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Micropalaeontology of the Galis Group, Hazara, West Pakistan

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Introduction

The stratigraphic unit to which the name Galis is herein applied, has been the subject of investigations by earlier workers. The unit was first recognised by Waagen & Wynne in 1872 as the Nummulitic Formation. It was described by Middlemiss in 1896 under the name Nummulitic Series (pp. 38—42). His Nummulitic Series included the grey limestones at the base which have now been clearly identified as being of Cretaceous age (Latif 1962), and of a distinctly different lithology, relatively more closely related to the preceding Hothla Group than to the succeeding one. Other workers, however, just referred to the units earlier definitions as descriptions, without any significant alteration.

Derivation of the group name

The rocks under discussion have been recognised as a group for the following reasons:

1. They show clear marker horizons at the base and the top of the group, marked by laterite and conglomerate respectively, both due to a break in deposition.
2. The constituent formations show a gradational passage within the group.
3. The constituent formations are mappable units.
4. The names like Nummulitic Formation and Nummulitic Series do not fulfil the requirements of the stratigraphic nomenclature, which require the use of a geographic term for a unit. Moreover, there is a major rearrangement of the formations. The Grey Limestones at the base of the Nummulitic Series, have been separated as part of the underlying Hothla Group, and the overlying Kuldana Series so far excluded from the Nummulitic Series, have been taken as the uppermost unit of the group.
5. The group is very well represented in the Galis, on the Murree-Abbottabad Road, between Kuldana and Bagnotar via Daryagali, Barian, Swargali, Khairagali, Changlagali, Kuzagali, Dungagali and Nathiagali etc. and as such the Galis area is suggested as a type area for the whole group.

The definition of the group is based on the definition of its constituent formations.

Subdivisions

The term Galis Group is applied by the present survey to the complete succession of rocks between the Hothla and the Rawalpindi Groups, marked by unconformities at the base and the top. Thus it differs from the Nummulitic Series of Middlemiss (1896), in that it excludes the Grey Limestones below and includes the Kuldana Series above (pp. 39—40 and 42—43 respectively). The following subdivisions are recognised:

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|---------------------------|--|
| 5. Kuldana Formation | ± 200 feet Lower to / Middle Eocene |
| 4. Lora Formation | ± 150 feet Lower Eocene |
| 3. Margala Hill Limestone | ± 350 feet Lower Eocene |
| 2. Kuzagali Shale | ± 600 Upper Paleocene to Lower Eocene |
| 1. Mari Limestone | ± 900 feet Lower / Middle to Upper Paleocene |

Lithology

The group overlies the Hothla Group unconformably, the contact being marked by laterite, which is followed by grey nodular limestones and khaki, buff to greenish grey shales with Foraminifera of very small size. These are followed by grey nodular to massive limestones, marly limestones and marls containing larger Foraminifera up to 5 mm. in size. The top of the group is marked by marls, shale, clay, sandstone and gypsum bands, dominantly of reddish colours.

Distribution of Microfossils

The following microfossils have been recorded from various formations of the Galis Group.

1. Mari Limestone

Globorotalia uncinata, *Globigerina* aff. *linaperta*, *Globigerina triangularis*, *Globigerina triloculinoides*, *Globigerina velascoensis*, *Bigenenerina* sp., *Textularia* sp., *Textularia smithvillensis*, *Dorothia oxycona*, *Pyrgo lupheri*, *Triloculina trigonula*, *Miliolidae*, *Pseudogloborotalia khairabadensis*, *Pseudogloborotalia ranikotensis*, *Cibicidina walli*, *Pleurostomella rimosa*, *Pleurostomella greatvalleyensis*, *Chilostomella ovoidea*, *Charltonina madruagaensis*, *Rotalia perovalis*, *Rotalia trochidiformis*, *Lockhartia conditi*, *Lockhartia conica*, *Lockhartia haimei*, *Daviesina khatiyahi*, *Kathina delseota*, *Miscellanea miscella*, *Eoannularia eocenica*, *Linderina* sp., *Acinosiphon punjabensis*, *Bairdia* sp., *Brachycythere* sp., and *Nephrokokkos* sp.

2. Kuzagali Shale

Globorotalia elongata, *Globigerina primitiva*, *Globigerina saldadoensis*, *Triloculina trigonula*, *Lenticulina fictus*, *Cibicorbis nammalensis*, *Cibicorbis* sp., *Cibicidina walli*, *Cibicides* cf. *lobatulus*, *Cibicides reinholdi*, *Cibicides*

aff. *reinholdi*, *Rotalia trochidiformis*, *Thalmannta crookshanki*, *Miscellanea prehaime*, *Miscellanea miscella* and *Operculina salsa*.

3. Mangala Hill Limestone

Rotalia trochidiformis, *Lockhartia conditi*, *Lockhartia hunti*, *Lockhartia tipperi*, *Assilina laminosa*, *Assilina subspinoso*, *Nummulites atacicus*, *Nummulites globulus*, *Nummulites mamilla*, *Fasciolites delicatissima*, *Fasciolites elliptica* and *Fasciolites elliptica* var. *flosculina*.

4. Lora Formation

Globorotalia reissi, *Globorotalia wilcoxensis*, *Globanomalina ovalis*, *Globigerina prolata*, *Globigerina yeguaensis*, *Glandulina laevigata*, *Discorbis calyptra*, *Gyroidina globosa*, *Rotalia crookshankiana*, *Rotalia eocena*, *Rotalia trochidiformis*, *Lockhartia conditi*, *Lockhartia hunti*, *Lockhartia tipperi*, *Assilina daviesi*, *Assilina* aff. *laminosa*, *Assilina subdaviesi*, *Assilina subspinoso*, *Assilina globulus*, *Assilina mamilla*, *Bairdia* sp., *Pontocyprilla* sp., *Parakrithe* sp., *Henryhowella* sp., *Quadracythere hornibrookella*, *Quadracythere* sp., *Xestoleberis* sp., and *Cytherella* sp.

5. Kuldana Formation

Assilina exponens, *Assilina granulosa*, *Nummulites* sp.

Age of the Galis Group

The Galis Group is composed of 5 distinct formations:

a) The Mari Limestone, b) Kuzagali Shale, c) Mangala Hill Limestone, d) Lora Formation and e) Kuldana Formation. The microfaunal study of these formations is based on 20 rock samples. Eight of the Mari Limestone come from Changlagali; 5 of Kuzagali Shale from Kuzagali; 3 of Mangala Hill Limestone from Shahdara; 2 of Lora Formation from Phallagali and 2 of Kuldana Formation from Bansragali. They reveal the presence of 75 species of Foraminifera and 10 genera of Ostracoda recorded from Hazara for the first time. Though the preservation of the materials is not very satisfactory, it was found possible to compare them with the microfaunal assemblages described from Pakistan, Qatar, Gulf Coast U. S. A. and Trinidad.

Sample numbers 6 to 8 from the Mari Limestone contain *Kathina delseota*, *Daviesina khatiyahi*, *Lockhartia conica* and *Actinosiphon punjabensis*. All these have been found restricted to the Upper Lower Paleocene to Middle Paleocene, the former 3 in Qatar and the later in the Salt Range of Pakistan. The base of the Galis Group therefore seems to be Lower (?) / Middle Paleocene. *Assilina exponens* has been recorded from sample number 25 of the Kuldana Formation. The species is supposed to appear above the Lower Eocene.

The Middle / Upper Paleocene boundary is placed between samples 11 and 12 both from the Mari Limestone. *Globigerina triloculinoides*, *Pseudo-*

globorotalia khairabadensis and *Pseudogloborotalia ranikotensis* found in sample number 11 are known to occur in Middle Paleocene of Pakistan and elsewhere.

Globorotalia elongata, *Miscellanea miscella* and *Operculina salsa* which range up to the top of Paleocene help to place the Paleocene / Lower Eocene boundary between sample number 18 and 19 from the Kuzagali Shale and Margala Hill Limestone respectively.

The Lower and Middle Eocene are separated on the first appearance *Assilina exponens* of the Middle Eocene in sample number 25 from the Kuldana Formation.

The Galis Group is therefore considered to range from Lower / Middle Paleocene to basal Middle Eocene.

A c k n o w l e d g e m e n t s

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