FOSSILS MOLLUSCA (BIVALVE) FROM THE FATHA FORMATION OF NORTHERN IRAQ

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ABSTRACT

Diagnoses, illustration and comments of four species and five genera of the class bivalvia from the Early Miocene Fatha Formation of northern Iraq are identified here to facilitate recognition and comparison with other countries. The Fatha Formation of Iraq can be dated of possible Burdigalian age based on the occurrences of *Ostera latimarginata* and *Ostera subangulata,* which are not known in rocks older than Early Miocene.

متحجرات ذات الصدفتيين من تكوين الفتحة في شمال العراق

عبد الحق ابراهيم مهدي

الخلاصة

تم وصف وتحليل اربعة انواع وخمسة اجناس من المتحجرات ذات الصدفتين من المايوسين الاسفل لتكوين الفتحة من شمال العراق لتميزها ومقارنتها مع الاقطار المجاورة. ان تكوين الفتحة في العراق استنادا لتواجد المتحجر *Ostrea latimarginata and O.subangulata* هو من عمر البرديكالين Burdigalian حيث ان اول ظهور المتحجرات لم يعرف بعمر اقدم من المايوسين الاسفل.

INTRODUCTION

The Fatha Formation in Iraq has been divided into two members lithologically according to the presence or absence of the brownish red mudstone. Asymmetrical cyclic deposition of marl, carbonates and nodular gypsum characterize the Lower Member, whilst similar cycle, but with the additional of brownish red mudstone at the top of each cycle, characterize the Upper Member.

Very few bivalves have been identified from the Fatha Formation of Iraq due to generally poor preservation, which reflect weathering and neomorphic diagensis of the rocks. Because of the poor preservation, reliable identification is often possible only to generic rather than species level.

The faunal diversity is low, although individual specimen abundance at particular horizons may be high, these monotypic or low diversity shell beds are in general associated with environments whose salinity differs from that of normal marine water (35 – 36)% (Hudson, 1963). Association of the faunas with evaporates is clear evidence of fluctuating salinity in these particular deposits. The low diversity is therefore a reflection of the original sedimentary environment rather than poor preservation.

PREVIOUS STUDIES

Although previous workers have cited identifications for mollusks from Fatha Formation, no published and unpublished illustration or description exist for material from Iraq. The only descriptive paleontology comprises account from Iran and Pakistan, all pre 1940 in date. Bellen et al. (1959) recorded only *Ostera latimarginata, Clausinella?amid* and *Clausinella* spp.Other pubished identifications are those of Al-Naqib(1959), who recorded *Clementia papyracea, Chlamya varia, Arca theobaldi, Clausinella* sp., *Amiantis* sp., and *Cardium* sp. from Fatha Formation , area south of Kirkuk. Diagnose, illustration, and comments are therefore provided here for key taxa from the Iraqi Fatha Formation at four localities (Fig.1), to facilitate recognition and comparison with other countries.

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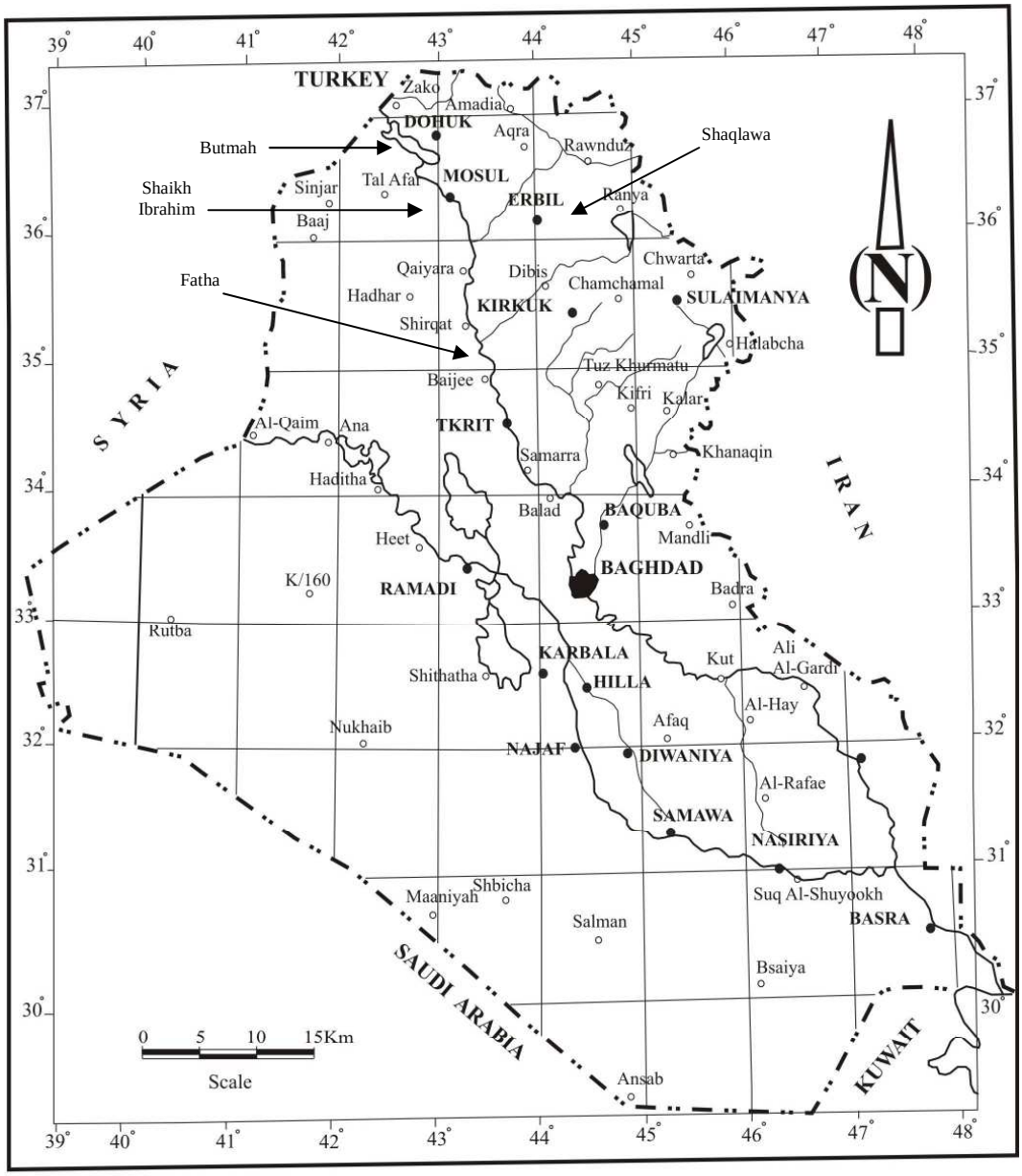

Fig. 1: Location map

DESCRIPTIVE PALEONTOLOGY

Class BIVALVIA
Subclass PTERIOMORPHIA
Order PTERIOIDA
Suborder OSTREINA
Superfamily OSTREACEA
Family OSTREIDAE
Genus*OSTERA* Linne, 1758
Ostrea latimarginata Vredenburg
Fig. 2, pl. (1 – 4)

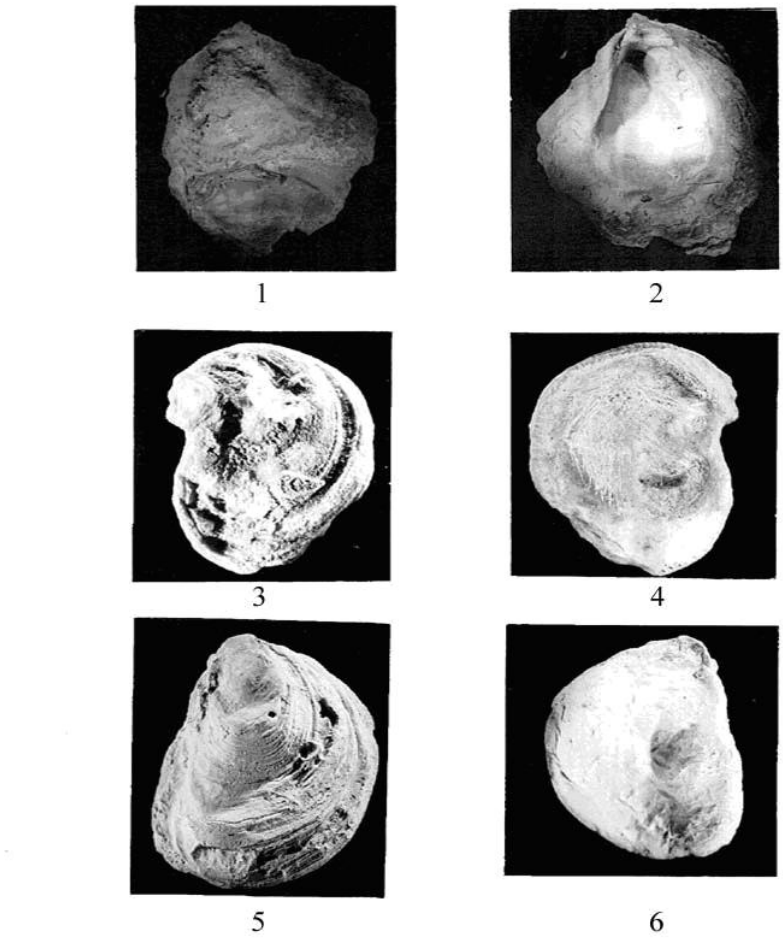

Fig. 2: Plate (1 – 4), *Ostrea latimarginata* – Fatha Formation, Sheikh Ibrahim area (N.lraq)

l. External view of left valve (xl)
2. Internal view of left valve (xl)
3. External view of right valve (x2.2)
4. Internal view of right valve (x2.2)

Plate (5 – 6): *Ostera subangulata* – Fatha Formation, Sheikh Ibrahim area (N.Iraq)

5. External view of right valve (xl.7)
6. Internal view of right valve (xl.6)

1840 *Ostrea flabellulum* J.de C. Sowerby; Trans. Geol. Soc. (2), V, pl. xxv, Fig. 18 (non- Lamarck, 1806).
1908 *Ostrea latimarginata* Vredenburg; Rec. Geol. Surv. Ind., XXXVI, part 4, p. 317.
1909 *Ostrea latimarginata* Vredenburg; Vredenburg and Stuart, Rec. Geol. Surv. Ind., XXXVIII, part 2, p. 127.
1927 *Ostrea latimarginata* Vrdenburg; Douglas, Contribution to Persian Pal., I, p. 3 (partim); pl. 1, Fig.1 and 2.
1928 *Ostrea latimarginata* Vredenburg; Vredenburg, Mem. Geol. Surv. Ind., L, p. 423. pl.XXIV, Fig.2, pl.XXIVa, Fig 1.
1936 *Ostrea latimarginata* Vredenburg; Cox, Mem. Geol. Surv. Ind., XXII, part 2, p. 69.

Type specimen: Figure Syntype, L98338, Unfigured Syntype, L98339, in Department of Palaeontology (British Museum of Natural History) from Cheeosir, Cutch, Upper Gaj Beds Formation (Burdigalian) of India.

Material: Five broken and two complete specimens represented partly by their impressions and preserved in marly limestone. One now donated to British Museum of Natural History (LL27971); six to the Geological Survey of Iraq; all from Sheikh Ibrahim area, north Iraq.

Diagnosis: A species of *Ostrea* characterized by a ribbed lower (left) valve and a smooth upper (right) valve without redial ribs, with exceptionally wide, flattened border surrounding the relatively small visceral cavity in the lower valve. The ribs on the lower valve are narrow, sinuous and branching. They are weak and have a distinct tendency to fade away.

Remarks*: Ostrea latimarginata* Vredenburg is a nom. For *Ostrea flabellulum* Sowerby non Lamarck. A full description of this widespread species is given by Douglas (1927), and Cox (1936), on the basis of Iranian material. The Iraqi specimens agree fully with this description. As Cox (1936) notes, *Ostrea subangulata* is similar to *O.latimarginata*, but in the latter, the ribs are narrow, more sinuous, and branching and weaker than those of *O.subangulata*. The overall diagnostic features cited above are characteristic of *O.latimarginata*.

In many localities outside Iraq yielding this species, its age is almost invariable given as Burdigalian. Since Bellen *et al*. (1959) and Budy (1980) agree that the species is "an index fossils of the Fatha Formation"; it therefore seems a clear indication of a Burdigalian age for the Iraqi strata. All records in other countries are associated with marl – carbonate facies and consistently normal marine associations.

Distributions: Upper Gaj Beds (Burdigalian) of India (Sowerby in Grant,1840; Vredenburg, 1908,1928); Lower Fars Formation (Burdigalian) and Akauktaung Series (Vindobonian) of Burma (Douglas, 1927); also Arabian and Portugese East Africa (Cox,1936). The unit termed Lower Fars Formation (Miocene) of Iran by Cox (1936) is now termed the Gachsaran Formation and dated as Burdigalian (fide James and Wynd, 1965).

Ostrea subangulata d'Orbigny
Fig. 2, Pl. (5 – 6), Fig. 3, pl. (1 – 3)

1840 *Ostrea angulata* G. de C. Sowerby, Trans. Geol. Soc. (2), V, (non - Lamarck).
1852 *Ostrea subangulata* d'Orbigny, prodrome de' Paleontologie, Vol. 3, species No.2520.
1854 *Ostrea multicostata* var. Deshayes; d'Archiac and Haime, Animaux fossils du groupe nummulitigue de I'Inde, Vol. 2, p. 273; pl. 24, Figs. 14, 14a.
1928 *Ostrea angulata* j. De C.Sowerby; Vredenburg, E.W., Mem. Geol. Surv. India, Vol.50, p. 422, pl. 24, Fig. 3, pl. 24b, Figs. 2 and 3.

Type specimen: Presumed lost; specimen figured d'Archiae and Haime, 1854, L985I2 in the Department of Paleontology (British Museum of Natural History); from the Gaj Beds (Lower Miocene) of Sind.

Materail: Numerous separated valves, preserved in a marly limestone and limestone from Sheikh Ibrahim and Shaqlawa area. Two specimens (LL27974; 27975) now donated to the British Museum of Natural History, five to the Geological Survey of Iraq, Baghdad.

Diagnosis: A species of *Ostrea latimarginata* (with a ribbed lower valve and a smooth upper valve, plus an exceptionally wide, flattened border surrounding the relatively small visceral cavity in the lower valve. The ribs are, however, broader, straighter and less branched, and slightly stronger.

Remarks: As Cox (1936) notes, *O.subangulata* is similar to *O.latimarginata* but the former has broader, straighter, less branched and slightly stronger ribs than those of *O.latimarginata.*

Outside Iraq, the species is consistently found in rocks ascribed to the Burdigalian. It has not previously been recorded in the Fatha Formation of Iraq. In Pakistan, as in Iraq, it is associated with marl-carbonate facies and normal marine faunal associations (Mahdi, 1983).

In Iraq, specimens here ascribed to *O.subangulata* occur at the same horizon and locality as *O.latimarginata*, so it is possible that they represent only the juveniles of one, variable species (*O.latimarginata*). It seems however, advisable to distinguish differences in morphology by differences in taxonomic name in the absence of intermediates between the two groups.

Distribution: Early Miocene Gaj Beds of Cutch (Sowerby in Grant, 1840); Gaj Beds of Sind (d'Archiac and Haime, 1854); Nari Beds (Oligocene) of Cutch and Sind, Gaj Beds of Cutch and Sind (Vredenburg, 1928).

Subclass HETERODONTA
Order VENEROIDA
Superfamily VENERACEA
Family VENERIDAE
Genus CLEMENTIA Gray, 1847
Clementia papyracea Gray
Fig. 3, pl. 4 – 6

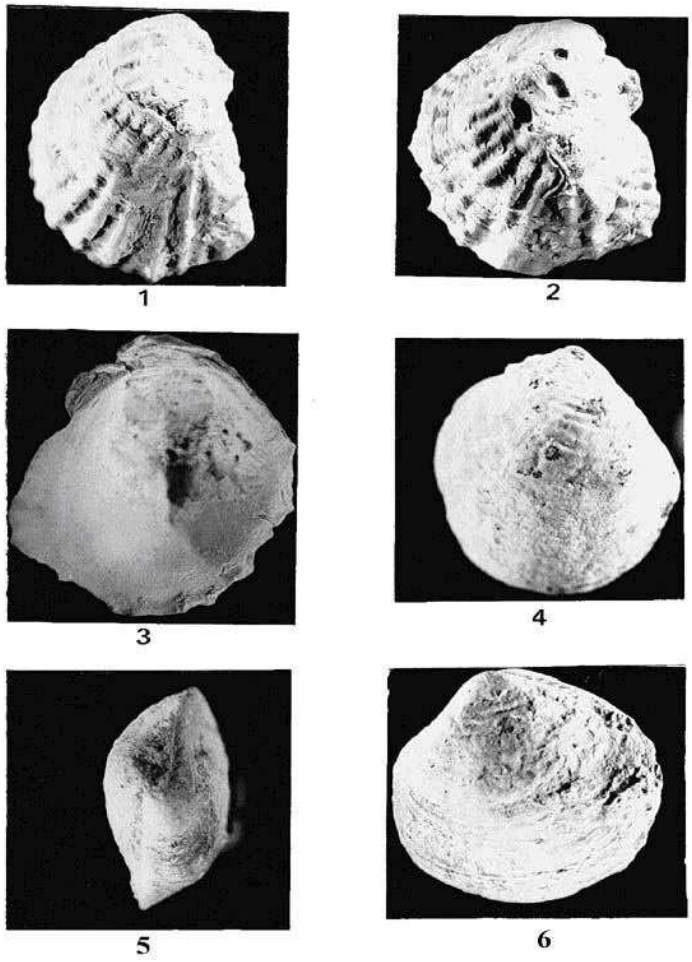

Fig. 3: Plate (1 – 3), *Ostrea subangulata* – Fatha Formation (Miocene), Sheikh Ibrahim area (N. Iraq)
1 & 2. External view of left valve (x1.7)
3. Internal vliew of left valve (x1.7)

Plate (4 – 6), *Clementia papyracea* – Fatha Formation (Miocene), basin – margin facies, Shaqlawa area (N. Iraq) (x2.5, x2.2 and x2.2)

1825 Venus? Papyracea Gray, Ann. Philosphy, XXV, p. 137
1840 Venus non-scripta J. de C. Sowerby, Trans. Geol. Sec. (2), V, pl.XXV, Fig. 8.
1927 Clementia papyracea (Gray); Cox, Report on the paleontology of the Zanzibar Protectorate, p.54; pl. IV, Figs. 3 and 4.
1928 Clementia papyracea (Gray); Douglas, Contribution to Persian Paleontology, III, p.10; pl.XllI, Fig. 10.
1928 Venus (Clementia) papyracea (Gray); Vredenburg, Mem. Geol. Surv. India, No.50, p. 455 (Cum syn), pl.32, Fig.3.
1930 Clementia papyracca (Gray); Cox, Mem. Geol. Dcpt. Hunterian Museum, Glasgow Univ., IV, pp.130, 158; pl.XV, Fig.4.
1932 *Clementia papyracea* (Gray), Prashed, Siboha-Exped. Monoger., LIIIC, p.262. .
1936 Clementia papyracea (Gray), Cox. Mem. Geol Surv. Ind., XXII, part 2, p.69.

Type specimen: Not known, although most of Gray's collection is in the Zoology Department (British Museum of Natural History); from the Lower Fars Formation (Burdigalian) of Iran.

Material: Numerous specimens, two now donated to British Museum (Natural History) (1.1, 27976; 27977); three to the Geological Survey of lraq, Baghdad; all from Shaqlawa area, northeast of Iraq.

Diagnosis: A species of *Clementia* characterized as ovate, very inequilateral, inflated, ornamented with conmarginal coarse corrugations (seen on internal casts because true species is very thin shelled); ligament short, external, sunk; no lunulc or escutcheon; pallial sinus long, wide, ascendant, tapering to an asymmetric apex.

Remarks: A full description of this widespread species is given by *Cox*(1936) on the basis of Iranian material and features are summarized by Eames (1971). The Iraqi specimens agree fully with these descriptions.

Specimens are all preserved as leached casts with the valves still tightly closed . In all localities outside Iraq yielding the species, its age ranges from Eocene to Recent. All records in other countries are associated with marl – carbonate facies and consistently normal marine faunal associations.

Distribution: Miocene to Recent, widespread in Indo-Pacific province including Gaj Beds of Cutch and Sind, Mekran Series of Mekran Coast (Vredenburg, 1928); close to Latidum; Puhal, 2 miles west of village (both west of Bander Abbas) (Burdigalina) of Iran (Cox, 1936); Middle Fars Formation (Vindobonian) of Iran (Cox, 1936).

Genus *CLAUSINELLA* Gray, 1851
Clausinella persica Cox

1936 *Clausinella persica* Cox, Mem. Geol. Surv. Ind., XXII, No. 2; pl.VII, Figs.12 and 13.

Type specimen: (L98532) in Department of Paleontology (British Museum of Natural History), from the Fatha Formation (Upper Burdigalina) of south western Iran.

Material: Limestone blocks crowded with individuals. One specimen (LL27970) now donated to British Museum (Natural History); 19 specimens to the Geological Survey of Iraq; all specimens are from Fathah, Sheikh Ibrahim, Butma, and Shaqlawa areas, north Iraq.

Diagnosis: Shell small trigonally ovate, moderately inflated, slightly longer than high. Umbonal region prominent, well inflated; umbones prospgyrous, slightly anterior to medium. Postero-dorsal profills strongly convex, sloping to meet the strongly convex ventral margin in a rounded-off angle; antero-dorsal profile only slightly excavated; anterior margin evenly convex. A long, narrow, smooth escutcheon is limited by a well defined ridge. Excavation of lunule (apparently) slight; surface of shell usually with pronounced concentric flods, but occasionally smooth; no trace of radial sculpture.

Remarks: A full description of this species is given by Cox (1936) on the basis of Iranian material. The Iraqi specimens agree fully with this description. Cox (1936) notes that it is impossible to determine how close the relationship is between *Clausinella persica* and the similar *Clausinella amidei* Meneghini because of the state of preservation. However, he comments that the original figures of *Clausinella amidei* indicate a shell with radial ornamentation while *Clausinella persica* appears to be devoid of radial ornamentation. Records of *C. amidei* from Iraq by Bellen et al. (1959) and Buday (1980) may therefore possibly be of *C. persica.*

Distribution: Previously known only from the Lower Fars Formation (Upper Burdigalian) of Iran (Cox, 1936).

OTHER BIVALVES

In addition to the species described above, five other bivalves are locally significant.

Veneridae

(Fig. 4, pl.1 – 4). Specimens are common in marly limestone of the Butma area (north Iraq), preserved as leached casts with the valves still tightly closed. These are equivalve; lunule and escutcheon usually well marked; cardinal teeth typically corbiculoid; anterior lateral obsolete; posterior laterals wanting; valve margin interally smooth. These features characterize them as members of the Heterodonta, family Veneridae, but they are too poorly preserved for more precise identification. According to Moore (1969) and Eames (1971), Veneridae are common from Early Cretaceous to Recent, and typically shallow marine water in occurrence, as shallow burrowers in normal marine, marly and muddy sediments.

Anadara

(Fig. 4, pl. 5 & 6). Specimens are common in marly limestone at Butma area (north Iraq), preserved as leached casts with the valves still tightly closed. Their thick equivalve valve, ovate trapezoidal in shape with commarginally beaded radial costae, ornaments similar on the two valves, hinge line relatively short and valve margins internally scalloped, characterise them as members of the Pteriomorphia, family Arcidae, genus *Anadara,* but they are too poorly preserved for more precise identification. According to Moore (1969) *Anadara* spp. Are common from Early Miocene – Recent, and typically shallow warm water in occurrence, as shallow burrowers in normal marine, marly sediments.

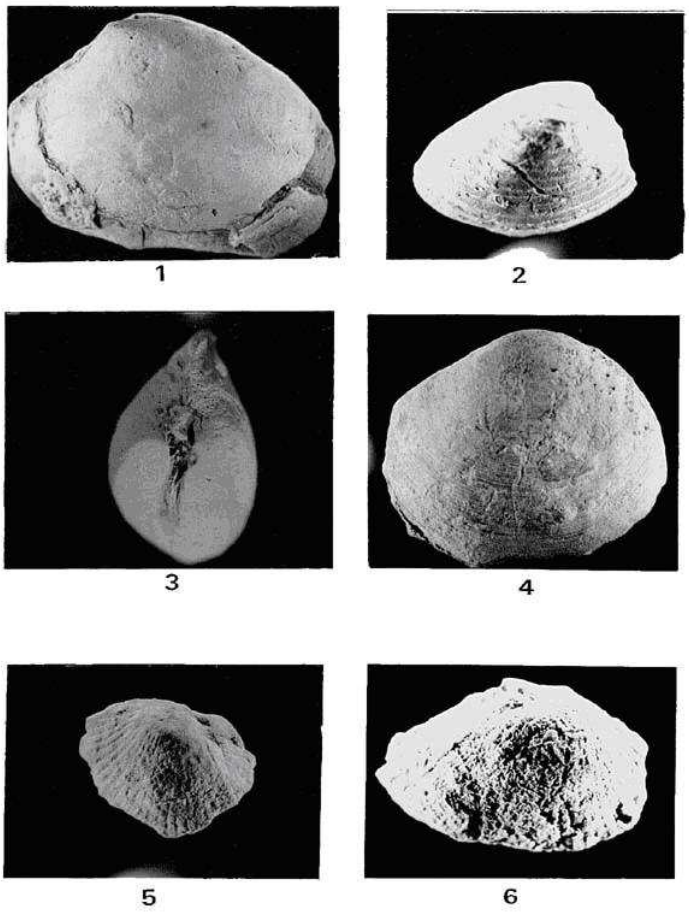

Fig. 4: Plate (1 – 4), *Veneridae* – Fatha Formation (Miocene), basin-centre facies, Butma area (N. Iraq); (x 1.9, x 2.0, x 1.5, and 2.1)

Plate (5 & 6) *Anadara* – Fatha Formation (Miocene), basin-centre facies Butma area (N.Iraq); (x 2.5 and 2.4)

Cardium (*Sensu lato***)**

(Fig. 5, pl. 1 – 3). Specimens are rare in marly limestone in the Butma area (north Iraq), preserved as leached casts with the valves still tightly closed. Their large, subquadrate, inflated shell and sharp radial costae giving rise to a coarsely corrugated interlocking margin characterize them as members of the Heterodonta, family Cardiidae, but they are too poorly preserved for more precise identification. According to Moore (1969) and Eames (1971), members of the family Cardiidae are common from Miocene to Recent, and typically marine water in occurrence, as shallow burrowers in marine marly sediments.

Lucina (*Sensu lato***)**

(Fig. 5, pl. 4 and 5). Specimens are rare in marly limestone in the Butma area (north Iraq), preserved as leached casts with the valves still tightly closed. They are medium-sized to large, subtrapezoidal, more or less flattened, with well marked dorsal areas; sculpture of somewhat evenly spaced concerntric lamellae with some areas smoother than the remainder to the disc, which characterizes them as members of the Heterodonta, family Lucinidae. According to Moore (1969) and Eames (1971), this widespread living group first appeared in the Palaeozoic and is typically marine to estuarine water in occurrence, as shallow burrowers in marly sediments.

Pectinidae

(Fig. 5, pl. 6). Specimens are common in limestone at the Fatha area (north Iraq), preserved in limestone blocks crowded with individuals, shells vary in size, orbicular to oval in shape, valves of some shells equally convex,but usually one valve more inflated than the other; surface with radiating folds; upper valve usually more brightly coloured. These features and their distinctive hinge line with ears, together with a monomgarian muscle scar characterize them as members of the Pteriomorphia, family Pectinidae. According to Moore (1969) and Eames (1971), Pectinidae are common from Triassic to Recent, and are always marine.

PALAEOECOLOGY

Oysters

Oysters (suborder Ostreina) originated in euhaline waters (Fide Moore, 1969; Hudson and Palmer, 1979). However, the family Ostreidae later evolved the ability to penetrate into brackish estuaries and lagoons. Some species can exist in salinities as low as 10 per mill. Both the species *O.latimarginata* and *O. subangulata* are typical members of the family Ostreidae according to the criteria listed by Hudson and Palmer (1976, Table 1).

The associated molluscs reported from Persia by Douglas (1927) and from Iran and Bahrein Island by Cox (1936) are certainly marine but it is not clear that these occur at precisely the same horizon as the oysters. Paleontological study indicates that the fossils precisely associated with the oysters in Iraq are benthonic forams, ostracode and gastropods together with occasional echinoid spines, indicating shallow marine water for these particular beds.

The shell material of the oysters is seemingly well preserved, a reflection of its relatively stable calcite mineralogy (Kennedy *et.al.*, 1969). Valves are otherwise little abraded, indicating transport.

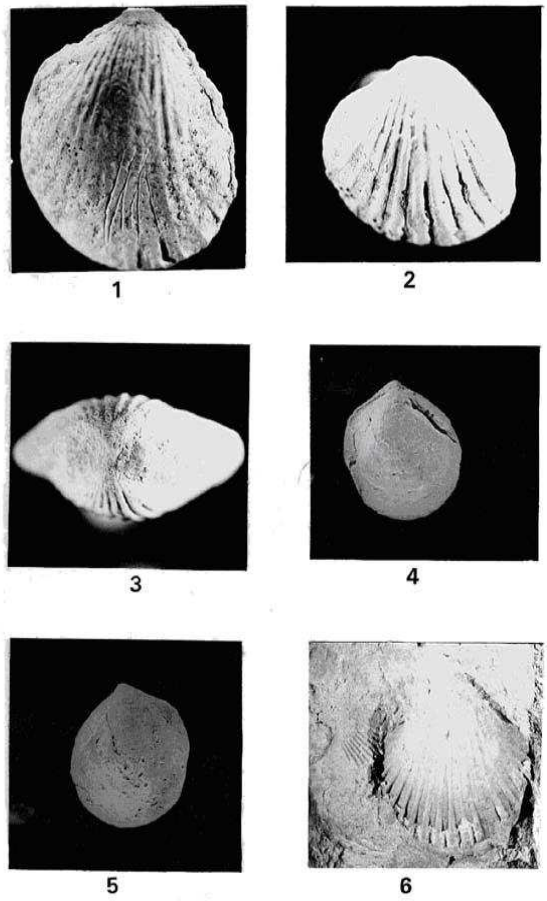

Fig. 5: Plate (1 – 3), *Cardium* – Fatha Formation (Miocene), basin-centre facies, Butma area (N. Iraq); (x 2.6, x 2.8 and x3.9)

Plate (4 & 5), *Lucina* – Fatha Formation (Miocene), basin-centre facies, Butma area (N. Iraq); (x 1.9)

Plate (6), *Pectinidae* – Fatha Formation (Miocene), basin-center facies, Fatha area (N.Iraq) ;(x1.7)

Veneridae

Veneridae may be euryhaline (fide Moore, 1969). Both *Clementia – papyracea* and *Clausinella persica* resemble other members of the family Veneridae in their shell shape and cardinal hinge teeth and would therefore seem to be potentially typical Veneridae. The associated molluscs reported from Persia by Douglas (1927) and from Iran and Bahrein Island by Cox (1936) are certainly marine but it is not clear that these occur at precisely the same horizon as the Veneridae. Paleontological study indicates that the fossils precisely associated with the same Veneridae in Iraq are benthonic forams, Ostracods, and gastropods, with occasional echinoid spines indicating shallow marine water for these particular beds.

The shell material of the Veneridae is not preserved, a reflection of its relatively unstable aragonite mineralogy (Kennedy *et.al*., 1969). Valves are preserved as leached casts with the valves still tightly closed, indicating death whilst burrowing or death followed by rapid burial

DSCUSSION AND CONCLUSIONS

The Fatha Formation in Iraq has been divided into two members, lithologically. It is not possible to distinguish biozones within the Fatha Formation, because of the low faunal diversity due to high salinity of the water and bad preservation of the fossils, which made specimen determination unreliable.

Identifiable fossils from Fatha Formation comprise mollusks, foraminifera and ostracods. The most important fossils are the bivalves *Ostrea latimarginata, O. subangulata and Clausinela persica*, and the foraminifera *Borelis melo* as well as the *Miogypsina* recorded by Al-Omari and Sadik (1972).

The named species *Ostrea latimarginata, Ostrea subangulata, Clementia papyracea* are a characteristic elements of a facies fauna recorded typically from Iran and India, but extending also to Burma. The Iraqi specimens constitute the most north westerly record of this Indo-West Pacific fauna.

Fossil assemblages with similar composition of foraminifera and bivalves as well as in lithology have been recorded in the Chehel Member of the Gachsaran Formation found in the Fars Province of SW Iran by Cox (1936), and by James and Wynd (1965); in the Gaj Beds succession in India by Vredenberg (1908); and the Pyalo Stage succession in Burma by Douglas (1927). All the above mentioned succession have been dated as Early Miocene.

The above species are generally ascribed to the Early Miocene (Burdigalian). Unfortunately, some of the species and all the genera identified have a long time range (*Clausinella persica, Clementia papyracea, Anadara, Cardium, Lucina and Pecten).* Some of the texa are not known in rocks younger than Burdigalian (notably O. *latimarginata*, C.P. Nuttall, pers. Comm.), whilst others (*Cardium, Anadara*, and *Clausinella persica*) are not known in rocks older than Early Miocene.

The faunal evidence and its correlation with succession similar in lithology and fossils assemblages in adjacent country seemingly indicate that the Fatha Formation can therefore be dated as possible Burdigalian age.

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