

Microbiostratigraphy and Microfacies of Tarbour Formation in Makhmal- kuh (North East of Khorram Abbad-Iran)

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ABSTRACT

Tarbour Formation is a predominately carbonate Lithostratigraphic unit that paleogeographically outcrops between the Interior Fars and northwestern of Zagros thrust fault. In order to study the microbiostratigraphy of Tarbur Formation, a stratigraphic section was selected from the northwestern of Khorram Abbad and at the far end of eastern highlands of Makhmalkouh National Park. This stratigraphic section mainly consists of limestone and gray marly limestone. The rich association of benthic foraminifera and rudists reveals that the age of Tarbur Formation at the study section is Maestrichtian, the latest stage of Cretaceous. Furthermore, according to the micropaleontology data, the studied biozone is an assemblage zone equivalent to biozone-37 of Wynd (1965).

KEY WORDS: Tarbur, Paleogeography, Maestrichtian, Biozone.

1- INTRODUCTION

The type section of Tarbur Formation was provided for the first time by Farshadfar et al.(1960) and selected as a type section by James and Wynd (1965). Tarbur Formation is a carbonate lithostratigraphic unit that outcrops along the margin of High Zagros between Main Zagros fault and High Zagros fault. The most Southern outcrops of Tarbur Formation are in the east of Sabzpushan fault and east of High Zagros fault (maghfouri Moghaddam, 2007). As afore-mentioned, the main outcrop of this formation is in the interior Fars; however, it has slim outcrops in the structural basin of Lorestan (West Zagros thrust fault).

Geographical Location of Studied Area and Study Method

In order to study the Microbiostratigraphy and lithostratigraphy of Tarbur Formation deposits, a stratigraphic section was selected from the northeast of Khorram Abbad at geographical coordinates of N 38, 53'35"33"/ E 46, 32'17". The interest section located in the northwest of Khorram Abbad Province is reachable after passing through the eastern highlands of Makhmal-Kuh National Park (Fig 1).

The paleontological studies of Tarbur Formation at the study area was conducted on the ideal section of the region were sampled based on the geological maps and aerial photographs on scale 1:5000.

Ultimately, the age of Tarbur Formation at the study section was determined based on the distribution patterns of foraminifers and biozonation (Wynd, 1965).

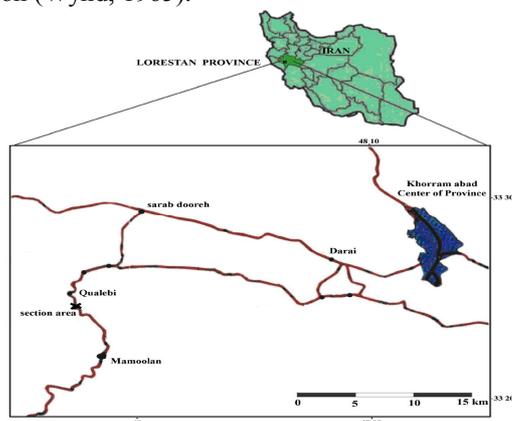


Figure 1. Access Roads and Geographical Location Map for Sections under Study

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2-Lithostratigraphy of Tarbur

Formation at the Study Section

The carbonate rocks of Tarbur Formation lie between Amiran Formation at the base and Kashkan Formation at the top. The lower part of Tarbur Formation overlies the Amiran formation with an erosional contact. This section of Amiran Formation which is called Khorram Abbad conglomerate mostly consists of gray conglomerates associated with fine- and course- grained sandstones and siltstones which turn into thin pink limestones of Tarbur Formation. The upper part of Tarbur Formation is overlain by the red conglomerate and siltstones of Kashkan Formation with apparent conformity along the line of this section.

The thickness of Tarbur Formation deposits in Makhmal kuh stratigraphic section was measured 78 m (real thickness) which considering the slim outcrops of Tarbur Formation in the structural basin of Lorestan is remarkable. The general trend and slope of layers is 110-120° toward the west (N110-120W) and 45-50° toward the north (45-50N), respectively. Tarbur formation deposits in this stratigraphic section comformably overlies dark- gray conglomerates of the Amiran Formation (khorram Abbad conglomerates) and is overlain by red conclomerates of the Kashkan Formation.

According to the result of lithologic and field survey studies, the deposits of Tarbur Formation at the study section consists of: 1- medium to thick-bedded limestones and thin-bedded marly limestone (32 m in thickness) 2- predominantly dolomite limestones with high abundance of rudists overlying the first section (44 m in thickness).

The lithostratigraphy characteristics of Tarbur Formation at the study section from bottom to top are as follows:

First Section

- 7.70m in thickness, composed predominantly of light to dark, gray limestones, thin to medium- bedded.
- 12 m in thickness, composed of mediun to thick, gray to dark- gray marly limestones.
- 12.3 m in thickness, composed of medium to thick bedded, light limestones rich in Loftusia.

Second Section

- 24.5 m in thickness, composed of medium bedded, off- white or yellowish limestones rich in rudists.
- 19.5 m in thickness, composed of medium bedded limestones rich in gastropods and light- gray rudists.

Biozonation

The microfaunal studies of Tarbur Formation in this stratigraphic section reveal the fossil content of diverse species of benthonic foraminifera. In addition, due to the high abundance of rudist fragments, the macrofauna of Tarbur Formation should be studied in more details.

In general, the age determination and study of upper cretaceous sediments based on the ratio of planctonic foraminifers is more considerable than benthic foraminifers. According to the distribution pattern of rudists and some benthonic foraminifers such as Luftosia and Omphalocyclus, Stubar & Loser (2000) and Meric & Gormoz, (2001) estimated a relatively precise age of Early-Middle Maastrichtian (under stage) for Tarbur Formation (Maghfori Moghadam,2007). Some index foraminifers were studied in this stratigraphic section includes:

Loftusia persica, (Brady, 1869)
Iraqia complanata (Henson, 1948),
Omphalocyclus sp. (macroporus), (Lamarck, 1816)
Gavelinella pertusa, (Brotzen, 1942)

In addition, some species of benthonic foraminifers can be seen as follows:

Loftusia sp.,
Omphalocyclus sp.,
Dicyclina sp.,
Valvulammina sp.,
Nezzazata sp.,
Lepidorbitoides sp.,
Idalina sp.
Rotalia sp.
Miliolids.
Valvulinids.
Textularids.
 Algal debris.
 Rudist frag.
 Gastropoda frag.
 Coral frag.

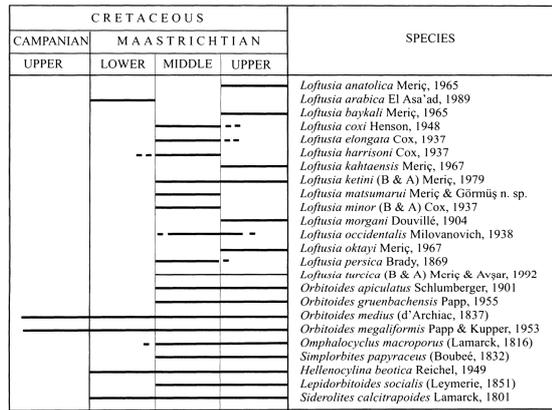


Figure2. Time chart of Index species such as Luftosia and other associated foraminifers from the Cretaceous (Engin Meric and Muhittin-2001 Gormu)

In this fossil assemblage, the presence of different species such as Luftosia and persica indicate the age of Middle Maastrichtian. Also, the distribution pattern of Omphalocyclus species which is an index of the lower Cretaceous (Middle- Lower Maastrichtian) as well as the precence of Luftosia and Omphalocyclus assemblages may reflect the age of Middle Maastrichtian for this stratigraphic section of Tarbur Formation (Fig. 2).

According to the originations and extinctions of index species were studied in this section and the presence of index species such as *Loftusia persica* and *Omphalocyclus* sp.(*macroporus*), the studied biozone is an assemblage zone equivalent to biozone-37 of Wynd (1965).

Omphalocyclus-Loftusia Assemblage zone No-37 (Wynd 1965) is observed in the coastal Fars and some parts at the base of Sachun Formation. Based on the correlation with afore-mentioned biozone, the age of Tarbur deposits at the study section is Maestrichtian. Perhaps, some parts of Semireh Limestone are equivalent to biozone-37 of Wynd (1965).

Some species such as *Siderolites* sp. & *Orbitoides media*, were observed at the type section and other outcrops of Tarbur Formation in Fars, haven't be seen in khorram Abbad. In addition, there are other species such as *Loftusia* only some of them due to the morphological and physiochemical characteristics of paleontological environment during the life time were identified in the study area (fig 3).

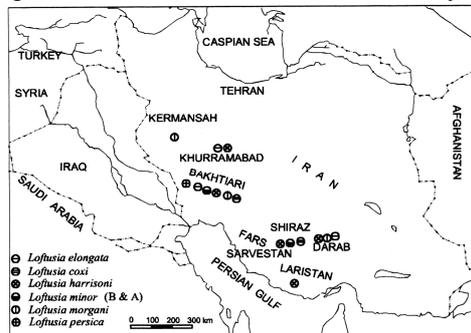


Figure3. Geographical Distribution Map of Loftusia Sp. in Iran (Merit and mojab, 1977)

The age comparison of *Loftusia harisoni*, *Loftusia elongate*, *Loftusia minor* with south margin of Tetis such as Turkey (Merit & Mojab, 1977; Meric & Görmüş, 2001; Meric & Ersoy, 2000) and Iraq indicates a Middle- Late Maastrichtian for Tarbur Formation (around Khorram Abbad). It should be noted that a high abundance of 3 species of afore-mentioned *Loftusia* were observed in Tarbur deposits (Table 1).

Table1: Age comparison of index species of Luftosia in different regions of Middle East with particular emphasis on Iran, Turkey and Iraq.) (Engin Merif and Muhittin Gormiis-2001)

| | IRAN (Cox, 1937) | IRAQ (Al-Omari and Sadek, 1976) | TURKEY (Meric et al. 2001) | MIDDLE EAST This study |
|---|--|---|---|---|
| M A A S T R I C H T I A N | LATE <i>Loftusia morgani</i> <i>Loftusia persica</i> <i>Loftusia elongata</i> | <i>Loftusia persica-Loftusia Elongata</i> | <i>Loftusia morgani</i> <i>Loftusia anatolica</i> <i>Loftusia oktayi</i> <i>Loftusia baykali</i> <i>Loftusia kahtaensis</i> | <i>Loftusia morgani</i> <i>Loftusia anatolica</i> <i>Loftusia oktayi</i> <i>Loftusia baykali</i> <i>Loftusia kahtaensis</i> |
| M I D D L E | <i>Loftusia elongata</i> <i>Loftusia minor</i> | <i>Loftusia elongata</i> <i>Loftusia coxi</i> and <i>Loftusia spp.</i> | <i>Loftusia elongata</i> <i>Loftusia harrisoni</i> <i>Loftusia minor B and A</i> | <i>Loftusia elongata</i> <i>Loftusia harrisoni</i> <i>Loftusia minor B and A</i> <i>Loftusia matsumarui n. sp.</i> |
| E A R L Y | <i>Loftusia harrisoni</i> | | | <i>Loftusia arabica</i> |

4. High percentage of Sparite cement indicates the presence of enough energy to transfer the lime muds
5. Presence of benthic foraminifers were identified in limestone of Tarbur Formation is an indicative of their deposition in shallow-water marine environments and also the presence of fossils such as rudist-dominated reefs

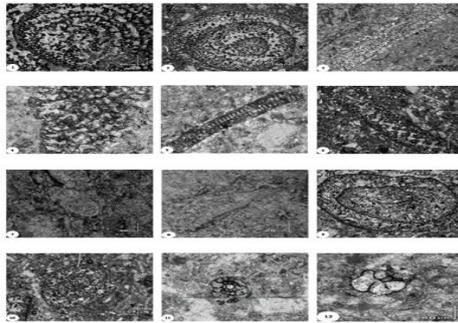
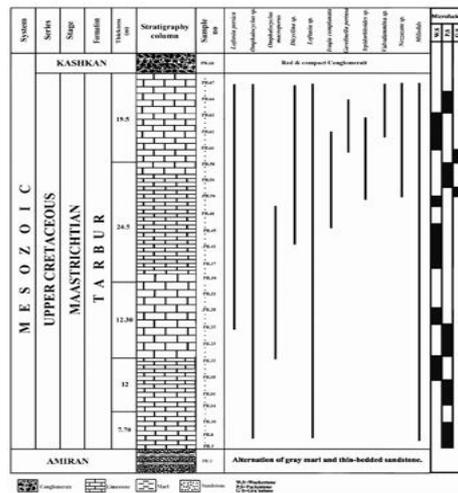


Fig 1&2:*Loftusia persica* Sample.No:P.R:28&45
 Fig 3:*Omphalocyclus macroporus* Sample.No:P.R:42
 Fig 4:*Iraqia complanata* Sample.No:P.R:53
 Fig 5&6:*Dicyclina* sp. Sample.No:P.R:49&56
 Fig 7:*Gavelinella pertusa* Sample.No:P.R:61
 Fig 8:*Lepidorbitoides* sp. Sample.No:P.R:54
 Fig 9&10:*Loftusia* sp. Sample.No:P.R:7&14
 Fig 11:*Nezzazata* sp. Sample.No:P.R:55
 Fig 12:*Valvulammina* sp. Sample.No:P.R:63



Biostratigraphic and Lithologic Column and Vertical Changes in Deositional Environment of Tarbur Formation in Stratigraphic Section of East of Makhmal-kuh



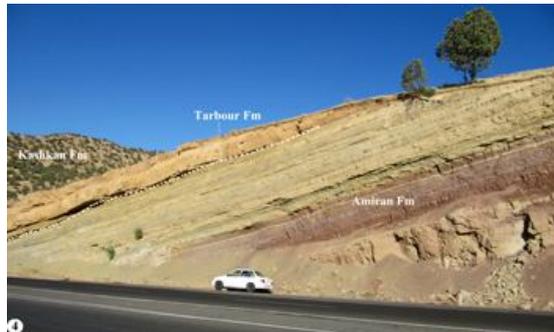
Figures: 1
 1. Inter-bedded marly limestone of upper parts of Tarbur Formation in stratigraphic section of east of Makhmal-kuh



2. unconformable outcrops of limestones of Tarbur Formation in stratigraphic section of east of Makhmal kuh (East North View)



3. Lower parts of Amiran Formation consist of conglomerates, shale and marl overlain by limestones of Tarbur Formation (East View)



4. A general view of succession of afore-mentioned formations besides main road (East North View)



5. Amiran formation (Khorram Abbad conglomerates) eroded by activity of rivers (South View)



6. Bio- accumulation of microfossils such as *Luftosia* in middle parts of Tarbur Formation at the study section.



7- Accumulation of some fossils of rudists filled with coarse- grained calcite under influence of secondary factors such as diagenesis

Depositional Environment Model

Relying on the results of studies, the lower parts of Tarbur formation at afore- mentioned stratigraphic section were deposited in fore-reef environment with relatively deep water circulation. Considering some factors such as the alucim size and sorting, the presence of miliolids as well as relatively high percentage of pellets, it is concluded that the deposition of Tarbur lime stones occurred in fore- and back reef environment.

The lower parts of Tarbur Formation in this stratigraphic section consists of facies such as Bioclast Pelloid Lime Wackstone and Bioclast Lime Wackstone which are typical in lagoon environments. Some characteristics of these facies as are available in many resources are attributed to the decrease in environmental energy and low water circulation. Some index foraminifers were observed are *Luftosia*, *Textularia*, *Miliolida* and non- foraminifers are algae, bryozoa, gastropod, Echinodermata, green and red marine algae, etc. The middle and lower parts of Tarbur Formation at afore-mentioned stratigraphic section were deposited in such a depositional environment. There are other facies were studied such as Bioclast Lime Packstone - Bioclast Intraclast Lime Packstone. The main characteristics of this facies are attributed to the increase in water circulation and as a result, decrease in carbonate mud or micrite which is an indicative of increasing the energy level of environment. The vertical changes in microfacies column reveal that Tarbur Formation mostly consists of limestone and microfacies (wackstone and packstone) has an upward change from wackstones to packston, indicating an upward retrogradational sequence.

4- Conclusion

The following results were obtained from the study of Tarbur Formation in the stratigraphic section of east of Makhmal-kuh:

1. The deposits of Tarbur Formation at afore-mentioned stratigraphic section is 78 m in thickness.
2. Based on the available evidences, Tarbur Formation in the stratigraphic section of east of Makhmal- kuh in east north of Khorram Abad conformably lies with an erosional contact on the dark- gray conglomerates of the Amiran Formation.
3. The upper part of Tarbur Formation is overlain by the red conglomerate and siltstones of Kashkan Formation with apparent conformity along the line of this section.
4. The succession of Tarbur Formation at the study section consists mostly of medium to thick- bedded limestones.
5. The successions of Tarbur Formation in east north of Khorram Abad consist of benthic foraminifer- dominated assemblages and no planktonic microfossils are present.

6. Although Tarbur deposits contain a high variety and abundance of rudist macrofauna, they describe less continuum form structure except for two layers (no real biostrome)
7. Based on available paleontological evidences and fauna of *Omphalocyclus-Loftusia* Assemblage zone No-37 (Wynd 1965), the age of Tarbur Formation at the study section is Maestrichtian . In addition, the age comparison of afore-mentioned species and species comparison between Iran and other neighboring countries such as Iraq and Turkey (Meric & Mojab, 1977; Meric & Görmus, 2001; Meric & Ersoy, 2000) indicates the age of Middle- Late Maastrichtian.
8. Fossil analysis evidences indicates the presence of benthic foraminifer fossils such as *Siderolites calciraporus*, *Orbitella media*, *Dictyoconella* at the type section. The recent studies also show their presence in west south of Lorestan.
9. Tarbur formation at the study section consists of a carbonate facies and four carbonate microfacies of benthic foraminifer wackstone – packstone which were deposited in shallow depth of the continental plateau (fore- and back reef environments). The existing limestone was deposited under different condition of energy increased from wackstone to packstone microfacies.

REFERENCES

1. Aghanabati, I., Iran Geology, Geological Survey Of Iran, 2004.
2. Alavi, M., 2004, Regional Stratigraphy of the Zagros Fold-Thrust Belt Of Iran and Its Proforeland Evolution, American Journal of Science, Vol. 304, January, 2004, P. 1–20
3. Engin Merif and Muhittin Gormiis, The Genus Loftusia, Micropaleontology, vol. 47, Supplement no. 1, 2001.
4. Dunham, R. J., (1962). Classification of Carbonate rocks according to depositional texture , in: Ham, W. E. (Ed.) , Classification of carbonate rocks AAPG Mem, 1: pp:62-84.
5. James, G. A., Wynd , J. G., (1965), Stratigraphic Nomenclature of Iranian Oil Consortium Agreement Area, A. A. p. G. Bulletin, vol. 49, No. 12. pp 2218-2232.
6. Maghfoori, M. I., Biostratigraphy of Tarbur Formation In Zagros Area, Third Symposium Of geology & Environment, 2007, Eslam shahr-Tehran, Iran.
7. MERIT, E., and MOJAB, F., 1977. World-wide geographical distribution of the species of the foraminiferal genus Loftusia. Istanbul Universitesi, Fen Fakiiltesi Mecmuasi, B, 42 (1-4): 143-155.
8. Wells, A. J., 1967, Lithofacies and geological history of lower Tertiary sediments in southwestern Iran (Asmari lithofacies study): Iranian Oil Operating Companies, Geological and Exploration Division, Report 1108, 48 p. Willett, S. D., Beaumont.
9. Wynd, J. G., (1965). Biofacies of the Iranian oil consortium Agreement Area . N.I.O.C Report. No. 1082, pp:57-66.
10. Wynd, J. G., 1965, Biofacies of the Iranian Oil Consortium Agreement area: Iranian Oil Operating Companies, Geological and Exploration Division, Report 1082, 89 p.