



Biostratigraphy and Lithostratigraphy of the Qom Formation in the Southeast of Damavand (Varaneh Village Section)

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Abstract—The Qom formation in Varaneh section with a thickness of 150.6 m generally includes thick layered marls with interlayers of sandy limestone, medium-to-thick layered limestone, alternatives of limestone and marl, and finally, gypsum. In this study, 6 stone units were identified. Based on the studies conducted in the area, units 1, 2, and 3 were equivalent to member "e" of the Qom Formation, and units 4, 5, and 6 were equivalent to member "f" of the Qom Formation. In order to determine the age of Qom Formation in the section studied, 31 thin sections were examined in detail. Finally, based on the studies, 13 genera and 14 species of benthic foraminifera and 2 genera of algae were identified. In addition, based on the distribution of microfossil stratigraphy, only one biozone was recognized. Due to the existence of indicator species including *Borealis melo curdica*, *Meandropsina iranica*, and other species such as *Dendritina rangi* and *peneroplis*, this biozone was comparable to *Borealis melo* group - *Meandropsina iranica* assemblage zone [1]. For this reason, it can be concluded that the deposits of the Qom Formation in this section are in the same age as Burdigalin.

Keywords-Qom formation; foraminifera; biostratigraphy; Bordigalin; Varaneh section



1. Introduction

Foraminifera are one of the most important producers of shallow carbonates in tropical regions, and sometimes they make up more than 80% of the deposits in these areas. In neritic carbonate deposits, since the Paleozoic period, foraminifera have always been part of a group of organisms that have an independent ecosystem compared to other biosystems. Also, foraminifera don't play an effective role in the food chain of marine vertebrates such as fishes, and this issue increases the possibility of their fossilization [2].

In general, the constituent components of the Qom formation are very diverse and include large benthic foraminifera such as:

- 1- Nummulites (Nummulites-operculina-Heterstegina-spiroclypeus)
- 2- Lepidocyclinides (Eulepidina-Nepherolepidina-lepidocyclina)
- 3- Alveolinids (Borelis)
- 4- Miogypsinoidea (Miogypsinoidea-Miogypsina) and genera such as Amphistegina-Archaias-Austrotrilina and also small benthic foraminifera, including Miliolids-textularids-Rotaliids, and the planktonic foraminifera, corals, bivalves, tube worms, especially Cophos, Corallinacea algae, Brizeora, echinoderms, gastropods. In this study, benthic foraminifera were used as the basis for determining biozonation.

2. Methodology

After collecting the sources and classifying them according to the objectives of the study, a geological visit was carried out in the target area, stratigraphic sections were determined, and several stages of sampling were performed. The lithological characteristics and fossil content of the samples were used as a basis for sampling. In the places where the facies did not show much changes, the sampling interval was considered more. From the collected samples, thin sections were prepared and examined with an optical microscope. Then, based on the available sources and articles, the foraminifera were identified and their photos were taken. After determining the stratigraphic distribution of these microfossils, the relative age of the section under study was determined based on the accumulation of foraminifera and especially the indicator species. The number of identified species was analyzed separately in each sample.

3. Discussion

The deposits of the Qom formation in Varaneh stratigraphic section with geographical coordinates Lon: 52.25, Lat:35.48 generally include thick marls with interlayers of sandy limestone, medium-to-thick layered limestone, alternatives of limestone and marl, and finally, gypsum. In this area, the lower border of the Qom formation with the lower red formation is characterized by conglomerate lithology (fig.1), and the upper border of the Qom Formation with the upper red formation is marked by gypsum-bearing marl layers (Figure 2). According to the changes in the type and color of the lithology, the Qom Formation can be divided into six units in this section. Units 1, 2, and 3 were equivalent to member "e" of the Qom Formation, and units 4, 5, and 6 were equivalent to member "f" of the Qom Formation. By examining the collected samples and preparing thin sections from this section, 13 genera and 14 species of benthic foraminifera and 2 genera of algae were identified. In addition, based on the distribution of microfossil stratigraphy, only one biozone was recognized. Due to the existence of indicator species of *Borealis melo curdica*, *Meandropsina iranica*, and other species such as *Dendritina rangi* and *peneroplis*, this biozone was comparable to *Borealis melo* group - *Meandropsina iranica* assemblage zone (Adams and Borja, 1967). For this reason, it can be



concluded that the deposits of the Qom Formation in this section are in the same age as Burdigalin. This faunal accumulation includes the following microfossils from the base to the top.

1. Meandrosmina iranica, 2. Dendritina rangi, 3. Peneroplis evolot, 4. Borelis melo curdic, 5. Miliolid, 6. Berozoa, 7. pseudotaberina malabrica, 8. meandrosmina anahensis, 9. astrotrilina asmarenis, 10. pseudolituella richeli, 11. Textularia, 12. penroplis farsensis, 13. praerhapydionina delicate, 14. Valvulinid +sp, 15. pseudolituonella reicheli, 16. borelis haueri, 17. elphidium sp, 18. nummulites vascus –incrassatus, 19. operculina complanata, 20. Bigenerina

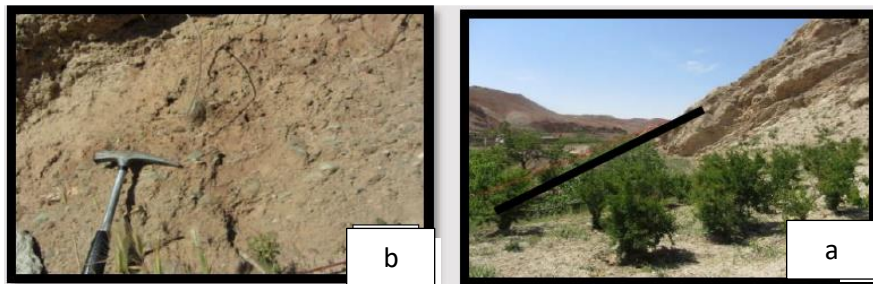


Figure 1. (a) Boundary of the Qom Formation with the underlying Red Formation; (b) Conglomerate lithology of the underlying Red Formation



Figure 2. Boundary between Qom Formation and upper Red Formation

3.1. The first unit

It is about 23.4 m thick, which includes green marls with interlayers of sandy limestone. (Figs. 3)

This unit has a lot of Borelismelo curdia in the base part, and Dendritina reng, pseudolituellaricheli, elphidium sp, Austrotrillina paucialveola, and Corallinacea red alga can be seen in abundance towards the top. At the top, Bivalvia is seen abundantly (Figure 4).



Figure 3. A view of the first marl unit with sandy limestone interlayers

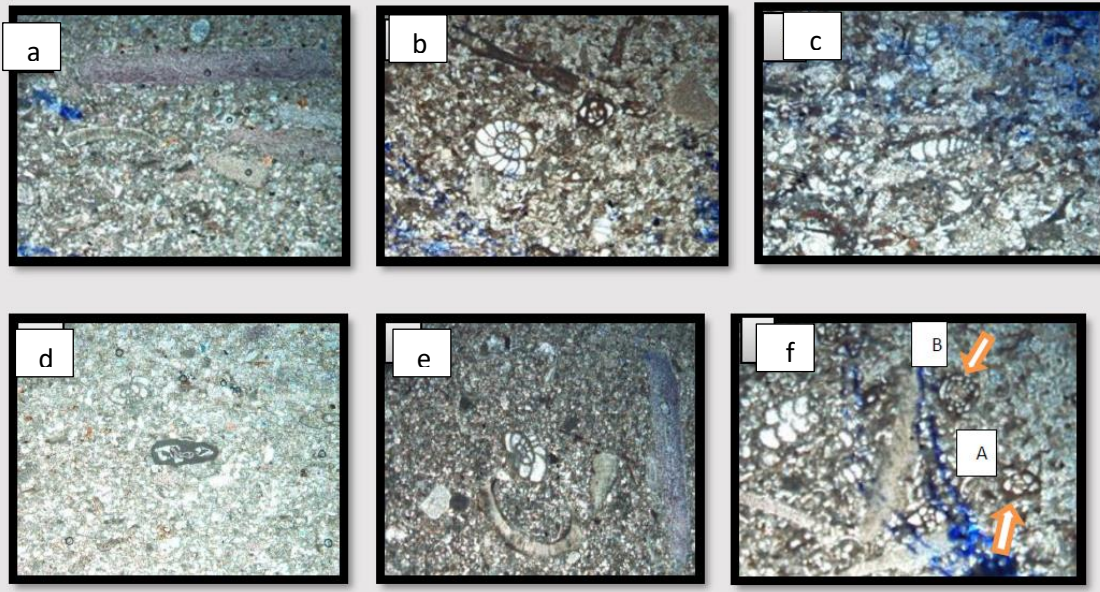


Figure 4. Microscopic images of foraminifera related to the first unit. (a) Corallinacea red alga; (b) Dendritina rengi; (c) pseudolituella richeli; (d) Dendritina rengi; (e) elphidium sp; (f) A: borelis melo cordia B: Austrotrillina paucialveolata

3.2. The second unit

It includes cream-colored fossil-filled limestone with a thickness of about 9.10 m (Figure 5) and Corallinacea red alga in abundance in the base part of this unit. The middle part includes 1. Onychocella sp, 2. Textularia, 3. peneroplis evolutus, 4. borelis melo cordia, 5. nummulites vascus –incrassatu, 6. astrotrilina asmarenis, 7. coral bandston. Finally, Corallinacea red alga is seen in the top part (Figure 5.)



Figure 5. A view of the second unit of cream-colored fossil-filled limestone

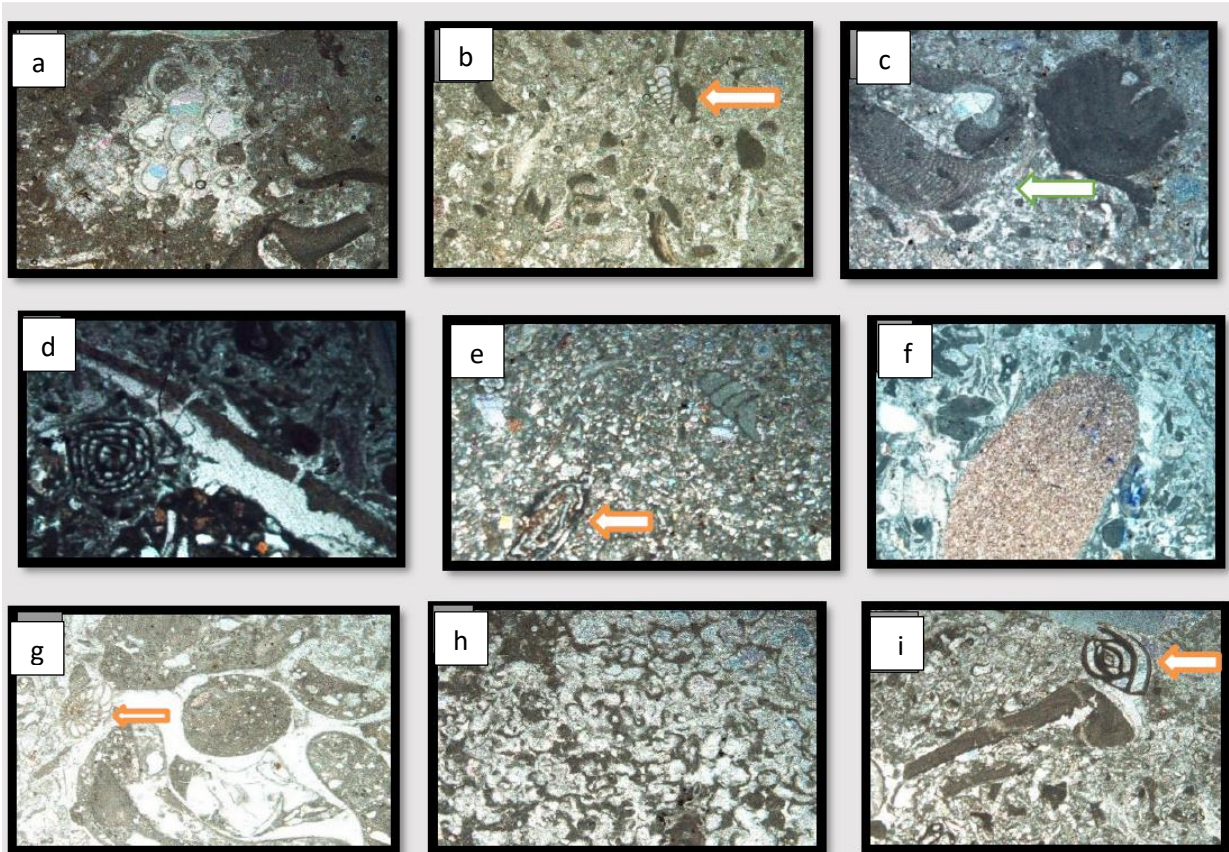


Figure 6. Microscopic images of foraminifera related to the second unit. (a) Onychocella sp; (b) Textularia; (c) peneroplis evolutus; (d) borelis melo cordia astrotrilina; (e) nummulites vascus -incrassatu; (f) Corallinacea red alga; (g) Peneroplis farsensis; (h) coral bandeston; (i) Asmarensis

3.3. The third unit

With a thickness of about 8 m, it includes green marls with interlayers of thick limestone (Figure 7).

meandropsina anhensis, praerhapydionina delicate, Valvulinid sp, nummulites vascus-incrassatus, Austrotrillina paucialveolata, meandropsina iranica, Borelis melo curdica, meandropsinairanica



Figure 7. A view of the third unit of green marls with interlayers of limestone

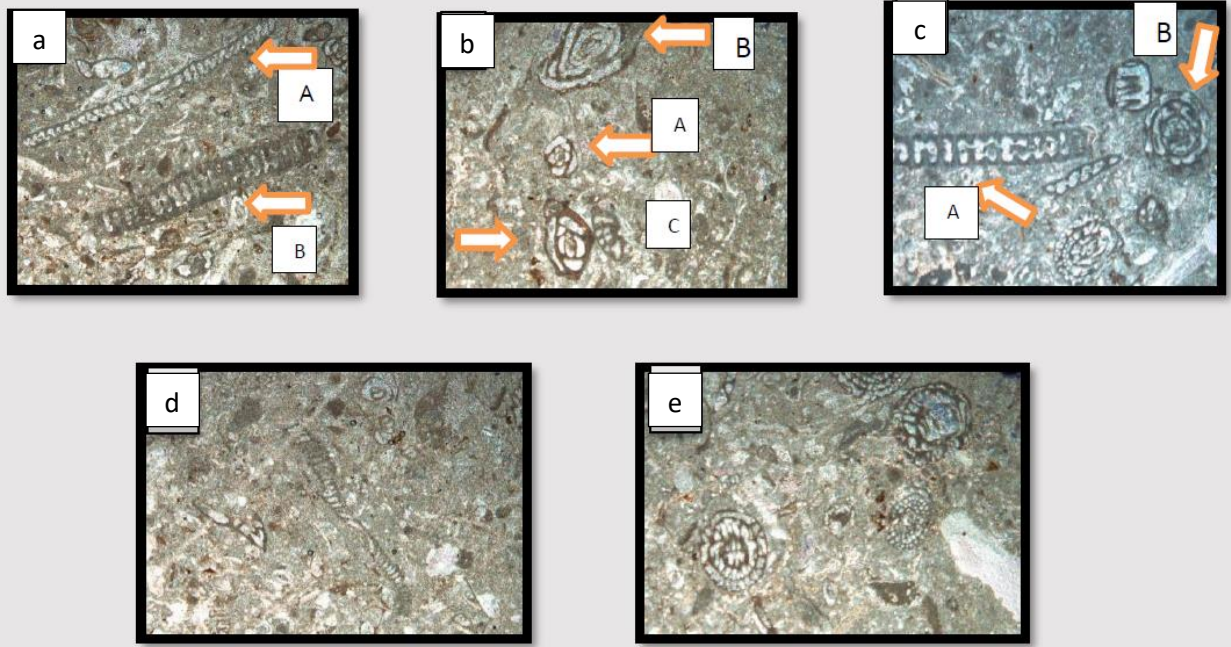


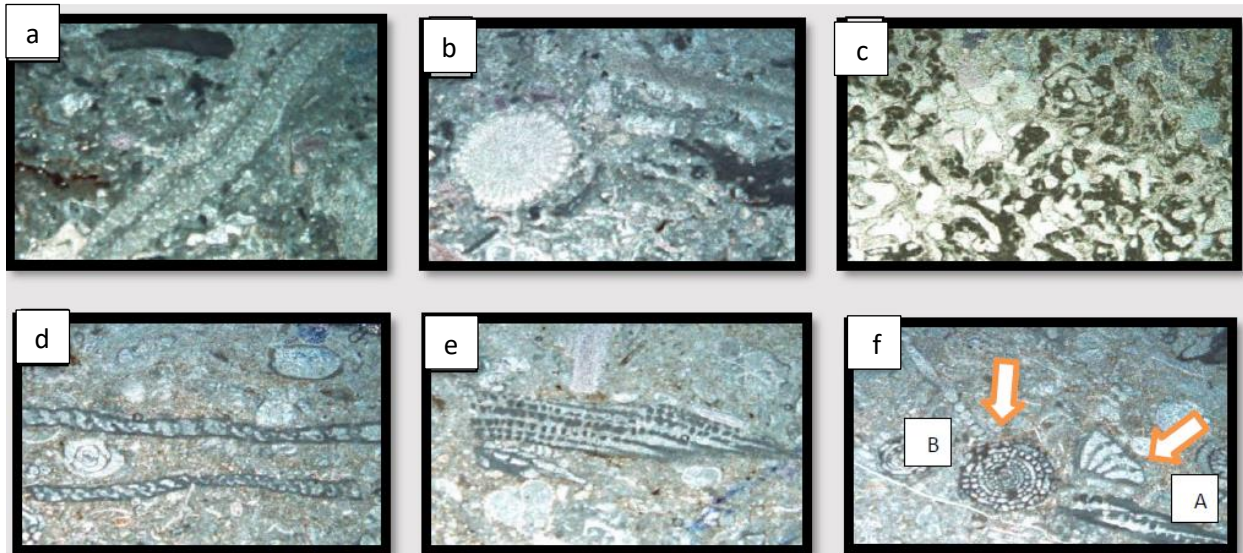
Figure 8. Microscopic images of foraminifera related to the third unit (a) A: meandrosmina anhensis, B: praeherapydionina delicata; (b) A: Valvulinid sp, B: nummulites vascus-incrassatus; (c) Austrotrillina paucialveolata, 3-A: meandrosmina iranica, B: Borelis melo curdica; (d) meandrosmina iranica; (e) orelis melo curdica

3.4. The fourth unit

It consists of thick-to-medium layer cream-colored limestone with a thickness of 3.46 meters. (Figure 9). It contains Mandrium corals at the base. As we move toward the top, Corallinacea red alga, Cophos limestone worm, and the groups including operculina complanata, Echinoid sp coral bandeston pseudolitunella reicheli, astrotrillina asmariensis, Valvulinid sp bigenerina, Meandrosminairanica, dandritina rangi, borelis melo curdica, penroplis evolot, and astrotrillina asmariensis can be seen.



Figure 9. A view of the fourth unit of the thick limestone layer in the area



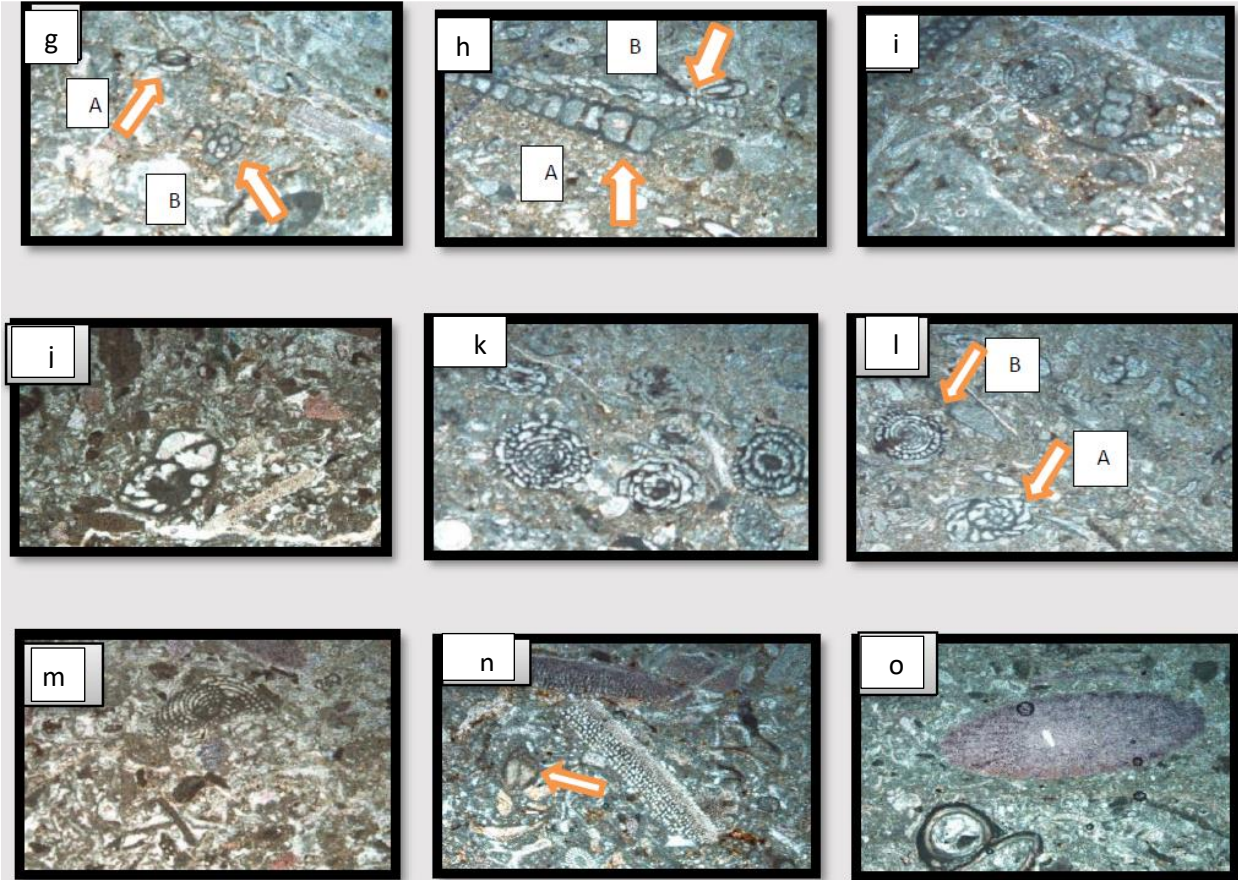


Figure 10. Microscopic images of foraminifera related to the fourth unit
 (a) operculina complanata; (b) Echinoid sp; (c) coral bandston; (d) Meandrospina iranica; (e) Meandrospina iranica; (f) A: pseudolitonella reicheli
 B: borelis melo curdica; (g) A: astrotrillina asmariensis B: Valvulinid sp; (h) A: bigenerina B: Meandrospina iranica; **(i); (j)** dandritina rangi; (k)
 borelis haueri and borelis melo curdica; (l) A: dandritina rangi B: borelis melo curdica; (m) penroplis evolot; (n) astrotrillina asmariensis; (o)
 corallinacea red alga

3.5. The fifth unit

It includes 17 m sandy limestone with 1- astrotrillina asmariensis, 2. borelis melo curdica in the base part and we will see greywacke at the top of the sandstone unit.



Figure 11. A view of the fifth unit containing sandy limestone

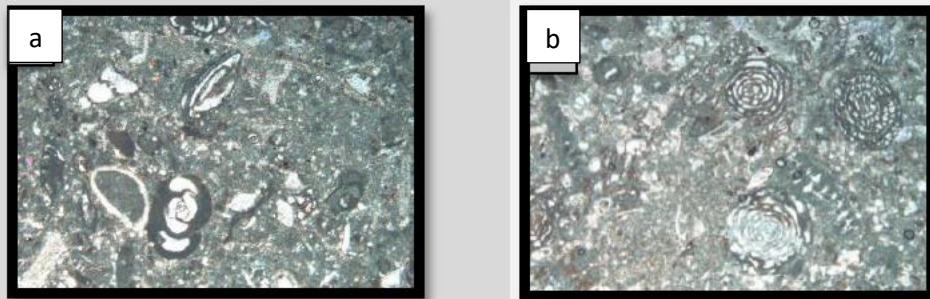


Figure 12. Microscopic images of foraminifera related to the fifth unit. (a) astrotrillina asmariensis; (b) borelis melo curdica

3.6. The sixth unit

Marl with interlayers of limestone with a thickness of about 45m including meandropsina anhensis, pseudotaberina malabrica, and borelis melo curdica.



Figure 13. A view of the sixth unit of green marls with interlayers of limestone

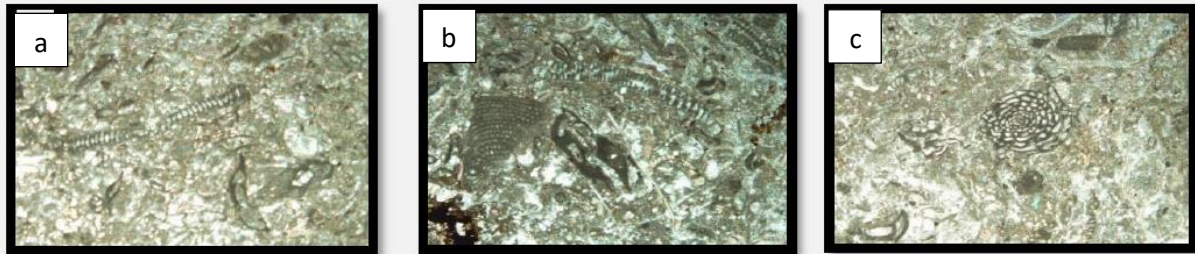


Figure 14. Microscopic images of foraminifera related to the sixth unit. (a) meandropina anhensis, (b) pseudotaberina malabrica, (c) borelis melo curdica

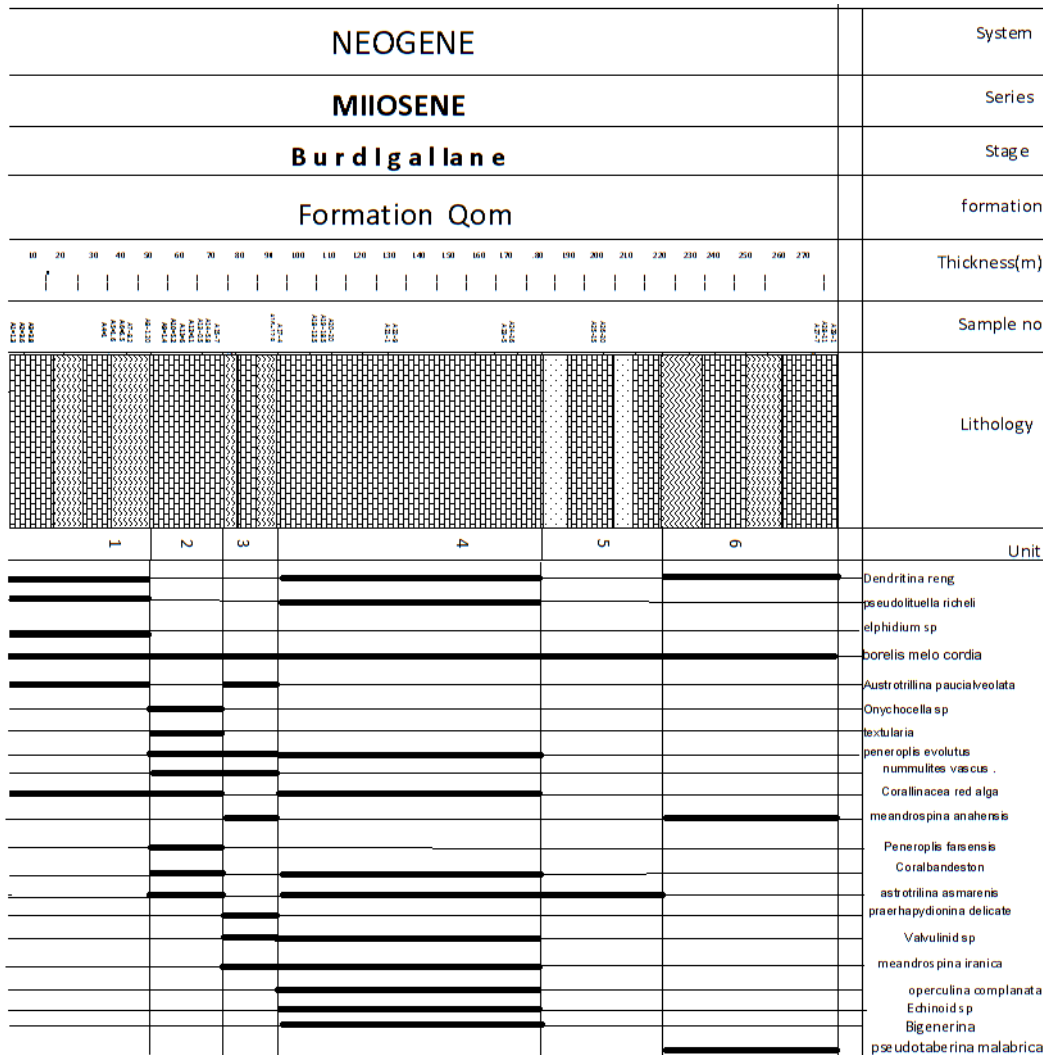


Figure 14. Biostratigraphic column of Qom formation in Varaneh region



Conclusion

1. In this section, due to the existence of *Borealis melo-Borealis melo curdica*, the entire thickness of the Qom formation in this pattern section belongs to the Bordigalin. Accumulation zone no. 1: Due to the existence of indicator species of *Borealis melo curdica* and *Meandropsina iranica*, this biozone was comparable to *Borealis melo* group - *Meandropsina iranica* assemblage zone (Adams and Borja, 1967). For this reason, it can be concluded that the deposits of the Qom Formation in this section are in the same age as Burdigalin in the southeast of Damavand.

2. Benthic foraminifera found in the Varaneh section can be classified into three groups as follows:

A. Foraminifera which are present in almost the entire length of the stratigraphic column, such as *miliolids*, *Borealis*, *meandropsina*

B. Foraminifera that appear only once in the stratigraphic column of this section and have a unique presence such as *Peneroplis thomasi*, *Peneroplis farsensis*, *Asterigerina*

C. Foraminifera that are not present in the initial parts of the column, but appear in the upper parts of the column, such as *Dandritina*.

3. Based on the studies conducted in the region, the first, second, and third units are equivalent to the member "e" of the Qom formation, and the fourth, fifth, and sixth units are equivalent to the member "f" of the Qom formation.

References

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