FORAMINIFERAL BIOSTRATIGRAPHY AND RECONNAISSANCE MICROFACIES OF PALEOCENE LOCKHART LIMESTONE OF JABRI AREA, HAZARA, NORTHERN PAKISTAN.

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Abstract: The Lockhart Limestone of Paleocene age is well exposed in Jabri area. A section along the Lora-Maqsood road is measured and sampled for foraminiferal and micrfacies studies. The total thickness is 73 meters and total 12 samples were collected at different intervals. Ten species of Benthic Forminiferas are observed including age diagnostic Miscellanea miscella and Lockhartia haimei along with Bigenerina sp. and Milliolids. Three major types of microfacies are observed including Mudstone, Packstone and Wackstone. The variation in faunal assemblages are used to recognize subenvironments within the shelf. The age of the Lockhart Limestone on the basis of observed fauna is Thanetian (Upper Paleocene).

INTRODUCTION

The Hazara mountains form the northern border of Potowar Basin, it is a NE-SW trending acute trough situated along the northern margin of Indo-Pakistan Plate and has been formed as a continent to continent collision. The Jabri area of southern Hazara is easily accessible from Rawalpindi-Islamabad via Ghora Gali, located on Lora-Maqsood road (long. 73 10’ 15”, lat. 35 54’ 45”) where rocks exposed from Jurassic to Eocene are as follows.

<table>
<thead>
<tr>
<th>Eocene</th>
<th>Margala Hill Limestone</th>
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<tbody>
<tr>
<td>Paleocene</td>
<td>Patala Formation</td>
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<tr>
<td></td>
<td>Lockhart Limestone</td>
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<tr>
<td></td>
<td>Hangu Formation</td>
</tr>
<tr>
<td>Cretaceous</td>
<td>Kawagarh Formation</td>
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<tr>
<td></td>
<td>Lumshiwal Formation</td>
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<tr>
<td></td>
<td>Chichali Formation</td>
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<tr>
<td>Jurassic</td>
<td>Samana Suk Formation</td>
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</tbody>
</table>

Davies (1930a) gave the name “Lockhart Limestone” to the Paleocene limestone unit in Kohat area and this name was extended by the Stratigraphic Committee of Pakistan (Fatmi 1973) to the “Mari Limestone” of Latif (1970a) in Hazara area. Waagen and Wynne (1872) are the pioneers of the work in this area, they have explained the basic geology of this area, Wynne (1873) had worked on the geology of the northern Punjab, Wynne (1874) had explained the geology of the Murree Hills and its surroundings. Waggen (1895) had given the comprehensive study of the geology of Sirban mountains near Abbottabad. Middlemiss (1896) had given a brief description of the geology of the Hazara and Black Mountains. Pinfold (1918) had explain the structure and stratigraphy of the north western Punjab. Cotter (1933) had given a brief description of the geology around the Attock area. Eames (1952) had explained the Eocene rocks of the Western Pakistan. Latif (1970, 1970a, 1970c) had mapped the Hazara area and explained the detailed stratigraphy and micropaleontology of all rocks from Pre-Cambrian to Recent, Latif (1976) has given a comprehensive account of the micropaleontology of Gallis Group of Hazara. Butt (1972) had discussed the problems of the stratigraphic nomenclature of the Hazara area. Shahnawaz and Sameeni et. al. (1992) have describe the preliminary microfacies of the Margala Hill Limestone of Jabri area. Sameeni (1993) have given a comprehensive study of the microfauna of the Margala Hill Limestone of
Bandi area. Kamran and Sameeni et. al. (2000) explained the stratigraphy and microfauna of the Patala Formation of the Jabri area only. Munir et. al. (2006) have explained the stratigraphy and microfauna of the Paleogene rocks of Hazara and Kashmir area. First time the comprehensive study of the microfauna and reconnaissance microfacies of Lockhart Limestone of Jabri area is carried out.

OBSERVATIONS

The Lockhart Limestone is well exposed on both sides of Harro River in Jabri area. A section on the northern bank of the river is selected for the present study (Fig-1) where its lower contact with Hangu Formation and upper contact with Patala Formation are sharp and conformable. The total thickness of Lockhart Limestone is 73 meters. Its lithology from bottom to top as observed is, in its lower part, 05 meters thick bedded dark grey, fossiliferous limestone is exposed, followed by 01 meter thick greenish grey shale having no fossils, then 14 meters thick massive, nodular, grey to dark grey fossiliferous limestone is present, 02 meters thick arenaceous unfossiliferous limestone of grey colour, 18 meters thick massive grey coloured nodular poor fossiliferous limestone, 04 meters thick bedded limestone of grey to dark grey in colour with less fossils, 12 meters thick massive fossiliferous limestone of grey to dark grey in colour with less fossils, 04 meters thick bedded fossiliferous limestone of dark grey colour, 01 meter thick band of light grey shale and at the top 01 meter thick band of dark grey sandy/shaly limestone is exposed (Fig-2). Total 12 samples were collected from bottom to top at different levels as shown in fig-2 and total 30 thin sections were prepared for micropaleontological and microfacies studies. The recorded species of foraminifera are as follows.

- **Miscellanea miscella** (d'Archaic & Haime)
- **Lockhartia haimei** (Davies)
- **Lockhartia conditi** (Nuttall)
- **Lockhartia tipperi** (Davies)
- **Ranikotalia sindensis** (Davies)
- **Ranikotalia sahnii** (Davies)
- **Operculina salsa** Davies & Pinfold
- **Operculina patalensis** Davies & Pinfold
- **Assilina subsinosa** Davies & Pinfold
- **Discocyclina ranikotensis** Davies
- **Bigenerina** sp.
- **Milliuloids**

SYSTEMATIC PALEONTOLOGY

**Miscellanea miscella** (d'Archaic & Haime)  
(Figs.A,B   Plate 1)

**Miscellanea miscella** (d'Archaic and Haime), Pfender 1934. Bull. Soc. Geol. France, vol. IV, pp.231-235 and Text figs. 1-4, pl. 11 , figs. 6-7, pl.13, figs. 2-4.

Remarks: This is the most common species present throughout the formation from bottom to top. Microspheric and megalospheric both types were observed.

**Lockhartia haimei** (Davies)  
(Figs.A   Plate 2)


Remarks: This species is a guide fossil for upper Paleocene rocks so very common in this formation from bottom to top.

**Lockhartia conditi** (Nuttall)  
(Figs. B,D   Plate 2)

**Lockhartia conditi** (Nuttall) Davies 1932. Trans. Roy. Soc. Edin., vol.57P1. 2, fig. 7; P1. 4, fig.7.

Remarks: This species is common to upper Paleocene and lower Eocene and is observed throughout the formation from bottom to top.

**Lockhartia tipperi** (Davies)  
(Figs. D   Plate 3)


Remarks: This species is recorded from the upper half of the formation where it is common.

**Ranikotalia sindensis** (Davies)  
(Figs.C,D,E   Plate 1)


Remarks: This species is common to the upper Paleocene and lower Eocene deposits and recorded from the formation from bottom to top.

**Ranikotalia sahnii** (Davies)  
(Figs.A,B   Plate 3)


Remarks: This species is not so common, only recorded from the middle upper part of the formation.

**Operculina salsa** Davies & Pinfold  
(Figs. C   Plate 3)


Remarks: This species is recorded from the upper part of the formation.
Fig. 2. Stratigraphic column of Lockhart limestone, Jabri, Hazara
Fig. 3. Vertical range of Formation recorded in Lockhart limestone, Jabri, Hazara
Fig. 4. Showing the microfacies and interpretation of subenvironments within the shelf of Lockhart limestone, Jabri, Hazara
DESCRIPTION OF PLATES

Plate-1
A, B Miscellanea miscella (d’Archaic & Haime)
C, D Ranikothalia sindensis (Davies)
E Upper- Ranikothalia sindensis (Davies)
      Lower left- Ranikothalia sahnii (Davies)
      Lower right- Lockhartia tipperi  (Davies)

Plate-2
A  Lockhartia haimei (Davies)
B, D Lockhartia conditi (Nuttall)
C   Milliolid
E  Operculina patalensis Davies & Pinfold
F   Assilina subspinosa Davies & Pinfold
G  Discocyclina ranikotensis Davies

Plate-3
A, B Ranikothalia sahnii (Davies)
C   Operculina salsa Davies & Pinfold
D   Lockhartia tipperi (Davies)
E   Bigenerina sp.
F   Discocyclina ranikotensis Davies
**Operculina patalensis** Davies & Pinfold  
(Figs. E  Plate 2)

**Remarks:** This species is recorded only from the upper most part of the formation.

**Assilina subspinosa** Davies & Pinfold  
(Figs. F  Plate 2)

**Remarks:** This species is recorded from the middle and upper part of the formation.

**Bigenerina sp.**  
(Fig. E  Plate 3)

**Milliolids**  
(Fig. C  Plate 2)

Remarks: These are observed only in the upper most part of the formation.

**CONCLUSION**

Ten species of larger foraminifera are recorded from the formation along with milliolids and *Bigenerina* sp. which confirm the Thanetian (Upper Paleocene) age of the Loickhart Limestone. The larger foraminifera are known to characterize the shallow shelf carbonate environments. The variation in faunal assemblage is used to recognize the subenvironments within the shelf, based on the salinity tolerance and habitat of various association of fauna. These subenvironments include inner, middle and outer shelf (Fig.4) where three major type of microfacies are deposited, these are Mudstone, Packstone, and Wackstone.

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