

## New approach on biostratigraphy of Permian deposits of Jamal formation in Bagh Vang section, Shirgesht area (central Iran)

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### Abstract

Bagh Vang Section is located at about 45 km to the Northwest of Tabas and South of Shirgesht areas. In Bagh Vang Section, the Permian deposits of the Jamal Formation with a thickness of 270 m are underlain by the Sardar Formation disconformably. The formation is also transitionally and conformably overlain by Lower Triassic deposits of Sorkh Shale Formation. A total of 124 rock samples have been systematically obtained from various layers of Bagh Vang Section for biostratigraphic study. Forty one genera and 48 species of foraminifera; 10 genera and 12 species of algae have also been determined through this study. According to the biostratigraphic study, some index fossils of Fusulinidae have been recorded and the following assemblage zones have been selected that are equivalent to international biozones (Leven, 1975; Ishii, 1975): Paradunbarula – Geinitzina Assemblage Zone (Murghabian), Dagmarita – Paraglobivalvulina Assemblage Zone (Djulfian), Colaniella – Reichelina Assemblage Zone (Changhsingien). Further, geochronology of Member 1 and Member 2 of the Jamal Formation (Bagh Vang Member) is attributed to Early Murghabian, according to the index fossils.

**Keywords:** Permian System, Bagh Vang Section, Jamal Formation, Assemblage Zone.

### Introduction

The Bagh Vang Section contain a sedimentary sequence of Sardar Formation (Carboniferous) as a basement, Jamal Formation (Permian) and Sorkh Shale Formation (Lower Triassic). The lower contact of the Jamal Formation with Sardar Formation is disconform, while its upper contact with Sorkh Shale Formation is transitional and conformable. The Bagh Vang stratigraphic section was measured and sampled by Ruttner *et al.*, (1968) for the first time. The Report No. 4 related to Geology of Shirgesht area has also been rendered by them by the Geological Survey of Iran. The objective of this study is to conduct lithostratigraphic and biostratigraphic studies and geochronology of the Bagh Vang Section.

### Study area

Bagh Vang stratigraphic section is located at about 45 km to the Northwest of Tabas and 4 km South of Shirgesht Area (Fig. 1).

The outcrop of this section is observed in Southwest of Kuh-e Bagh Vang. In relation to the viewpoint of geographic coordinates, longitude and latitude of the basal part of this section is E: 56°, 46, 06 and N: 33°, 58, 23, respectively (Figs. 2 and 3). The strike of the beds indicates N50W and

dip of the beds varies between 25 NE and 30 NE.

### Methods

Geology operation has been done by surveying the area. Trend of the beds shows northern–southern pattern in Bagh Vang Section. Both the sample gathering and surveying path have been chosen according to the bed strike. The observable lithological specifications, bed strike, dip and apparent distance have been documented for each sample-gathering layer. The actual distance and thickness were calculated. A total number of 124 rock samples have been systematically taken from Bagh Vang Section considering more samples taken from the places with lithology variations and probable age boundary. Subsequently, the gathered samples were sent to a laboratory for providing thin section; then, biostratigraphy study has been done and some photographs were taken from the index fossils.

### Discussion

*Stratigraphy and Biostratigraphy of Permian in Bagh Vang Section*

In relation to the viewpoint of lithostratigraphic changes, sedimentary sequence of Permian up to 270 m thickness divided into 6 members (Fig. 4).

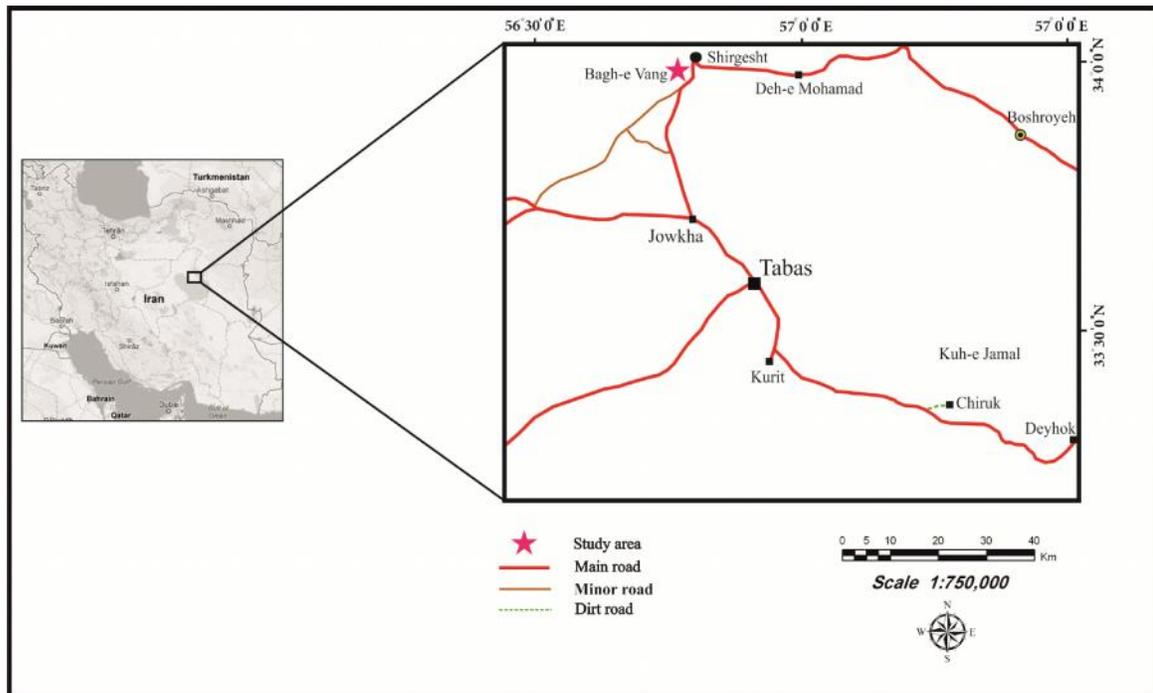


Figure 1. Location of the study area in north of Tabas

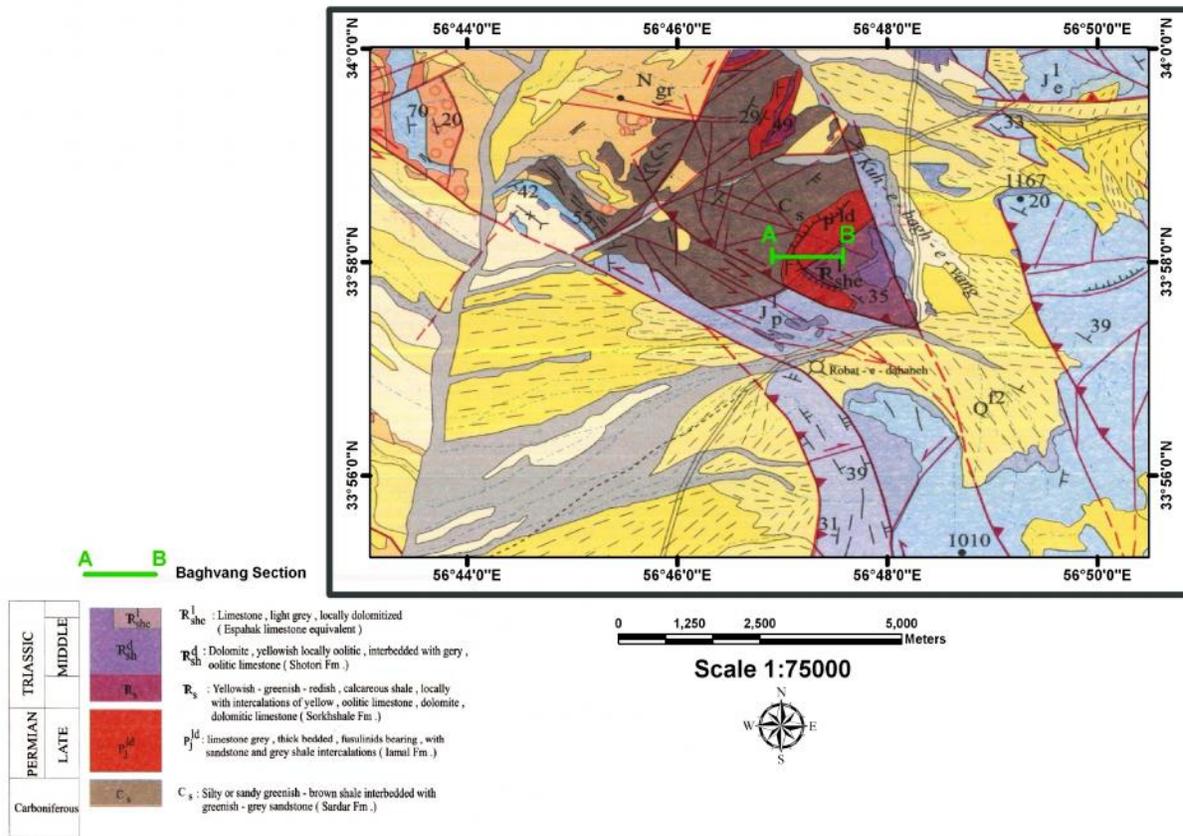
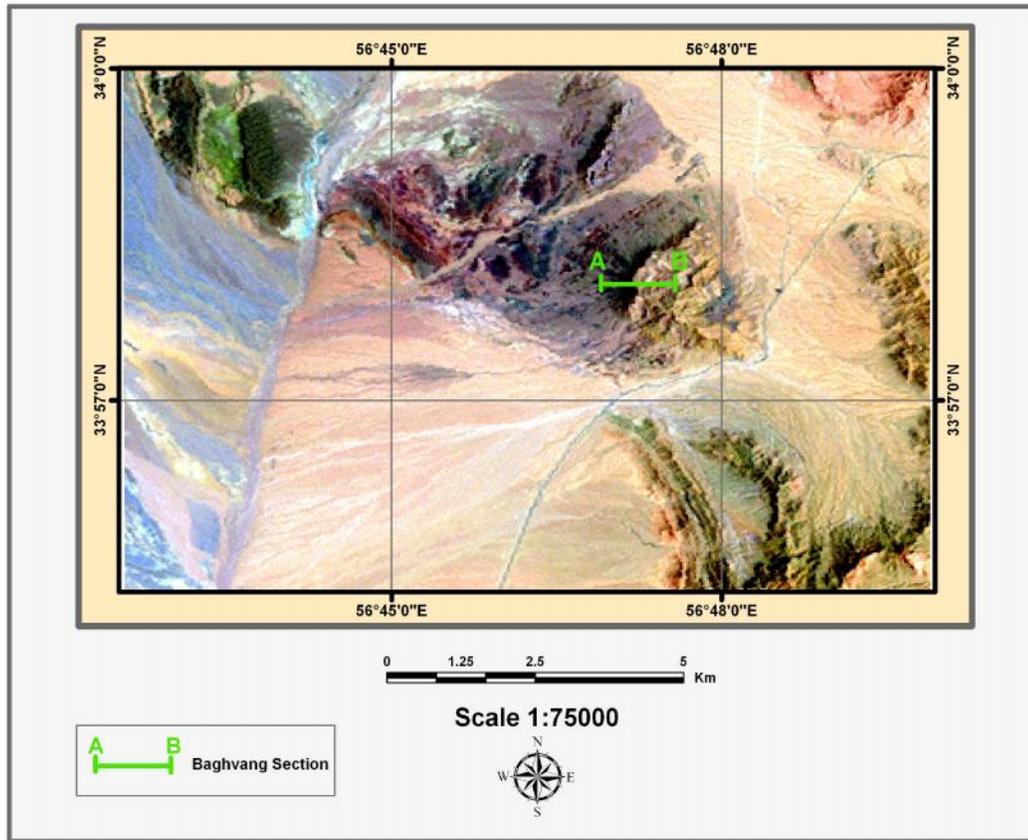


Figure 2. Location of Bagh Vang Section in geological map of Tabas (quotation of Tabas Map in the scale of 1:100,000) (Karimi-Bavandpur, 1976)

Figure 3. Photomap of Landsat ETM<sup>+</sup> of Bagh Vang Section

From bottom to top, these members are included in:

#### Stratigraphy of Member 1 of Jamal Formation

The Member 1 thickness is about 4 m. It is included in basal conglomerate and red shale, which is comprised of rounded and sub-rounded grains with poor sorting.

This member overlies Sardar Formation disconformably (Fig. 5); moreover, it indicates commence of Permian marine transgression in Early Murghabian.

#### Member 2

Member 2 thickness is about 40 m. It contains grey to dark grey shale and coal-bearing with intercalation of thin-bedded fossiliferous marly limestone, including abundant fusulinidae (Plate 5), corals, brachiopods, cephalopods, goniatites, ceratites, crinoids, algae (Plate 6) etc., illustrates platform environment. Member 2 of the Jamal Formation contains the following index foraminifera:

*Geinitzina reperta*, *G. postcarbonica*,

*Globivalvulina vonderschmitti*, *Pseudofusulina huecoensis*, *Paradunbarula dallyi*, *Mesoschubertella thompsoni*, *Neoendothyra bronnimanni*, *Rauserella erratica*, *Pseudoendothyra (Fusulinella) struvii*, *Schubertella transitoria*, *S. cf. kingi*, *Agathammina pusilla*, *Langella acantha*, *Lasiodiscus tenuis*, *L. cf. minor*, *Tuberitina collosa*, *Tetrataxis planulata*, *Parafusulina cf. wordensis*, *Parafusulina cf. incognita*, *Paleotextularia sp.*, *Deckerella sp.*, *Lasiodiscus sp.*, *Tetrataxis sp.*, *Glomospira sp.*, *Tuberitina sp.*, *Fusulinella sp.*, *Globivalvulina sp.*, *Langella sp.*, *Pamirina sp.*, *Millerella sp.*, *Mesoschubertella sp.*, *Geinitzina sp.* and *Hemigordius sp.*

The above assemblage indicates an Early Murghabian age. Twenty-three genera and 19 species of foraminifera have been determined in this Member. Also, this age is suggested by Flugel (1995). Member 2 includes in the following algae as well:

*Tubiphytes obscurus*, *Epimastopora regularis*, *Gyroporella kwantoensis*, *Pseudoepimastopora*

*pertunda*, *P. Japonica*, *Nipponophycus elegans*, *Physoporella ovata*, *P. cf. japonica*, *Oligoporella horiguchii*, *Diplopora pusilla*, *Vermiporella nipponica*, *Osagia* sp.

According to lithology changes of Member 1 and

Member 2, these two members are named “Bagh Vang Member” of Jamal Formation. Bagh Vang Member is conformably underlain cliff-forming limestone of the formation.

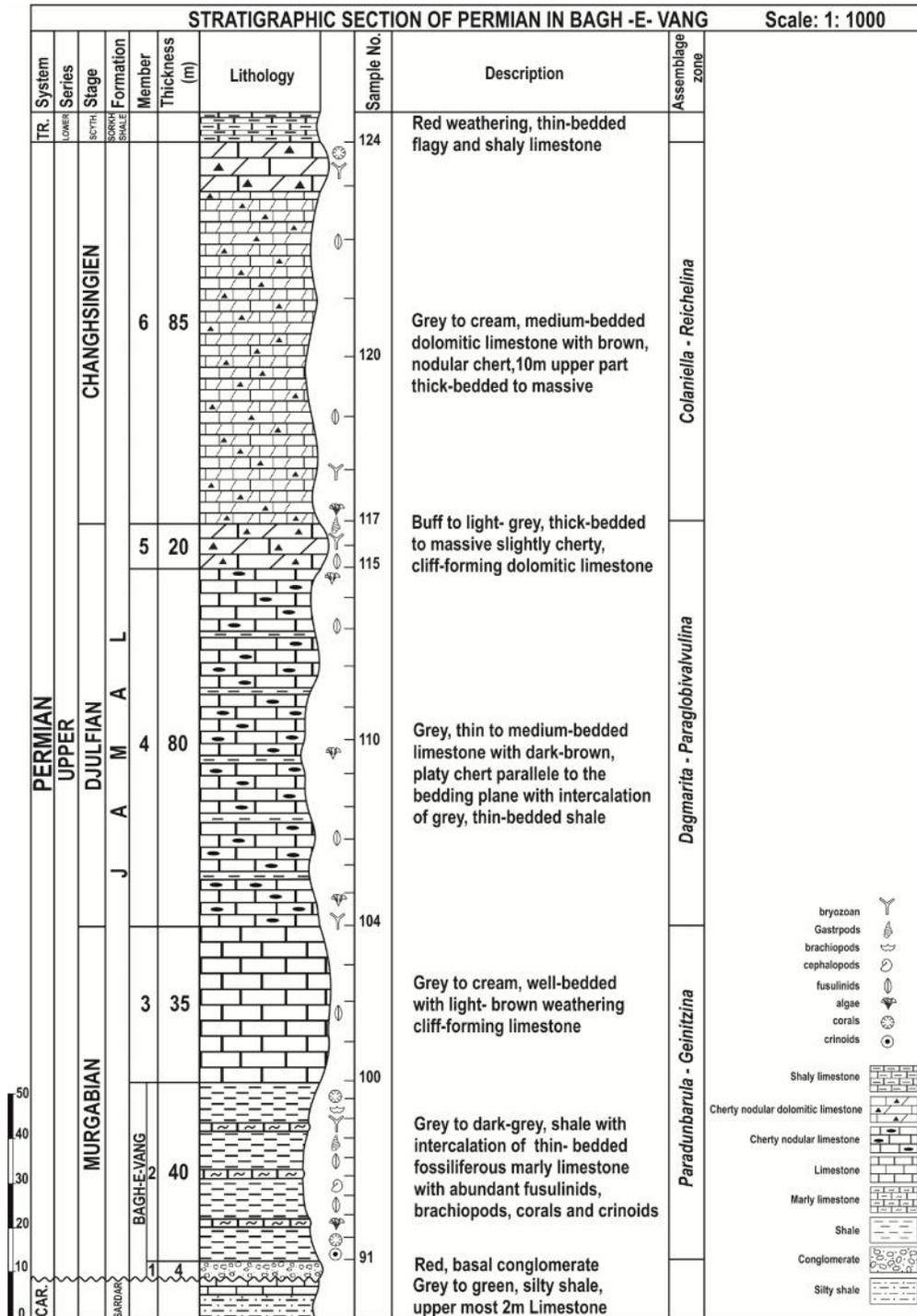


Figure 4. Stratigraphic column of Bagh Vang Section in Shirgesht Area (Central Iran)

### Member 3

Member 3 thickness is about 35 m. It consists of relatively well-bedded grey to cream limestone with beige to light-brown weathering. In relation to morphology, this Member is a cliff-forming limestone, including abundant spicules in microscopic scale.

This unit consist the following foraminifera:

*Geinitzina reperta*, *G. postcarbonica*, *Globivalvulina vonderschmitti*, *Agathammina pusilla*, *Lasiodiscus tenuis*, *Tuberitina collosa*, *Schubertella* cf. *kingi*, with abundant *Tuberitina* spp., *Globivalvulina* spp., *Diplosphaerina* sp., *Mesoschubertella* sp., *Geinitzina* sp., *Hemigordius* sp., and *Langella* sp..

The above fossils illustrate a platform environment belongs to Murghabian. The number of 10 genera and 7 species of foraminifera has been recognized in this Member.

Also, *Paradunbarula* – *Geinitzina* Assemblage Zone has been established for Member 1, Member 2 and Member 3, which is equivalent to *Neoschwagerina margaritae* – *N. craticutifera* – *N. simplex* Assemblage Zone that has been suggested by Leven (1975).

Furthermore, this Member is included in the following algae in Bagh Vang Section:

*Tubiphytes obscurus*, *Epimastopora regularis*, *Gyroporella symetrica*, *Osagia* sp.

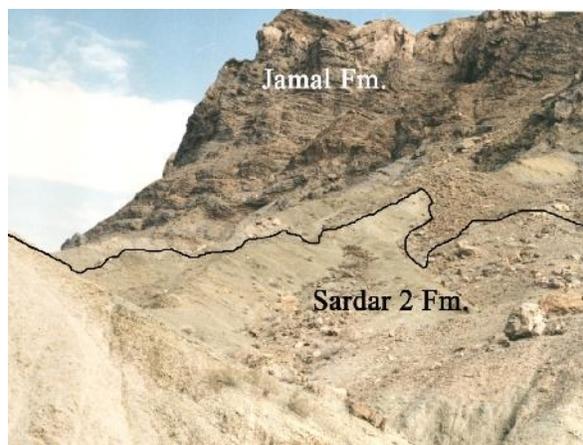


Figure 5. Contact of Sardar Formation (Carboniferous) and Jamal Formation (Permian) in Kuh-e Bagh Vang

### Member 4

Member 4 thickness is about 80 m. It consists of well-bedded and thin to medium-bedded grey limestone. It is also included in platy dark-brown

cherts paralleling with bedding plane containing thin-bedded grey intercalation of shale.

This Member similar to Member 3 consists of abundant spicules. Member 4 is composed of the bellowing foraminifera in Bagh Vang Section:

*Kahlerina pachythea*, *Dagmarita chanakchiensis*, *Globivalvulina vonderschmitti*, *G. bulloides*, *Geinitzina reperta*, *G. postcarbonica*, *Schubertella transitoria*, *Pachyphloia cukurkoyi*, *Neoendothyra bronnimanni*, *Langella conica*, *L. ocarina*, *Dumbarula mathieui*, *Ichtyolaria latilimbata*, *Tuberitina collosa*, *Forondina permica*, *Lasiodiscus* cf. *tenuis*, *Reichelina* cf. *pulchra*, *Protonodosaria* cf. *praecursor*, *Pseudostaffella* sp., *Geinitzina* sp., *Langella* sp., *Paleotextularia* sp., *Globivalvulina* sp., *Neoendothyra* sp., *Glomospira* sp., *Dumbarula* sp., *Tetrataxis* sp., *Codonofusiella* sp. and *Protonodosaria* sp.

The above fossils represent Djulfian in age. Twenty genera and 18 species of foraminifera have been identified in this Member in Bagh Vang Section.

### Member 5

Member 5 thickness is about 20 m. It consists of cliff-forming and massive dolomitic limestone containing the following foraminifera:

*Ichtyolaria latilimbata*, *Paraglobivalvulina mira*, *Geinitzina reperta*, *Tuberitina collosa*, *Glomospira* sp., *Codonofusiella* sp., *Reichelina* sp., *Deckerella* sp., *Dumbarula* sp.

This member belongs to Djulfian. Nine genera and 4 species of foraminifera have been recognized in this Member.

Consequently, *Dagmarita* – *Paraglobivalvulina* Assemblage Zone has been chosen for Member 4 and Member 5, which is equivalent to *Colaniella minima* - *C. minima* Assemblage Zone (Ishii, 1975).

### Member 6

Member 6 thickness is about 85 m. It consists of well-bedded and medium-bedded, grey to cream dolomitic limestone, containing brown-cherty bands, and nodules. According to the field observations, about 10 m thickness of the upper layers shows thick-bedded to massive type. When compared with the lower layers, the upper layers have more strength and are included in platy cherts parallel to bedding plane. Member 6 is composed of the following foraminifera:

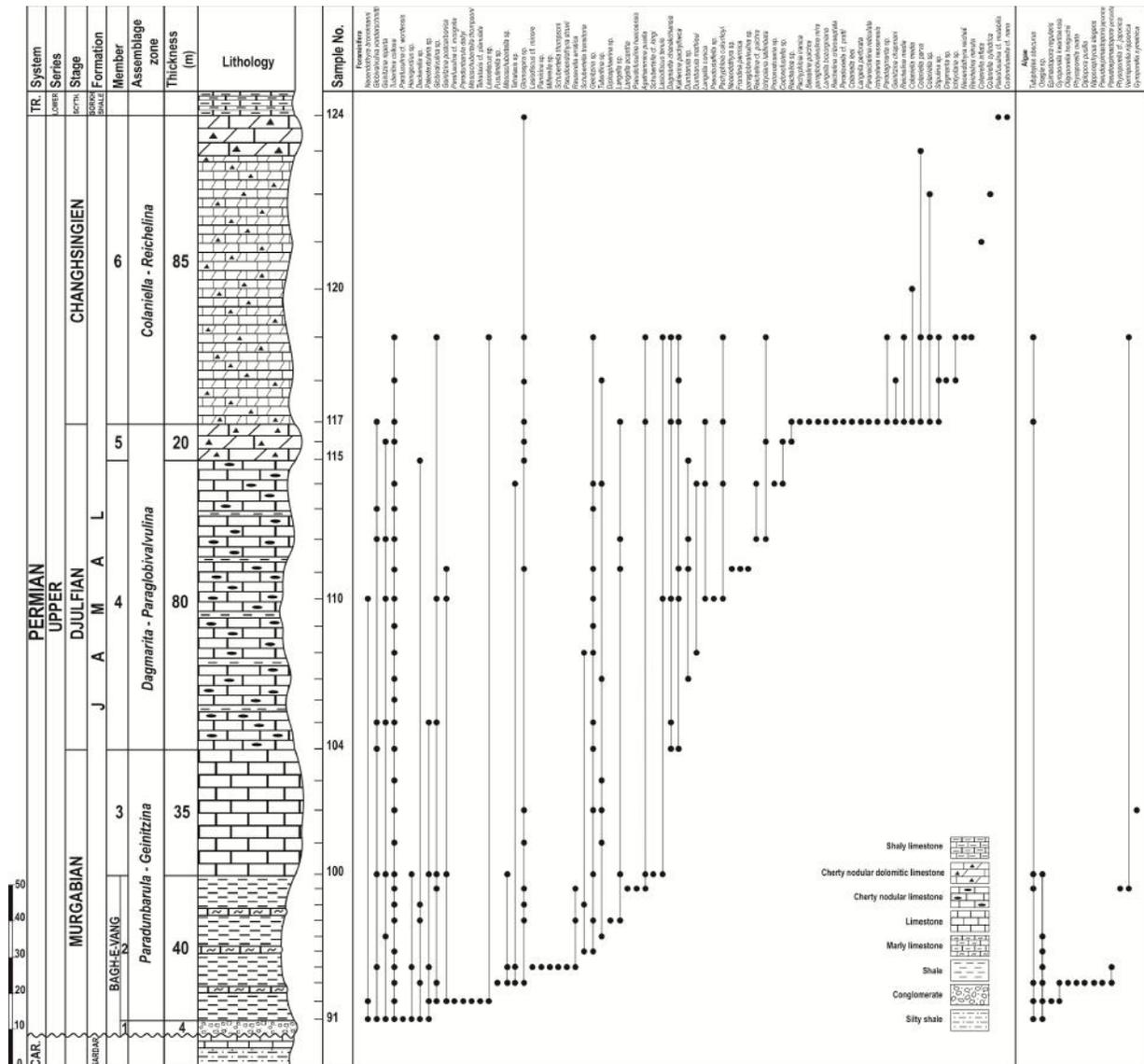


Figure 6. Biostratigraphic range chart of Foraminifera and Algae in Bagh Vang Section

*Kahlerina pachythea*, *Dagmarita chanakchiensis*, *Baisalina pulchra*, *Globivalvulina vonderschmitti*, *G. bulloides*, *Geinitzina chapmani*, *G. reperta*, *Colaniella leei*, *Co. media*, *Co. parva*, *Co. cylindrica*, *Co. inflata*, *Pachyphloia cukurkoyi*, *P. ovata*, *P. iranica*, *Neendothyra reicheli*, *Langella bozorgniana*, *L. ocarina*, *L. perforata*, *Reichelina media*, *R. minuta*, *R. cribrosebtata*, *Parareichelina reticulata*, *Agathammina pussila*, *Ichtyolaria nessenensis*, *I. latilimbata*, *Lasiodiscus tenuis*, *Tuberitina collosa*, *Dumbarula mathieui*, *Paleofusulina cf. mutabilis*, *Paradoxiella cf. pratti*, *Codonofusiella cf. nana*, *Reichelina sp.*,

*Diplosphaerina sp.*, *Protonodosaria sp.*, *Paradagmarita sp.*, *Stipulina sp.*, *Tuberitina sp.*, *Geinitzina sp.*, *Langella sp.*, *Globivalvulina sp.*, *Glomospira sp.*, *Ichtyolaria sp.*, *Dagmarita sp.*, *Colaniella sp.*, with abundant *Lasiodiscus sp.*

The above fossils indicate Changhsingien stage. Chronologically, Changhsingien is equivalent to Dorashamian of Alibashi Formation; however, these two stages are completely different in relation to lithology and facies. Twenty-four genera and 32 species of foraminifera has been determined in this Member.

## Plate 1

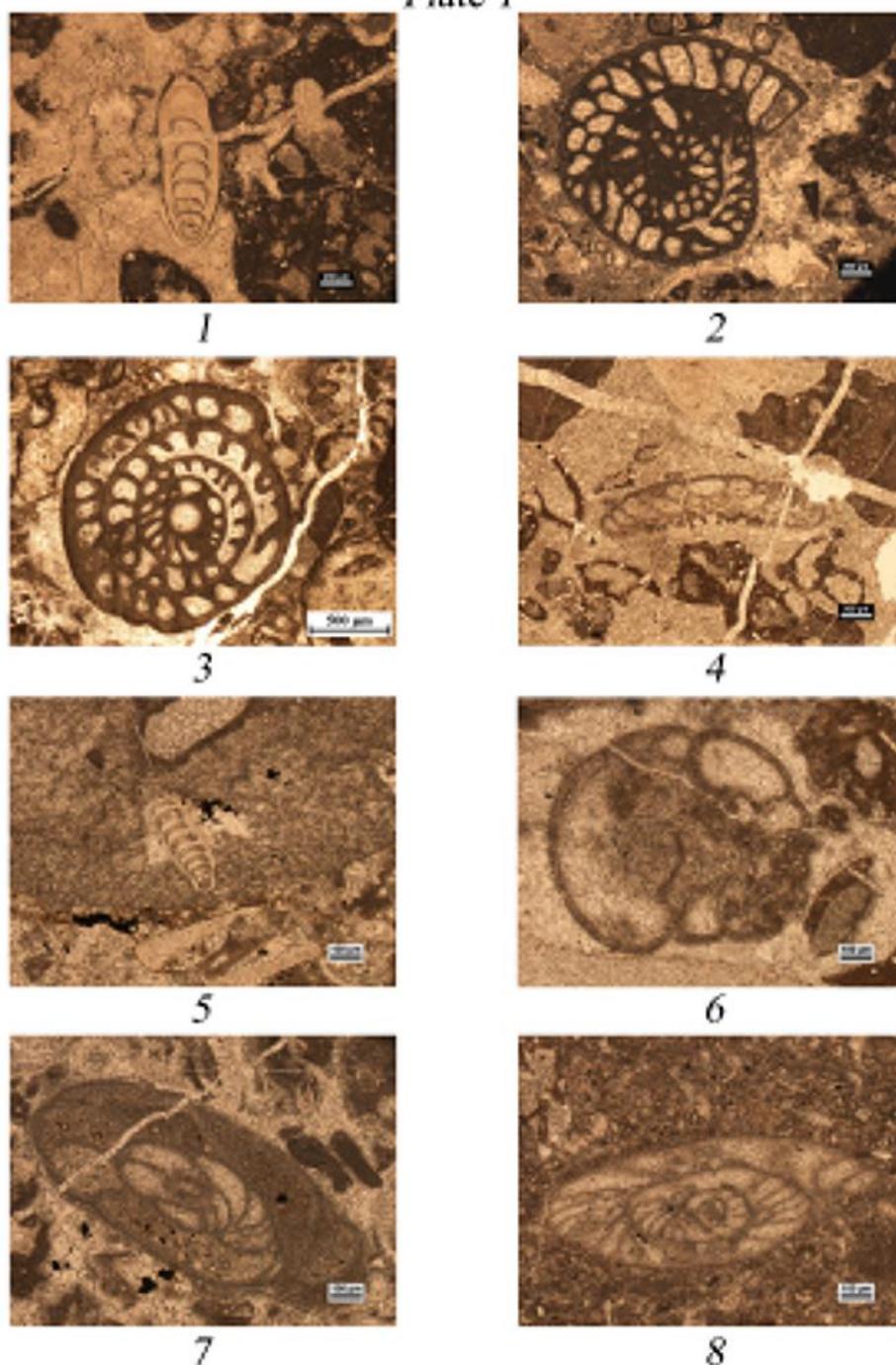
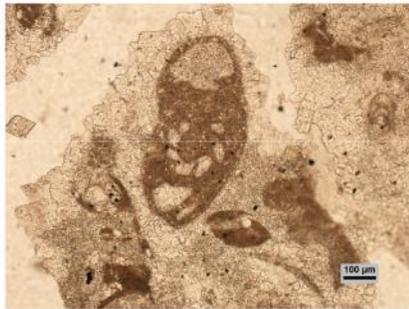


Plate 1. 1. *Langella acantha* (LANGE) 1925, Member 2 of Jamal Fm., sample no. 99, Late Permian (Early Murgabian). 2. *Paradunbarula dallyi* Skinner 1969, Member 2 of Jamal Fm., sample no. 92, Late Permian (Early Murgabian). 3. *Pseudofusulina huecoensis* Dunbar & Skinner 1931, Member 2 of Jamal Fm., sample no. 99, Late Permian (Early Murgabian). 4. *Tetrataxis planulata* Morozova 1949, Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian). 5. *Geinitzina reperta* Bikova 1952, Member 2 of Jamal Fm., sample no. 91, Late Permian (Early Murgabian). 6. *Globivalvulina vonderschmitti* Reichel 1945, Member 2 of Jamal Fm., sample no. 94, Late Permian (Early Murgabian). 7. *Rauserella erratica* Dunbar 1944, Member 2 of Jamal Fm., sample no. 94, Late Permian (Early Murgabian). 8. *Schubertella* cf. *kingi* Dunbar & Skinner 1937, Member 2 of Jamal Fm., sample no. 97, Late Permian (Early Murgabian).

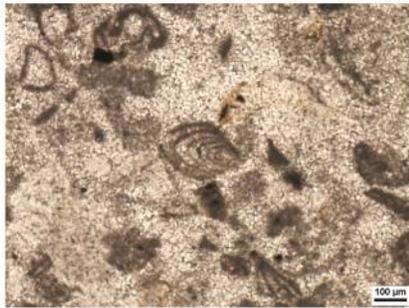
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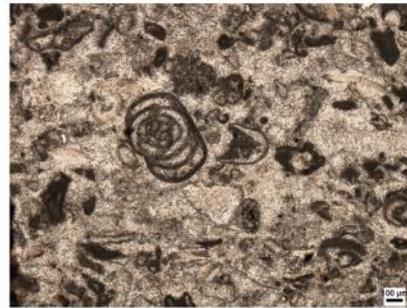
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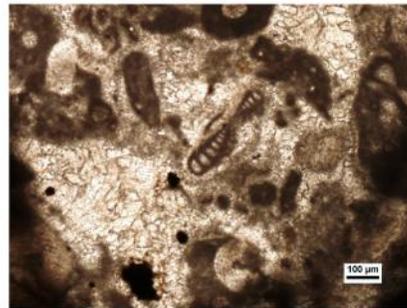
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Plate 2. 1. *Neoendothyra bronnimanni* Bozorgnia 1973, Member 2 of Jamal Fm., sample no. 92, Late Permian (Early Murgabian). 2. *Deckerella* sp., Member 2 of Jamal Fm., sample no. 92, Late Permian (Early Murgabian). 3. *Ichtyolaria latilimbata* Civrieux & Dessauvagie 1965, Member 6 of Jamal Fm., sample no. 119, Late Permian (Changhsingien). 4. *Glomospira* sp., Member 4 of Jamal Fm., sample no. 114, Late Permian (Djulfian). 5. *Mesoschubertella* sp., Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian). 6. *Lasiodiscus minore* Reichel 1946, Member 2 of Jamal Fm., sample no. 94, Late Permian (Early Murgabian). 7. *Hemigordius* sp., Member 2 of Jamal Fm., sample no. 91, Late Permian (Early Murgabian). 8. *Pamirina* sp., Member 2 of Jamal Fm., sample no. 94, Late Permian (Early Murgabian).

## Plate 3

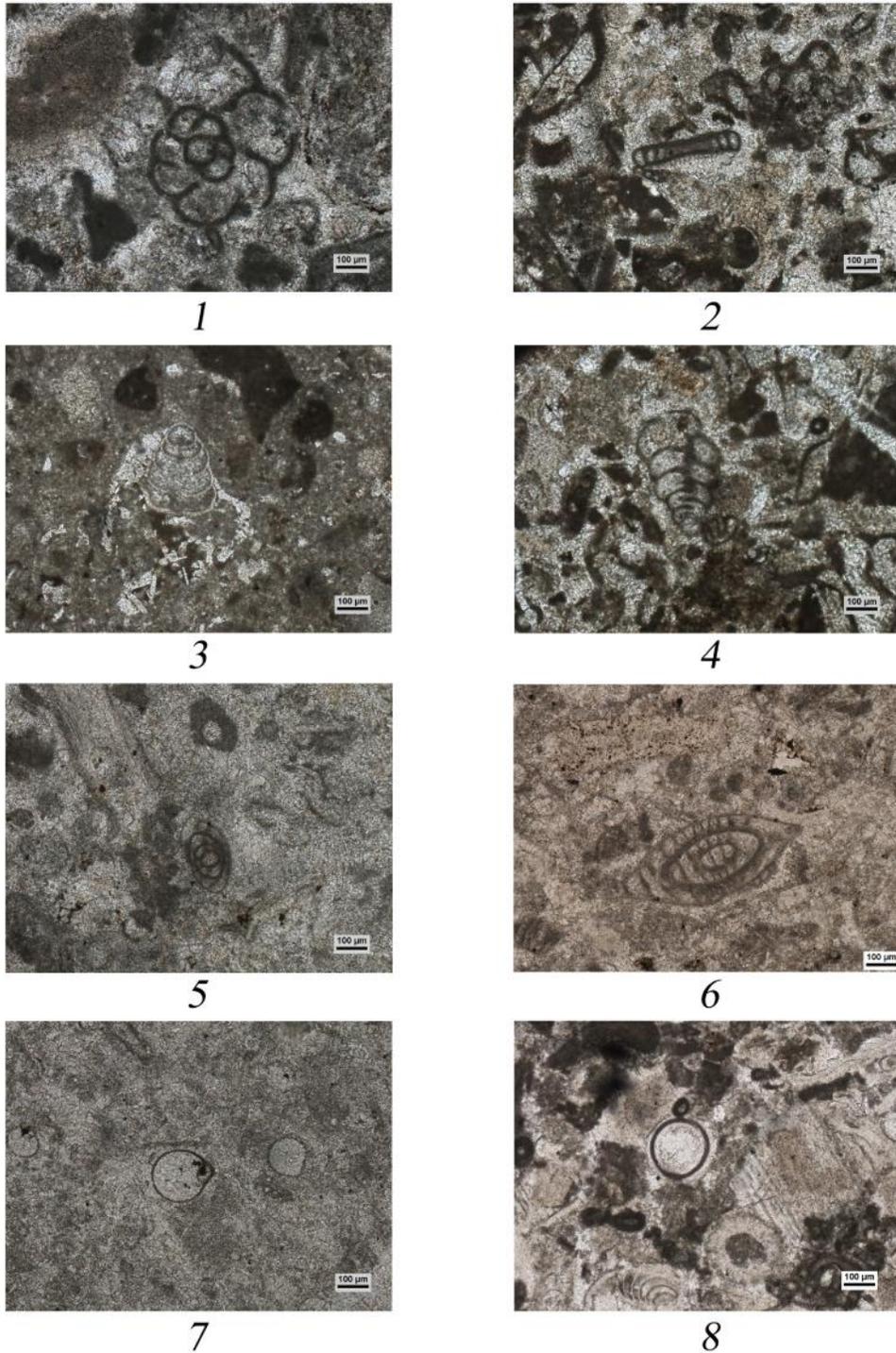


Plate 3. 1. *Kahlerina pachythecha* Kochansky & Ramors 1955, Member 6 of Jamal Fm., sample no. 117, Late Permian (Changhsingien). 2. *Lasiodiscus tenuis* Reichel 1945, Member 3 of Jamal Fm., sample no. 100, Late Permian (Murgabian). 3. *Geinitzina postcarbonica* Spandel 1901, Member 3 of Jamal Fm., sample no. 100, Late Permian (Murgabian). 4. *Paleotextularia* sp., Member 3 of Jamal Fm., sample no. 100, Late Permian (Murgabian). 5. *Reichelina media* K.V. Miklukho-Mclay 1954, Member 6 of Jamal Fm., sample no. 117, Late Permian (Changhsingien). 6. *Reichelina minuta* Erk 1942, Member 6 of Jamal Fm., sample no. 119, Late Permian (Changhsingien). 7. *Diplosphaerina* sp., Member 3 of Jamal Fm., sample no. 102, Late Permian (Murgabian). 8. *Tuberitina collosa* Reitlinger 1950, Member 4 of Jamal Fm., sample no. 114, Late Permian (Djulfian).

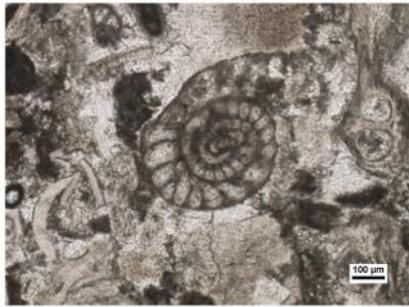
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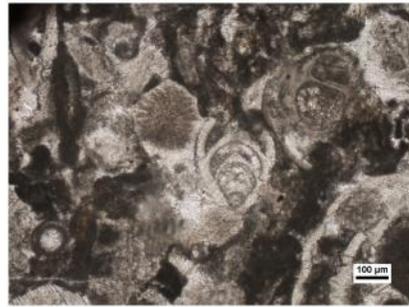
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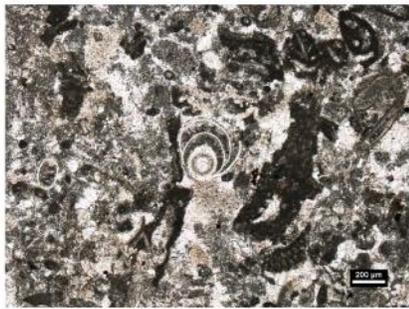
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Plate 4. 1. *Colaniella parva* (Colani) 1924, Member 6 of Jamal Fm., sample no. 119, Late Permian (Changhsingien). 2. *Colaniella leei* (wang) 1966, Member 6 of Jamal Fm., sample no. 117, Late Permian (Changhsingien). 3. *Danbarula mathieui* Ciry 1948, Member 4 of Jamal Fm., sample no. 114, Late Permian (Djulfian). 4. *Pachyphloia cukurkoyi* Civrieux & Dessauvage 1965, Member 4 of Jamal Fm., sample no. 114, Late Permian (Djulfian). 5. *Frondina Pernica* Civrieux & Dessauvage 1965, Member 4 of Jamal Fm., sample no. 111, Late Permian (Djulfian). 6. *Agathammina pusilla* (Geinitz) 1848, Member 6 of Jamal Fm., sample no. 117, Late Permian (Changhsingien). 7. *Stipulina* sp., Member 6 of Jamal Fm., sample no. 119, Late Permian (Changhsingien). 8. *Dagmarita chankchiansis* Reitlinger 1965, Member 6 of Jamal Fm., sample no. 119, Late Permian (Changhsingien).

Plate 5

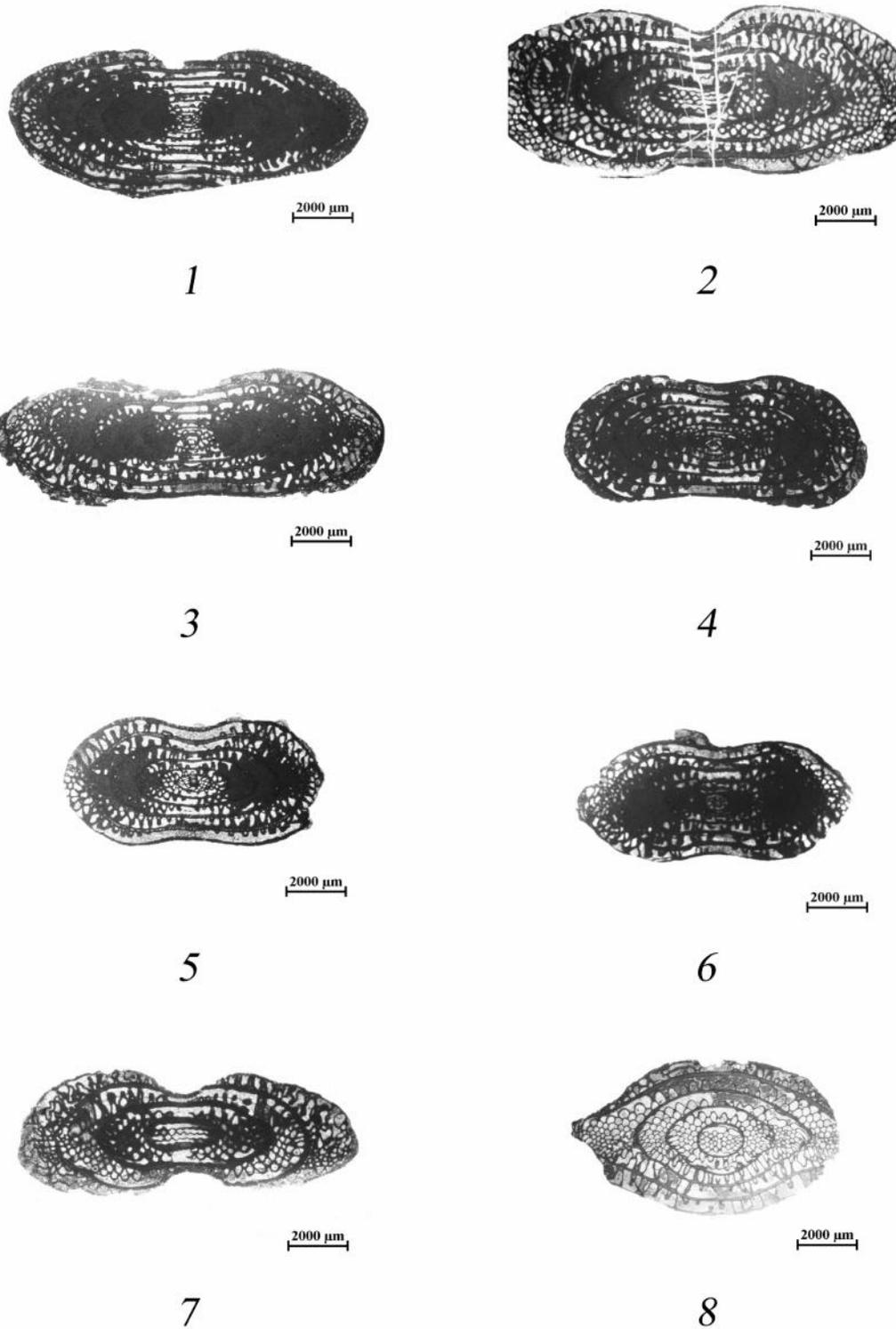
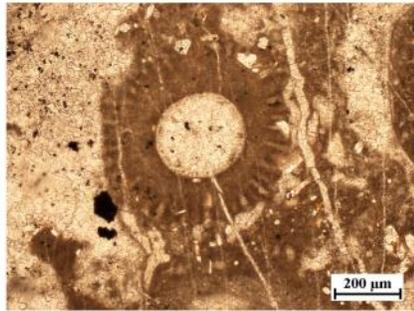
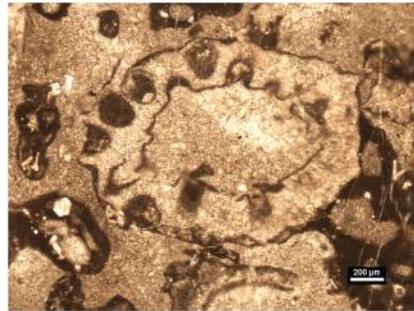


Plate 5. 1-3. *Parafusulina wordensis* Dunbar & Skinner 1931, Member 2 of Jamal Fm., sample no. 99, Late Permian (Early Murgabian). 4-7. *Pseudofusulina huecoensis* Dunbar & Skinner 1931, Member 2 of Jamal Fm., sample no. 91, Late Permian (Early Murgabian). 8. *Chusenella ishanensis* Hsu 1942, Member 2 of Jamal Fm., sample no. 95, Late Permian (Early Murgabian).

## Plate 6



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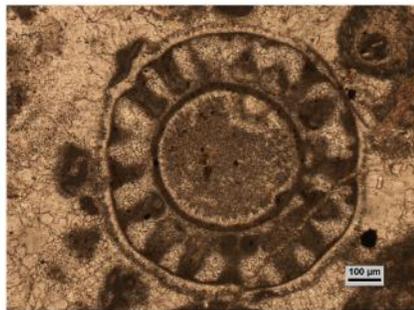
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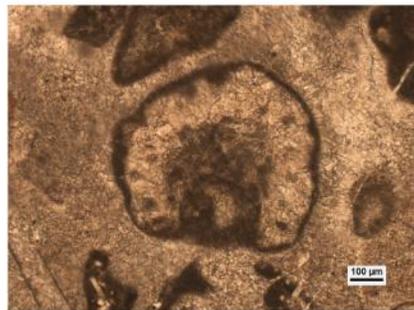
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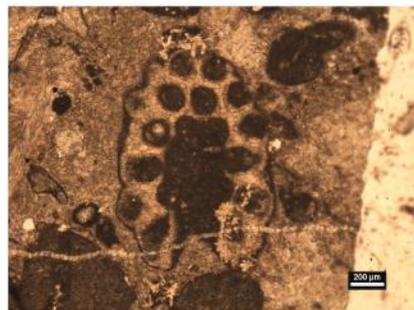
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Plate 6. 1. *Vermiporella nipponica* Endo 1954, Member 2 of Jamal Fm., sample no. 85, Late Permian (Early Murgabian). 2. *Physoporella ovata* Endo 1957, Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian). 3. *Physoporella japonica* Endo 1957, Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian). 4. *Tubiphytes obscures* Maslov 1956, Member 2 of Jamal Fm., sample no. 91, Late Permian (Early Murgabian). 5. *Pseudoepimastopora pertunda* Endo 1960, Member 2 of Jamal Fm., sample no. 94, Late Permian (Early Murgabian). 6. *Oligoporella horiguchii* Endo 1957, Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian). 7. *Diplopora pusilla* Kochansky & Herak 1960, Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian). 8. *Gyroporella kwantoensis* Endo 1956, Member 2 of Jamal Fm., sample no. 93, Late Permian (Early Murgabian).

Moreover, *Colaniella* - *Reichelina* Assemblage Zone belongs to Upper Permian is selected for this Member considering presence of index fossils of fusulinidae, which is equivalent to *Colaniella parva* - *C. sinensis* Assemblage Zone (Ishii 1975).

Also, this member included in the following algae:

*Tubiphytes obscures*, *Vermiporella nipponica*.

The strata of the Jamal Formation in Bagh Vang Section is overlain by those of Sorkh Shale Formation transitionally and conformably. According to Ruttner *et al.*, (1968) the Jamal Formation (Permian deposits), Sorkh Shale Formation (Lower Triassic) and Shotori Formation (Middle Triassic) are a conformable sequence, which are named Tabas Group. The Sorkh Shale Formation is the second formation of the Tabas Group. The Sorkh Shale Formation could be considered equivalent to Elika Formation (Glaus, 1964) in Alborz. It is composed of flaggy red shaly limestone with interbeds of yellow oolitic limestone, cross-bedding and ripple mark structures

### Conclusion

1. In Bag Vang Section, Permian Sea transgression has been commenced in Early Murghabian resulting from its specific topography.
2. There is a disconformity between sediments of Sardar Formation (Carboniferous) and Jamal

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Formation (Permian) in Bagh Vang Section.

3. Based on biostratigraphic studies, Bagh Vang Member belongs to Early Murghabian. Sediments of this Member have not yet seen in any outcrops of Jamal Formation.

4. In relation to lithostratigraphy, there is a conformable and transitional contact between Jamal and Sorkh Shale Formations in Bagh Vang Section. In addition, Member 6 of Jamal the Formation belongs to Upper Permian (Changhsingien) and lower contact of Sorkh Shale deposits belonging to Lower Triassic (Scythian) indicate a conformable contact according to biostratigraphic studies.

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