finer this accounts for the absorption of organic matter by finer sediments (Kunenen, 1950). A brief discussion on the classification of the sediments and the heavy minerals, including their aid in the interpretation of the depositional environment and provenance, is also made.

The sediment is mostly unconsolidated and is associated with sand, silt, and clay in different proportions and with shell fragments of gastropods, pelecypods, echinoids, wood chips, pieces, laterite fragments, coal chips and foraminifera.

Conclusions

Integration of benthic Ostracoda assemblage from the 15 samples (Surface and Down surface) are studied allows to draw the following conclusions:

. 15 sediment samples were analyzed for Ostracoda assemblage variations and the study yielded Out of the total 21 genera, 26 species, 4 sub family, 17 family, 8 super family. The present study reveals that al-faw coast in the city of Basrah, south of Iraq, sea level fluctuated locally and that the rise and fall of sea level has been much small since the middle Current estuaries and tidal zones date from the Holocene, and they overlie the older accumulation in the subsidence zones.

. 26 species belonging to 21 genera have been identified, of which are. One new species *Heterocypris giesbrechtii* one new variety been observed, 26 species are recorded the first time in study area.

. Among all 26 taxa, *Cypreidis, Tanella, Actinocythereis and Neocytheromorpha* are the most abundant and composition species. to low in the study area.

. Based on the investigation carried out on coastal of faw in the Basrah city in the kasar al-muge in the study area, it can be concluded that Ostracoda assemblage appears to be more suitable and congenial and further from the present study it can be inferred that south coast is more congenial for production, diversity and distribution of Ostracoda.

. The sediments are grouped under three classes Slightly clay sandy silt, slightly sandy clay and slightly sandy slightly clay silt it is of important is knowing of the environment

. In the present observations, the organic matter is abundantly locked up in the finer sediment types.

Acknowledgments

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