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Biostratigraphy and Depositional History of the Paleozoic Deposits in the South of Central Alborz Basin, Based on Foraminifera

Ebrahim Ghasemi-Nejad
Dept. of Geology, Faculty of Sciences, University of Tehran, Tehran – Iran.
Email: eghasemi@khayam.ut.ac.ir
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Abstract

Paleozoic sediments of a section in south of Central Alborz Mountains near the village of Aru were studied in order to determine faunal assemblages, their precise ages and the history of the basin. A sum of 120 samples was collected from four different formations of Jeirud, Mobarak, Doroud and Ruteh. A total of 150 thin sections were prepared and analyzed. Fifty species of Foraminifera were identified and classified in 38 genera. From the biostratigraphic and lithostratigraphic evidence presented here it is clear that excep for the upper contact of the Jeirud Formation, the upper and lower contacts of each of the other three formations cropping out in the Aru area are disconformable and, during the Paleozoic, the sedimentary basin underwent a few major and minor transgressive and regressive events. The absence of Middle - Upper Cambrian, Ordovician, Silurian and Lower Devonian sediments is a result of post-orogenic erosional processes of the Caledonian Orogeny, while the absence of Upper Carboniferous sediments was a result of the Hercynian Orogeny.

Keywords: *Paleozoic, Foraminifera, biostratigraphy, depositional history, Aru, Alborz, Iran.*

Introduction

The purpose of this research was to conduct an intensive study of biostratigraphy, lithostratigraphy and depositional history of the Paleozoic strata of the south-central Alborz Mountains in Iran. The fieldwork was conducted at an outcrop 90 kilometers east of Tehran near the village of Aru (Fig.1). The samples were collected at an interval of two meters and one or sometimes two to four thin sections

were made from each sample. A total of 120 samples and 150 thin sections were obtained and used to determine lithology and foraminifer present and to biostratigraphically date the sediments.

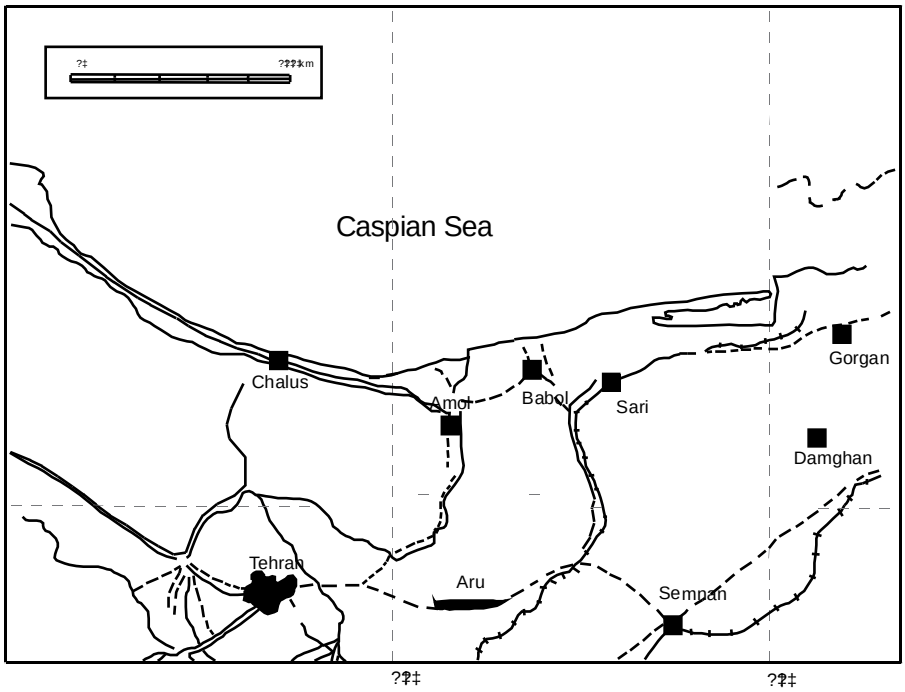

Figure 1 - Location map of the studied section

Litho- and Biostratigraphy

Four formations were included in the studied section. These are the Jeirud, Mobarak, Dorud and Ruteh formations with a general age range of Upper Devonian to Upper Permian. The Jeirud Formation disconformably overlay a lower Cambrian white quartzite called Top-quartzite (Fig. 2).

The Jeirud Formation is 36 meters thick and consists of conglomerate, sandstone and shales. Foraminifera were not found in thin sections obtained from the samples, but the formation is interpreted to be of an Upper Devonian age from brachiopods of nearby outcrops.

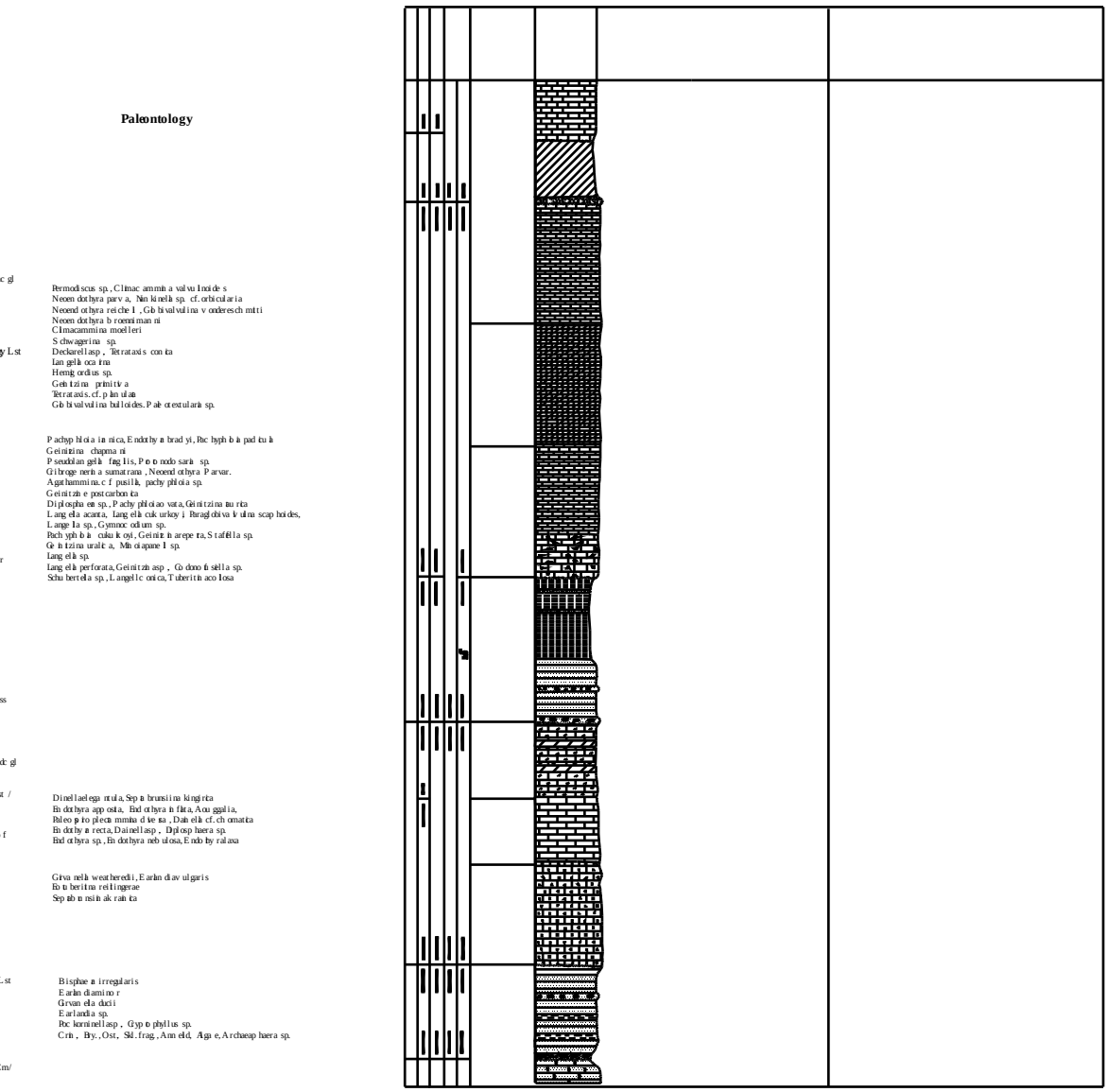

Figure 2- Stratigraphic column of the Paleozoic sediments of the Aru section

The Mobarak Formation conformably overlies the Jeirud Formation. This formation consists of 96 meters of biomicritic and sandy biomicritic limestones. For the purpose of this study the Mobarak Formation was subdivided into a lower, a middle and an upper unit.

The lower unit consists of 40 meters of thickly-bedded sandy biomicrites rich in crinoid, bryozoan, ostracode, calcareous algae (*Girvanella ducii*) and skeletal fragments.

Studies of the thin sections also revealed a sparse assemblage of foraminifera consisting of *Bisphaera irregularis*, *Bisphaera ovoidea*, *Septabrunsiina krainika*, and *Earlandia minor*. The assemblage indicates a Middle Tournaisian age for the lower unit.

The middle unit is comprised of 30 meters of thickly-bedded crinoid, brachiopod and trilobite bearing biomicrite that is gradational from the sandy biomicrites of the lower unit. Coral fragments are also present in the beds of the middle unit. The foraminifer assemblage of this unit is similar to that of the lower unit; however, in addition, the occurrence of *Septabrunsiina krainica*, *Earlandia vulgaris* and *Eotuberitina reitligerae* suggests an Upper Tournaisian age for the middle unit.

The remaining 26 meters of the Mobarak Formation forms the upper unit. These beds are thickly-bedded, fossiliferous, cherty, gray limestones rich in crinoid, brachiopod and coral clasts. Two yellow dolomite beds are also found within the limestone beds of the upper unit (figure 2). The upper unit contains a rich foraminifer assemblage that include many of the taxa also found in the lower and middle units. Moreover, this assemblage contains the additional taxa *Endothyra laxa*, *Endothyra* sp., *Endothyra opposita*, *Septabrunsina kingirica*, *Diplosphaerina inequalis*, *Endothyra omphalota*, *Dainella chomatica*, *Dainella elegantula*, and *Paleospiroplectammina diversa*.

The first appearance of the genus *Endothyra* indicates an early Visean age. *Endothyra laxa* has been reported from Lower Visean rocks of Belgium (Conil & Lys 1967) and *Paleospiroplectammina diversa* has been reported from the sediments of Upper Tournaisian - Lower Visean age from Belgium, Russia, Germany and Poland (Grozdilova & Lebedeva 1954). In the Central Alborz, these species have been reported only from rocks of Lower Visean (V1a) age (Bozorgnia 1973). Moreover, *Dainella elegantulla* and *Dainella*

chomatica have been reported from sediments of an Early Visean age (V1a) from Russia, Belgium and other parts of the Central Alborz (Grozdilova & Lebedeva 1954, Conil & Lys 1968, Bozorgnia 1973). Thus, the foraminiferal assemblage of the upper unit indicates an Early Visean age. Consequently, the Mobarak Formation ranges in age from Middle Tournaisian to Early Visean.

The Doroud Formation disconformably overlies the Mobarak Formation. It is comprised of 59 meters of conglomerate, sandstone and shale beds, which suggests a period of transgression. The top of the Doroud Formation is capped by a thin lateritic layer which indicates a regressive period with erosion and weathering during the Late Asselian. This formation is barren of foraminifera, but nearby outcrops of the formation contains a limestone bed that has been dated as Asselian (Early Permian) on the basis of foraminifera (Bozorgnia 1973).

The Doroud Formation is disconformably overlain by the Ruteh Formation. The Ruteh Formation consists of 152 meters of limestone and dolomitic limestones. This formation was also subdivided into three units based upon the dominant lithologic characteristics of the beds.

The lower unit is comprised of 52 meters of fine-grained limestone and gradually changes from thickly-bedded at the base of the unit to thinly-bedded at its top. The middle unit consists of 50 meters of a dolomitic limestone barren of foraminifera, which is probably due to secondary dolomitization, since outlines of foraminifera are present in the dolomitic fabric. The upper unit is also 50 meter thick and is comprised of thinly-bedded gray limestone.

Although Foraminifera were not recognizable in the middle unit; both the upper and lower units contain a rich and unique foraminifer assemblage. The foraminifer assemblage of the lower unit consists of *Tuberitina collosa*, *Schubertella* sp., *Langella cukurkoyi*, *Langella perforata*, *Langella conica*, *Langella ocarina*, *Langella* sp., *Minojapanella* sp., *Protonodosaria* sp., *Codonofusiella* sp., *Gymnocodium* sp., *Staffella* sp., *Pachyphloia cukurkoyi*, *Pachyphloia iranica*, *Pachyphloia ovata*, *Pachyphloia* sp., *Geinitzina uralica*, *Geinitzina taurica*, *Geinitzina postcarbonica*, *Geinitzina primitiva*,

Geinitzina reperta, *Geinitzina chapmani*, *Geinitzina* sp., *Frondinodosaria pyrula*, *Agathammina* sp., *Cribrogenerina sumatrana*, *Pseudolangella fragilis*, *Endothyra bradyi*, *pachyphloia pedicula*, *Globivalvulina bulloides*, *Paleotextularia* sp., *Tetrataxis planula*, *Cryptoseptida anatoliensis*, *Hemigordious ovatus*.

The assemblage of the upper unit consists of *Deckerella* sp., *Schwagerina* sp., *Protonodosaria praecursor*, *Climacammina valvulinoides*, *Climacammina moelleri*, *Climacammina* sp., *Neoendothyra broennimani*, *Neoendothyra parva*, *Neoendothyra reicheli*, *Neoendothyra* sp., *Tetrataxis conica*, *Globivalvulina vonderschmitti*, *Nankinella orbicularia*, *Permodiscus rotundus*.

The foraminifer assemblage of the Ruteh Formation is similar to the fauna of other outcrops of the Ruteh Formation in the Central Alborz as described by Bozorgnia (1973) and also is similar to an assemblage reported from Afganistan by Delapparent and Lys (1972). Both works indicated an Upper Artinskian? - Upper Murghabian age for the foraminifer assemblages of those areas. The presence of the genus *Neoendothyra*, an index fossil for the Upper Murghabian age, in the upper unit confirms an Upper Murghabian age for the unit. Because the upper beds of the lower unit are also Upper Murghabian in age, the middle unit considered to be of the Upper Murghabian age as well. Consequently, the Ruteh Formation in this area has an age range of Lower? - Upper Murghabian.

Twenty meters of green, red, brown and gray shales and lateritic sediments (ironstones) with a basal conglomerate overlie the Ruteh Formation in the studied area. The lateritic sediments resulted from a regressive phase of marine conditions that began in the Late Murghabian persisting until the Early Triassic.

Taxonomic remarks.

In this study 50 species of Foraminifera belonging to 38 genera were identified in the thin sections studied and are illustrated here in seven plates. The species *Permodiscus rotundus* (Plate 7, figure. 5), that was previously reported only from strata of Middle - Upper Carboniferous age in various areas of the world was for the first time found in Upper Murghabian sediments.

Conclusions

From the biostratigraphic and lithostratigraphic evidences presented here, it is clear that except for the upper contact of the Jeirud Formation, the upper and lower contacts of each of the other three formations cropping out in the Aru area are disconformable. During the Paleozoic, parts of the Central Alborz basin underwent four major and minor transgressive and regressive events. The absence of Middle -Upper Cambrian, Ordovician, Silurian and Lower Devonian sediments is a result of post-orogenic erosional processes of the Caledonian Orogeny, while the similar absence of Upper Carboniferous sediments was a result of the Hercynian Orogeny. The Gondwanic fauna presented indicates attachment of Persia to Gondwana during later Paleozoic time.

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Plate 1

1- *Archaesphaera* sp. x126
2- *Archaesphaera* sp. x126
3- Algae x32
4- *Pockorninella* sp. x32
5- *Pockorninella* sp. x32
6- *Girvanella wetheredi* CHAPMAN, x80

7- Oncolithes x32
8- *Girvanella ducii* WETHERED, x100
9- Cryptophyllus x32

Plate 2

1- *Bisphaera ovoidea* CONIL & LYS, x32
2- *Bisphaera* sp. x100
3- *Geinitzina uralica* SULEIMANOV, x80
4- *Eotuberitina reitlingerae* MIKLUKHO-MAKLAY, x126
5- *Pachyphloia iranica* BOZORGNIA, x126
6- *Earlandia minor* RAUZER-CHERNOUSSOVA, x80
7- *Geinitzina capmani* SCHUBERT, x126
8- *Protonodosaria* sp. x100
9- *Geinitzina reperta* BIKOVA, x126

Plate 3

1- *Endothyra apposita* (GANELINA)
2- *Agathammina* sp. x32
3- *Paleospiroplectammina diversa* CHERNYSHEVA, x80
4- *Neoendothyra reicheli* REITLINGER, x126
5- *Protonodosaria* sp., x126
6- *Septabrunsiina kingirica* (REITLINGER), x80
7- *Septabrunsiina krainica* (LIPINA), x126
8- *Profusulinella* sp. x126
9- *Earlandia vulgaris* (CHER & REIT), x32

Plate 4

1- *Endothyra bradyi* MIKHAILOV, x100
2- *Endothyra convexa* RAUZER-CHERNOUSSOVA, x126
3- *Globivalvulina scaphoidea* CUSHMAN & WATERS, x100
4- *Endothyra omphalota* RAUZER-CHERNOUSSOVA & REITLINGER, x126
5- *Schubertella* sp. x126
6- *Endothyra laxa* CONIL & LYS, x126
7- *Endothyra* sp. x80
8- *Frondinodosaria pyrula* DE CIVRIEUX & DESS, x126
9- *Geinitzina primitiva* POTIEVSKAIA, x126

Plate 5

1- *Minojapanella* sp., x32
2- *Tuberitina collosa* REITLINGER, x126
3- *Tetrataxis conica* EHRENBERG, x32
4- *Climacammina valvulinoides* LANGE, x20
5- *Climacammina moelleri* REITLINGER, x32
6- *Deckerella composita* REITLINGER, x32
7- *Schwagerina* sp., x20
8- *Nankinella orbicularia* Lee x80
9- *Cribrogenerina summatrana* (VOLZ), x20

Plate 6

1- *Langella conica* DECIVRIEUX & DESS, x80
2- *Cryptoseptida anatoliensis* DECIVRIEUX & DESS, x126
3- *Pachyphloia pedicula* LANGE, x126
4- *Hemigordius ovatus* REITLINGER, x25
5- *Neoendothyra broennimanni* BOZORGNIA, x80
6- *Geinitzina uralica* SULEIMANOV, x126
7- *Langella ocarina* DE CIVRIEUX & DESS, x126
8- *Neoendothyra parva* (LANGE), x80
9- *Codonofusiella reki* DUNBAR & SKINNER, x80

Plate 7

1- *Langella perforata* (LANGE), x80
2- *Langella perforata* (LANGE), x100
3- *Langella cukurkoyi* DE CIVERIEUX & DESS, x100
4- *Paraaechaediscus* sp., x126
5- *Permodiscus rotundus* CHERN, x126
6- *Pseudolangella fragilis* DE CIVRIEUX & DESS, x126
7- *Protonodosaria praecursor* CHERN, x32
8- *Vermiporella niponica* x32
9- *Cribrogenerina sumatrana* (VOLZ), x126