

Microbiostratigraphy of Asmari Formation in Robat Namaki section, Zagros Basin

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Abstract

Asmari Formation was deposited in the foreland Zagros Basin (southwest Iran). In this research, biostratigraphy related to the Asmari Formation in North of Khorram Abad, Robat Namaki section, is discussed. In the studied stratigraphic section, the Asmari Formation overlies the Shahbazan Formation and underlies Gachsaran Formation and consists of cream to gray medium to thick limestone and marl. A study of 61 samples of the 102 m-thick Asmari Formation led to identification of 4 species and 23 genera of foraminifera. On the basis of the recognized foraminifera, the age of middle part of the Asmari Formation in the studied section is assigned to Early Miocene (Burdigalian) which is comparable to *Borelis melocurdica* Assemblage Zone. The lower and upper parts of Asmari Formation are characterized without diagnostic microfossils and due to their stratigraphical position, assigned to the Aquitanian – Burdigalian, respectively.

Keywords: Asmari Formation, Biostratigraphy, Zagros Basin, Burdigalian, Aquitanian.

1- Introduction

The Asmari Formation was deposited in a northwest- southwest oriented foreland Zagros Basin which extended from northeastern Syria through northern and northeastern Iraq into southwestern Iran (Alavi, 2004). The Zagros Basin was a part of the stable supercontinent of Gondwana in Paleozoic time and a passive margin in Mesozoic time and became convergence orogene in Cenozoic Time (Farahpour and Hessami, 2012). The Zagros basin has been the subject of detailed study ever since the first petroleum reservoir in Cenozoic sediments (Oligo-Miocene carbonate of the Asmari Formation) was discovered at Masjed Soleyman in Iran. Oligo-Miocene reservoirs currently produced prolifically not only elsewhere in Iran but also in Iraq (e.g. Kirkuk Field), Oligocene Kirkuk Group reservoir

(Beydon, 1991). Stratigraphical investigation of the Asmari Formation in Zagros started with the work of Busk and Mayo (1918), Subsequence Workers such as Richardson (1924) and Thomas (1948) reported lithostratigraphy of the Asmari Formation. The biostratigraphic framework of the Asmari Formation was established by Wynd (1965) and revised by Adams and Bourgeois (1967). The age of the Asmari Formation was defined from Rupelian to Burdigalian. It is divided into lower (Oligocene), middle (Aquitanian) and upper (Burdigalian) parts. Ehrenberg *et al.* (2007), Laursen *et al.* (2009) and Van Buchem *et al.* (2010) applied strontium isotope dating to the Asmari Formation and established biozonation of wynd (1965) and Adams and Bourgeois (1967).

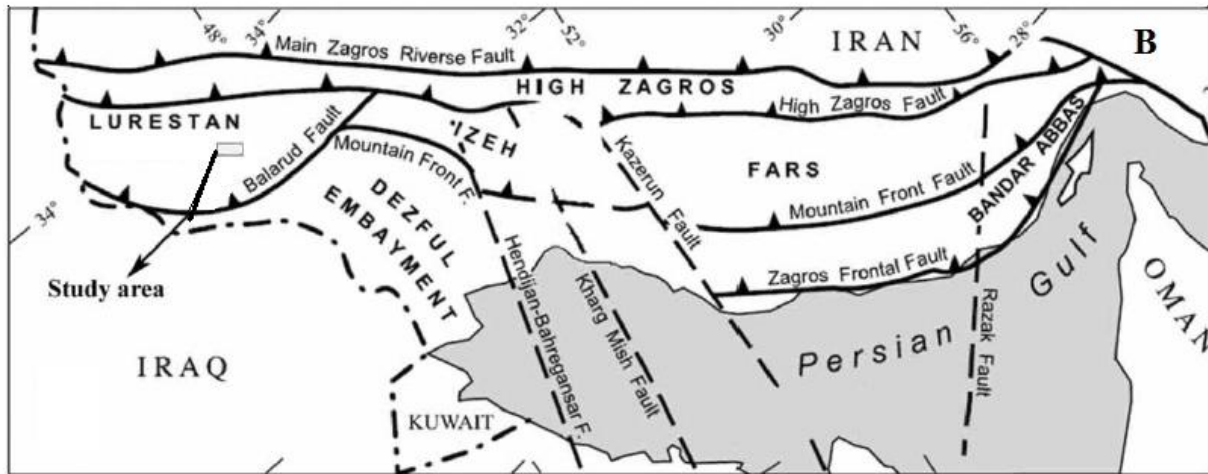


Figure 1) Structural framework of Zagros Basin (Sherkati and Letouzey, 2004).

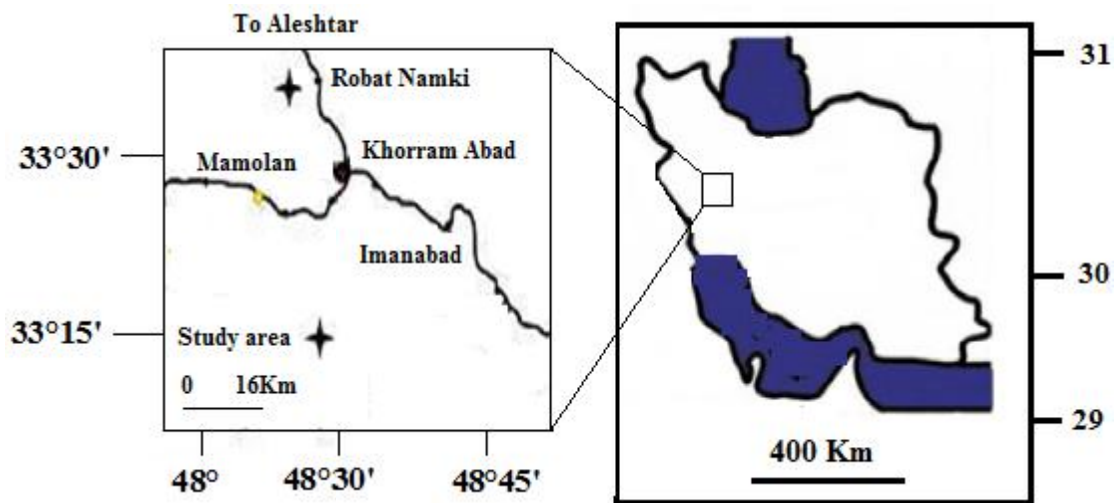


Figure 2) Location map of Robat section in the Zagros region, southwest Iran.

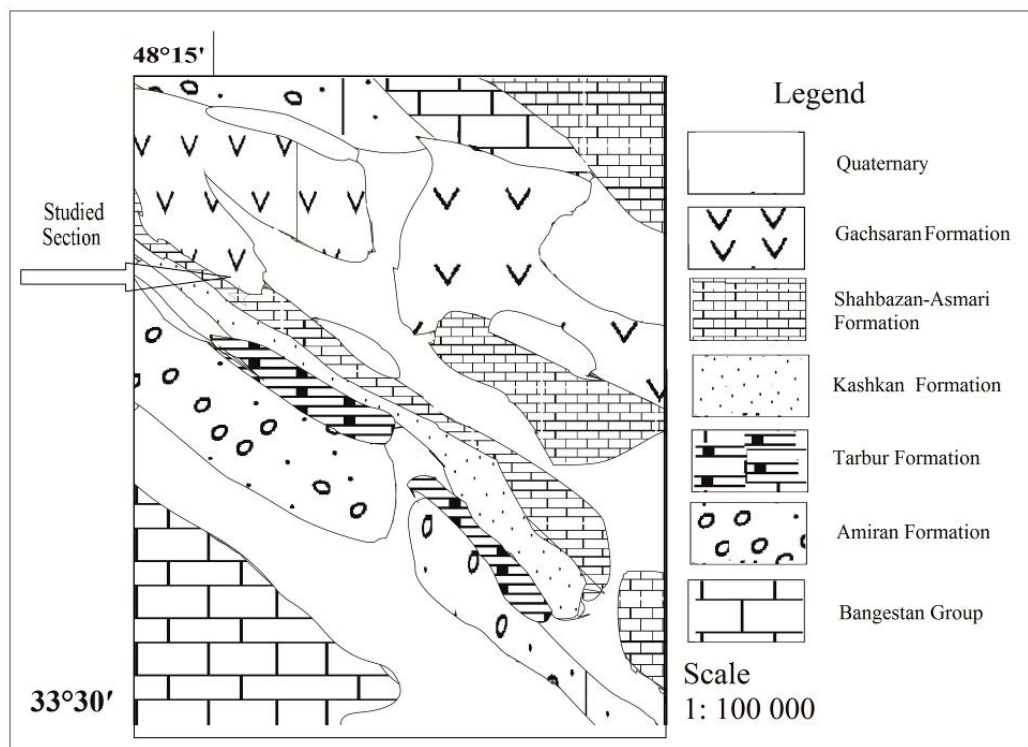


Figure 3) Simplified lithological map of studied section (modified after N.I.O C).

More recent studies of the Asmari Formation have been conducted on the biostratigraphy criteria, microfacies and sequence stratigraphy (e.g. Ahmadi *et al.*, 2012; Amirshahkarami *et al.*, 2007a, 2007b; Ehrenberg *et al.*, 2007; Hakimzadeh and Seyrafian, 2008; Maghfouri Moghaddam, 2014; Maghfouri Moghaddam and Bayatanian, 2013; Mossadegh *et al.*, 2009; Sadeghi *et al.*, 2009; Seyrfian and Hamedanian 1998, 2003; Seyrfian *et al.*, 2005; Soltanian *et al.*, 2011, Van Buchem *et al.* 2006, 2010, Vaziri Moghaddam *et al.*, 2006, 2010, Vincent *et al.*, 2006).

The present study examines the biostratigraphy based on large benthic foraminifera of the Asmari Formation, at the Robat Namaki section, North of Khorram Abad, Zagros Basin.

2- Regional geological setting

In the Late Jurassic time, Orogenic movement caused Zagros Basin divided into several subbasins included the Fars arc, Izeh, Dezful Embayment (Khuzestan province) and Lorestan Basin, from south to northeast respectively (Fig. 1). Three parts of the Asmari Formation (lower, middle and upper) can be seen only in the center of these subbasins (Laursen *et al.*, 2009). Toward margin of subbasins, Lower part of the Asmari Formation pinch out and Jahrum Formation (In Fars) and Shabazan Formation (In Lorestan) replaced it.

The Robat section crops out at 18 km north of Khorram Abad city (Fig. 2) and in Lorestan Basin. In south of Khorram Abad the lower contact of the limestone of the Asmari Formation with dolomite of the Shahbazan Formation is disconformable. At the contact, a leached brecciated zone marks the disconformity (Maghfouri Moghaddam and Bayatanian, 2013). In the most places of the Lorestan basin, the Shahbazan Formation lies conformably on the clastic facies of the Kashkan Formation. In south and southwest Lorestan the Shahbazan Formation interfingers

with marl of the Pabdeh Formation. In north and northeastern Lorestan, the Shahbazan and Asmari Formations form a prominent topographic unit. It is differentiated from the Asmari Formation by an intervening conglomeratic leached zone and a change from limestone of the Asmari to the dolomite of the Shahbazan Formation. This boundary is often difficult to place, thus making it necessary to map the two formations as one unit. In this case, the two names are by hyphenated (Fig. 3).

In this area, the Asmari Formation lies unconformably on the dolomite of Shahbazan Formation (Fig. 3). Upper contact of the Asmari Formation with the Gachsaran Formation is marked by an unconformity (Fig. 3).

3- Material and Methods

For this research, 61 samples from the Asmari Formation were studied. All rock samples and thin sections are housed in the Department of Geology, Islamic Azad university (Khorram Abad branch) University. The taxonomic determination of the foraminifera is based on the foraminiferal classifications: Loeblich and Tappan (1988), Rahaghi (1983) and Hottinger (1983, 1999 and 2000). Larger benthic foraminifera are widely distributed in the carbonate of the Asmari Formation. Therefore, biostratigraphic zonation is based on this organism. Biozonations established for the Asmari Formation in this study are largely based on biozonation of Laursen *et al.* (2007) that comprises an Oligocene to Early Miocene Carbonate sequences.

3- Biostratigraphy

Based on distribution of foraminifera following assemblage zone are recognized (Fig. 4):

1- Indeterminate Zone 1: This zone spans 25 m of the base of the Asmari Formation in Robat Namaki section and contains medium to thick limestone. It is characterized by presence of some genus such as *Miliola* sp. and *Bigerina* sp. Since we could not find any index microfossils in this zone we named it Indeterminate Zone.

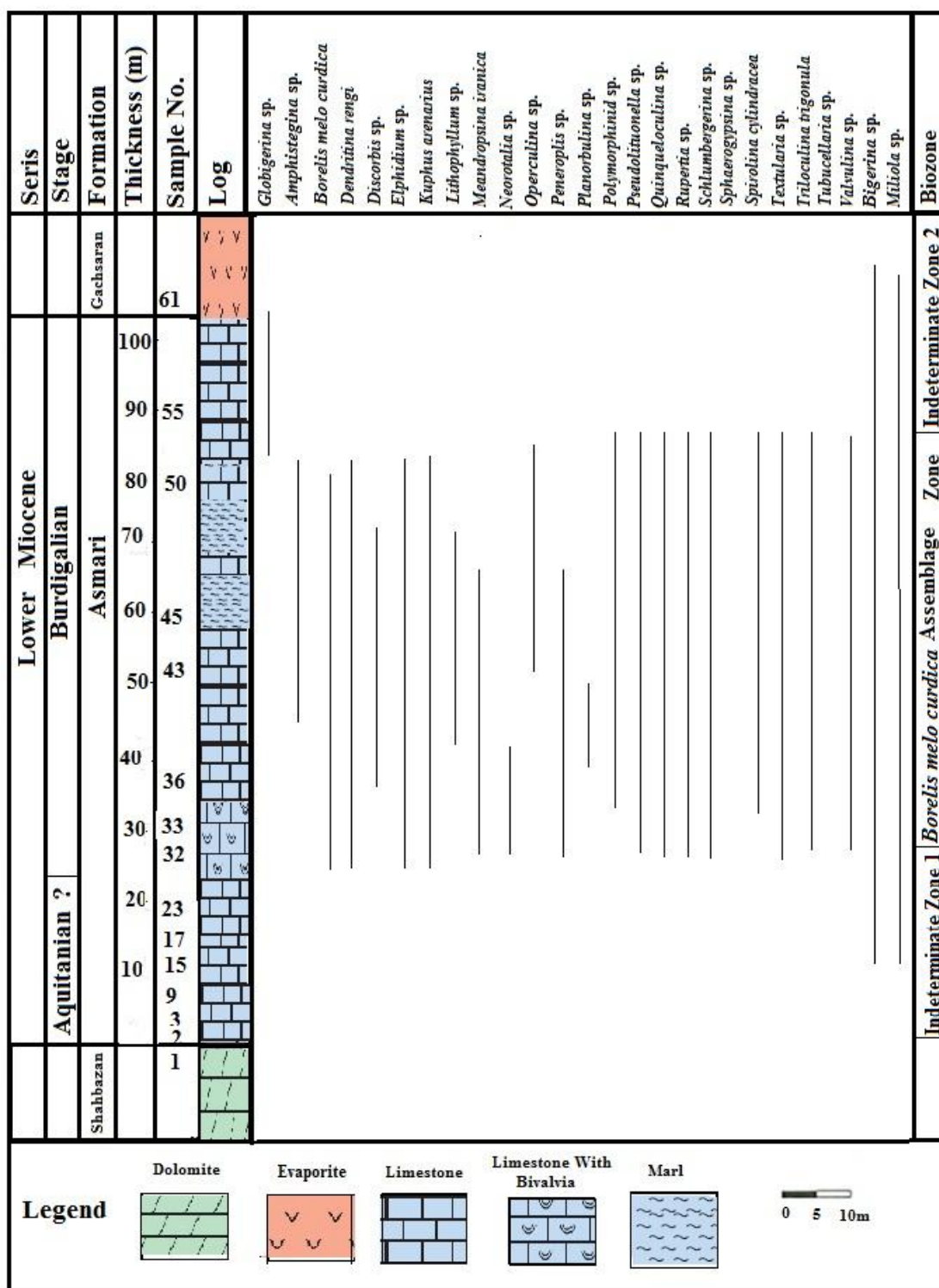


Figure 4) Lithostratigraphic column and vertical distribution of some benthic foraminifers in Robat Namaki, north of Khorram Abad.

Indeterminate Zone 1 lies on the Shahbazan Formation. In eastsouthern Lorestan Basin, Shahbazan Formation forms a transitional facies between fluvial and siliciclastic facies of the Kashkan Formation and deep – water facies limy mudstones, calcareous shale and marl of the Pabdeh Formation. This progradational

stratigraphic arrangement is inverted in the Middle to Upper Eocene (Motiei, 1993). Toward northern Lorestan Basin, The Shahbazan Formation lies between Kashkan and Asmari formations and changes to dolomite and dololimestnoe without any index Fossil. So, we are not able to determine the age of Shahbazan

Formation. Therefore, only on stratigraphical position of zone 1 and age of upper zone, we prefer age of Indeterminate Zone 1 to Aquitanian?.

2) Borels melocurdica Assemblage Zone: This assemblage attributed to the Burdigalian and is correlateable with *Borels melocurdica- Borels melo melo* Assemblage Zone Laursen *et al.*, (2009). It is present in the middle part of Asmari Formation in section under study. It is characterized by presence a bryozoans (*Tubucellaria* sp.); a trace of pelecypoda siphon (*Kuphua arenius*), a red algae (*Lithophyllum* sp.) and following foraminifera (Plate 1): *Amphistegina* sp.; *Borelis melocurdica*; *Dendritina rengi*; *Discorbis* sp.; *Elphidium* sp.; *Meandropsina iranica*; *Neorotalia* sp.; *Operculina* sp.; *Quinqueloculina* sp.; *Peneroplis* sp.; *Planorbulina* sp.; *Polymorphid.*; *Pseudolituonella* sp.; *Rupertia* sp.; *Schlumbergina* sp.; *Spherogypsina* sp.;

Spirolina clindracea.; *Textularia.*; *Triloculina trigonula.*; *Valvulina* sp.

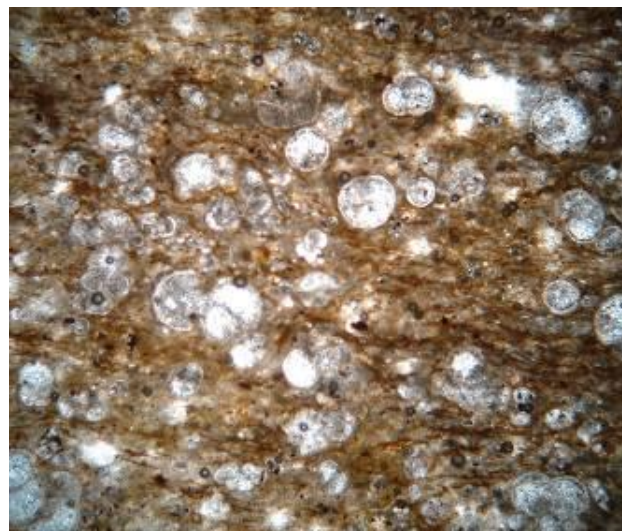


Figure 5) Photomicrograph of Limestone bearing *Globigerina* spp. in upper part of Asmari Formation, no 99.

3) Indeterminate Zone 2: It is at the top of the Asmari Formation (from 83 to 102 m thick) in Robot Namaki section.

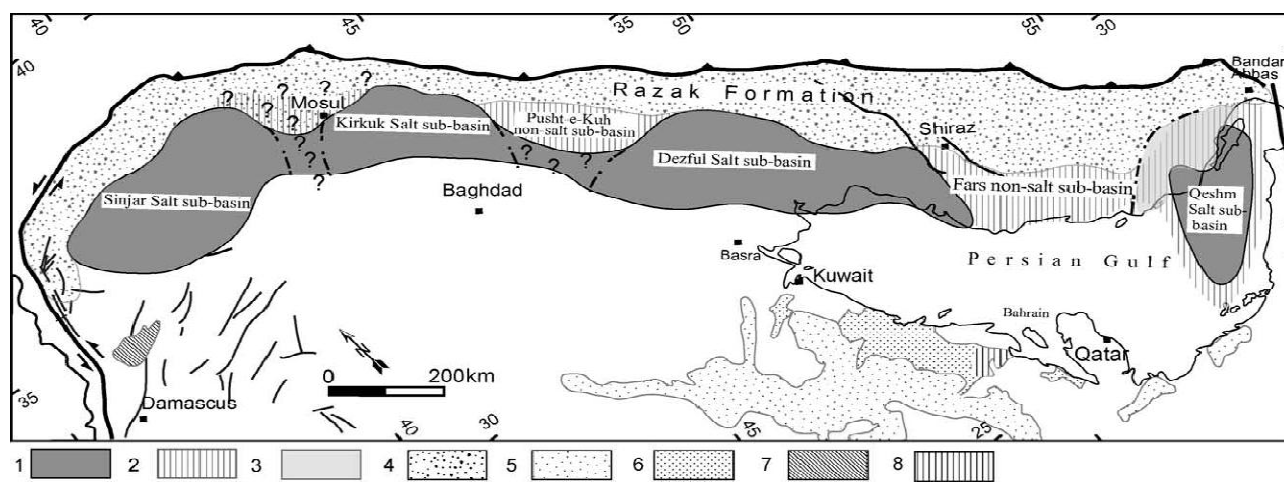


Figure 6) Distribution of Gachsaran litho-facies and its time-equivalents along the Zagros basin. (1) Gachsaran salt facies, (2) Gachsaran non-salt facies, (3) Chehel, Champeh and Mole members, (4) Razak formation, (5–8) time-equivalents of Razak Formation (Bahroudi and Koyi, 2004).

It is characterized by presence a lot of planktonic Foraminifera such as *Globigerina* spp. (Fig. 5). *Globigerina* spp, Assemblage Zone introduced by Wynd (1965) and attributed to the Oligocene age in the Izeh and northeasren Dezful Embayment. But in the Robot Namaki section, planktoic foraminifera assemblage are allochthonous, therefore we named it Indeterminate Zone 2. This zone is

characterized without diagnostic microfossils and due to its statigraphical position, assigned to the Burdigalian. We think, they transported from north and northeast. They are correlated with Razak Formation. The Asmari Formation is generally underlined by Gachsaran Formation (James and Wynd, 1965). The Gachsaran Formation deposited along the axis of the Zagros foreland basin but to north-eastward

(toward the Zagros Main Reverse Fault), it is transitionally replaced by the detritus of the Razak Formation (Fig. 6). Razak Formation conformably overlies the upper Oligocene–Lower Miocene Asmari limestone and is underlain by the Miocene Mishan or Gachsaran Formations.

4- Conclusions

In this research, microbiostratigraphy of the Asmari Formation at the northern Lorestan, Zagros Basin, is discussed. In the studied stratigraphic section, the Asmari Formation overlies the Shahbazan Formation and underlies Gachsaran Formation and contains of 102 m-thick medium to thick limestone and marl. A study of 61 samples of the Asmari Formation led to identification of 4 species and 23 genera of benthic foraminifera, a genus of planktonic foraminifera, red algae, a trace fossil and bryozoans. On the basis of the foraminifera recognized in northern Khorram Abad, the middle part of Asmari Formation is comparable to *Borelis melocurdica*-*Borelis melo melo* Assemblage Zones (Laursen *et al.*, 2007). The age of this part of Asmari Formation at the study area is Burdigalian. The lower part of Asmari Formation has not index fossil and only based of stratigraphical position probably is Aquitanian in age. Upper part of Asmari Formation in studied section contain clastic limestone with abundant *Globigerina* sp. which correlateable with Razak Formation.

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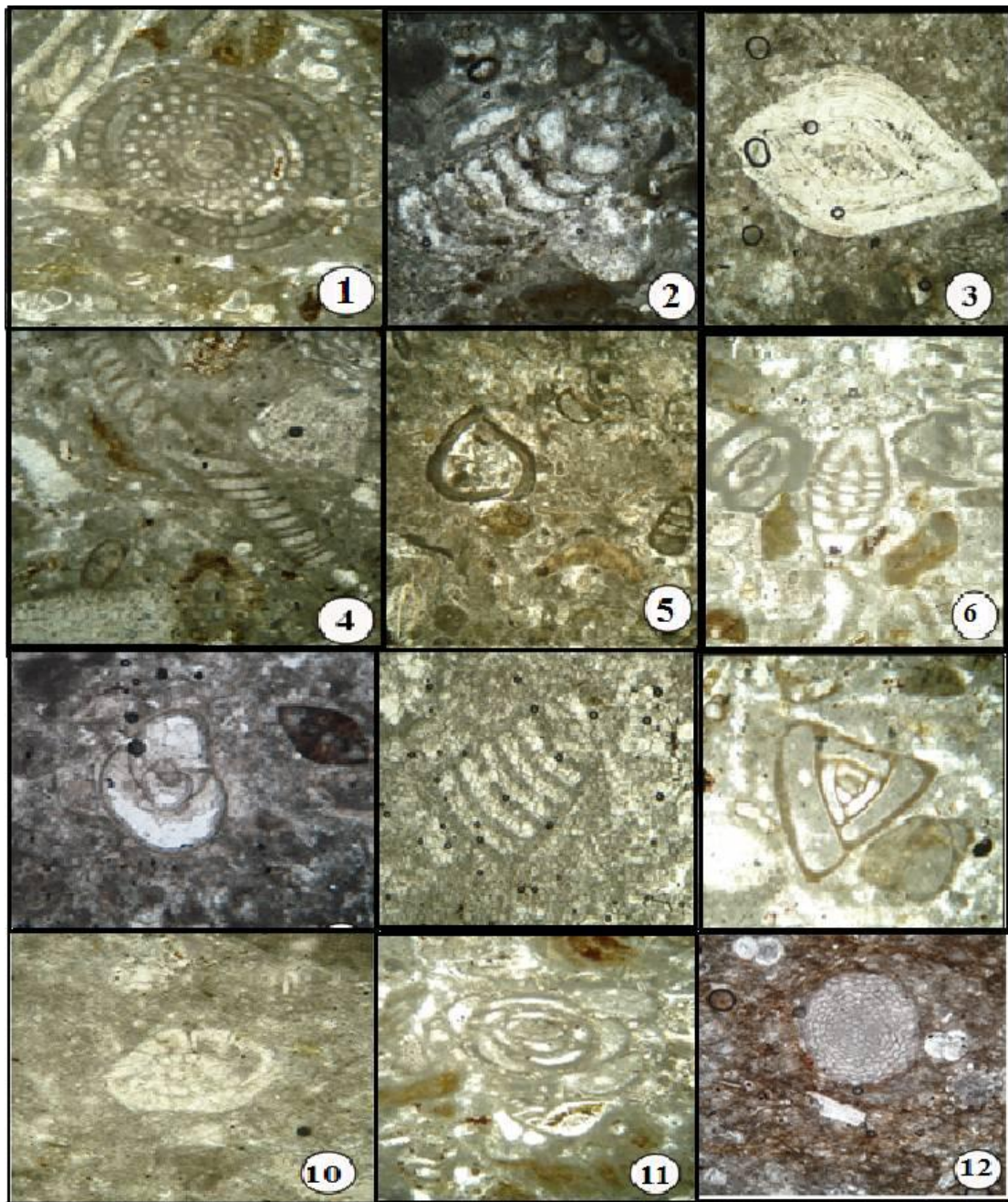
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Plate 1



- 1) *Borelis melo curdica*, sample no. SS22, (X1 14), Robat Namaki section; 2) *Bigenerina* sp., sample no. SS55, (X1 14), Robat Namaki section; 3) *Amphistegina* sp., sample no: SS54, (X1 14), Robat Namaki section; 4) *Peneroplis evolutus*, sample no. SS24 (X1 14), Robat Namaki section; 5) *Kuphus arenarius*, sample no. SS45, (X1 14), Robat Namaki section; 6) *Elphidium* sp., sample no. SS52, (X1 14); Robat Namaki section; 7) *Polymorphinid*, sample no. SS35, (X1 14), Robat Namaki section; 8) *Pseudolitounella* sp., sample no. SS15, (X1 14), Robat Namaki section; 9) *Triloculina trigonula*, sample no: SS23, (X1 14), Robat Namaki section; 10) *Neorotalia* sp., sample no. SS22, (X1 14), Robat Namaki section; 11) *Schlumbergerina* sp., sample no. SS22, (X1 14), Robat Namaki section; 12) *Sphaerogypsina globulus*, sample no: SS44, (X1 14), Robat Namaki section.