

Lithostratigraphy and Microbiostratigraphy of the Ruteh Formation in Northwest of Khur, Central Alborz, Iran

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Abstract

A sequence of Permian rocks crops out in Northwest of Khur in Central Alborz, North of Iran. This sequence consists of the Dorud (Asselian-Sakmarian), Ruteh (Artinskian-Murgabian) and Nesen (Early Djulfian) formations. The Ruteh and Nesen formations in Alborz Range were deposited in a shallow marine environment of the continental margin in the Paleo-Tethys. The Ruteh Formation with a thickness of 221m unconformably overlies the Dorud Formation and consists of fossiliferous limestones. This formation in the studied section can be subdivided into three informal members and overlain disconformably by the Nesen Formation (Early Djulfian). This sequence is disconformably overlain by the Elikah Formation (Scythian-Ladinian). The rich foraminiferal fauna indicates an Artinskian to Early Djulfian age of the succession that can be established with the *Schubertella-Mesoschubertella* Assemblage Zone (Artinskian), *Dunbarula-Deckerella* and *Neoendothyra-Pachyphloia* Assemblage zones (Murgabian), and *Paraglobivalvulina-Ichtyolaria* Assemblage Zone (Early Djulfian).

Keywords: Permian; Foraminifera; Biozonation; Khur area; Central Alborz

Introduction

Lower to Upper Permian rocks are widely distributed throughout North of Iran (Alborz Zone). They consist mainly of clastic rocks in the lower part and fossiliferous carbonate rocks in the upper part [13]. These rocks have been named as the Dorud, Ruteh and Nesen formations [3, 8, 1]. The main purpose of this research is lithostratigraphy and microbiostratigraphy of the succession based on the foraminiferal contents and to

establish biozones. The research on the Khur area has been carried out by Sieber [20]. Annells et al. [2] prepared geological map of Shakran with scale of 1:100,000, Central Alborz that includes the studied area. For the foraminiferal biostratigraphy, one hundred and twenty four limestone samples were collected from the Ruteh and Nesen formations. The samples were collected at an interval of two meters and one or some times two to four thin sections were prepared.

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Lithostratigraphic Description of the Section

Well-defined outcrops of the Lower to Upper Permian rocks lie along the Khur area, northwest of Khur in central Alborz, northern Iran with the following coordinates:

N 36°.03', E 50°.41' (Fig. 1). Permian rocks overlies non-conformably the black volcanic rocks Devonian and are covered disconformably by the Elikah Formation that has not shown in the map. The Permian rocks of the Khur area consists of three formations: The Dorud, Ruteh and Nesen formations with Asselian to Early Djuflian age (Fig. 2).

The Dorud Formation

The clastic sediments of the Dorud Formation characterize the Lower Permian rocks of the Alborz Zone. The type section of the Dorud Formation is located in central Alborz near the village of Dorud (North Tehran), where it has a thickness of 180 meters [3]. It overlies nonconformably the Jeirud Formation (Upper Devonian) and consists of red sandstones, shales, conglomerate, fossiliferous limestones and quartzite. This Formation in the Khur area consists of red to purple, thick-bedded sandstones, white quartzite and red shales with Early Permian (Asselian-Sakmarian) age (Fig. 3: c, d, e), which is covered unconformably by the Ruteh Formation. (Fig. 3b).

The Ruteh Formation

The type section of the Ruteh Formation is located in central Alborz near the village of Ruteh (North Tehran), where it has a thickness of 230 meters and consists of dark gray, medium-bedded to massive fossiliferous limestones [3]. In the Khur area, this formation with a thickness of 221 meters unconformably overlies the Dorud Formation and consists of fossiliferous limestones. This Formation in the study section can be subdivided into three informal members as following:

member 1 (7.5 m)

Alternating dark gray, thin-bedded limestones to medium-bedded fossiliferous shaly and wavy limestones. The bedding shows N 297° W strike and 36°SW dip (Fig. 3f). This member contains macrofossils such as Bellerophontid, brachiopoda, ostracoda, ichnofossil of the *Zoophycos* and cyanobacteria of the *Tubiphytes obscurus* Maslov. *Tubiphytes* is commonly interpreted as a calcified cyanobacterium [15]. Senowbari-Daryan and Flugel [17] asserted that a combination of non-preserved soft

organism (central tube) and a cyanobacterial envelope is the original interpretation of Maslov regarding *Tubiphytes*. Riding [16] emphasized that the correct name of *Tubiphytes obscurus* is *Shamovella obscura*. The traditional name is consequently used in the article.

This member also includes the following microfossils (thin sections no. M. KH-1~5): **Foraminifera:** *Climacammina sphaerica* Potieskaya, *Eotuberitina reitlingerae* MikLukho-MakLay, *Geinitzina reperta* Bykova, *Geinitzina uralica* Suleimanov, *Langella perforata* Lange, *Mesoschubertella thompsoni* Kanuma & Sakagami, *Pachyphloia cukurkoyi* De Civrieux & Dess., *Schubertella transitoria* Staff & Wedekind, *Tuberitina collosa* Reitlinger; **Algae:** *Permocalculus* sp., *Pseudovermiporella* sp., *Vermiporella* sp., *Vermiporella nipponica* Endo; **Cyanobacteria:** *Tubiphytes* sp., *Tubiphytes obscurus* Maslov.

Conodont species *Sweetognathus whitei* Clark [23], has been obtained from member 1 of the Ruteh Formation that is an index for the *Whitei* biozone. This confirms an Artinskian age. Another species, *Hindeodus* sp. and *Hindeodus minatus* Ellison, has also been recorded in this member.

member 2 (119 m)

Alternating dark gray, medium to thick-bedded and massive limestones with medium-bedded shaly limestones. The bedding shows N 271° W strike and 43° SW dip. (Fig. 3g). This member contains macrofossils similar to member 1 and includes the following microfossils (thin sections no. M. KH-6~47): **Foraminifera:** *Climacammina sphaerica* Potieskaya, *Climacammina valvulinoides* Lange, *Codonofusiella nana* Erk., *Deckerella composita* Reitlinger, *Dunbarula mathieui* Ciry, *Frondinodosaria* cf. *Pyrula* De Civrieux & Dess, *Geinitzina chapmani* Schubert Var. Longa Suleimanov, *Geinitzina postcarbonica* Spandel, *Geinitzina primitiva* Potievskaja, *Geinitzina reperta* Bykova, *Geinitzina* cf. *taurica* De Civrieux & Dess., *Geinitzina uralica* Suleimanov, *Globivalvulina biserialis* Cushman, *Globivalvulina vonderschmitti* Reitlinger, *Kahlerina pachythea* Koch. Deive et Ramors, *Langella* cf. *acantha* Lange, *Langella conica* De Civrieux & Dess., *Langella cukurkoyi* De Civrieux & Dess., *Langella ocarina* De Civrieux & Dess., *Langella perforata* Lange, *Minojapanella elongata* Fujimoto and Kanuma, *Nankinella orbicularia* Lee., *Pachyphloia iranica* Bozorgnia, *Pachyphloia pedicula* Lange, *Pseudolangella fragilis* De Civrieux & Dess., *Tuberitina collosa* Reitlinger; **Algae:** *Gymnocodium* sp., *Gymnocodium bellerophontis* Rothpletz, *Gymnocodium nodosum* Rothpletz, *Permocalculus* sp., *Pseudovermiporella* sp., *Vermiporella* sp., *Vermiporella nipponica*

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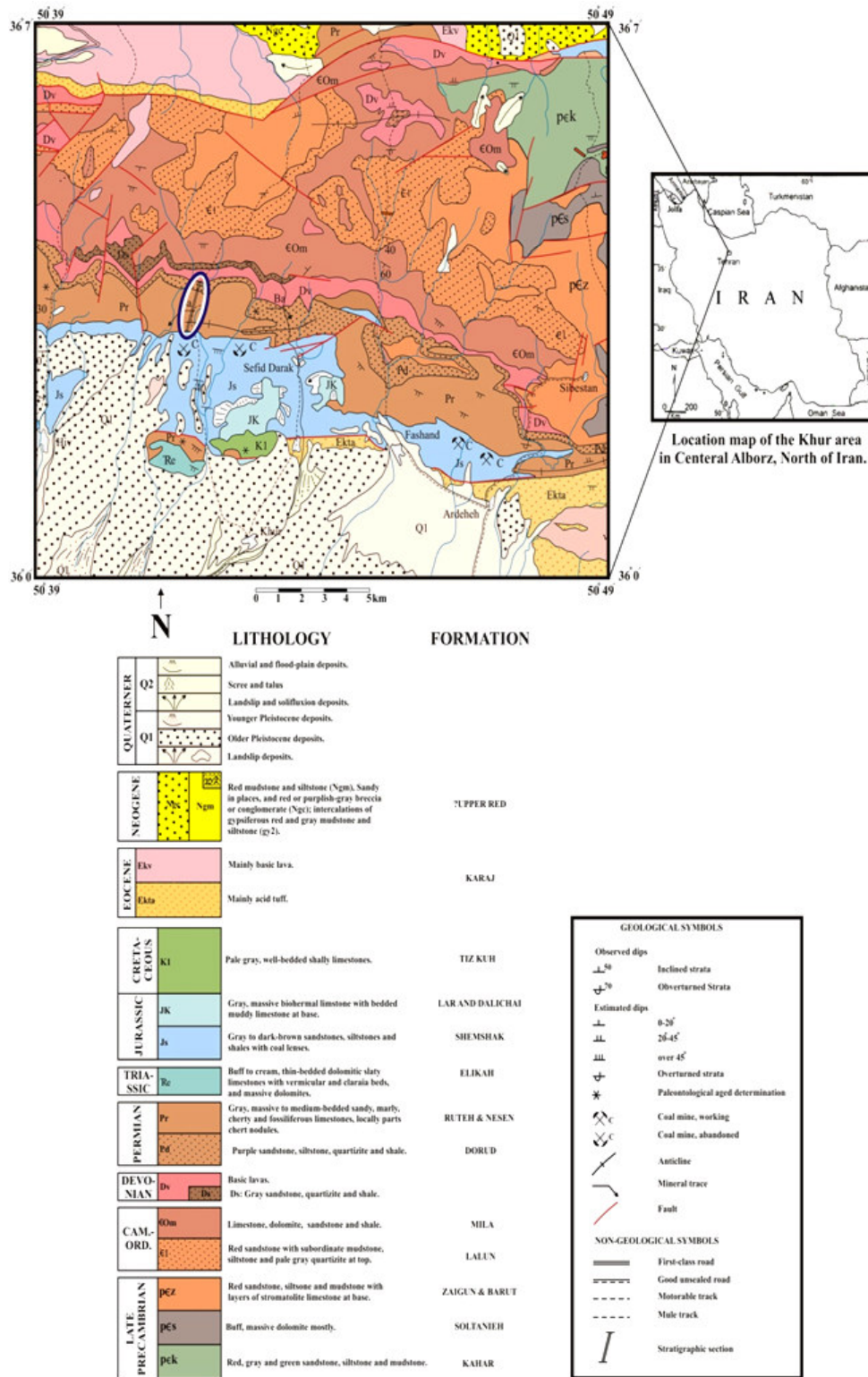


Figure 1. Geological map of the Khur area in Central Alborz, North Iran (Annells et al., 1977).

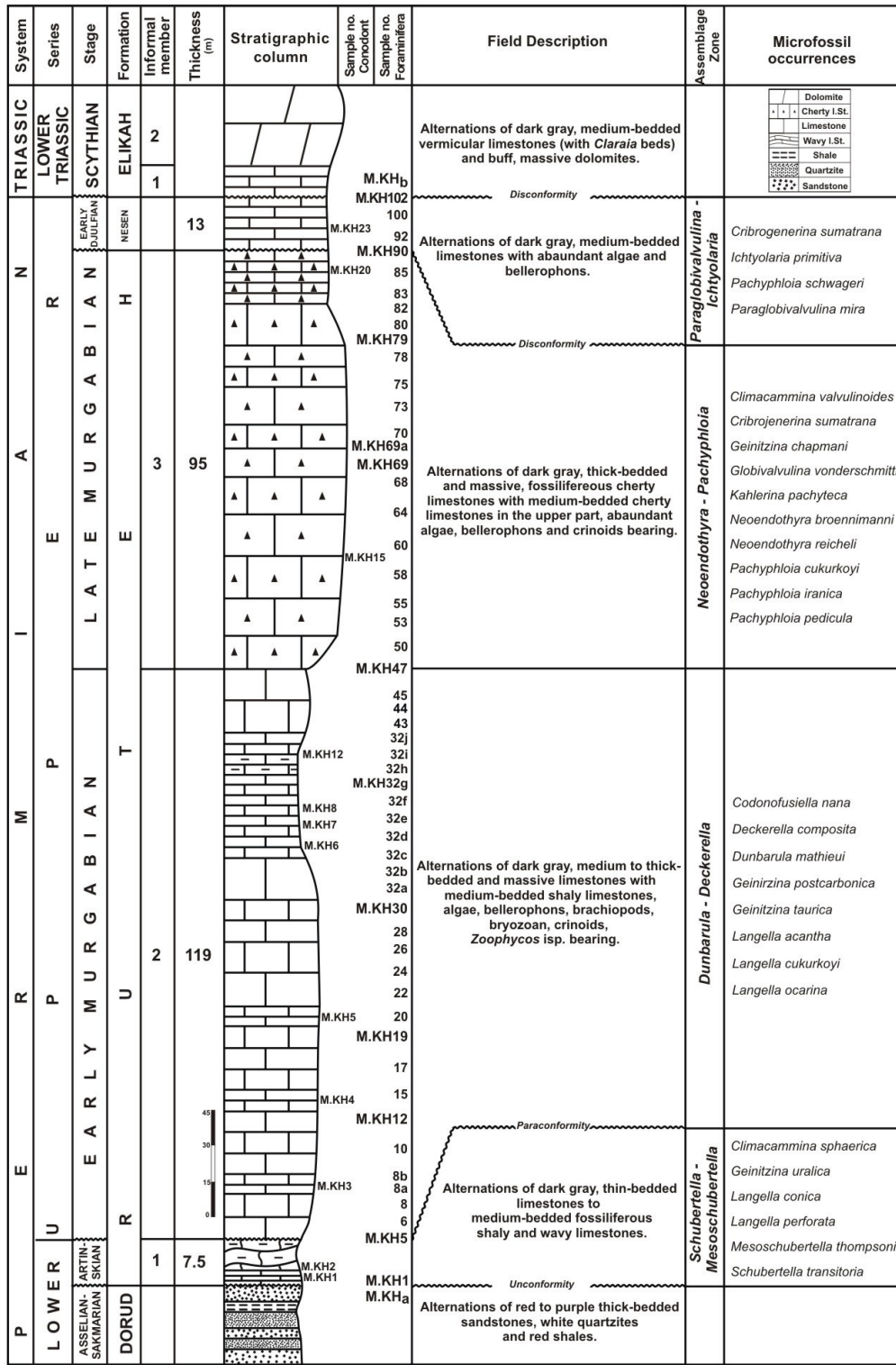


Figure 2. Lithostratigraphical characteristics and biozones of the Ruteh Formation in northwest of Khur, Central Alborz, North of Iran.



Figure 3. (a) Volcanic rocks of the Jeirud Formation. (b) The contact between Dorud and Ruteh Formations. (c) Sandstone of the Dorud Formation. (d) Quartzite of the Dorud Formation. (e) Shale of the Dorud Formation. (f) Thin to medium-bedded fossiliferous shaly and wavy limestones of the Ruteh Formation (member 1). (g) Alternating medium to thick-bedded and massive limestones of the Ruteh Formation (member 2). (h) Ichnofossil (*Zoophycos*) in limestone of the Ruteh Formation (member 2).

Endo; **Cyanobacteria:** *Girvanella permica* Pia, *Tubiphytes* sp., *Tubiphytes obscurus* Maslov.

member 3 (95 m)

Alternating dark gray, thick-bedded and massive fossiliferous cherty limestones with medium-bedded cherty limestones in the upper part. The bedding shows

S 92° E strike and 44° NE dip (Fig. 4: c, d).

This member includes the following microfossils (thin sections no. M. KH-48–89): **Foraminifera:** *Climacammina sphaerica* Potieskaya, *Climacammina* sp., *Cribrogenerina sumatrana* Volz, *Deckerella composita* Reitlinger, *Dunbarula mathieui* Ciry, *Geinitzina chapmani* Schubert, *Geinitzina postcarbo*

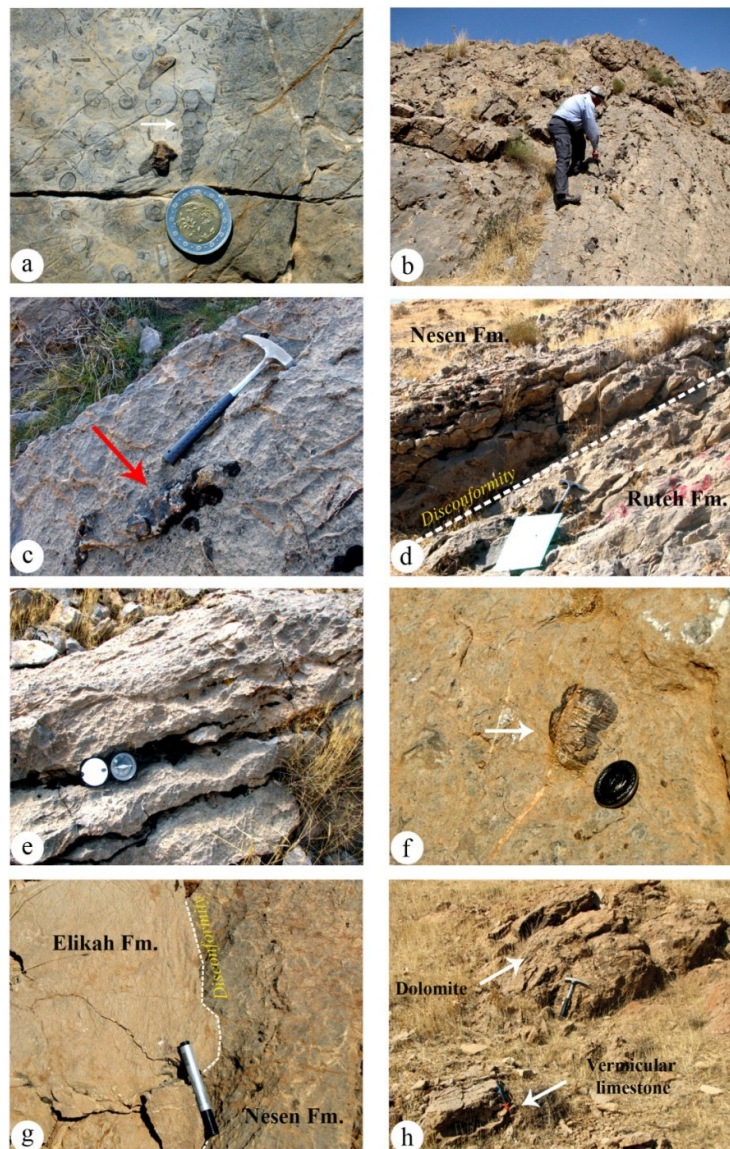


Figure 4. (a) Gastropoda in limestone of the Ruteh Formation (member 2). (b) Alternating limestones of Ruteh Formation (member 3). (c) Chert nodules in alternating limestones of the Ruteh Formation (member 3). (d) The contact between Ruteh and Nesen Formations. (e) Alternating medium-bedded limestones of the Nesen Formation. (f) Brachiopoda in the Nesen Formation. (g) The contact between Nesen and Elikah Formations. (h) Vermicular limestones and dolomites of the Elikah Formation.

nica Spandel, *Geinitzina reperta* Bykova, *Globivalvulina biserialis* Cushman, *Globivalvulina vonderschmitti* Reichel, *Kahlerina pachythea* Koch. Devide et Ramors, *Langella conica* De Civrieux & Dess., *Langella perforata* Lange, *Minojapanella elongata* Fujimoto and Kanuma, *Nankinella orbicularia* Lee., *Neoendothyra broennimanni* Bozorgnia, *Neoendothyra reicheli* Reitlinger, *Pachyphloia cukurkoyi* De Civrieux

& Dess., *Pachyphloia iranica* Bozorgnia, *Pachyphloia pedicula* Lange, *Tuberitina collosa* Reitlinger; **Algae:** *Gymnocodium* sp., *Gymnocodium bellerophontis* Rothpletz, *Gymnocodium nodosum* Rothpletz, *Permo-calculus* sp., *Pseudovermiporella* sp., *Vermiporella* sp., *Vermiporella nippnica* Endo; **Cyanobacteria:** *Tubiphytes* sp., *Tubiphytes obscurus* Maslov.

The Nesen Formation

The type section of the Nesen Formation is located in northeast Nesen village (Central Alborz) and has a thickness of 144 meters [8]. This formation consists of black shales (with abundant brachiopods and corals) and dark gray, cherty fossiliferous limestones. The lower as well as the upper boundary of the Nesen Formation is disconformable. The Elikah Formation (Lower to Middle Triassic) disconformably overlies the Ruteh Formation. The Nesen Formation in the studied section consists of dark gray, medium-bedded limestones. These beds show N 320° W strike and 57° SW dip (Fig. 4f).

This Formation includes the following microfossils (thin sections no. M. KH-90~102): **Foraminifera:** *Climacammina* sp., *Deckerella composita* Reitlinger, *Ichtyolaria primitiva* De Civrieux & Dess, *Langella perforata* Lange, *Nankinella orbicularia* Lee., *Neoendothyra reicheli* Reitlinger, *Pachyphloia cukurkoyi* De Civrieux & Dess., *Pachyphloia iranica* Bozorgnia, *Pachyphloia pedicula* Lange, *Paraglobivalvulina mira* Reitlinger, *Tuberitina collosa* Reitlinger; **Algae:** *Gymnocodium* sp., *Gymnocodium bellerophontis* Rothpletz, *Gymnocodium nodosum* Rothpletz, *Mizzia* sp., *Permocalculus* sp., *Pseudovermiporella* sp., *Vermiporella* sp., *Vermiporella nippnica* Endo; **Cyanobacteria:** *Tubiphytes* sp., *Tubiphytes obscurus* Maslov.

The Nesen Formation overlies disconformably the Ruteh Formation and is covered disconformably by the Elikah Formation (Scythian-Ladinian), (Fig. 4g).

List of the foraminifera species in the Ruteh Formation are shown in (Fig. 5) and list of the algae and cyanobacteria species are shown in (Fig. 6).

The Elikah Formation

The Elikah Formation in the study section consists of dark gray, medium-bedded vermicular limestones (with *Claria* beds) and buff, massive dolomites with Early to Middle Triassic (Scythian-Ladinian) age. (Fig. 4h). The Elikah Formation was deposited on a vast platform along the shelves of Paleo-Tethys and Neo-Tethys. The rather poor fossil content can deduce the age of the Elikah Formation, mainly concentrated in the lower part. Except in the Jolfa area in northwestern Alborz, where the Permo-Triassic boundary is rather continuous [9,21], elsewhere along the Alborz Zone, the Elikah Formation overlies a distinct disconformity Upper Permian or even older strata [18, 19] and may have thickness up to 1000 meters.

Foraminiferal Biozones of the Permian System in the Study Section

Four informal foraminiferal biozones have been established in the study section as the following:

Schubertella-Mesoschubertella Assemblage Zone

This biozone includes member 1 of the Ruteh Formation with a thickness of 7.5 meters. It indicates an Artinskian age and includes foraminifers of the *Climacammina sphaerica* Potieskaya, *Geinitzina uralica* Suleimanov, *Langella perforata* Lange, *Mesoschubertella thompsoni* Kanuma & Sakagami, *Schubertella transitoria* Staff & Wedekind.

Dunbarula-Deckerella Assemblage Zone

This biozone includes member 2 of the Ruteh Formation with a thickness of 119 meters. It indicates an Early Murgabian age and includes foraminifers of the *Codonofusiella nana* Erk, *Deckerella* sp., *Deckerella composita* Reitlinger, *Dunbarula mathieui* Ciry, *Geinitzina postcarbonica* Spandel, *Geinitzina taurica* De Civrieux & Dess, *Langella acantha* Lange, *Langella cukurkoyi* De Civrieux & Dess, *Langella ocarina* De Civrieux & Dess.

Neoendothyra-Pachyphloia Assemblage Zone

This biozone includes member 3 of the Ruteh Formation with a thickness of 95 meters. It indicates a Late Murgabian age and includes foraminifera of the *Climacammina* sp., *Climacammina valvulinoides* Lange, *Cribrogenerina sumatrana* Volz, *Geinitzina chapmani* Schubert Var. Longa-Suleimanov, *Globivalvulina vonderschmitti* Reichel, *Kahlerina pachythea* Koch. *Devide et Ramors*, *Langella vensoa* *Neoendothyra broennimanni* Bozorgnia, *Neoendothyra reicheli* Reitlinger, *Pachyphloia cukurkoyi* De Civrieux & Dess, *Pachyphloia iranica* Bozorgnia, *Pachyphloia pedicula* Lange. The Foraminifer assemblage of the Ruteh Formation is similar to the fauna of other outcrops of the Ruteh Formation in the central Alborz [4] and also is similar to an assemblage reported from Afghanistan [5]. Both works indicated an Artinskian-Murgabian age for the foraminifer assemblages of those areas.

Paraglobivalvulina-Ichtyolaria Assemblage Zone

This biozone include of the Nesen Formation with a thickness of 13 meters. It indicates an Early Djulfian age and includes frominifers of the *Climacammina*

Stage	Formation	Early Djulfian	Nesen	H	E	T	U	R																																																																																																																																																																																																																																																																																																																																																																																																									
Assemblage Zone	Sample no.	<i>Paraglobbulina-ichthyolaria</i>																																																																																																																																																																																																																																																																																																																																																																																																															
		MJH403	MJH401	MJH400	MJH399	MJH398	MJH397	MJH396	MJH395	MJH394	MJH393	MJH392	MJH391	MJH390	MJH389	MJH388	MJH387	MJH386	MJH385	MJH384	MJH383	MJH382	MJH381	MJH380	MJH379	MJH378	MJH377	MJH376	MJH375	MJH374	MJH373	MJH372	MJH371	MJH370	MJH369	MJH368	MJH367	MJH366	MJH365	MJH364	MJH363	MJH362	MJH361	MJH360	MJH359	MJH358	MJH357	MJH356	MJH355	MJH354	MJH353	MJH352	MJH351	MJH350	MJH349	MJH348	MJH347	MJH346	MJH345	MJH344	MJH343	MJH342	MJH341	MJH340	MJH339	MJH338	MJH337	MJH336	MJH335	MJH334	MJH333	MJH332	MJH331	MJH330	MJH329	MJH328	MJH327	MJH326	MJH325	MJH324	MJH323	MJH322	MJH321	MJH320	MJH319	MJH318	MJH317	MJH316	MJH315	MJH314	MJH313	MJH312	MJH311	MJH310	MJH309	MJH308	MJH307	MJH306	MJH305	MJH304	MJH303	MJH302	MJH301	MJH300	MJH299	MJH298	MJH297	MJH296	MJH295	MJH294	MJH293	MJH292	MJH291	MJH290	MJH289	MJH288	MJH287	MJH286	MJH285	MJH284	MJH283	MJH282	MJH281	MJH280	MJH279	MJH278	MJH277	MJH276	MJH275	MJH274	MJH273	MJH272	MJH271	MJH270	MJH269	MJH268	MJH267	MJH266	MJH265	MJH264	MJH263	MJH262	MJH261	MJH260	MJH259	MJH258	MJH257	MJH256	MJH255	MJH254	MJH253	MJH252	MJH251	MJH250	MJH249	MJH248	MJH247	MJH246	MJH245	MJH244	MJH243	MJH242	MJH241	MJH240	MJH239	MJH238	MJH237	MJH236	MJH235	MJH234	MJH233	MJH232	MJH231	MJH230	MJH229	MJH228	MJH227	MJH226	MJH225	MJH224	MJH223	MJH222	MJH221	MJH220	MJH219	MJH218	MJH217	MJH216	MJH215	MJH214	MJH213	MJH212	MJH211	MJH210	MJH209	MJH208	MJH207	MJH206	MJH205	MJH204	MJH203	MJH202	MJH201	MJH200	MJH199	MJH198	MJH197	MJH196	MJH195	MJH194	MJH193	MJH192	MJH191	MJH190	MJH189	MJH188	MJH187	MJH186	MJH185	MJH184	MJH183	MJH182	MJH181	MJH180	MJH179	MJH178	MJH177	MJH176	MJH175	MJH174	MJH173	MJH172	MJH171	MJH170	MJH169	MJH168	MJH167	MJH166	MJH165	MJH164	MJH163	MJH162	MJH161	MJH160	MJH159	MJH158	MJH157	MJH156	MJH155	MJH154	MJH153	MJH152	MJH151	MJH150	MJH149	MJH148	MJH147	MJH146	MJH145	MJH144	MJH143	MJH142	MJH141	MJH140	MJH139	MJH138	MJH137	MJH136	MJH135	MJH134	MJH133	MJH132	MJH131	MJH130	MJH129	MJH128	MJH127	MJH126	MJH125	MJH124	MJH123	MJH122	MJH121	MJH120	MJH119	MJH118	MJH117	MJH116	MJH115	MJH114	MJH113	MJH112	MJH111	MJH110	MJH109	MJH108	MJH107	MJH106	MJH105	MJH104	MJH103	MJH102	MJH101	MJH100	MJH99	MJH98	MJH97	MJH96	MJH95	MJH94	MJH93	MJH92	MJH91	MJH90	MJH89	MJH88	MJH87	MJH86	MJH85	MJH84	MJH83	MJH82	MJH81	MJH80	MJH79	MJH78	MJH77	MJH76	MJH75	MJH74	MJH73	MJH72	MJH71	MJH70	MJH69	MJH68	MJH67	MJH66	MJH65	MJH64	MJH63	MJH62	MJH61	MJH60	MJH59	MJH58	MJH57	MJH56	MJH55	MJH54	MJH53	MJH52	MJH51	MJH50	MJH49	MJH48	MJH47	MJH46	MJH45	MJH44	MJH43	MJH42	MJH41	MJH40	MJH39	MJH38	MJH37	MJH36	MJH35	MJH34	MJH33	MJH32	MJH31	MJH30	MJH29	MJH28	MJH27	MJH26	MJH25	MJH24	MJH23	MJH22	MJH21	MJH20	MJH19	MJH18	MJH17	MJH16	MJH15	MJH14	MJH13	MJH12	MJH11	MJH10	MJH9	MJH8	MJH7	MJH6	MJH5	MJH4	MJH3

Figure 5. List of foraminifera species of the Ruteh and Nesen formations in Khur area, Central Alborz, North of Iran.

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Armatian	Lower Murgabian		Upper Murgabian		Early Djulfian		Stage Formation
	R	T	E	H	Nesen	Assemblage Zone	
Schubertella - Meoschubertella	MK31-1						Sample no.
	MK31-2						Langella sp.
	MK31-3						Langella acutius
	MK31-4						Langella conica
	MK31-5						Langella cuberkoyi
	MK31-6						Langella oscarini
	MK31-7						Langella perforata
	MK31-8						Langella venosa
	MK31-9						Meoschubertella sp.
	MK31-10						Meoschubertella thompsoni
	MK31-11						Mitropopovella elongata
	MK31-12						Nankinella sp.
	MK31-13						Neosendothya sp.
	MK31-14						Neosendothya parva
	MK31-15						Neosendothya reichelti
	MK31-16						Neosuberitina maljanini
	MK31-17						Neosuberitina sympetala
	MK31-18						Pachyphloia sp.
	MK31-19						Pachyphloia caltharoyi
	MK31-20						Pachyphloia tramica
	MK31-21						Pachyphloia pedicula
	MK31-22						Pachyphloia schwaegeri
	MK31-23						Paraglobobulimina nitra
	MK31-24						Palaotectularia sp.
	MK31-25						Parafiminea cf. yabei
	MK31-26						Permodiscus sp.
	MK31-27						Pronomolaxia sp.
	MK31-28						Schubertella sp.
	MK31-29						Schubertella transitoria
	MK31-30						Stafella sp.
	MK31-31						Tetrataxis sp.
	MK31-32						Tuberitina sp.
	MK31-33						Tuberitina collosa

Figure 5. Continued.

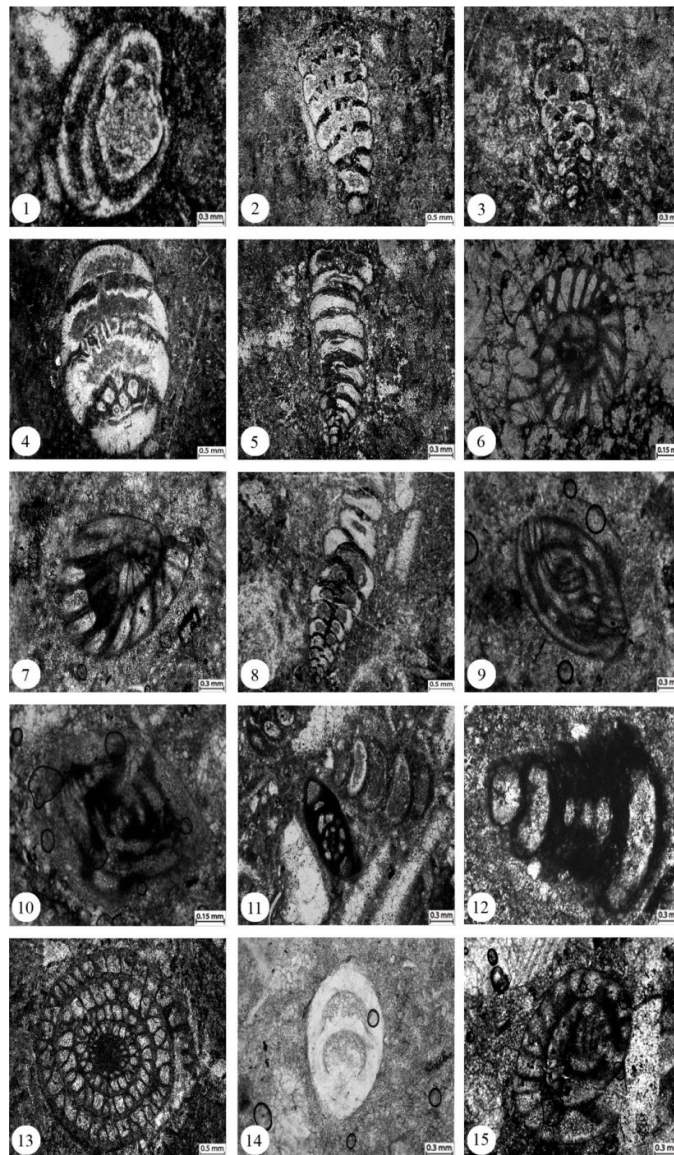


Plate 1.

- Figure 1. *Hemigordius* sp. GEINITZ, thin section no. M. KH-1.
 Figure 2. *Climacammina major* REITLINGER, thin section no. M. KH-53.
 Figure 3. *Deckerella composita* REITLINGER, thin section no. M. KH-4.
 Figure 4. *Cribrogenerina* sp., thin section no. M. KH-1.
 Figure 5. *Climacammina valvulinoidea* LANGE, thin section no. M. KH-36.
 Figure 6. *Codonofusiella* sp., thin section no. M. KH-20.
 Figure 7. *Codonofusiella* sp., thin section no. M. KH-2.
 Figure 8. *Deckerella composita* REITLINGER, thin section no. M. KH-18.
 Figure 9. *Schubertella transitoria* STAFF & WEDEKIND, thin section no. M. KH-3.
 Figure 10. *Mesoshubertella thompsoni* KANUMA & SAKAGAMI, thin section no. M. KH-2.
 Figure 11. *Neoendothyra broennimanni* REITLINGER, thin section no. M. KH-18.
 Figure 12. *Neoendothyra reicheli* BOZORGIA, thin section no. M. KH-78.
 Figure 13. *Parafusulina yabei* HAZAWA, thin section no. M. KH-20.
 Figure 14. *Langella perforata* LANGE, thin section no. M. KH-32.
 Figure 15. *Codonofusiella* sp., thin section no. M. KH-2.

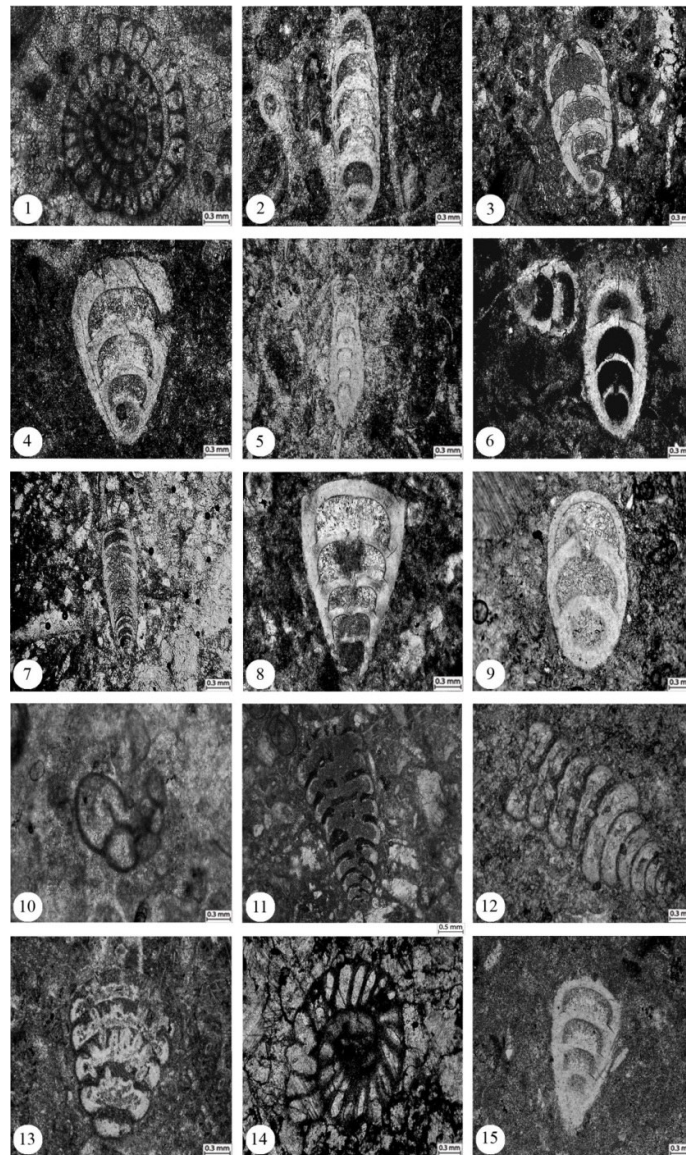


Plate 2.

- Figure 1. *Dunbarula mathieui* CIRY, thin section no. M. KH-14.
 Figure 2. *Langella acantha* LANGE, thin section no. M. KH-55.
 Figure 3. *Langella perforata* LANGE, thin section no. M. KH-8.
 Figure 4. *Langella conica* DE CIVRIEUX & DESS, thin section no. M. KH-15.
 Figure 5. *Langella ocarina* DE CIVRIEUX & DESS, thin section no. M. KH-34.
 Figure 6. *Langella perforata* LANGE, thin section no. M. KH-22.
 Figure 7. *Pachyphloia* sp., thin section no. M. KH-38.
 Figure 8. *Geinitzina uralica* SCHUBERT var. Longa - SULEIMANOV, thin section no. M. KH-32d.
 Figure 9. *Langella perforata* LANGE, thin section no. M. KH-87.
 Figure 10. *Globivalvulina Vonderschmitti* REITLINGER, thin section no. M. KH-20.
 Figure 11. *Climacammina valvulinoides* LANGE, thin section no. M. KH-20.
 Figure 12. *Deckerella composita* REITLINGER, thin section no. M. KH-32g.
 Figure 13. *Cribrogenerina* sp., thin section no. M. KH-37.
 Figure 14. *Codonofusiella* cf. *nana* ERK, thin section no. M. KH-2.
 Figure 15. *Langella perforata* LANGE, thin section no. M. KH-56.

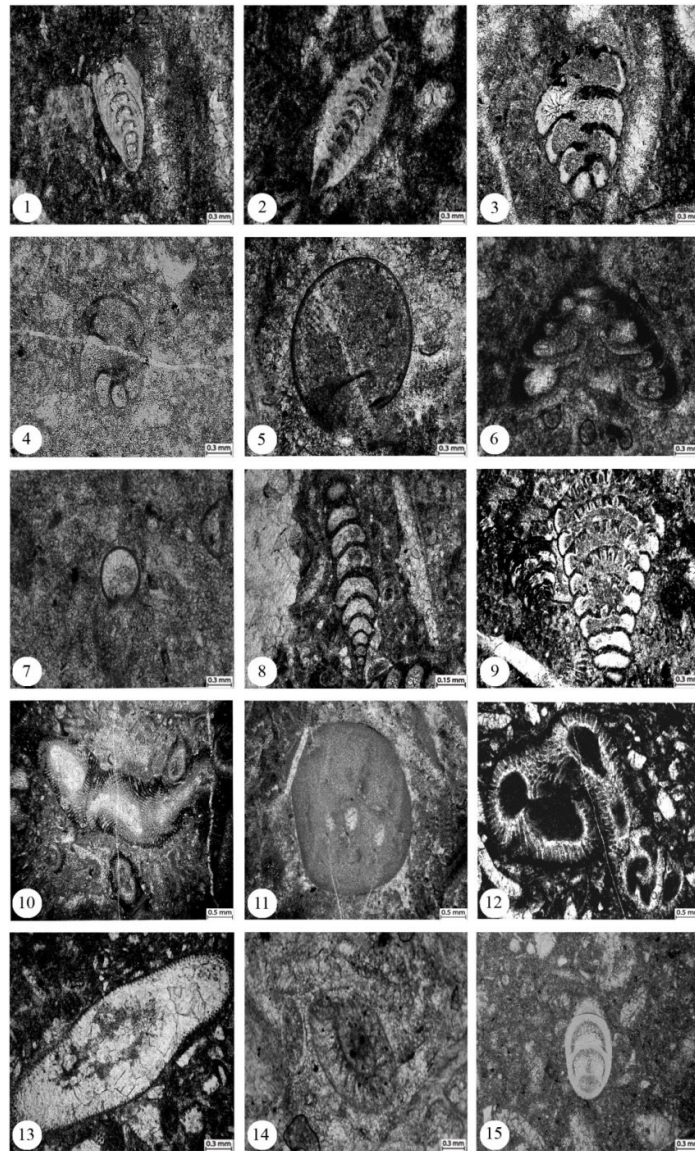


Plate 3.

- Figure 1. *Pachyphloia pedicula* LANGE, thin section no. M. KH-98.
 Figure 2. *Pachyphloia cukurkoyi* DE CIVRIEUX & DESS, thin section no. M. KH-22.
 Figure 3. *Paleotextularia* sp., thin section no. M. KH-52.
 Figure 4. *Globivalvulina* sp., thin section no. M. KH-99.
 Figure 5. *Paraglobivalvulina mira* REITLINGER, thin section no. M. KH-90.
 Figure 6. *Tetrataxis planolocula* DE CIVRIEUX & DESS, thin section no. M. KH-38.
 Figure 7. *Neotuberitina maljavkini* MIKHAILOV, thin section no. M. KH-20.
 Figure 8. *Deckerella* cf. *composita* REITLINGER, thin section no. M. KH-25.
 Figure 9. *Cribrogenerina sumatrana* VOLZ, thin section no. M. KH-99.
 Figure 10. *Pseudovermiporella nipponica* ENDO, thin section no. M. KH-71.
 Figure 11. *Tubiphytes obscurus* MASLOV, thin section no. M. KH-94.
 Figure 12. *Vermiporella nipponica* ENDO, thin section no. M. KH-54.
 Figure 13. *Gymnocodium bellerophontis* ROTHPLETZ, thin section no. M. KH-65.
 Figure 14. *Codonofusiella* sp., thin section no. M. KH-60.
 Figure 15. *Langella perforata* LANGE, thin section no. M. KH-90.

moelleri Reitlinger, *Cribrogenerina sumatrana* Volz, *Ichtyolaria primitiva* De Civrieux & Dess., *Pachyphloia Schwageri* De Civrieux & Dess., *Paraglobivalvulina mira* Reitlinger.

Results and Discussion

The Permian sequence in the Khur area consists of three formations in the studied section: The Dorud, Ruteh and Nesen formations. The Ruteh Formation in the study section consists mainly of fossiliferous limestones that were deposited in marine shallow environment. The Ruteh Formation with a thickness of 221 meters can be subdivided into three informal members. In the Present study, three foraminiferal biozones were differentiated for the Ruteh Formation these include: *Schubertella-Mesoschubertella* Assemblage Zone (Artinskian), *Dunbarula-Deckerella* and *Neoendothyra-Pachyphloia* Assemblage zones (Murgabian). The Ruteh Formation is equivalent to the Surmaq Formation in the Abadeh (Central Iran) and Jolfa (northwestern Iran) regions, middle part of the Jamal Formation in the Shotori Range, Tabas area (eastern Iran) and the lower part of the Dalan Formation in the Zagros Range, Southwestern Iran. Comparing the studied section with those of equivalent sediments in western and eastern parts of Alborz shows that the Permian sediments decrease in thickness from west to eastern Alborz.

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