Microbiostratigraphy and Paleoeocology of bentic foraminifers study based on the Microfacies and Sedimentary Sequence identification and interpretation in Asmari Formation of South-East of Shiraz (Fars province)

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Abstract
In this research, two stratigraphic sections were chosen from Asmari Formation. These sections include Shamsabad and Runiz plus 280 meters. For this investigation 251 thin-sections were prepared and 14 samples analysed by XRF. We studied paleobiotope that includes biozone and sedimentary sequence. These index biozones and percentage of elements that appear in paleobiotope are identified. Principally index bentic foraminifers, identified in the studied sections, are listed below:

Based on aforementioned foraminifers, the age of studied sediments is Oligocene to early Miocene and also three biozones have been identified for these sediments. Regarding the frequency, sedimentary sequence (parasequence and system tract), type of wall and paleobiotope percentage ratio of each foraminiferal biozone, there are different paleobiotopes that indicate change in the trend of paleoecologic conditions of Asmari formation.

Keywords: Biozone; Paleobiotope; Sedimentary Sequence; Foraminifer; Asmari Formation;

1- Introduction
the Asmari Formation in Fars region overlays the Jahrum Formation with an erosional disconformity. The first time, the type section of Asmari Formation has been studied by R.K.Richardson (1924) in the strait of Goltorsh. In the type section exists only middle and upper part of Asmari Formation. The age of Asmari Formation has been said Oligocene to Burdigalian by Thomas (1948). And the Asmari Formation has been divided by three part, lower Asmari with the Oligocene age, middle Asmari with the Aquitanian age of Miocene and upper Asmari with the Burdigalian age of Miocene. The lithology of this Formation consists of cream to brown limestone with the fossil shell and the thickness of the sediments is 314 m. (Motiei 1372, Khosrotehrani 1384, Darvishzade 1385)
2- Geographical situation of the studied stratigraphic sections
The studied stratigraphic sections are situated in South-East of Shiraz (Fars province), we can approach it through the main road of Shiraz-Estahban. The geographic coordinates of Runiz section is N 29º, 19’ – E 53º, 25’ and The geographic coordinates of Shamsabad section is N 29º, 13’ – E 53º, 23’.

3- Introducing Biozonation of the studied stratigraphic sections
Actually, in the studied stratigraphic sections, three biozones have been determined for benthos foraminifers in the sediments of Upper Oligocene (Chatian) to Lower Miocene (Burdigalian) which are as follow:

3-1- Biozone No. 1 - Nummulites fichteli – Nummulites intermedius – Nummulites vascus assemblage - zone
The thickness of this biozone in Shamsabad section is 56 m. and in Runiz section is 25.5 m. and its microfossils includes: Pearhapydionina delicate, Spiroclypeus ranjanae, Rotalia viennoti, Ditruba sp. which indicates the age of Chatian. According to Thomas’s definition, this assemblage zone is equivalent to lower Asmari.

3-2- Biozone No. 2 - Austroterillina howchini – Peneroplis evolutus assemblage – zone
The first time, this assemblage zone has been recognized by Wynd (1965) and according to division of Thomas, it is equivalent to middle Asmari (Aquitanian) and its phonetic contents includes: Peneroplis thomasi, Archaias sp., Pyrgo sp., Archaias krikukensis, Valvulinid sp., Spirolina cylindracea, Triloculina trigonula. The thickness of this biozone in Shamsabad section is 46 m. and in Runiz section is 49 m.

3-3- Biozone No. 3 - Borelis melo group – Meandropsina iranica assemblage – zone
This assemblage zone is equivalent to Borelis melo group – Meandropsina iranica assemblage – zone (Adames and Bourgeois, 1967) and according to division of Thomas, it is equivalent to upper Asmari (Burdigalian). Its microfossils contents includes: Dendritina rangi, Valvulinid sp., Pyrgo sp., Triloculina trigonula, Peneroplis sp., Rotalia viennoti, Austroterillina sp., Borelis sp., Meandropsina anahensis. The thickness of this biozone in Shamsabad section is 45 m. and in Runiz section is 58.5 m.

4- Description of Sequence Stratigraphy and microfacies of Asmari Formation in the Studied Stratigraphic Sections
Actually, based on the sequence stratigraphic studies, the studied sections of (Shamsabad and Runiz) includes two 3rd order sediment sequence and 6 facies groups is recognized.

4-1- Sediment sequence 1
The age of this sequence is Chatian to Aquitanian and it consists of lower and middle part of Asmari Formation. lower boundary of SB1 type is placed on Jahrum Formation and upper boundary of SB2 type is in the end of middle part of Asmari Formation. the thickness of this
The 1st International Applied Geological Congress, Department of Geology, Islamic Azad University - Mashad Branch, Iran, 26-28 April 2010

4-1- Sediment sequence 1

The sediment sequence in Runiz section is 75.5 m. and in Shamsabad section is 102 m. Maximum flooding surface (mfs) in studied sections is Wackestone-Packestone Bioclastic with Crinoid shelf, Gastropoda, Ostracoda, Bryozoa, spine Echinoid and foraminifers for example Pyrgo sp., Reusella sp., Elphidium sp., Amphistegina sp. This sequence consists of Transgressive System Tract (TST) with open marine facies (fore bar shelf) and Highstand System Tract (HST) with bar and lagoon facies. The thickness of TST in Runiz section is 31 m and in Shamsabad section is 26 m. Parasequence stacking pattern of TST is a regressive form. The thickness of HST in Runiz section is 45 m. and in Shamsabad section is 76 m. Parasequence stacking pattern of TST is an aggradational form.

4-2- Sediment sequence 2

The age of this sequence is Burdigalian. The thickness of this sediment sequence in Runiz section is 57.5 m. and in Shamsabad section is 45 m. Lower boundary is SB2 type and upper boundary is SB1 type. Maximum flooding surface (mfs) in studied sections is Packestone facies with microfossils for example Globorotalia sp., Triloculina tricarinata, Meandropsina sp. (TST) facies is open marine limestones that the thickness of it in Runiz section is 27 m. and in Shamsabad section is 14 m. HST consists of shoal and lagoon facies that the thickness of it in Runiz section is 30 m. And in Shamsabad section is 31 m. (Lassemi, 1980)(Flugel, 2004)(Dunham, 1962). Parasequence stacking pattern of TST and HST show a regressive form. (Fig.1, Fig.2) (Sarg, 1988) (Emery & Myers, 1996) (Sloss, 1963) (Khosrotehrani, 1386)

5- Paleoecology

The most abundant rate of foraminifers is in lower part of the studied stratigraphic sections (Biozone No.1). And this amount is decreased in middle and upper part (Biozone No.2 & 3). The variety of species in lower part is more than middle and upper part. The percentage of Na_2O in biozone no.1 is the most amount and this percentage is decreased in biozone no.2 & 3. Increasing in becoming thick of porcelain test is the mot amount in biozone no.1. In fact, fauna test in order to resist collision of waves to bar is became thick in this biozone. The percentage of CaO and MgO is decreased. but in biozone no.3, becoming thick Hyalin test is observed for example Rotalia viennotti, that in this biozone, the percentage of MgO and CaO is increased. The most availability of foraminifers with Agglutinate test and Porcelanous test are observed in paleobiotope related to TST, facies and the most availability of foraminifers with Hyaline test is in paleobiotope related to HST facies.

(Fig.3, Fig.4, Fig.5, Fig.6) (Khosrotehrani, 1382) (Zavarei, 1387)

6- CONCLUSIONS

a) Two stratigraphic sections of Runiz and Shamsabad have a lot of similarities in view of biozonation and sequence stratigraphy.

b) Based on the investigation of foraminifers of the studied sections, there are these biozones that have been identified which includes:

Biozone No. 1- Nummulites fichteli–Nummulites intermedius–Nummulites vascus assemblage – zone of Chatian.

Biozone No. 2- Austroterillina howchini–Peneroplis evolutus assemblage–zone of Aquitanian.
Biozone No. 3- *Borelis melo group* – *Meandropsina iranica* assemblage–zone of Burdigalian. However the age of both stratigraphic sections is from Chattian to Burdigalian.

c) The most availability of foraminifers with Agglutinate test and Porcelanous test were observed in paleobiotope related to TST, facies and the most availability of foraminifers with Hyaline test was in paleobiotope related to HST facies.

d) The lower border of the Asmari Formation (SB1) has been distinctive with an erosion-made disconformity as the result of an Peirian Orogenic phase operation and the upper border of Jahrum Formation is erosion-made disconformity.

e) According to the biostratigraphic limits of the studied sections, datum line is determined in U.Oligocene (Chatian).

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Fig 1: Sequence Stratigraphy description of Runiz stratigraphic section

Fig 2: Sequence Stratigraphy description of Shamsabad stratigraphic section

Fig 3: The distribution of index elements in Runiz stratigraphic section sediment

Fig 4: The distribution of index elements in Shamsabad stratigraphic section sediment
Fig 5: The process of changes in abundant rate of microspheric, megalospheric form, bentic and pelagic foraminifera and changes rate of test kinds of foraminifera in biozones and different facies of the studied stratigraphic sections.

Fig 6: The block diagram of Asmari Formation sedimentary basin in the studied stratigraphic sections, according to sedimentary facies condition and sequence facies sets condition and biozones.