Biostratigraphy of the Eocene sediments in Alborz Province, Iran

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ABSTRACT

For biostratigraphy of the Eocene sediments in Iran, we studied Maroosk (398.2 m thickness) and Someah e Pain (72.3 m thickness) areas (Alborz Province). 200 thin sections and 40 isolated samples were prepared and studied under microscope. 35 generaes and species have been identified. Based on identified species of foraminifera, four Acme zones (SBZ 10, SBZ 13, SBZ 17, and SBZ 19) and one assemblage zone are assigned in these areas. The proposed age for the Maroosk section, is dated back to Eocene, and for the Someah e Pain section is Late Paleocene to Middle Eocene. Based on this information, studied deposits are equivalent to Ziarat Formation.

INTRODUCTION

The primary studies on Ziarat Formation, was done firstly by Steiger,[34], adjacent of Arjmand village , in Alborz Province. Several next years, its type section was introduced by Dellenbach, [11]. More recent studies of the Eocene deposits in Alborz province were carried out by [21,23,1]. Alborz Province, include mountainsin north of Iran plate that inform of anticliniarious placed in western-eastern trend from Azarbayjan to Khorasn. Formation of Alborz is based on three causes: collision of Iran and Touran, reverse faults and strike-slip faults. [3-4], The purposes of this study is biostratigraphy of two sections of the Eocene sediments in Alborz Province.

Geological setting and study area:

Maroosk Section located in the East Alborz zone, 3 km east of Mohamadkaltate town. Fieldwork concentrated on the Maroosk village at 36˚ 31’ 17” N, 58˚ 34’ 41” E (Fig.1). Lower boundary in Maroosk has unconformity with Jurassic sediments (Chamanbid Formation) and upper boundary has unconformity with red conglomerates of neogene. The Ziarat Formation at the Maroosk section is 398.2 m thick (Fig. 2). Some HQ Section located in the West Alborz zone, 40 km east of Hashtrood (Sareskand) town Fieldwork concentrated on the Someah Pain village at 37˚ 16’ 00” N, 46˚ 33’ 26” E (Fig.1). The Someah e Pain deposition start with red conglomerate of Fajan Formation unconformably and continue with limestone of Ziarat Formation. In upper part of it, Karaj Formation has been placed gradually on Middle Eocenenummulitic limestone. The Ziarat Formation at the Someah pain is 72.3 m thick (Fig.3).

MATERIAL AND METHODS

At first, systematically sampling from the sections was performed. Then thin sections were provided from them and also isolated samples were chosen and suitable thin sections were provided. Isolated samples cleaned by hydrogen peroxide and for determining of internal structures of nummulitides, they abraded by Carborandum powder. When we need rinsing, 300 gr of each sample placed in mixtures of H2O and hydrogen peroxide for 12 to 24 hours. We used sieves with aperture diameters of (30,50,70,150 mesh) for rinsing of samples then sieves placed in Blodometilen in order to determination of residual samples in apertures. It is necessary to use Blodemetilen in this step and particularly for biostratigraphic studies. Residual samples on sieves kept in suitable containers. For separation and studying, we applied specific devices and microscope and based on the presence of fossils, biostratigraphy was done.

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Fig. 1: Access way of study area.

Fig. 2: Out crop of the Maroosk section: a and b pg: Paleogene, And: Andesite, h: Chamanbid Formation.

Fig. 3: a) Out crop of Nummulites Limestone of ZiaratFormation, Someah e pain section. b) Close up view.

Discussion:
Some species in studied section are as follows (based on: Blondeau, [8], Bozorgnia and Kalantari, [6], Bou Dagher-Fadel, [7], Bolli and Beckman, [9], Boukhary et al [10], Ellis et al [12], Jorissen et al [20], Loeblich and Tappan, [24], Moor, [27], Pearson, [31], Ernest et al, [13])
Someah e Pain area:
Alveolinacucuminformis, Discocyclina sp, Rotalia sp, Quinqueloculina sp. 
Spiroloquina sp, Textularia sp, Valvulammina sp, Nummuliteslaevigatus
Triloculina sp, Nummulitesburdigalensis, Nummulitesglobulus (Fig.5)

Maroosk area:
Robulsumusteri, Gyrodinidessglobosa, Vaginulina sp, Ammodiscuslatus, Bulimina sp, . Lagenaapiculata, 
Planulinaaustina, Cibicicesstephenosis, Marginulinaaustina, Quinquelinaasp., Asterocyclinaaff. Stellate, 
Nummulitesacatus, Nummuliteslaevigatus, Nummulitesdistans, Nummulitespuschi, Nummulitesbrongriarti, 
Nummulitesfabianii, Acrarinabulbrooki, Subbotinaeocaena, Globigerina lozani, Globigerina hagni, 
Turborotaliacerozaulensis, Globigrinaeocaena(Fig.4).

It is necessary to note that there are diverse macrofauna associated with mentioned microfauna: bryozoan, 
corals, echinoids and bivalve (Plates 1,2 and 3).

Biostratigraphy:
Because Eocene sediments in studied sections have been deposited in shallow environments, planktonic 
foraminifera can help in determination of age. So, zoning based on large benthic foraminifera (SBZ) carried out. 
Zoning of SBZ is due to research of IGCP project and published in article: stratigraphy of Mesozoic and 
Cenozoic sediments in west of Europe by Serra-Kie et al. Also, they are results of review and investigation of 
classic biozones in Paleocene- Eocene based on nummulitides and Alveolina. Some of these biozones mentioned 
here, Chronological tables used from [15].

One assemblage and four Acme zones were identified and are discussed in as follows:
-Assemblage 1 is present in Someah e Pain area. The most important and common foraminifera in the 
assemblage are: Alveolinacucuminformis, Rotalia sp, Quinqueloculinaasp, Spiroloquina sp, Textularia 
sp, Triloculina sp, Nummulitesglobulus

This zone identified by alveolinids and small nummulitides as well as milliolides and textularides. Because of 
presence of AlveolinaCucuminformis which introduced by [11] intytype section of Ziarat Formation, they 
deposited in Late Paleocene. This assemblage corresponds to the SBZ 5and is considered to be Ilerdian in age. 
-Acme zone 1 is present in Someah e Pain and Maroosk areas.

The most important and common foraminifera in both sections are: Robulsumusteri, Gyrodinidessglobosa, 
Vaginulina sp, Asterocyclinaaff Stellate, Acrarinabulbrooki, Rotaliasp, Nummulitesburdigalensis, Discocyclina 
sp. This Acme zone 1 corresponds to the SBZ10and is considered to be Ypresian in age. This zone include large 
benthic foraminifera from the first to the last presence of Nummulitesburdigalensis. This biozone is in someah e 
Pain and Maroosk areas.
- Acme zone 2: is present in Maroosk area. The most important and common foraminifera in section, 
are: Ammodiscuslatus, Bulimina sp, Nummulitesacatus, Nummuliteslaevigatus, Nummulitesdistans, 
Nummulitespuschi, Globigerina lozani, Globigerina hagni. This Acme zone 2 corresponds to the SBZ13 and is 
considered to be Lutetian in age. This zone include large benthic foraminifera from the first to the last presence of 
Nummuliteslaevigatus. This biozone is in Someah e Pain and Maroosk areas. Lower boundary of this biozone 
corresponds with boundary of P10-P9 and upper boundary corresponds with boundary of P11-P10 in middle 
Eocene.
- Acme zone 3: is present in Maroosk area. The most important and common foraminifera in section, 
are: Nummulitesbrongriarti, Acrarinabulbrooki, Subbotinaeocaena, Globigerina lozani. This Acme zone 3 
corresponds to the SBZ17, and is considered to be Bartonian in age. This zone include large benthic 
foraminifera from the first to the last presence of Nummulitesbrongriarti. This biozone is seen in Maroosk 
section. Lower boundary of them corresponds with upper part of P12 and upper boundary corresponds with P15 – P14.
- Acme zone 4: is present in Maroosk area. The most important and common foraminifera in section, 
are: Nummulitesfabianii, Turborotaliacerozaulensis, Globigrinaeocaena. This Acme zone 4 corresponds to the 
SBZ19, and is considered to be Priabonian in age (Table1). This zone include large benthic foraminifera from the 
first to the last presence of Nummulitesfabianii. This biozone is seen in Maroosk section. Lower boundary is in 
P15 Berggren, and Np18 Martini. Upper boundary corresponds with end of P15. According to mentioned 
biozones, two succession have biologic similarities up to Middle Eocene then sedimentation continued in 
Maroosk section and there are sediments of Bartonian and Priabonian. It should be noted that, sedimentation in 
Someah e Pain ceased after Lutetian, tuffs equivalent of Karaj Formation are seen gradually.

Table 1: One assemblage and four Acme zones were identified and are discussed in the paper.

<table>
<thead>
<tr>
<th>Biozone</th>
<th>Maroosk</th>
<th>Someah e Pain</th>
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<tbody>
<tr>
<td>Acme zone 1</td>
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<td>Acme zone 2</td>
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<td>Acme zone 3</td>
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<td>Acme zone 6</td>
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Fig. 4: Stratigraphical chart of the Maroosk Section.

Fig. 5: Stratigraphical chart of the Someah e Pain Section.
Results:
By study two sections, the following results have been obtained:
Sections of Mroosk in eastern Alborz and Someah e Pain in western Alborz studied for biostratigraphy.
Lower boundary in Mroosk has unconformity with Jurassic sediments and upper boundary has unconformity with red conglomerates of neogene, too. Someah e Pain placed on Fajan Formation unconformably and covered by Karaj Formation gradually.

24 genesis and species in Maroosk and 11 genesis and species in Someah e Pain are identified. Five biozones has recognized from benthic foraminifera including four Acme zones and one Assemblage zone. According to genesis, species and biozonation, age of Maroosk and Someah e Pain is Eocene and Late Paleocene-Middle Eocene, respectively.

Plate 1:

Fig.1. Subbotinaeaocaena Guembel, 1868, Maroosk section, Sample No: 47. X 700
1a: Umbilical view, 1b: Peripheral view, 1c: Spiral view
Fig.2. Truborotaliacerroazulensis Cole, 1928, Maroosk section, Sample No: 63. X 600
2a: Umbilical view, 2b: Peripheral view, 2c: Spiral view
Fig.3. Acarininabullbrooki Bolli, 1957, Maroosk section, Sample No: 47. X 600
3a: Umbilical view, 3b: Peripheral view, 3c: Spiral view
Fig.4. Truncorotaloideslibyensis Khoudary, 1977, Maroosk section, Sample No: 5. X 500
4a: Umbilical view, 4b: Peripheral view, 4c: Spiral view
Fig.5. Globigerina eocaena Guembel, 1868, Maroosk section, Sample No: 66. X 700
5a: Umbilical view, 5b: Peripheral view, 5c: Spiral view
Fig.6. Globigerina lozani Colom, 1926, Maroosk section, Sample No: 49. X 800
6a: Umbilical view, 6b: Peripheral view, 6c: Spiral view
Fig. 7. *Globigerina hagni* Gohrbandt, 1967, Maroosk section, Sample.No: 40. X 800
7a: Umblical view, 7b: Peripheral view, 7c: Spiral view

Fig. 8. *Globigerina hagni* Gohrbandt, 1967, Maroosk section, Sample.No: 51. X 800.
8a: Umblical view, 8b: Peripheral view, 8c: Spiral view

Fig. 9. *Cibicides stephensoni* Cushman, 1944, Maroosk section, Sample.No: 71. X 500
9a: Side view, 9b: Peripheral view

Fig. 10. *Robulus Munsteri* Cushman, 1941, Maroosk section, Sample.No: 75. X 25.10a: Side view, 10b: Peripheral view

Fig. 11. *Gyrodinium globosa* Cushman, 1941, Maroosk section, Sample.No: 2. X 600
11a: Side view, 11b: Peripheral view

Fig. 12. *Gyrodinium besitielli* Cushman & Jarvis, 1941, Maroosk section, Sample.No: 41. X 400, 12a: Side view, 12b: Peripheral view

Fig. 13. *Eponides lotus* Schwager, 1883, Maroosk section, Sample.No: 74. X 400
13a: Side view, 13b: Peripheral view

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Plate 2:

Fig. 1. *Pararotaliainermis* Terquem, 1882., Maroosk section, Sample.No: 19. X 400.
1a: Side view, 1b: Peripheral view

Fig. 2. *Pararotaliainermis* Terquem, 1882, Maroosk section, Sample.No: 22. X 600
2a: Side view, 2b: Peripheral view

Fig. 3. *Spiroplectammina semicomplanata* Plummer, 1931, Side view, Maroosk section, Sample.No: 68. X 500

Fig. 4. *Lagenapiculata* Reuss, 1845, Maroosk section, Sample.No: 63. X 300, Side view

Fig. 5. *Plectinawatersi* Cushman, 1937, Maroosk section, Sample.No: 70. X 550
Side view

Fig. 6. *Marginulinaaustinana* Cushman 19372, Maroosk section, Sample.No: 69. X 250
6a: Side view, 6b: Peripheral view

Fig. 7. *Quinqueloculina* Plummer, 1931, Maroosk section, Sample No: 73. X 700, Side view
REFERENCES


