



Research Paper

THIN SECTION STUDIES ON FORAMINIFERA FROM LIMESTONE OF GURPI FORMATION (CRETACEOUS) SARABLEH, NORTH OF ILAM AREA, IRAN

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Gurpi Formation is one of the important formations in the Zagros Mountain which belongs to Cretaceous age. Cretaceous is one of the important geological period showing the global record from stratigraphic important. Many fossil records are important showing stratigraphic boundary between Cretaceous and Tertiary (K-T). The present investigation of microfossils in particular Foraminifera has a good amount of well preservation in limestone. Thin section reveals a large amount of preservations in the limestone sedimentary beds in different orientation. Thin section data are good and reliable data in particular on depositional condition. About twenty eight rock samples from different height of the quarry section. About twenty eight samples which are a presentation from limestone deposits the selected thin section study under phase contrast microscopes have observed and identified their coiling pattern, morphology shown typical characters like chambers arrangements and other characters. Fifteen taxa of foraminifera were identified on their coiling, chamber arrangement and size data also. By using thin section data by oriented samples of limestone helps to interpret the depositional conditions.

Keywords: Foraminifera, Assemblage, Coiling, Chamber arrangement, Size, Gurpi formation, Limestone, Depositional condition

INTRODUCTION

Foraminifera are the biggest living microscopic, aquatic, single celled classified under Protozoan. These micro fauna are sensitive to all environments like salinity, temperature, aquatic energy levels, fathoms, aquatic current and many other factors. The present study is on thin sections of limestone from Sarableh open cast quarry.

About twenty eight oriented samples are prepared thin sections and observed under phase contrast binocular Letiz microscope and observed oriented manner following grid method. This thin sections reveal the foraminifera shells in a different orientations. Different orientations of foraminifera with field oriented thin sections, revealed the energy levels during deposition. The limestone

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under investigations is highly fossiliferous, rich and much abundant suggest the growth of foraminifera controlled with all paleoecological conditions which supports the growth and abundance of foraminifera in limestone deposits. Paleoecological factors like shallow and benthic can be easily interpreted through planktonic and benthic nature of habit can be inferred.

Geology of the Study Area

Gurpi Formation is found in Zagros mountain folded belt. Zagros oriented North West to South East direction refer (Figure 1) Iran topo sheet No. NI 38-11.

Gurpi Formation falls between North 32°26'50" and East 49°13'47" in this Gurpi Formation important Lithostratigraphy unit that points to major stratigraphic boundary belonging to the Maastrichtian and Danian periods. Zagros mountain belt comprises large amount of

Cretaceous Formation which also produces large amount of gas and petroleum deposits. The major oil and gas produced from this region (Agha Nabati, 2004). Zagros mountain orientation is shown in the topo sheet (Figure 1) and the present location of Gurpi Formation which located Northern region of Gurpi Formation in Ilam. In Figure 2 gives the explanation of Lithostratigraphy of Ilam area. The order of super position of Ilam area the oldest rock is limey moral followed by marly limestone and above clay marl, marl, sandstone and terminates with purple shale. This purple shale separates from Cretaceous and Quarternary age at many places the purple shale exposed as outcrop and which is marker between Cretaceous and Quartenary (Fazli and Senemari, 2016). The order of super position relation between Ilam Formation, Gurpi Formation and Papdeh Formations are shown in a schematic diagram (Figure 3). This

Figure 1: Topo Sheet NI 38-11 Window Showing North of Zagros Mountain of Ilam Area, Iran



Figure 2: Geological Map Showing Gurpi Formation with Key Map

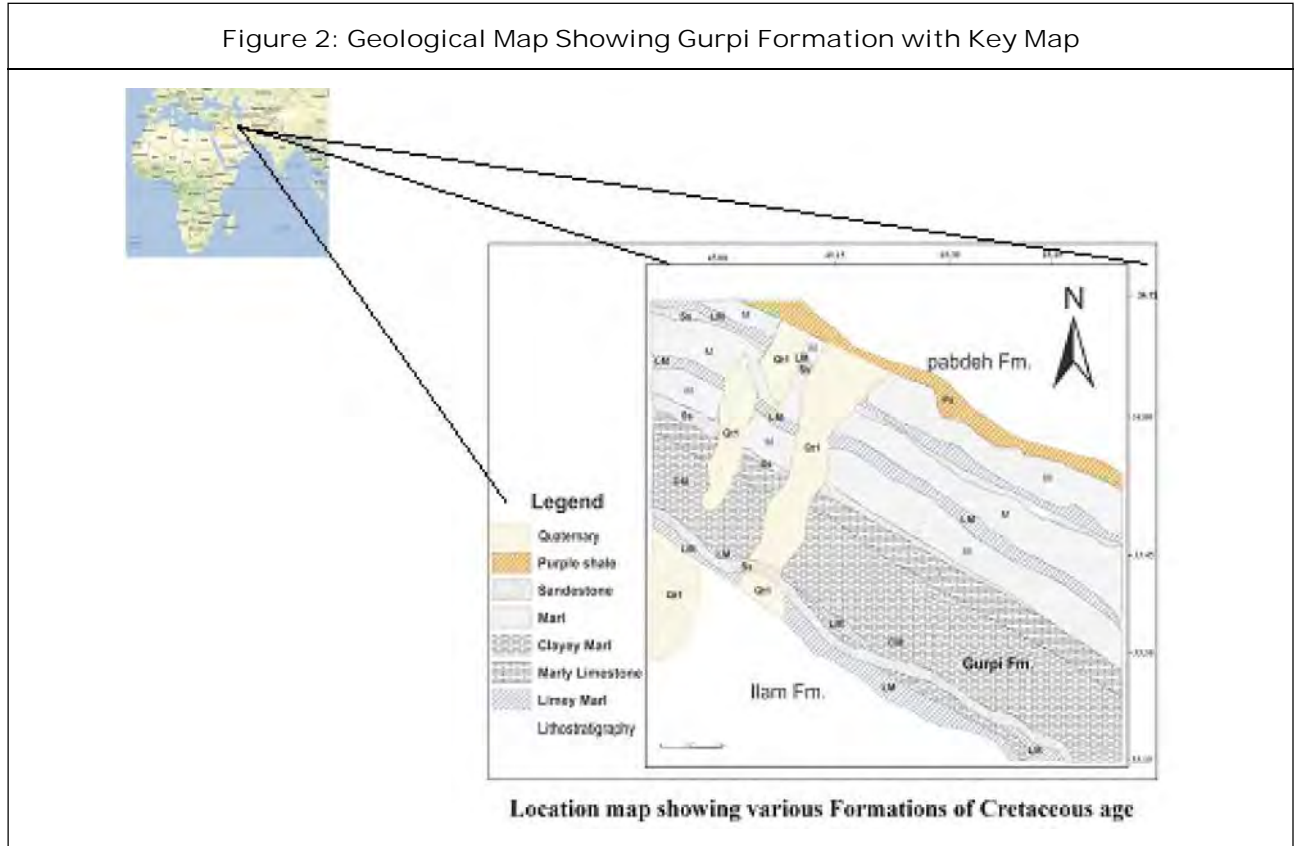
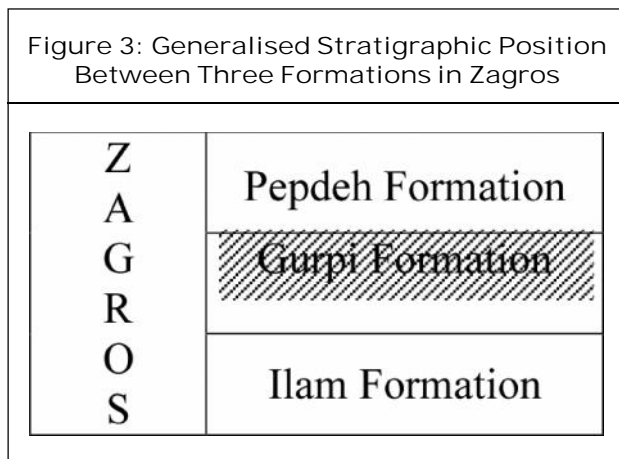


Figure 3: Generalised Stratigraphic Position Between Three Formations in Zagros



schematic diagram will show the lithology and formations.

The Lithostratigraphy chart (Figure 5) of Iran (1993) shown all the formations of Zagros area and the order of super position of all the formations are given. This chart shows there are several beds and formations are not uniform. Because of tectonic and structural disturbance there are

very uneven thicknesses of formations are well presented.

MATERIALS AND METHODS

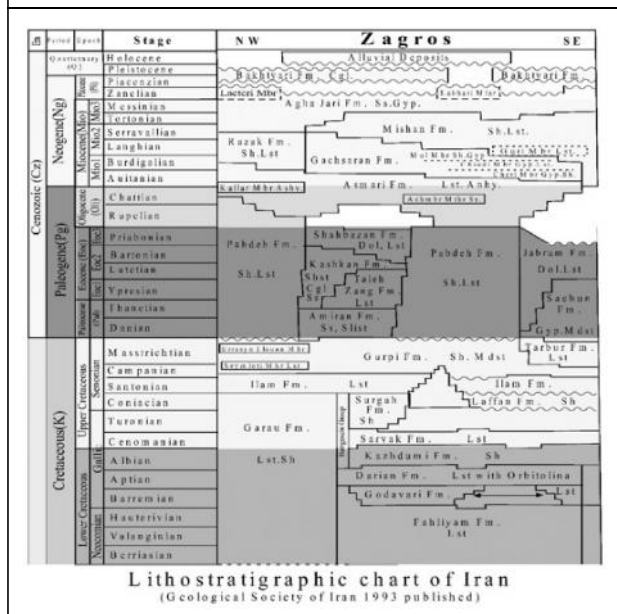
All limestone rock samples selected from (Figure 4) the outcrop section the orientation of samples are shown in the arrow mark. The same samples brought to the laboratory to do thin section vertically as shown in the field photographs. This will enable to understand the distribution of foraminifera in thin section. The present thin section study for all the twenty eight samples are subject to study under the microscope. From this present study based on morphology chamber and coiling arrangement also its size.

The present investigation concerned to only outcrop limestone samples. Samples are given to prepare thin section following oriented manner. All the samples are marked with marker as seen

Figure 4: Shows Limestone Cuttings in Sarableh Open Cast Mine, In this 28 Fresh Oriented Representative Samples Collected for Thin Section Studies

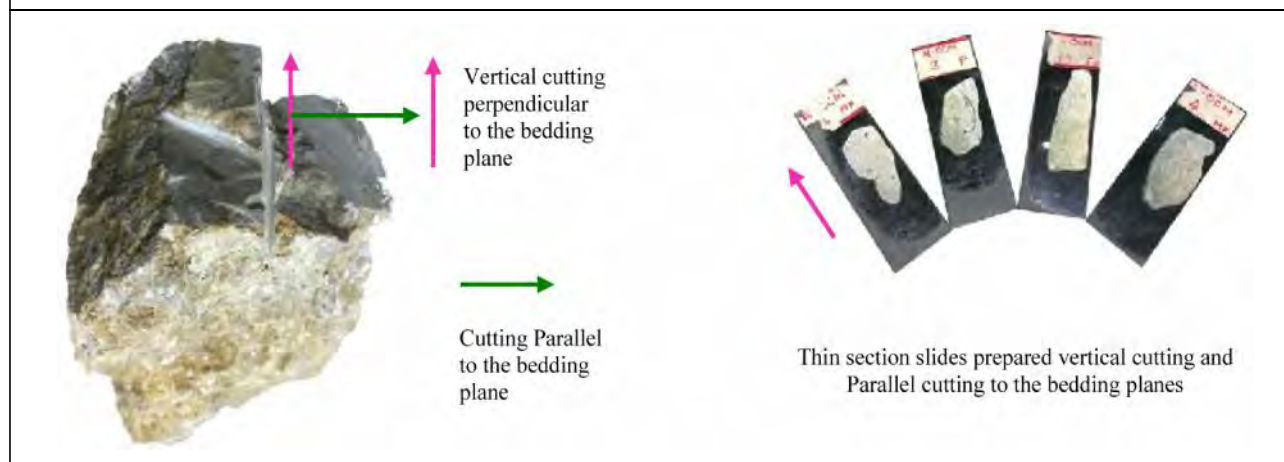


Figure 5: Showing Lithostratigraphic Chart of Iran (1993)



oriented in the outcrops. Fresh limestone samples of about 500 gms collected by using field equipments and labeled. Sample field orientation marked to show thin section perpendicular to the bedding plane and also parallel to the bedding plane (Figure 6). The arrow mark indicates the orientation as head of the arrow is towards top direction and tail is towards bottom. The orientation of the sample reveals the position of sediments deposition along with foraminifera microfauna. The foraminifera is much abundant than the sediments. The sediments are very few and more foraminifera and other micro shells. This particular thin section is planned to find out the vertical distribution of microfossils in a bed. This study resulted in understanding the micro

Figure 6: Shows Vertical Plane (Perpendicular to the Bedding Plane) and Another Section Shows Parallel to the Bedding Plane Thin Section Prepared



fossils distribution in the sedimentary bed and their orientations helps to understand the energy levels during deposition of sediments and as well as the microfossils.

The result of this oriented samples of thin section study revealed the nature of micro fossils embedded in the sediments whether thin section is oblique or cross or parallel. Micro fossils in thin sections is very prominent and significant, because the occurrence during depositional condition.

In the Zagros mountain found lithologically three formations namely bottom, Ilam Formation, above Ilam, Gurpi Formation and above Gurpi, Pabdeh Formation Agha Nabati (2004). The present study particular Gurpi Formation well exposed open cast mine in Sarableh. The location of Sarableh as per the GPS reading North 33°36'414" and East 46°24'054".

Systematics

After studying all thin sections were identified through chamber arrangement, whorl character, shape and size. Seven taxa identified with thin section. The following foraminifera in thin sections identified with observed characters.

Family GLOBOROTALIIDAE

Genus GLOBOTRUNCANA Cushman, 1927

Genotype, *pulvinulina arca* Cushman

(Plate 1 & Figure 1)

Diagnostic Character: The shape of the specimen in the center of the photo shows globose periphery usually with the double keel. Well preserved specimen with the thin plate like structure over umbilical area.

Number of Specimen Observed in Thin Section: Around ten.

Nature of Preservation: Good and several other foraminifera species found in different sizes and number.

Rock Material: Hard, buff white color and compact.

Occurrence: Sarableh open cast limestone quarry.

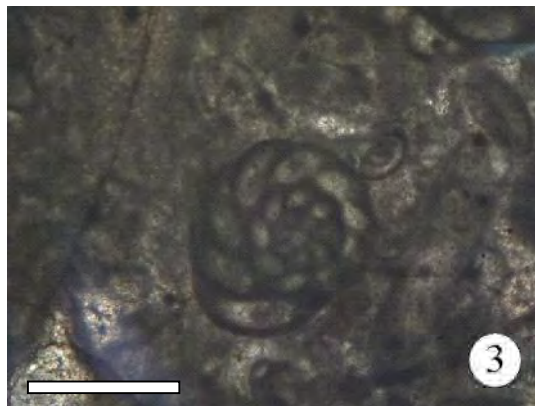
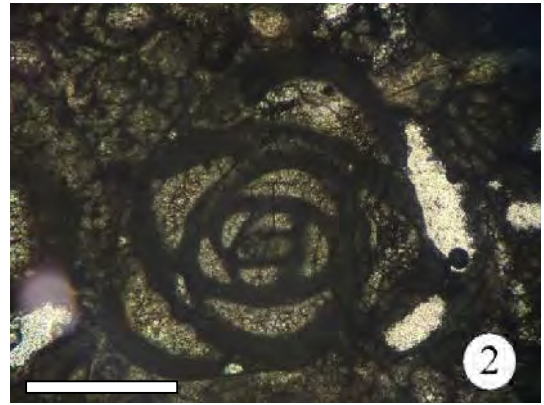
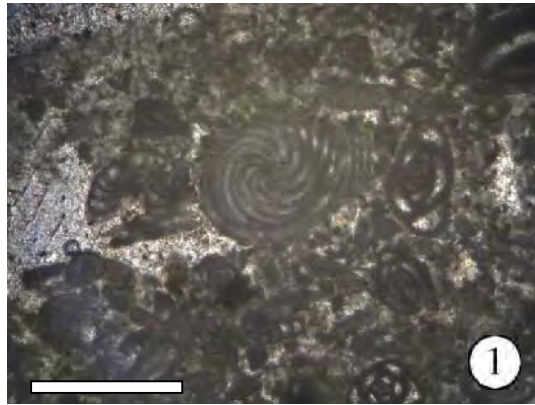
Age: Upper Cretaceous.

Family MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

Genotype, *Serpula seminulum* Linne'

Plate 1

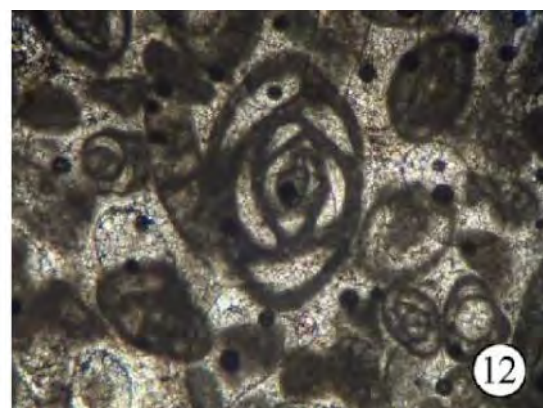
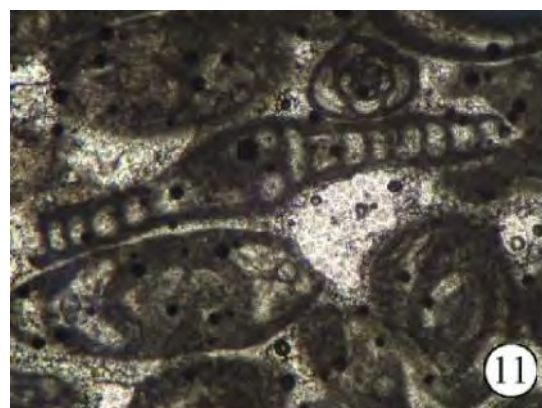


Note: Explanation of plate 1: Scale bar indicates the size of the specimen 0.2 mm. 1. *Globotruncana* sp., 2 & 4. *Quinqueloculina* sp., 3. *Ammonia beccarii*, 5. *Sigmolina* sp., 6. *Nummuloculina* sp.

Plate 1 & Figures 2 and 4, Plate 2 & Figures 7, 8, 10 and 12).

Diagnostic Character: Test showing the coiling pattern in equatorial planes, coiling of chambers

Plate 2



Note: Explanation of plate 2: Scale bar indicates the size of the specimen 0.2 mm. 7, 8, 10 & 12. *Quinqueloculina* sp. equatorial section, 9. *Amphistegina canaensis*, 11. *Pseudophragmina (Atheocyclina)* sp. equatorial section.

is half way length. The specimen in this section exhibits four to five whorls in juxtaposition

arrangement. Chambers are crescent shape. Prominent protochonch. The chambers fields

with sediments are well exhibited. More adult than young one are observed in thin section.

Number of Specimen Observed: Around twenty.

Nature of Preservation: Good and well preserved adult foraminifera species found in different sizes and number. So many stages of development are recorded in different rock samples. Majority are showing equatorial section than longitudinal sections.

Rock Material: Hard, buff white color and compact.

Occurrence: Nurdan inan and Selim inan (2008) reported benthic foraminifera from Selandian in the Eastern Pontides from Tecer section *Quiqueloculina* sp. found similar morphology. Similar *Quiqueloculina* sp. Sarableh open cast limestone quarry.

Age: Jurassic to Recent

Family AMMONIIDAE

Genus AMMONIA Linnaeus, 1758

Ammonia beccarii

(Plate 1 & Figure 3)

Diagnostic Character: Test morphology rounded trochospiral coil with two whorls umbilical surface regular with plug like structure seen in adult forms also. Based on umbilical whorl and chamber arrangement it is specimen identified as *Ammonia beccarii*.

Number of Specimen Observed: Around twelve.

Nature of Preservation: Good and well preserved adult foraminifera species found in different sizes and number. Majority are showing equatorial section than longitudinal sections.

Rock Material: Hard, buff white color and compact.

Occurrence: Sarableh open cast limestone quarry.

Age: Triassic to Recent

Family MILIOLIDAE

Genus SIGMOLINA Schlumberger, 1887

Genotype, *planispirina sigmoidea* H.B. Brady
(Plate 1 & Figure 5)

Diagnostic Character: Test early chambers *Quiqueloculina* almost 180° from each other. It appears like sigmoid shape, aperture round with simple tooth like.

Number of Specimen Observed: More than twenty.

Nature of Preservation: Good and well preserved adult foraminifera species found in different sizes and number. Majority are showing equatorial section than longitudinal sections.

Rock Material: Hard, buff white color and compact.

Occurrence: Sarableh open cast limestone quarry.

Age: Triassic to Recent

Family MILIOLIDAE

Genus NUMMOLOCULINA Steinmann, 1881

Genotype, *Biloculina contraria* d'Orbigny
(Plate 1 & Figure 6)

Diagnostic Character: Test morphology similar to that of *Quiqueloculina* appears like single plane, several to a coil. Chamber arrangement like almost semicircular. It is not like *Planispirina*.

Number of Specimen Observed: Few

Nature of Preservation: Good and well preserved adult foraminifer's species.

Rock Material: Hard, buff white color and compact.

Occurrence: Sarableh open cast limestone quarry.

Age: Cretaceous

Family AMPHISTEGINIDAE

Genus AMPHISTEGINA d'Orbigny, 1826

Genotype, *Amphistegina vulgaris* d'Orbigny
(Plate 2 & Figure 9)

Diagnostic Character: Specimen morphology shows chamber arrangement opposite to each other and second whorl chamber are in opposite shows locking mechanism type. Shape of the specimen is elongated, well preserved in thin section. Thin section is longitudinal plane.

Number of Specimen Observed: Very few.

Nature of Preservation: Good and well preserved adult foraminifer's species.

Rock Material: Hard, buff white color and compact.

Occurrence: Sarableh open cast limestone quarry.

Age: Cretaceous to Eocene

Family DISCOCYCLINIDAE

Genus PSEUDOPHRAGMINA H. Douville', 1923

Genotype, *Orthofragmina floridana* Cushman
Pseudophragmina (Atheocyclina) sp.

(Plate 2 & Figure 11)

Diagnostic Character: Morphology in thin section shows discoidal type showing periphery

chambers are arranged like a single row and the center subglobular chambers complete annular stolons. Lateral chambers are present and distinct.

Number of Specimen Observed: Few

Nature of Preservation: Good and well preserved adult foraminifer's species.

Rock Material: Hard, buff white color and compact.

Occurrence: Laura et al. (2012) have reported larger Benthic foraminifera middle Eocene to Oligocene of Tanzania. The species *Heterostegina* sp. is similar to that of present *Pseudophragmina (Atheocyclina)* sp. in its morphology. Also reported from Sarableh open cast limestone quarry.

Age: Danian

CONCLUSION

Present research data is from thin sections observed in detail and recorded with microphotographs. The area is very small and significant occurrence of micro fossils point of view. Sarableh is a open cast limestone quarry found in Ilam area. During sample collection for micropaleontological studies some mega fossils also found to occur in this out crop section. Mega fossils like Brachiopoda, Cephalopoda, Pelecypoda and Gastropoda (Nooshin Habibi Babadi et al., 2017). The present investigation the samples collected following orientation as shown in Figure 4.

Attempt made with oriented rock samples are subjected thin section preparation and studies.

- Limestone is highly fossiliferous in nature with number of mega and micro fossils were also observed.

- Thin section studies is very difficult to identify the foraminifera because only with thin section plane, no other option.
- From this study reveals all sizes of forms in particular depth of sediments shows there must be good paleoecological factors supporting the growth.
- The good preservation of fossils also supports the paleoecological factors.
- Thin section studies with fresh field oriented limestone samples are studied in detail shows majority of foraminifera are benthic in nature. Not found any planktonic forms during investigation.

Further, scope of study for this limestone deposit the role of currents and energy level of the marine paleoenvironment of this area.

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