Non Marine Molluscs in the Injana Formation, Kand Anticline, NW of Mosul / Iraq

Mansur A. Amin
Department of Geology
College of Science
MOSUL University

Basem M. Al-Dewachi
Remote Sensing Center
MOSUL University

(Received 2/10/2002; Accepted 2/22/2003)

ABSTRACT

Marine brittle shell beds of molluscan skeletal aspects are coeval in the non-marine, fluval sequence of Injana Formation of upper Miocene age Kand Anticline, as yet undescribed previously. These carbonate beds are characterized only by abundant pelagonids, oyster with seehed and epipariette gastropods and smooth-stalked ostracods. This faunal assemblage is in agreement with non-marine low salinity oolitic lime, brackish water. The sudden change in their composition and distribution has been influenced by salinity variation. The exclusion of normal marine molluscan taxa point to their deposition in non-marine setting including interchannel lakes initiated or distal floodplain under river dominated bay estuary, or an delta back-lagoon.

الرخويات غير البحرية في تكوين أجنحته ، طليعة قين المحجرية:
شمال غرب الموصل / العراق

الملخص

كانت الرواسب النهرية لتكوين أجنحته بعض المعيشتين الاستثنائيتين، ضمن طبقة تقع تحت طبقة المرخويات البحريَّة. أجريت دراسة تفصيلية على تلك الطبقة، وتضمنت تجميعات رخويات غنية بالورود العصبي القديم. وشملت تلك الورود العصبي القديم، الأوزار، والورود الأوزار ذات الأصداف النحاسية، وصبيغة الورود العصبي القديم. وتواجدت تلك الورود العصبي القديم في مناطق مختلفة من المحجرية. وقد تم توزيع تلك الورود العصبي القديم في مناطق مختلفة من المحجرية. وقد تم توزيع تلك الورود العصبي القديم في مناطق مختلفة من المحجرية. وقد تم توزيع تلك الورود العصبي القديم في مناطق مختلفة من المحجرية. وقد تم توزيع تلك الورود العصبي القديم في مناطق مختلفة من المحجرية. وقد تم توزيع تلك الورود العصبي القديم في مناطق مختلفة من المحجرية. وقد تم توزيع تلك الورود العصبي القديم في مناطق مختلفة من المحجرية.
INTRODUCTION

Upon visiting the northern limb of Kand Antelina (Fig. 1), A-Dewacht made extensive observation on the richly, dense and fossiliferous carbonate beds occurring a mudstone – sandstone succession attaining 2.5m in thickness.

This incomplete section is situated at the middle part of the basal sequence of Inaja Formation, whereas the road cut crosses the dipping strata. Although these carbonate beds, about 30 cm thick, remain planar in orientation, they extend over a few 120 m laterally.

1. Flood plain Deposit
2. Residual Soil
3. Slope Deposit
4. Mukdadiya Fm.
5. Inaja Fm.
6. Fathe Fm.

Fig. 1: Location map showing the study area and the surface lithostratigraphy of Kand Antelina.
The non-marine, fluvial Iniama Formation has been the focus of many
sedimentological and palaeontological investigations (Samih et al., 1977; Al-Mubarak,
1978; Al-Saadi, 1985; Al-Futah, 2001) but has not been documented in the carbonate bed at
this level. To the north, a part from Lawa (1993) who just mentioned the only
association of oyster, brachiopods, and chitonlike shells with gastropods in the
Miocene of Yemeni area without petrographical examination.

Fluvial facies are often associated with karstic facies in their rock record (Friedl and
Kadri-Saaid, 1975; Eglaster et al., 1980; Gierlowkski, Kordek, 1990). Many ancient and
modern non-marine carbonate can be identified by their stratigraphical setting in
exclusively non-marine setting or their fossil content which consists mainly to polyps and,a
gastropods and worm's shells. Ostracods (Parka, 1953; Picard & Fligh, 1972; Hallam,
1981; Freyter, 1982). On the other hand some intraclastic clayey, iron-rich carbonates
with dense charater are also considered as incrustation (Freyter, 1984; Eglaster et al.,
1990). These non-marine carbonates are generally associated with siliciclastic deposits in
lake, even floodplain, lagoon and lagoon setting with fresh-brackish water
(Hudson, 1965a; 1965b, Gierlowkski, Kordek, Jó and Chaug, 2001).

The present paper, records and describes monotypic shell carbonate with non-marine mollusks from the Iniama section and the emphasis places on the depositional
environment in the subject of this research.

Surface Stratigraphy And Depositional Setting

Miocene sedimentation on the stable shelf of the Arabian platform is represented by

The extent of the lagoon, setting, representing the northern limit of the strait.
basin is between Kawk Ausar and Al-Qasim-Anetin anticlines (Girding and Bolter, 1985; Shihab et al., 1987). Kawk Ausar anticline located on the Main uplift and is aligned with wing of two basin; namely Sina and Kirkuk (Girding and Bolter, 1985; Mahdi, 1987).

The surface stratigraphy of Kawk Ausar includes the Fatihia Formation (Middle
Miocene) in the core and the Iniama Formation occupying the greater part of the basin.
The Fatihia Formation (156m thick) consists of typical repetition of red mud, breccia
and volcanic, interpreted as a sequence of paralic lagoon facies. The Iniama Formation
(445m thick) is composed of thin, red-brown, wavy beds alternating with red
mudstone slightly brown, considered as non-marine fluvial facies. The fluvial facies are devoid of fossils, except those mentioned by Lawa (1983) as Stromata
biomass accompanied by oysters, gastropods, ostracods and chara. In contrast, the
Fatihia facies are enriched with brachiopods and ammonite mollusks preserved as mold (authors own examination). But at the top the mollusks occur occur
abundantly in two successive horizons of greenish-gray mud with occasional gypsum
(Girding and Bolter, 1959; Shihab et al., 1984; Mahdi, 1983).

Lithologic Units:

The vertical succession of bedded lithologies processes a tripartite division of the
studied profile explored in figure (2). This three division allows the recognition of three
typical sedimentary units.
Unit A: Red Mudstone

It occurs at the base with indeterminate thickness as constrained by the road-cut, it is highly fractured with massive slightly laminated appearance; devol of facies. Petrographic examination shows a fine-sized quartz, feldspar and sand pebbles set in clayey carbonate matrix stained with iron oxides.

Unit B: Brown-Buff sandstone

Fine medium, massive fairly laminated sandstone, composed of quartz, feldspar, mica and other minerals embedded in clayey carbonate matrix stained with iron oxide. Diagenesis renders the sandstone more resistant to dissolution, recrystallization and vugs development. This unit contains 10-30% of sandy carbonate content by volume. The indistinct sedimentary structures are constrained by grade-wise uniformity.

Unit C: Buff - creamy limestone

This unit comprises various types of limestone.
1. Internastic limestone, in which it is difficult to recognize the allochthonous and autochthonous material in the rock with fading out boundaries.
2. Pelocyool limestone. It appears as skeletal, fossiliferous limestone that is impressively dense and with elastic texture imposed by fragmented fossils and their debris. Thin section study reveals authentically distributed unsorted benthos.
Photo A: showing the vertical progression of lineage units described.
Shells with their original calcitic mineralogy and solid structure preserved (Fig. 3). The shell material is set in a grainstone of microcrystalline calcite. Other fossils are sparse gastropods (Fig. 4) and thin-walled Ostracods (Fig. 5). The limestone contains pelacypods in preserved form to appear as monomorphous shell beds. This implication gained is that it represents accumulation of transported and reworked shells.

III- Oyster Limestone: This carbonate bed appears as massive, greyish or yellowish-white, coarse-grained bioclastic limestone with hypercalcite shells. Petrographic examination demonstrated the calcitic mineralogy of the Oyster shell and their preservation as calcite. The foliaceous streak and branching-veined character of discrete shell fragments in diagenetic (Fig. 5) and validates their identity.

Fig. 3: Disarticulated pelacypod shell with their calcitic mineralogy unaltered and well preserved shell structure. Monomorphous shell bed. Groundmass is closely microcrystalline calcite. Bar scale of all photographs is 1 mm.

Fig. 4: Gastropod preserved as a cast. The outer margae is marked by a thick calcite layer. Pelacypod fragments are also present. Very upper in white patches.
Fig. 5: Thin-walled calcareous bioclast with carry calcite and associated with pelecypod fragments dark groundmass with empty vasci.

Fig. 6: Micritized calcareous fragment having thin shell with foliated, venticel-branching character.

Paleoenvironmental Interpretations

The distinct signature of fresh water is evident in the Injana Formation, imparted by sedimentological attributes of the interbedded mudstone-sandstone which are commonly conformable and devoid of fossil (Salib, et al., 1977; Al-Mutairi, 1978; Al-Bahay, 1983). The general consensus is that the red sandstone-siltstone and fine
sandstone represents alluvial plain levees, spilt deposit while the coarse sandstones are considered channel bar deposits (Hallam, 1981; Al-Batrah, 1982; Al-Fahad, 2001).

Flood plain deposits may be proximal intermediate and distal with respect to active channel belt (Molzendorf, 2002). The association of carbonate-fractured limestones with distal overbank facies has been described from basin sequence (Iln and Chang, 2001).

Transitional environments with deltaic tidal flat attributes are non-familiar, but have been reported from the lower part of the fluvial sequence of Injana clastics overlying the Rotba Formation (Al-Najib and Agbola, 1982, Al-Talal, 2001). This may lead to occasional ambiguity due to the absence of diagnostic features. However the succession described from the middle upper part of the Injana sequence, thus highlighting its non-marine character. Nevertheless, the carbonates are expected to contain tangible evidence for bio-zoning problems about their identity. The high density, clayey-siltitic intraclastic unit A is similar to many fresh-water limestone preserved to be of lacustrine origin (Prades and Hill, 1990). This permits to view the vertically juxtaposed arenitic carbonate units (B and C) as prioritized non-marine bearing facies, represented by the foram assemblage comprising indurated peloidal oyster, crass with stromatoporoids and oyster microfacies (Hallam, 1981).

Reinforcing and indirect lines of evidence come from other areas where the Injana formation has been allocated to Shuwaikh facies with oyster, gastropod and ostracod assemblage, the fresh-water character (Lowe, 1975). In this context the criteria diagnostic of brackish water fauna integrate the contemporaneity of reduction in number of species and great abundance of crustacean fauna (mainly pelagic with some gastropods and ostracods), and the absence of normal marine (bivalves) fauna (Hudson, 1963 a, 1962b). These combined data qualify the Injana carbonate bearing facies as brackish water formations, characterized by their monospecific shell industry and absence of bivalve fauna: implying low salinity. In the Great Eastern Group and Great Od, in its northern extension, the molluscs univalves and bivalves are considered as indication of freshwater (Hudson, 1963 a, Palmer, 1979, Hallam, 1981, Andrew and Walton, 1990) where as the univalves gastropods, planolites and oysters, inhabit lacustrine lakes or tidal—brackish water (Lowe, 1984) and preserve their calcite shell structures whereas their marine counterpart are commonly preserved as biocement (Borhan, 1978).

These beds exhibit a remarkable compositional variation in fauna, and even at scale of centimeter thick laminae, which contain reworked fragmented shells. The effect of advanced salinity is considered to be of paramount importance in influencing the variable distribution, of macrofauna, particularly the molluscs, where the fauna of low-salinity—water assumes monotypic shell character (Palmer, 1959, Palmer, 1979). A factual indication is portrayed by the sudden change from intraclastic bed to peloidal and then oyster monotypic shell beds in the Injana Formation. Indeed this possible assimilation of fauna change with salinity implies modern river influenced bay where low salinity—brackish water assemblage: hardbodied pelagic which are replaced by low—salinity—brackish water oyster, in the Injana Facies, caused by salinity variation (Palmer, 1959). Consequently, the most favorable site for the establishment of both water conditions are fluvial interchannel mud facies, lagunette, bay, and estuarine settings which are more responsive to freshwater influx and salinity fluctuation. The opportunity of initiating freshwater
conditions is enhanced under wet climate, leading to synchronized between high runoff and little evaporation.

Taking into consideration all the above mentioned attributes of the Injama analog, a non-marine lake on floodplains within fluvially dominated bay, estuary or lagoon seems more plausible alternative to accommodate the freshwater fluvial deltaic and intercalated carbonate beds. Indeed, at the terminal stage of Karata Formation accumulation, vast areas of lagoon setting where flushed by freshwater, perhaps influenced by regression or climatic change. With progressive withdrawal of the lagoon and consequent propagation of the fluvial system fresh water environment of the Injama Formation dominated the scene. Alternatively, it represents lake-lagoon establishment at the distal part after fluvial flooding.

The correlatability of these non-marine carbonate and those mentioned elsewhere by Lava (1995) is worthwhile may need the mollusca as extant species, thus marking a boundary event in distal marine regime in fluvial sequence stratigraphy. Analogous freshwater brackish water mollusca have been used in correlating shallow short-lived Miocene lakes. From western Anatolia, Turkey, in order to infer their ages, based on faunal variability, and stage level changes due to water influence (Yosly and Turner, 2002).

In conclusion, the intercalated micritic molluscan beds and sediments carbonate with the fluvial sequence of Injama Formation are considered as freshwater brackish water non-marine conditions. The abrupt faunal variation in brackish water with salinity change can explain the difference in benthic communities encountered in the carbonate intercalated in the fluvial sequence of Injama Formation.

REFERENCES


Al-Jabal, R.M., 1978. Regional geological mapping of Mosul-Tel Afar area, SOM 1 library.


