STUDIES ON THE BOTTOM DEPOSITS AND THE MEIOFAUNA OF SHATT-AL-ARAB AND THE ARABIAN GULF.

by

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Résumé

Des échantillons **de** sédiments **ont été** prélevés **dans** l'Euphrate et l'estuaire du Tigre (Shatt-al-Arab), ainsi **qu'à** l'entrée du Golfe Persique, en janvier **1974,** et soumis **à** quelques recherches physico-chimiques. **La** distribution qualitative et quantitative de la méiofaune **a** également été étudiée. Les conditions ambiantes ont **un** remarquable effet sur la nature et la composition des sédiments. Leurs différents composants (matière organique, matériaux calcaires et alloctones) se déposent en quantités variées sur le fond, en rapport surtout avec certains facteurs qui sont ici discutés.

La méiofaune se répartit en treize groupes, représentés quelques-uns **par** un petit nombre d'individus et dans quelques stations seulement, d'autres (Nématodes et Copépodes benthiques) rencontrés dans l'ensemble des stations et en quantité énorme. **Le** nombre total d'animaux est variable dans toutes les stations. **En** ce qui concerne **la** salinité de l'eau, **la** région considérée se différencie en trois ensembles **:** eau douce, saumâtre et marine. Le peuplement de **la** région saumâtre est remarquablement plus faible que celui des eaux douces et marines, en rapport surtout avec les conditions instables de l'environnement dues **aux** courants de marée. **La** grande abondance des Nématodes et des Copépodes benthiques dans la zone marine dépend essentiellement de certains facteurs qui sont discutés ici. **La** distribution de la méiofaune dans la région explorée est en relation avec les conditions locales d'environnement (surtout la température, la teneur en oxygène, **la** nourriture et les courants) plutôt qu'avec la nature et la composition des sédiments.

Introduction

Although Shatt-al-Arab is very important for the fishery economy of Iraq and Iran, only very few studies were carried out on its water (Mohammad, 1965 a, b; Al-Saadi and Arndt, 1973; Arndt and Al-Saadi, 1975; Kell and Saad, 1975; Saad and Kell, 1975). As far as we know, the sediments of this river were not subjected to studies, except those of Saad (1975) and Arlt and Saad (in press). However, the bottom of the Arabian Gulf was subjected to several geological investigations, most of which were carried out for the purpose of oil production in the region.

The present study deals with some physico-chemical investigations of the surface sediments collected from Shatt-al-Arab and the

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entrance of the Arabian Gulf in order to throw light on their nature and composition. It also deals with the qualitative and quantitative distribution of the meiofauna living in these sediments.

Description of the studied region

The river Euphrates divides at its lower reaches in Iraq into two branches. One branch joins the river Tigris at the town Qurna

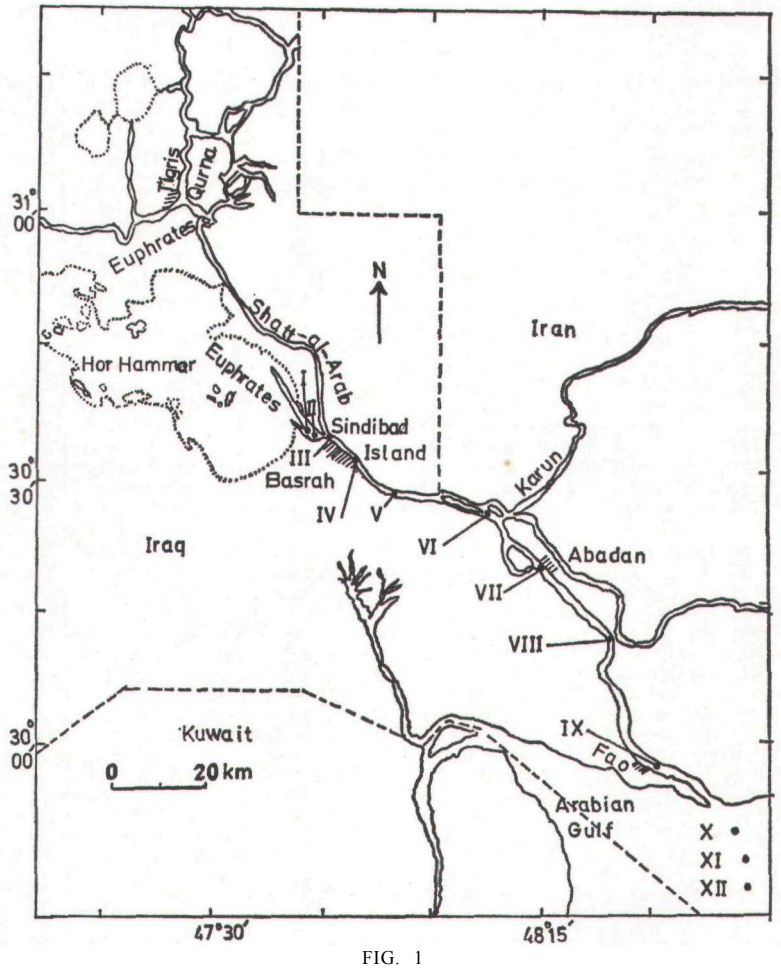

FIG. 1
Map of the studied area showing the position of stations.

forming Shatt-al-Arab. The other branch traverses Hor Hammar and then joins Shatt-al-Arab at Sindibad Island.

Shatt-al-Arab runs in a south eastern direction to open in the Arabian Gulf (Fig. 1). The water of its mouth may reach a distance of about 5 km inside the Gulf. Shatt-al-Arab transports annually to the Gulf about 35300 millions m^3 of water from the rivers Tigris, Euphrates and Karun. Karun crosses the Persian lands and finally

opens in Shaat-al-Arab at about 20 km north of Abadan. In addition, huge quantities of fine sediments accumulate at the mouth of Shatt-al-Arab. Most of these sediments enter this estuary from Karun. A considerable part of the accumulated sediments is distributed inside the Gulf, mainly by the influence of tidal currents. A long deep channel was dug inside the Gulf for the purpose of navigation.

The length of Shatt-al-Arab from Sindibad Island to its mouth in the Gulf amounts to 139 km. Its width varies at different regions, ranging from 0.4 km at Basrah to 1.5 km at its mouth. The water depth increases, in general, in the direction of the Gulf, varying from 7.5 m at Sindibad Island to 12.5 m at the mouth. However, the water depth relatively decreases at the mouth of Karun in Shatt-al-Arab, due to the continuous accumulation of large amounts of sediments transported by Karun to this locality. The water level is mainly affected by the tides of the Gulf. Numerous big ships enter into Shatt-al-Arab from the Gulf and many of them reach Basrah. The wastes discharged from these ships and also from other smaller ones always found in Shatt-al-Arab can be considered as main pollutants in this estuary. Hundreds of outlets in the form of small rivers and canals are found on both sides of Shatt-al-Arab.

A large marsh, Hor Hammar, lies at the north western side of Sindibad Island and is enriched with aquatic plants. The water of Shatt-al-Arab may reach this Hor during the high tide. The brackish water of this Hor may enter into Shatt-al-Arab and affects its chlorosity.

Materials and Methods

Ten stations (from III to XII) were selected, representing different regions of the main channel of Shatt-al-Arab and the entrance of the Arabian Gulf (Fig. 1). Sediment samples for the physico-chemical investigations were collected by means of a modified Ekman-bottom sampler. For qualitative and quantitative studies of the meiofauna, 36 sediment samples were collected by means of a plastic tube (3 cm^2). Two other stations (I and II) were also taken in Euphrates after leaving Hor Hammar only for the study of the meiofauna.

The density of wet mud was determined, on the same day of collection, using a pyknometer. The density of dry mud was calculated from the density of wet mud and the water content (Saad, 1970). The amount of water was determined by drying the wet sediments in an oven at 105°C.

The organic matter was estimated as ignition loss by igniting about 500 mg dry mud in a Muffel furnace at 525°C from 4 to 5 hours (Ungemach, 1960).

The HCl-soluble and insoluble parts of the sediments were determined by adding 12.5 percent HCl to the remaining inorganic fractions of the deposits in conical flasks, which were heated for one hour on an electric plate. Filtration was carried out using ashless filter paper. The dissolved parts of the sediments were considered as calcareous substances. The undissolved parts, on the other hand, were considered as allochthonous materials plus diatom frustules.

The upper 3 cm of each sample taken by the plastic tube were sieved using the sieves having the mesh size 0.4, 0.08 and 0.02 mm. The meiofauna were sorted in a fixed condition using special plexiglass troughs and a magnification of 25X (Arlt, 1973 a).

RESULTS

Sediments

The values of different components of the sediment samples are represented as percentages per dry mud in order to give a good picture for comparing these percentages at different localities of the studied region (Table 1). These values were also calculated in g per 10 cm^2

TABLE 1
Density of the wet and dry mud, as well as the percentages of some constituents of the sediments.

Stations	Water depth (m)	Density (g/cm3) wet mud	dry mud	Water (In percentage)	Dry matter	Org. matter	Calcar. substances	Alloch. materials
III	7.5	1.66	2.78	38.1	61.9	6.9	46.3	46.10
IV	10.6	1.62	2.59	37.4	62.6	6.7	43.6	49.00
V	10.2	1.63	2.58	36.7	63.3	8.0	46.5	44.73
VI	7.3	1.66	2.78	38.2	61.8	3.3	49.6	46.55
VII	12.4	1.79	2.55	27.5	72.5	3.3	53.9	42.25
VIII	12.3	1.59	2.59	39.7	60.3	3.0	51.6	44.70
IX	12.2	1.51	2.59	44.7	55.3	10.3	51.9	37.17
X	7.0	1.48	2.85	49.8	50.2	14.0	41.0	44.40
XI	9.0	1.55	2.96	46.6	53.4	14.8	44.4	40.25
XII	18.0	1.40	6.71	66.6	33.4	9.8	51.2	38.30

wet mud, in order to give a clear idea about the quantitative distribution of the various constituents of the sediments at different localities (Fig. 2).

The sediments of station VII (taken near Abadan) gave a maximum value of the wet density (1.79 g/cm^3) and a minimum value of the dry density (2.55 g/cm^3). These sediments were characterized by their lowest value of water content (27.5 percent) and highest value of dry matter (72.5 percent). On the other hand, the deposits of station XII had the minimum density of wet mud (1.40 g/cm^3) and the maximum density of dry mud (6.71 g/cm^3). These deposits were characterized by their highest value of water content (66.6 percent) and lowest value of dry matter (33.4 percent).

The organic matter gave a maximum value of 14.8 percent at station XI and a minimum of 3.0 percent at station VIII. A relatively high percentage of organic matter (14.0 percent) was also found at station X. A remarkable low value of 3.3 percent was recorded from stations VI and VII. The maximum and minimum values of calcareous substances reached 53.9 and 41.0 percent at stations VII and X,

respectively. Relatively high percentages of calcareous substances were also found at stations VIII, IX and XII. The sediments collected from stations IV and XI had relatively low values of calcareous

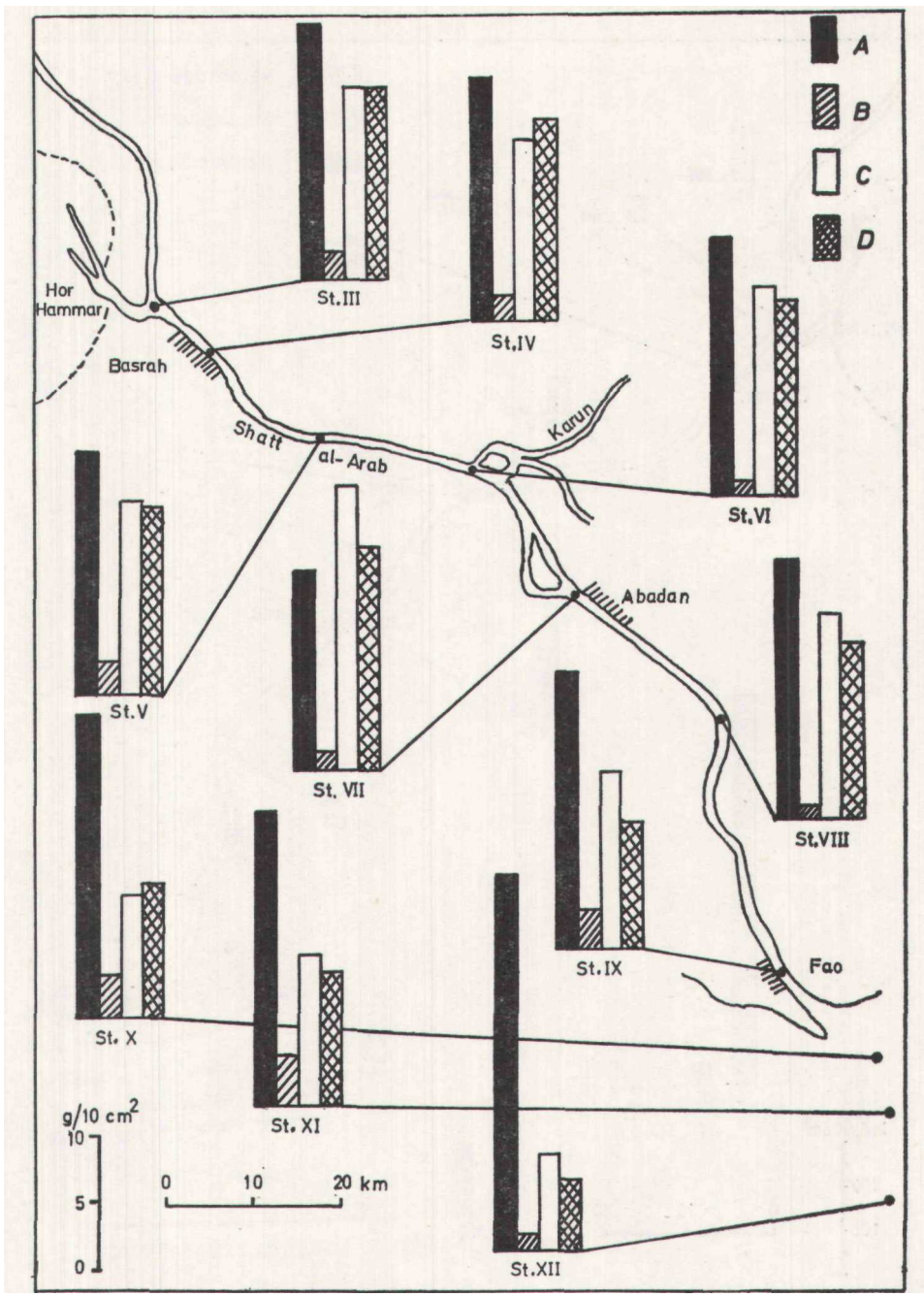

FIG. 2
Amounts of different components of the sediments in g/10 cm^2 wet mud.
A = water, B = organic matter, C = calcareous substances,
D = allochthonous materials.

substances. The allochthonous materials gave a maximum of 49.0 percent at station IV and a minimum of 37.17 percent at station IX. These materials were also found in a remarkable low percentage (38.30 percent) at station XII.

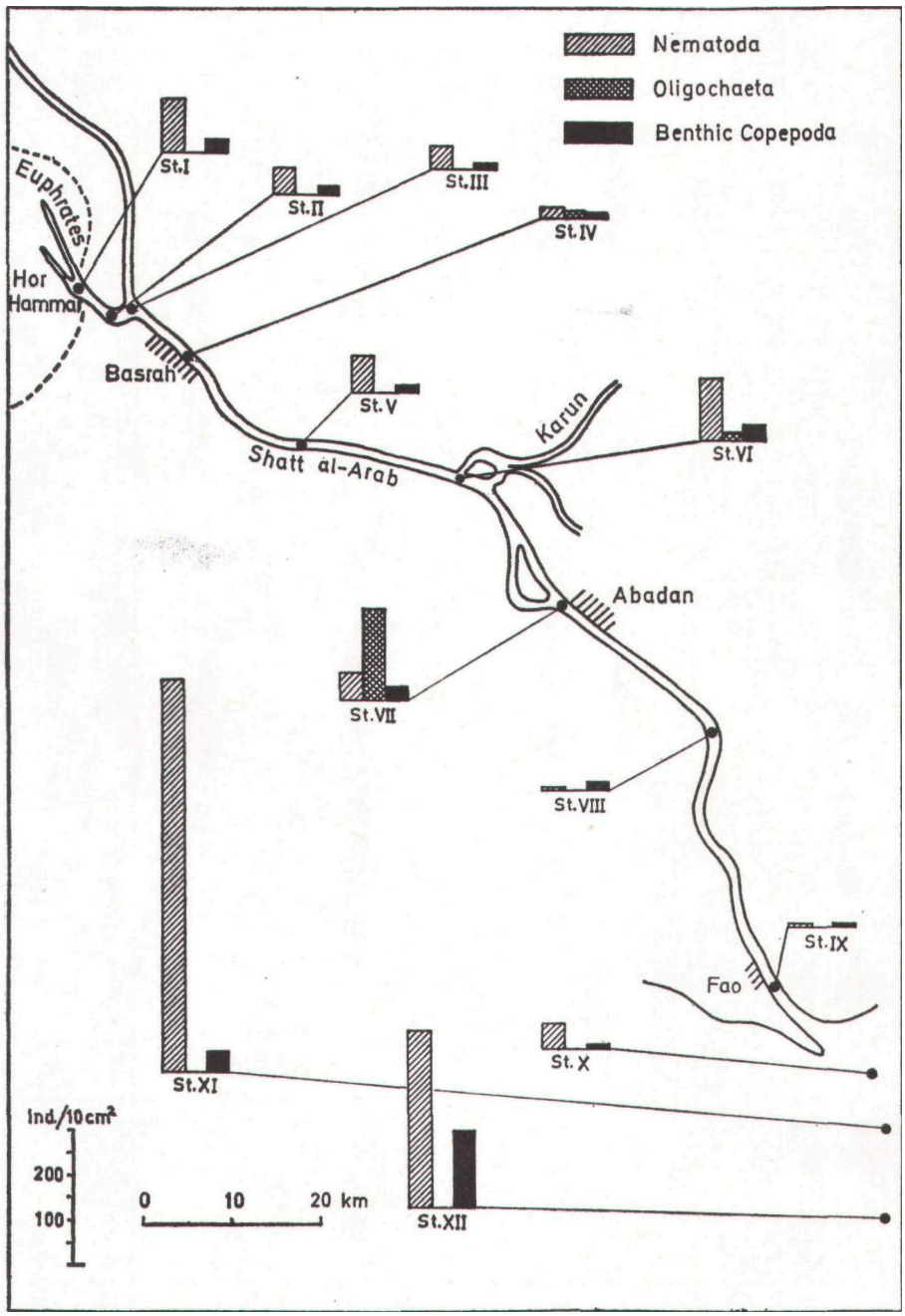

FIG. 3
Numbers of individuals of the most frequent animal **groups** in **10 cm²** **of** the bottom.

Fig 2 shows that the amounts of water found in the sediment samples gave a maximum of 27.9 g/10 cm^2 at station **XII** and a minimum of 14.7 g/10 cm^2 at station **VII.** The sediments of station **VII** had the maximum amounts of calcareous substances **(21.03** g/10 cm^2) and allochthonous materials (16.47 g/10 cm^2). The maximum amount of organic matter (3.69 g/10 cm^2) was found at station **XI.** A relatively high amount of organic matter was also found at station X. The sediments of station **XII** gave also the minimum amounts of calcareous substances (7.23 g/10 cm^2) and allochthonous materials (5.40 g/10 cm^2). Remarkable low amounts of calcareous and allochthonous materials were also recorded from stations **IX,** X and **XI.** The minimum amount of organic matter (0.87 g/10 cm^2) was found at station **VIII.** Markedly low amounts of organic matter were also recorded from stations **VI, VII** and **XII.**

Meiofauna

Table 2 gives the numbers of individuals in **10** cm^2 and the dominances in percent of different animal groups. Fig. 3 shows a comparison between the numbers of individuals of the most frequent animal groups. The meiofauna were sorted into 13 groups. Some as Coelenterata, Kinorhyncha, Cladocera and Gastropoda were represented by markedly few numbers of individuals and only in one or two stations. The animals of Nematoda and benthic Copepoda, however, were found in all stations and generally in exceedingly greater numbers than those of the other groups.

The total number of animals was irregular at all stations. The maximum total number (961 ind./10 cm^2) was found at station XI and mainly related to Nematoda. The minimum total number (24 ind./10 cm^2) was recorded from station IX, where only Nematoda and benthic Copepoda were found. A remarkably large total number was found at station **XII** and principally related to Nematoda and benthic Copepoda. The sediments of station **VII** also had a relatively great total number of animals which was mainly related to Oligochaeta. The meiofauna of stations I and VI were also found in a relatively large total number which was principally related to Nematoda and benthic Copepoda. On the other hand, an exceedingly low total number of animals was recorded from station VIII, where only Nematoda, benthic Copepoda and Tardigrada were found.

DISCUSSION AND CONCLUSION

The quantity and quality of the materials deposited on the bottom of a water body are determined by external and internal events. In case of Shatt-al-Arab and the entrance of the Arabian Gulf, the external events have a remarkable effect on the nature and composition of the sediments of this region. The feeding rivers of Shatt-al-Arab, especially Karun, continuously transport to it large amounts

of fine suspended particles of silt and clay. The amounts of these sediments reach highest values during the flood period. Moreover, fine sand and clay particles are carried away from the surrounding lands by the effect of the prevailing wind to settle on the bottom of Shatt-al-Arab. This fraction of allochthonous material is exceedingly lower than that entering this estuary from its feeding rivers.

Every substance mentioned in the present study was found in all sediment samples, fluctuating between a maximum and a minimum values. The maximum density of wet mud found at station VII was associated with the minimum density of dry mud. This maximum wet density is mainly due to the increase in the amount of dry matter which reached its maximum value, and the decrease in the amount of water content which reached its minimum value. The great increase in the weight of dry matter in the sediments of station VII is principally attributed to the maximum amounts of allochthonous and calcareous materials. These results suggest the influence of Karun on the sediments of this station taken at about 20 km south the mouth of this river in Shatt-al-Arab.

The minimum density of wet mud recorded from station XII was associated with the maximum density of dry mud. This minimum wet density is mainly due to great decrease in the amount of dry matter which reached its minimum value and the increase in the amount of water content which reached its maximum value. This minimum value of dry matter is attributed to the minimum amounts of allochthonous and calcareous materials. These results suggest the nature of the sediments of this station taken from the Arabian Gulf further away from the mouth of Shatt-al-Arab. At this locality the velocity of water currents relatively decreased leading to the accumulation of loose sediments enriched with water.

The amounts of organic matter found in the sediments were affected by the amounts of the autochthonous organic matter produced inside the water body and also by the quantities of the allochthonous organic matter entered into Shatt-al-Arab from its sides and transported to it by the feeding rivers. The intensity of decomposition of organic matter, its utilization as a food material by the bottom fauna and the particle composition of the sediments must also be considered.

The higher amounts of organic matter found in 10 cm^2 of the sediments of the Gulf stations X and XI can be mainly attributed to the continuous supply of allochthonous organic matter transported to the bottom of these localities. In addition, great amounts of plankton organisms were transported from Shatt-al-Arab to these stations. The dead bodies of most of these organisms and also of those flourished in this area under favourable conditions of nutrient supply from this estuary might reach the bottom slightly decomposed due to the shallowness of water at these two stations. They were incorporated in the sediments and increased its organic content.

The markedly lower amount of organic matter found at station XII may be attributed to the relatively lower amounts of allochthonous organic matter and plankton organisms reached this locality from Shatt-al-Arab, due to the decrease in the current velocity there.

In addition, most of the descending plankton might be decomposed completely after death through the relatively deep water column at this station (18 m). According to Saad (1975), the amount of diatom-silica found in the sediments of this station (70 g SiO_2/m^2) was relatively lower than those recorded from the sediments of stations X and XI (100 g SiO_2/m^2).

The amounts of calcareous substances recorded from the sediments were mainly affected by the amounts of calcareous shells and shell fragments of calcareous organisms found in these sediments. Accordingly, the higher amounts of calcareous substances found at certains stations are principally due to the abundance of calcareous shells at these stations (El-Wakeel, 1964; Saad, 1974, 1976, in press). On the other hand, the lower amounts of these substances found at the other stations coincide with the relative decrease in the amounts of calcareous shells at these localities. Such decrease of calcareous shells may be due to certain local conditions which might be unfavourable for the growth of calcareous organisms and the increase in the rate of supply of non-calcareous substances. The solution of calcium carbonate, which might be occurred after death of the organisms, must also be considered.

The importance of the meiofauna and microfauna for benthos communities was pointed out by many authors (Muus, 1967; Stripp, 1969; Ax, 1969; Fenchel, 1969; Gerlach, 1971, 1972; Arlt, 1973a). In addition, small fishes feed on relatively great amounts of the meiofauna especially the Nematoda and Copepoda (Arndt and Nehls, 1964; Arlt, 1973 b). Also, many species of meiofauna produce annually several generations (Stripp, 1969; Skoolmun and Gerlach, 1971; Gerlach, 1972; Arlt, 1973 b). Therefore, the distribution of meiofauna on the bottom of an aquatic habitat may give an indication for its fertility.

The temperature measurements recorded by Arndt and Al-Saadi (1975) in Shatt-al-Arab gave a wide range of variations, fluctuating between a maximum of 32.5°C in August and a minimum of 10.5°C in January. Such a wide range of seasonal temperature variations was also reported by Kell and Saad (1975). The samples of the present study were only collected in January 1974 (winter) and, therefore, the seasonal distribution of the meiofauna could not be studied.

It seems impossible to make an exact comparison from the available samples for the horizontal distribution of meiofauna. This is due to technical reasons that the samples from different stations of Shatt-al-Arab could not be taken from similar regions. Stations III, IV and V were taken from the middle of this estuary, whereas the other stations from relatively shallower regions. In spite of this condition, important and interesting variations in the qualitative and quantitative horizontal distributions of meiofauna were found.

The presence and abundances of meiofauna depend on local environmental conditions of the sediments and the deeper layers of the waters. The absence of certain animal groups (Coelenterata, Kinorhyncha, Cladocera and Gastropoda) from most of the stations, or their presence only by a markedly few number of individuals in one

TABLE 2

The numbers of individuals in 10 cm^2 (A) and the dominances in percent (B) of different animal groups

Animal Groups	Stations																							
	I		II		III		IV		V		VI		VII		VIII		IX		X		XI		XII	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Cœlenterata	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	0.5
Turbellaria	2	1.2	4	4.1	1	1.0	1	1.8	—	—	1	0.5	3	0.9	—	—	—	—	—	—	5	0.5	3	0.5
Nematoda	113	69.3	52	53.6	50	50.0	21	39.0	75	68.8	128	67.4	60	18.9	6	20.7	13	54.2	53	67.1	885	92.1	386	64.4
Kinorhyncha	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	0.6	5	0.8
Polychaeta	4	2.5	1	1.0	1	1.0	1	1.8	3	2.8	1	0.5	2	0.6	—	—	—	—	11	13.9	13	1.4	8	1.3
Oligochaeta	1	0.6	—	—	—	—	13	24.1	1	0.9	20	10.5	198	62.5	—	—	—	—	—	—	2	0.2	7	1.2
Cladocera	—	—	—	—	—	—	—	—	—	—	3	1.6	8	2.5	—	—	—	—	—	—	—	—	—	—
Ostracoda	—	—	1	1.0	—	—	5	9.3	—	—	—	—	—	—	—	—	—	—	—	—	1	0.1	11	1.8
Benthic Copepoda.	24	14.7	19	19.6	13	13.0	8	14.8	9	8.3	36	18.9	30	9.5	19	65.5	11	45.8	12	15.2	44	4.6	165	27.5
Nauplii	9	5.5	—	—	1	1.0	—	—	7	6.4	—	—	—	—	—	—	—	—	3	3.8	2	0.2	—	—
Bivalvia (juv.) ...	10	6.1	18	18.6	30	30.0	3	5.5	14	12.8	—	—	6	2.0	—	—	—	—	—	—	3	0.3	11	1.8
Gastropoda	—	—	2	2.1	—	—	—	—	—	—	—	—	7	2.2	—	—	—	—	—	—	—	—	—	—
Tardigrada	—	—	—	—	4	4.0	2	3.7	—	—	1	0.5	3	0.9	4	13.8	—	—	—	—	—	—	—	—
TOTAL	163	100	97	100	100	100	54	100	109	100	190	100	317	100	29	100	24	100	79	100	961	100	599	100

or two stations, suggests the unfavourable environmental conditions for their survival. On the other hand, the appearance of Nematoda and benthic Copepoda at all stations and, also, the exceedingly increase in the number of their individuals can be mainly related to the favourable environmental conditions necessary for their abundances.

Regarding the salinity, the studied region includes three different water bodies, the fresh (stations I, II, III, IV, V, VI, VII), the mixed (VIII, IX, X) and the marine (XI, XII). The total numbers of animals found in the regions of fresh and marine waters were generally higher than those in the mixed water. This is mainly due to the stable environmental conditions in these two regions. The remarkable decrease in the total number of animals found in the region of mixed waters greatly coincides with the diurnal variations of the salinity caused by the tidal currents and which many species could not tolerate. Such decrease was much more pronounced at stations VIII and IX than at station X. This may be due to the position of station X in the Gulf relatively further away from the direct effect of the estuarine water. Al-Saadi and Arndt (1973) recorded salinity values slightly higher than 30 permile for the bottom water of this locality and lower than 10 permile for the surface water. According to Arndt and Al-Saadi (1975), the lower reaches of Shatt-al-Arab represent a typical estuary characterized by great variations of salinity.

The abundances of Nematoda in the sediments of the marine regions (st. XI and XII) were extraordinary high. Also, the benthic Copepoda were abundant in these two stations when compared with those of the other stations. The high abundances of these two groups of animals at stations XI and XII depend mainly upon certain factors:

1) the abundances of certain marine species of these two groups which had optimum favourable conditions in this marine region;
2) the transportation of meiofauna from other localities by the outflow of water from Shatt-al-Arab. This evidence is supported by the presence of typical brackish water species of Copepoda together with the marine species;
3) the decrease in the velocity of water current at this region leading to the continuous accumulation of loose sediments having a relatively thick presedimented layer. This layer had the ideal environmental conditions for the meiofauna by offering relatively sufficient oxygen and food materials, which consist of the remains of organisms found in the inner spaces between the inorganic sediment particles. Generally, the sediments of this region were characterized by their relatively higher water content and lower amounts of the allochthonous and calcareous materials. Whether the food supply or the loose nature of the sediments affects the abundances of meiofauna is now difficult to be decided. However, the maximum total number of meiofauna found at station XI was associated with the maximum amount of organic matter recorded from this station. Naturally, the meiofauna migrates upwards when the upper layer of these loose sediments is covered by new sediments transported from Shatt al-Arab and deposited from the upper water column.

The extraordinary abundances of Oligochaeta found at station VII

(Abadan) may be mainly related to the remarkable effect of pollution at this locality. Similar relations were also found in other marine environments (Laakso, 1965; Oliff et al., 1967; Tulkki, 1968, 1969; Reish, 1972; Arlt, 1975).

It can be concluded from the results of the present investigation that the qualitative and quantitative horizontal distribution of meiofauna in Shatt al-Arab and the entrance of the Arabian Gulf was related to local environmental conditions (mainly temperature, dissolved oxygen, food and currents) more than to the nature and composition of the sediments.

Summary

Sediment samples were collected from the Euphrates and Tigris estuary (Shatt al-Arab), and the entrance of the Arabian Gulf in January 1974 and subjected to some physico-chemical investigations. The qualitative and quantitative distribution of the meiofauna was also studied. The external events had a remarkable effect on the nature and composition of the sediments. The different components of the sediments (organic matter, calcareous and allochthonous materials) were deposited in variable amounts on the bottom, mainly due to certain factors which were discussed. The meiofauna were sorted into 13 groups, some were represented by few numbers of individuals and only in few stations, whereas others (Nematoda and benthic Copepoda) were found in all stations and in exceedingly greater numbers. The total number of animals was irregular at all stations. Regarding the salinity, the studied region was differentiated into three different water bodies, the fresh, the mixed and the marine. The total number of animals found in the region of mixed waters was remarkably lower than that in the fresh and marine waters, mainly due to the unstable environmental conditions caused by the tidal currents. The high abundances of Nematoda and benthic Copepoda in the marine region were found to depend mainly upon certain factors which were discussed. The distribution of meiofauna in the investigated region was related to local environmental conditions (mainly temperature, dissolved oxygen, food and currents) more than to the nature and composition of the sediments.

Zusammenfassung

Im Januar 1974 wurden Sedimentproben des Shatt al-Arab (Ästuar des Euphrat und Tigris) und dessen Mündungsgebietes im Arabischen Golf untersucht und die Ergebnisse zu einigen physiko-chemischen Parametern in Beziehung gesetzt. Parallel dazu wurde die qualitative und quantitative Zusammensetzung der Meiofauna untersucht. Äussere Einflüsse hatten einen bemerkenswerten Effekt auf die Natur und Zusammensetzung der Sedimente. Die unterschiedlichen Komponenten der Sedimente (organische Substanz, Kalk und allochthones Material) waren in unterschiedlichen Mengen abgelagert, hauptsächlich in Abhängigkeit von gewissen Faktoren, welche diskutiert werden. Die Meiofauna wurde in 13 Gruppen unterteilt. Während einige Vertreter nur in einer kleinen Anzahl von Individuen und nur an wenigen Stationen vertreten waren, wurden andere (Nematoden und benthische Copepoden) an allen Stationen und in beachtlich grosser Anzahl gefunden. Die Gesamtzahl der Tiere war unregelmässig an allen Stationen. Hinsichtlich der Salinität wurde das untersuchte Gebiet in drei unterschiedliche Wasserkörper unterteilt, einen Süsswasser, einen Brackwasser und einen marinen Bereich. Die Gesamtzahlen der Tiere, die im Brackwasserbereich gefunden wurden, waren beträchtlich niedriger als die im Süsswasser und marinen Bereich, was hauptsächlich auf die durch die Gezeitenströmungen verursachten unstabilen Umweltbedingungen zurückzuführen war. Es wurde festgestellt, dass die hohe Abundanz der Nematoden und benthischen Copepoden im marinen Bereich hauptsächlich von gewissen Faktoren abhängig ist, die diskutiert werden. Die Verbreitung der Meiofauna war im untersuchten Gebiet in stärkerem Masse von den lokalen Umweltbedingungen (hauptsächlich Temperatur, gelöster Sauerstoff, Nahrung, Strömungsverhältnisse) als von der Natur und Zusammensetzung der Sedimente abhängig.

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