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GEOLOGY AND MICROPALAEONTOLOGY OF KIRTHAR GROUP OF SULAIMAN RANGE, DERA GHAZI KHAN, PUNJAB, PAKISTAN

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Abstract

The present research work is focused on the General Geology and Micropaleontology of Kirthar Group of Sulaiman Range. The Kirthar Group comprises of four Formations, Habib Rahi Limestone, Domanda Formation, Pirkoh Formation & Drazinda Formation (Older to younger). As the best exposure of Kirthar Group, the Gorthal and Zain area were selected for the detail studies. Kirthar Group mainly consists of shale, marl and thin to thick bedded fossiliferous limestone. Thirty thin sections were prepared and studied for the micropalaentology of the Kirthar Group which shows that it contains Discocyclina ranikotensis, Discocyclina dispensa, Assilina spinosa, Assilina granulosa, Nummulites mamillatus, Alveolina elliptica, etc. The presence of these species shows that the Kirthar Group deposited in lower to middle early Eocene age.

Keywords
Geology, Micropaleontology, Sulaiman Range, Kirthar Group, Gorthal and Zain area

1. Introduction

Pakistan is blessed with two major sedimentary basins i.e. Indus and Baluchistan, which are divided by the left-lateral Ornach-Nal and Chamman transformed fault system onshore and the Murray Ridge on offshore respectively. From east to west, these two sedimentary basins are carved with breathtaking platforms, foredeeps, and fold belts (Nazeer *et al.*, 2013). The Upper, Middle, and Lower portions of the Greater Indus Basin, which extends from north to south, make up the majority of the sedimentary basin. Middle Indus basin's large Sulaiman fold belt is

bounded by the Fordeep basin to the east, the Chaman fault to the west, and the Sulaiman lobe to the south, which forms as a result of compression in the Indian and Afghan plates (Jadoon *et al.* 1992).

1.1.Objectives and Location

This research work focused on two different aspects of Geology (Micropalaeontology and Stratigraphy) whereas these two branches of geology have direct relationship with each other. Micropalaeontology deals with the micro fossils by which a geologist can conclude the age of the formation on scientific way and Stratigraphy concern toward the study of stratified (layered) rocks. The study areas (Zain, and Gorthal) lies politically in Dera Ghazi khan district, Punjab province Pakistan. Zain and Gorthal are about 80 - 110 Km northwest of Dera ghazi Khan City respectively. The area lies in the Geological toposheet no 39 J/6, 39 J/5 and 39 J/1. Geographically it lies on 30˚ 43' 48" latitudes and 70˚ 25' 07" longitudes. In the Gorthal section Eocene succession is exposed on both limbs of zindapir anticline but for study eastern limb was selected. Eocene succession consisting of Kirthar Group is comprised of four Formations i.e. Habib Rahi Limestone, Domanda Formation, Pirkh limestone and Darazinda Formation from older to younger respectively. In this section Habib Rahi Limestone is about 60-meter-thick, Domanda Formation 130-meter-thick, Pirkoh Formation 7-meter-thick and Drazinda Formation is 125 meter thick respectively. In the Zain Saction Eocene succession is also well exposed along the both limbs of Zindapir anticline, but the for study eastern limb like in Gorthal section was selected. In this section Habib Rahi limestone is about 63-meter-thick, Domanda Formation 120-meter-thick, Pirkoh Formation 5.5-meter-thick and Drazinda Formation is 133 meter thick respectively.

Figure 1: Google map of the area

2. Geological Setting and Stratigraphy

The vast Sulaiman fold and thrust belt was created in a transpressional manner, which involves both compression and strike slip characteristics. It was also produced by southerly pushing along the western edge of

the Indian subcontinent (Sarwar, & DeJong, 1979). The pressure that occurs between the Indian and Afghan plates mostly shapes the foredeep basin that extends south and east of the active Sulaiman lobe (Allemann, 1979). The Sulaiman Range contains a Permian to Pleistocene succession of rocks that are either exposed at the surface or can be seen by drilling (Shah, 1977). The study region is located in the eastern section of the Sulaiman Range, where a complete stratigraphic sequence of Early to Middle Eocene (Kirthar Group) age is exposed widely and stratigraphy Ranges from Paleocene to Recent. Four Formations make up the Kirthar Group, ranging in age from older to younger as Habib Rahi Limmestone consists of limestone, shale and mudstone intercalations (fig: 03, 04), Domanda Formation mainly consists of variegated shale having greenish grey to reddish maroon shale (fig: 05, 08), Pirkoh Formation composed of buff white color limestone with greenish grey shale at base (fig: 07, 08) and Dranzinda Formation have olive green and maroon splintery shale and siltstone (fig: 06, 08). Complete succession of Kirthar Group is shown in (fig: 08) and stratgraphic chart of the study area in (fig: 02).

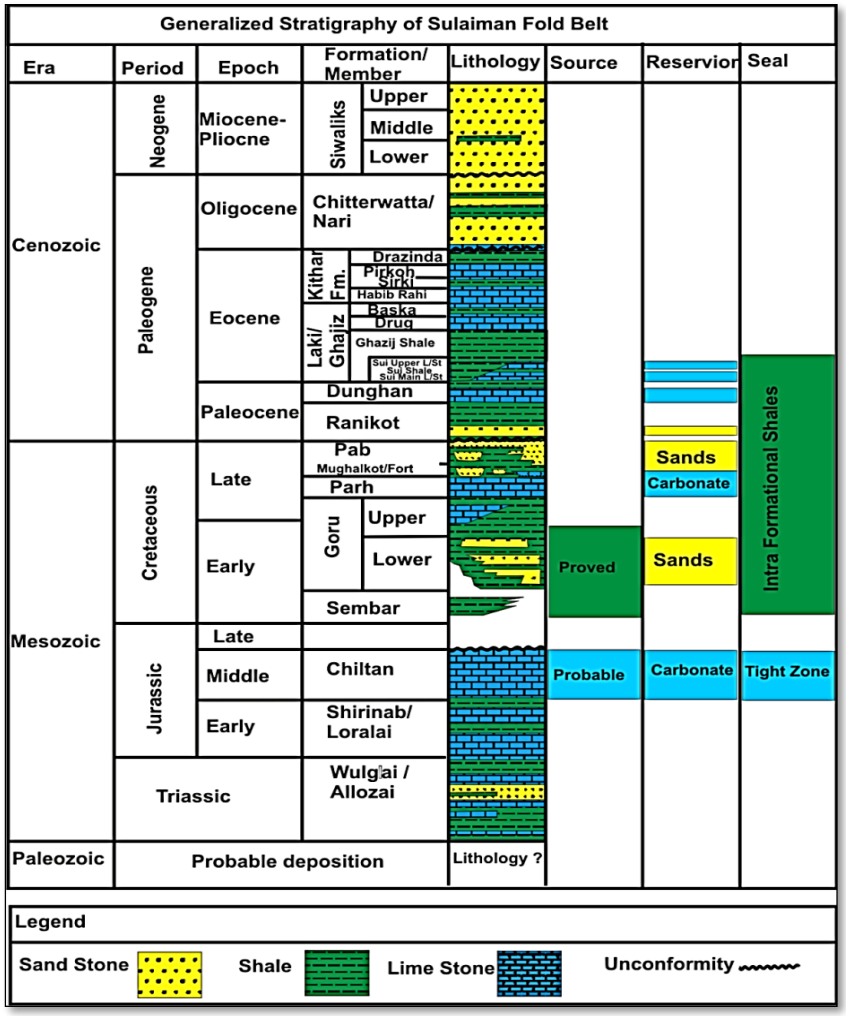


Figure 2: Generalized Stratigraphy of Sulaiman Fold Belt (Nazeer *et al.*, 2013)

3. Methodology

Field work was carried out in the month of March and April, 2016 to investigate the paleontological and stratigraphical behavior of kirthar Group (Eocene) of Sulaiman Range middle Indus basin. Before detail study, extensive reconnaissance survey was mad by the field party in the area of Dera Ghazi khan and surroundings to choose the best site for samples collection and allied studies. Most of area around the D G khan where Eocene succession is best exposed is under the control of Pakistan atomic energy, so to access these areas is not possible due to high security. During the reconnaissance survey two section of Eocene succession were selected which are best exposed along the eastern limb of Zindapir anticline i.e. Gorthal and Zain section. For detail investigations of the lithological and paleontological changes in the vertical succession of Kirthar Group, samples were collected at different interval, beginning from the older Habib Rahi Limestone continuing though the Domanda foamtion, Pirkoh Limestone and younger Drazinda Formation of kirthar Group where the lithological, biostratigraphical and physical changes occur. The foraminifera found in kirthar Group were identified and interpretations were made concerning geologic age of the rocks and conditions under which they were deposited. Sample density was according to change in behavior of the Formation's lithology and biostratigraphy. Most of the samples were collected from Habib Rahi Limestone (fig: 03, 04) and Pirkoh formtion (fig: 07, 08) and few from Darazinda (fig: 06, 08). and Domanda Formations (fig: 05, 08). Total number of samples that were collected from both sections is 80.

Figure 3: Shale and Mudstone in the Habib Rahi Limestone

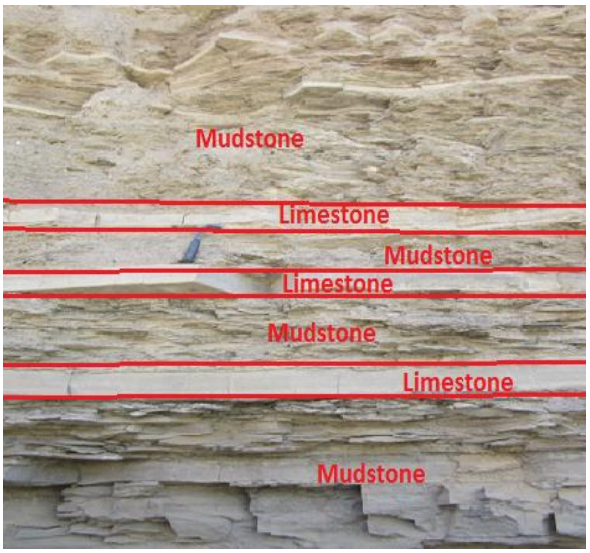


Figure 4: Intercalation of Mudstone and Limestone in Habibe Rahi Limestone

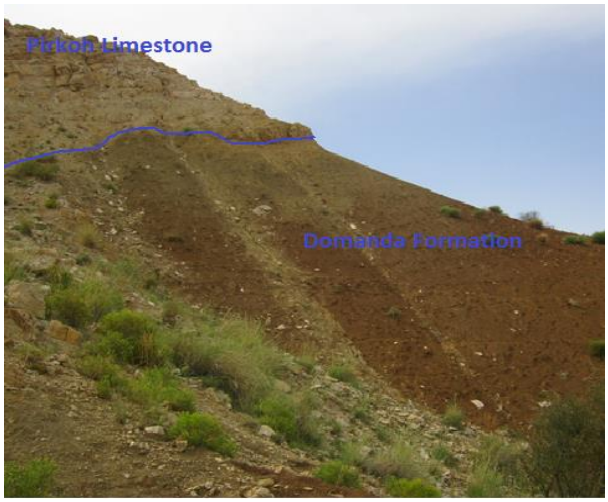


Figure 5: Contact between Pirkoh and Domanda Formation

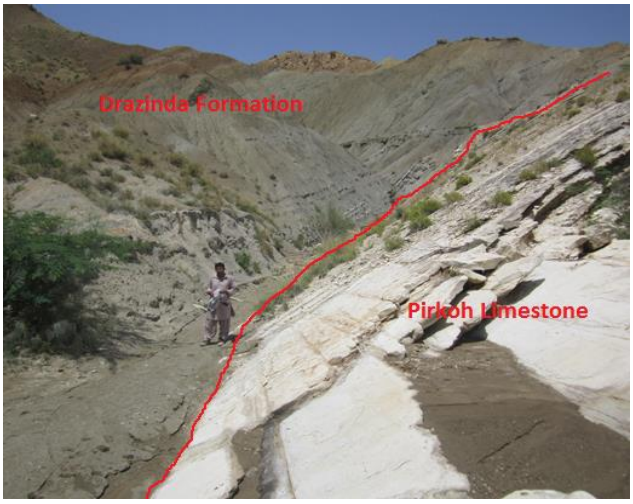


Figure 6: Contact between Pirkoh and Darazinda Formation

Figure 7: Fossiliferous bed of Pirkoh Formation

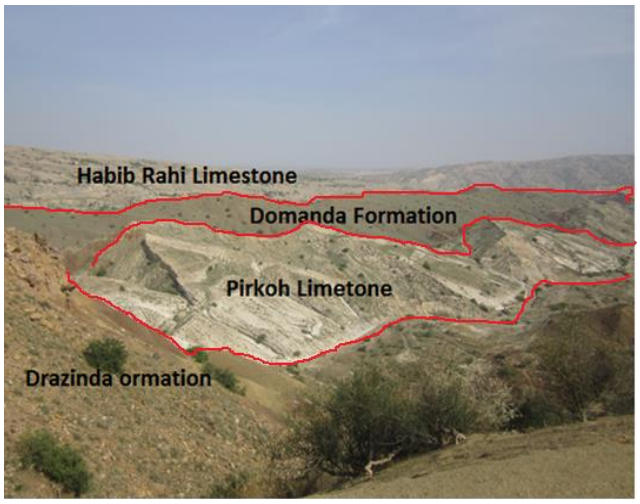


Figure 8: View of Complete Succession of Kirthar Group

4. Petrographic work

Petrographic study is necessary to check the microscopic changes i.e. lithological and biostratigraphical that occur upward in the lithological succession. So for this purpose 30 thin section were prepared in Geoscience Research advance laboratories, Islamabad. These were studied under the microscope in Centre of Excellence in advance mineralogy, University of Baluchistan for paleontological identification. Following are the results of this study.

5. Micropaleontology

The Eocene, according to Hottinger (2003), is the third stage in the global society's maturation cycle. Following the collapse of the Cretaceous / Palaeocene (KP) boundary, this phase shows a dramatic shift in the diversification of many species and is suggestive of the full recovery of bigger benthic foraminifera in the Indus basin. During

the study of the micropaleontology of Kirthar Group following species of the foraminifera are discovered.

- Discocyclina ranikotensis (Davies)
- Discocyclina dispensa (Sowerby)
- Assilina spinosa (Davis & pinfold)
- Assilina granulosa (d' Archiac)
- Assilina Subspinosa (Davis & pinfold)
- Nummulites atacicus (Leymerie)
- Nummu,ites mamillatus (Fichtel & Moll)
- Alveolina elliptica (Sowerby)

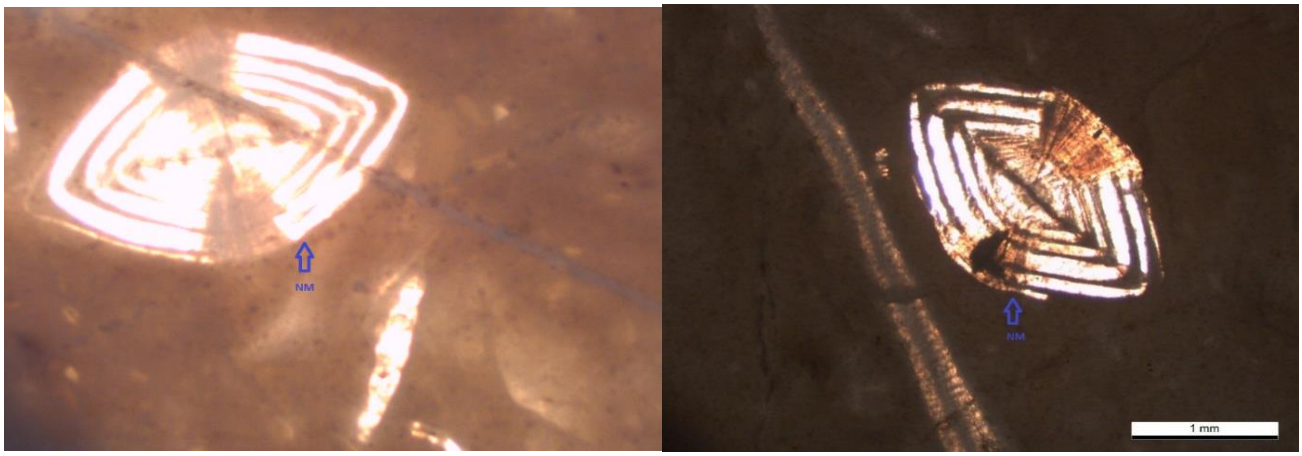
6. Systematic Palaeontology

Genus: *Nummulites* (Lamarck, 1881)

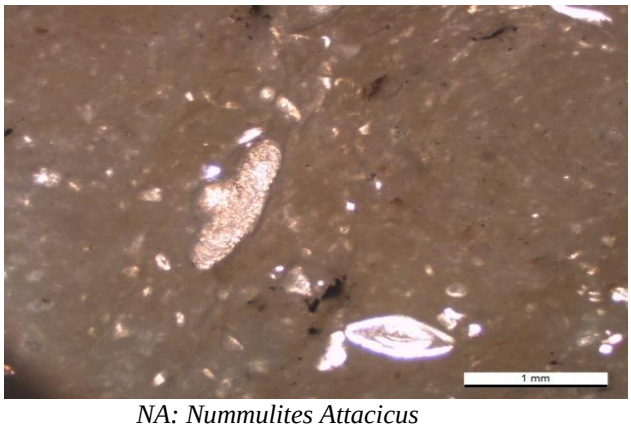
Species: *Nummulites mamillatus* (Fichtel & Moll 1798). Plate: 03

Remarks: This species is distinguished by its robust biconvex shell, which has septal filaments and strong walls, closely spaced overlapping chambers (involute), well-developed peripheral canals, and an umbonal boss in cross-section.

Plate: 03



NM: Nummulites memilatus



NA: Nummulites Attacicus

Species: *Nummulites atacicus (*Leymerie 1846). Plate: 03

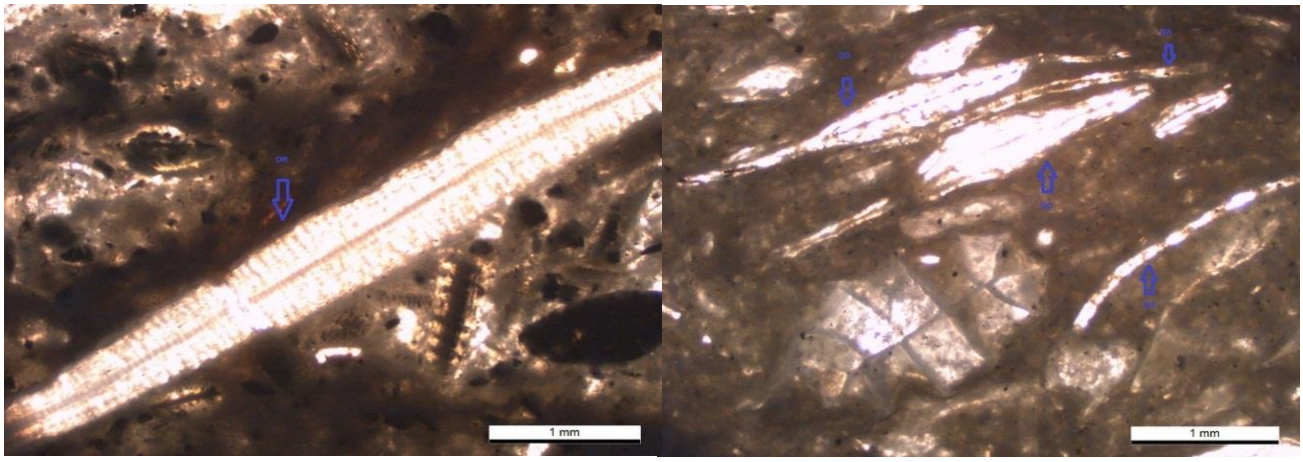
Remarks: The presence of septal pillars rather than an umbonal boss distinguishes this species from Nummulites mamillatus (Fichtel & Moll 1798).

Genus: Discocyclina (Gumbel, 1868)

Species: *Discocyclina ranikotensis* (Davies, 1937). Plate: 02

Remarks: Discocyclina ranikotensis Davies is distinguished by its flattened shell. The Upper Ranikot Beds in Sindh, today known as the Lakhra Formation, were where the Stratigraphic Committee of Pakistan initially identified it. It is Paleocene in age but does extend into the Lower Eocene.

Plate: 02

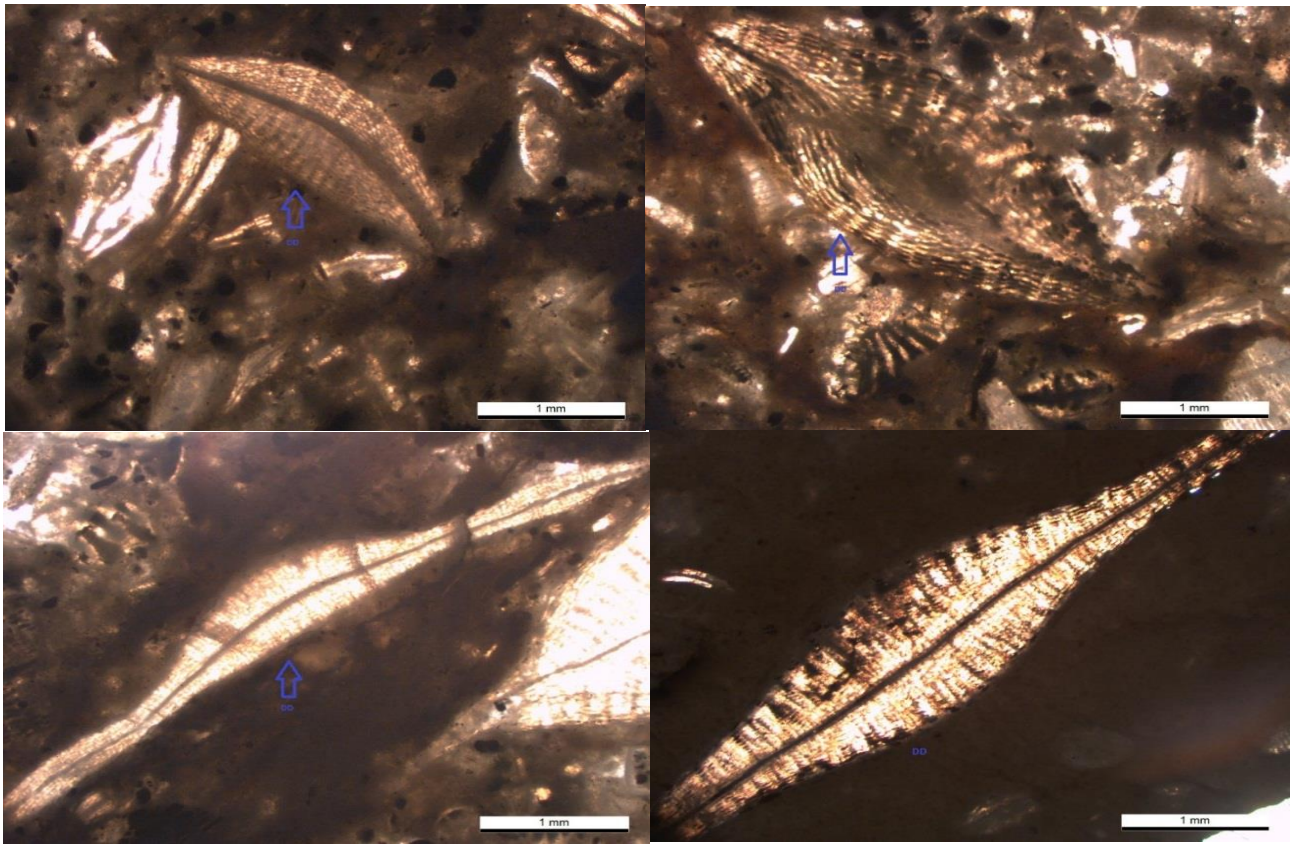


DR: Discocyclina ranikotensis, DD: Discocyclina Dispensa,

Species: *Discocyclina dispansa* (Sowerby 1840) Plate: 01

Remarks: Discocyclina dispansa (Sowerby) differs from Discocyclina ranikotensis Davies by having a thicker shell in the centre

Plate: 01 *DD: Discocyclina Dispensa*



Genus: Assilina (d'Orbigny, 1826).

Species: *Assilina spinosa* (Davies & Pinfold, 1937). Plate: 05

Remarks: The conspicuous ornamentation of granules and the centrally depressed region of the test give Assilina spinosa (Davies & Pinfold) its spinose appearance. Vertically, the contour is undulating, and pillar-like surficial granules run throughout the interior of the shell. Age-wise, the species is from the Lower Eocene.

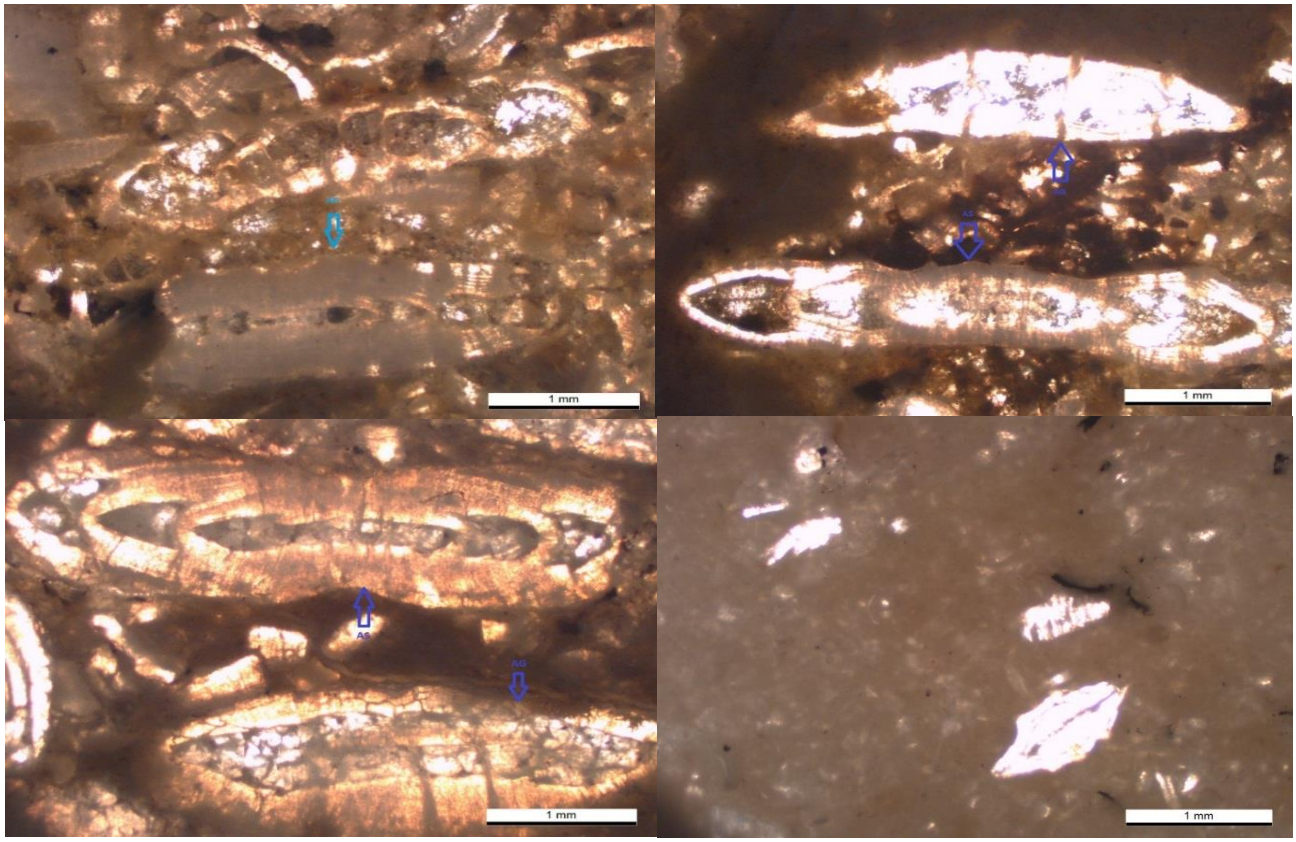
Species: *Assilina subspinosa* (Davies & Pinfold, 1937). Plate: 05

Remarks: A strongly ornamented shell called Assilina subspinosa Davies & Pinfold has thick surface granules that give the shell a spinose appearance. The shell's interior is covered in pillar-like grains. It can be distinguished from Assilina spinosa Davies & Pinfold by the lack of a central depression. In terms of stratigraphy, it extends from the Upper Paleocene to the Lower Eocene.

Species: *Assilina granulosa* (d'Archiac, 1847). Plate: 05

Remarks: A discoidal shell called Assilina granulosa (d'Archiac) has granules and ridges on the surface. The interior of the skeleton is not penetrated by the granules, so the shell appears smooth when cut vertically. It is from the Lower Eocene epoch.

Plate: 05



AS: Assilina Spinosa, AG: Assilina Granulosa, ASb: Assilina Subspinosa

Genus: Alveolina, (d'Orbigny 1826).
Species: *Alveolina elliptica* (sowerby 1840). Plate: 06

Remarks: This species has been described and illustrated by Hottinger (1960) from the same kirthar Group. This species' early growth has loose coiling, whereas its later growth has precisely spaced coils

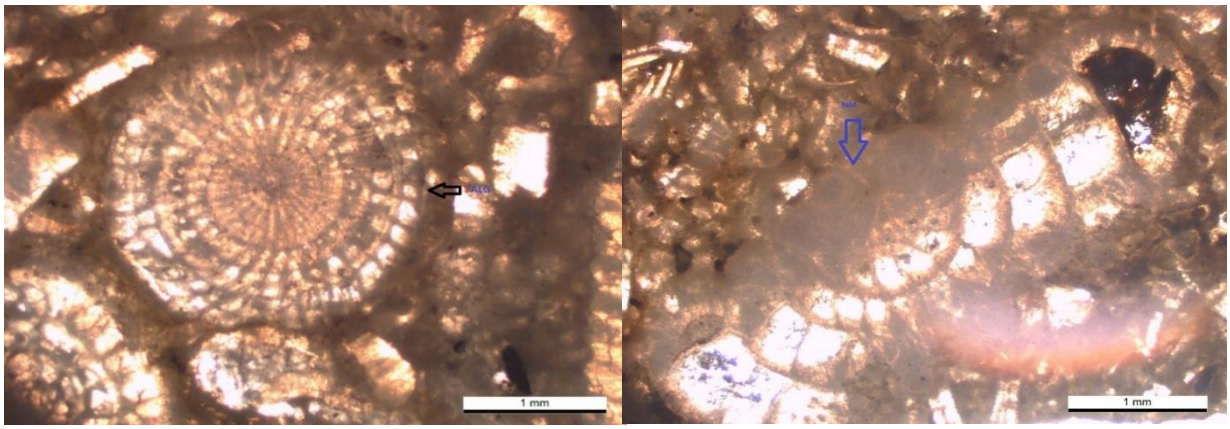


Plate 06: *Alveolina elliptica*

7. Conclusion

Kirthar Group of Sulaiman Range is well preserved in the Zain and Gorthal area. Kirthar Group comprise of four formations, main lithology is thin to bedded fossiliferous limestone variegated shales and marl. The micropaleontogical studies of Kirthar Group shows that it was deposited in lower to middle early Eocene age.

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