Lithostratigraphy and Biostratigraphy of Dariyan Formation in Southwest of Iran

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Abstract: The study of Lithostratigraphy and Biostratigraphy of Dariyan Formation in the interior Fars, Zagros folded zone and recognition of relationship Lithostratigraphy and Biostratigraphy, one stratigraphic section (Gadvan section) have been selected and studied. The total thickness of Darian Formation in study area is 285 m. The Khami group within the petroliferous Zagros Basin of Iran includes the Surmeh, Hith, Fahliyan, Gadvan and Dariyan Formations. According to the lithostratigraphic investigations, the Dariyan Formation in these sections is subdivided into three: lower, middle and upper, which include thin-bedded to thick-bedded and massive limestone. The Dariyan Formation, previously known as Orbitolina limestone is very significant as a reservoir rock in the Zagros Basin. In this study, the age of the Dariyan Formation is examined based on biostratigraphic and paleontological investigations. Micropaleontologic study of the Dariyan Formation has led to the recognition of two biozones in the Gadvan area in stratigraphic column. The identified microfossils index in these thin section respectively as: Mesorbitolina texana, Mesorbitolina parva, Mesorbitolina subconcaeva, Mesorbitolina ovalis, Dictyoconus sp., Debarina hahourensisis, Iraqia sp., Lenticulina sp., Orbitolina kurdica, Dictyoconus cf arabicus, Pseudocyclammina littus, Praechrysalidina sp, Trocholina cf.alpina, Nezzazata sp., Marssonella sp., pseudolitunella sp.,conicorbitolina conica. Based on the identified foraminifera, the age of the Dariyan Formation in the Gadvan area is assigned to Aptian-Albian.

Keywords: Biostratigraphy, Lithostratigraphy, Dariyan Formation, Microfossils
1. Introduction

Aptian to Albian sediments within the area of study consist of Dariyan Formation. The best extension of Dariyan Formation is in Fars province. This Formation is the youngest Formation of Khami group at the age of Aptian to Albian and it is located in the Zagros folded-faulted belt (Alavi, 2007). The Jurassic to early Cretaceous carbonates of the petroliferous Zagros Basin in Iran are known as the Khami Group. It includes the Surmeh, Hith, Fahlilyan, Gadvan and Dariyan Formations. The Dariyan Formation, present in the southwest of Iran, within the Khami Group was studied for the first time by James and Wynd (1965) at a type section which is located 65 km from eastern Shiraz. The lithological aspect of the Dariyan Formation is generally composed of grey to brown thick-bedded to massive Orbitolinid sandy limestone (James and Wynd, 1965; Kalantari, 1976).

Generally, an iron nodule zone is distinguishable between the Dariyan and Kazhdumi Formations. Based on micropaleontologic study of the type section, the age of the Dariyan Formation is assigned to Aptian (James and Wynd, 1965). Kalantari (1976) has studied the Dariyan Formation in the southwest of Shiraz and the age of the Dariyan Formation was determined as Aptian in this area too. Since the biostratigraphic limits of the Aptian successions change in some parts of the Zagros Basin, Aptian biostratigraphy can be used as a tool for the interpretation of faunal assemblage characteristics along the Zagros area. Furthermore, the Aptian-Albian strata are very significant as reservoir rock in the Zagros (Mirzapour et al., 2010) and are amongst the most important targets for oil field development in Iran. Many authors have focused on the phylogenetic and biostratigraphic study of Orbitolina taxa (Husinec, 2001; Castero et al., 2001; González-León et al., 2008; Schroeder et al., 2010).

2. Geographical Location of the Study Area:

Stratigraphic section of the study area is located in the folded Zagros zone. Geographical coordinates and lithostratigraphic status of the stratigraphic section is according to Table 1. Stratigraphic section of Gadvan is located 65km of Shiraz (Figure 1).

Table 1. Geographical coordinates and lithostratigraphic status of Gadvan stratigraphic section

<table>
<thead>
<tr>
<th>No</th>
<th>Section Name</th>
<th>Formation</th>
<th>Dominant Lithology</th>
<th>Coordinate U.T.M</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gadvan</td>
<td>Dariyan</td>
<td>Limestone</td>
<td>52° 59’ 06” E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29° 35’ 20” N</td>
</tr>
</tbody>
</table>

Figure 1. Geographical status of Gadvan stratigraphic section
3. Lithostratigraphy of Dariyan Formation in stratigraphic section of Gadvan

The overall thickness of Dariyan Formation at the stratigraphic section of Gadvan is 285 m. The Dariyan Formation is overlaid conformably on the marls of the Gadvan Formation (Barremian) as the gradational lithostratigraphic limit. The Gadvan Formation is made of light grey to brown medium- to thick-bedded marls and bioclastic argillaceous wackestone. The marl limestone and bituminous shale of the Kazhdumi Formation (Albian) overly the Dariyan limestone, and the boundary is marked by a sharp contact. Generally, an iron nodule zone is distinguishable between the Dariyan and Kazhdumi Formations. The Kazhdumi Formation is composed of marl at the top, which is followed downwards by successions of dark argillaceous limestone and marls.

According to index Foraminifera, the geologic age of Dariyan Formation at the stratigraphic section of Gadvan is from Aptian to Albian. Sequences of Dariyan Formation at Gadvan stratigraphic section include 285 m of limestone and Orbitolina limestone that are divided into three top-down lithological part as follows:

a) Lower part:
The lower part is 70 m. Light gray thick- bedded limestone. The age of this part has been determined from Aptian.

b) Middle part:
The middle part is 73.5 m. gray to light brown medium – bedded to thick- bedded limestone.

c) Upper part:
The Upper part is 141.5 m. gray to light brown thin – bedded to massive limestone (Figure 2).

The existing foraminifera such as:

- Mesorbitolina subconcava
- Mesorbitolina ovalis
- Dictyoconus sp., Debarina hahouensis, Iraqia sp., Lenticulina sp., Orbitolina kurdica, Dictyoconus cf arabicus, Pseudocyclusmmina liltus, Nezzazata sp., Praechrysalidina sp, Trocholina cf.alpina, Marssonella sp., pseudolitunella sp., conicorbitolina conica.

The age of the Dariyan Formation in the Gadvan area is assigned to Aptian- Albian.

4. Biostratigraphy of Dariyan Formation at stratigraphic section of Gadvan

4-1. Description of Biozones

Based on vertical diffusion and distribution of existent Foraminiferas in Dariyan Formation in studied stratigraphic section, 2 biozones were identified as related to Dariyan Formation with Aptian to Albian age. Determining the study
Formations’ biozones is performed according to biozones presented by James and Wynd (1965) Previous biostratigraphic data of the Dariyan Formation confirms Orbitolinid taxa as clearly dominant biofacies which are recognizable in Dariyan limestone (e.g James and Wynd, 1965; Kalantari, 1976). Schroeder et al. (2010) have explained the evolutionary trend of the Orbitolinidae family and the regional stratigraphic correlation of the Arabian plate. Paleoenvironmental evidence recommends the Aptian biofacies relationship to a shallow water carbonate system, particularly in the Zagros area (Alsharhan and Nairn, 1986). Hence the Orbitolinids bed of the Aptian is of paleoecological significance in the studied stratigraphic sections. The two above mentioned biozones established in this stratigraphic section are numbered as biozones I and II. (Figure 3)

Biozone 1: The Orbitolina (Mesorbitolina) texana-Orbitolina (Mesorbitolina) parva Assemblage Zone.

This biozone is described by the first appearance of M. parva Douglass and M. texana (Roemer). This range zone is considered consistent with the Lithostratigraphic Lower part of Darian Formation at stratigraphic section of Gadvan. Benthic foraminifer taxa are well distributed in this biozone, and particularly Orbitolinids. Common foraminifer association of this biozone consists of Mesorbitolina texana, Mesorbitolina parva, Mesorbitolina subconca, Mesorbitolina ovalis, Dictyoconus sp., Debarina hahourensis, Iraqia sp., Lenticulina sp., Orbitolina kurdica, Dictyoconus cf arabicus, Pseudechyclammina luitus, Praechrysalidina sp., Trocholina cf. alpina, Nezzataza sp., Marssonella sp., conicorbitolina conica., pseudolitinella sp. There is a clear abundance of Orbitolinids in the M. parva and M. texana Assemblage zone.

However, Late Aptian-Early Albian foraminifers are well developed in this biozone. Therefore, late Aptian-Early Albian age is acceptable for Biozone I in this stratigraphic column.

Biozone 2: The Conical orbitolina Assemblage Zone is the upper zone of Albian sediments belonging to Darian Formation at Gadvan stratigraphic section. This assemblage zone is considered consistent with the Middle to upper Lithostratigraphic part of Dariyan Formation at Gadvan stratigraphic cross-section. Fossils contents of this biozone are conicorbitolina conica.

However, Albian foraminifers are well developed in this biozone. Therefore, Albian age is acceptable for Biozone I in this stratigraphic column.

5. Conclusions

Deposits of Dariyan Formation with 285m of thickness with limestone lithology was sampled and studied at the stratigraphic cross-section of Gadvan. In order determine that are divided into three Upper-Lower lithological part. All previous studies of the Dariyan Formation have looked into the biozones with characteristic benthic foraminifers (James and Wynd, 1965 and Kalantari, 1976). According to biostratigraphy, the existence of genera and species existent in 2 biozones of Dariyan Formation in stratigraphic section was identified.

Biozone 1: The Orbitolina (Mesorbitolina) texana-Orbitolina (Mesorbitolina) parva Assemblage Zone.

Biozone 2: The Conical orbitolina Assemblage Zone.

Regarding the index microfossils, the age of Dariyan Formation Aptian to Albian.

References


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Figure 3. Biostratigraphy column of Dariyan Formation at Gadvan stratigraphic section

Figure 4. Image of Dariyan Formation in stratigraphic type section of Gadvan
Figure 5. Some microfossils indices of Dariyan Formation at stratigraphic cross-section of Gadvan

Fig. 5-1: *Marssonella* sp., Cushman 1933, Longitudinal section, x40, thin section no. DA-55.

Fig. 5-2: *Lenticulina* sp., Lamark 1804, Axial section, x100, thin section no. DA-98.

Fig. 5-3: *Orbitolina (Conicorbitolina) conica* d’Archaic 1837, x100, thin section no. DA-108.

Fig. 5-4: *Praechrysalidina* sp., Luperto Simi 1979, x40, thin section no. DA-28.

Fig. 5-5: *Dictyoconus cf arabicus*, Schrieder 1965, Transvers section, x40, thin section no. DA-58.

Fig. 5-6: *Trocholina cf. arabica*. Henson, 1949 Axial section. (x40), thin section no. DA-120.

Fig. 5-7: *Iraqia* sp., Henson 1948. Axial section, x40, thin section no. DA-80.

Fig. 5-8: *Debarina hahourensis* Fourcadet 1972, Transverse section, x100, thin section no. DA-59.

Fig. 5-9, 5-12: *Mesorbitolina texana* Roemer 1852, Axial section, x40, thin section no. DA-116.

Fig. 5-10: *Mesorbitolina subconcava* Leymerie 1878, Axial section, x100, thin section no. DA-64.

Fig. 5-11: *pseudoollitunella* sp., Marie 1955, Axial section, x40, thin section no. DA-99.

Fig. 5-13: *Pseudocyclammina littus* Yokoyama, Axial section, x40, sample no. DA-98.

Fig. 5-14: *Trocholina cf. alpina* Leupold & Bigler 1936, Axial section, x40, thin section no. DA-112.

Fig. 5-15: *Orbitolina kurdica* Henson 1948, Axial section, x100, thin section no. DA-104.

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