

Paleocene-Eocene Biostratigraphy of the Yadgar Area, Muzaffarabad, Azad Kashmir, Pakistan

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ABSTRACT

The Yadgar area of Muzaffarabad, Azad Kashmir, lies along the eastern limb of the Hazara-Kashmir Syntaxis. The Paleocene-Eocene sequence includes the Hangu Formation, the Lockhart Limestone, the Patala Formation, the Margala Hill Limestone, the Chor Gali Formation and the Kuldana Formation. Age diagnostic shallow benthic larger foraminiferal species have been encountered which includes *Operculina salsa* (Davies and Pinfold), *Operculina subsalsa* (Davies and Pinfold), *Miscellanea miscella* (d'Archiac and Haime), *Nummulites ataticus* (Leymerie), *Nummulites mamillatus* (Fichtel and Moll), *Ranikothalia sindensis* (Davies), *Ranikothalia nuttalli* (Davies), *Assilina spinosa* (Davies and Pinfold), *Assilina subspinosa* (Davies and Pinfold), *Assilina laminosa* (Gill), *Lockhartia tipperi* (Davies), *Lockhartia conditi* (Nuttall), *Lockhartia conica* (Smout) and *Dasycladacean* (Algae) are also present. This assemblage is characteristic of shallow shelf marine environment.

INTRODUCTION

The Yadgar section is situated about three Kilometers north of Muzaffarabad, the capital city of Azad Kashmir along the roadside towards the Neelum Valley (latitude 34° 25' 20" north and longitude 73° 25' 20" east). Geologically the area lies in the apex of western limb of the Hazara Kashmir Syntaxis (Figure 1). Wadia (1928) described the Tertiaries of Kashmir as "Subathu" of Eocene age along with Miocene Murree and Miocene-Pleistocene Siwalik Group having bend at the Jehlum stretches eastwards through the Kashmir area, preserving all its geological characters and relations unchanged, to the Ravi and then to The Sutluj, where it merges into Kangra Himalayas. He correlated the Tertiaries of the Jammu hills to the corresponding rocks of the Kurmaon and Simla Himalayas as "Hill limestone" and "Chhart" in the western Punjab, Kashmir Himalayas and northern part of Potwar as Eocene Subathu with Kurmaon and Simla Himalayas. He placed the unconformity between the Eocene Chhart and Subathu strata and the Lower Miocene Lower Murree and Dagshai in Kashmir and Simla Himalayas. However, there has been no work on the Paleocene-Eocene biostratigraphy of the Yadgar area of Muzaffarabad, Azad Kashmir, Pakistan.

LITHOSTRATIGRAPHY OF THE PALEOCENE-EOCENE SEQUENCE

The lithostratigraphy of the Paleocene-Eocene rock units exposed in the apex of Hazara-Kashmir Syntaxis is illustrated in Figure 2. The area is structurally complex and the Lower Paleocene Hangu Formation unconformably overlies the Late Cambrian Abbottabad Formation in the area. The Neogene (Miocene) Murree Formation, representing molasse sediments, in turn disconformably overlies the Middle Eocene Kuldana Formation (Table 1).

Table.1: Stratigraphic Succession of the Yadgar Muzaffarabad, Azad Kashmir, Pakistan.

Age	Formation
Miocene	Murree Formation
-----Unconformity-----	
Middle Eocene	Kuldana Formation
Early Eocene	Chor Gali Formation
Early Eocene	Margala Hill Limestone
Late Paleocene	Patala Formation
Late Paleocene	Lockhart Limestone
Paleocene	Hangu Formation
-----Unconformity-----	
Late Cambrian	Abbottabad Formation

The Paleocene-Eocene sequence in the study area includes the Hangu Formation, the Lockhart Limestone, the Patala Formation, the Margala Hill Limestone, the Chor Gali Formation and the Kuldana Formation (Table 1, Figure 2).

BIOSTRATIGRAPHY OF THE PALEOCENE-EOCENE SEQUENCE

The Paleocene-Eocene sequence of the Yadgar area is investigated for benthic larger foraminifers (Plate 1 and 2). For this purpose 59 rock samples are collected from the

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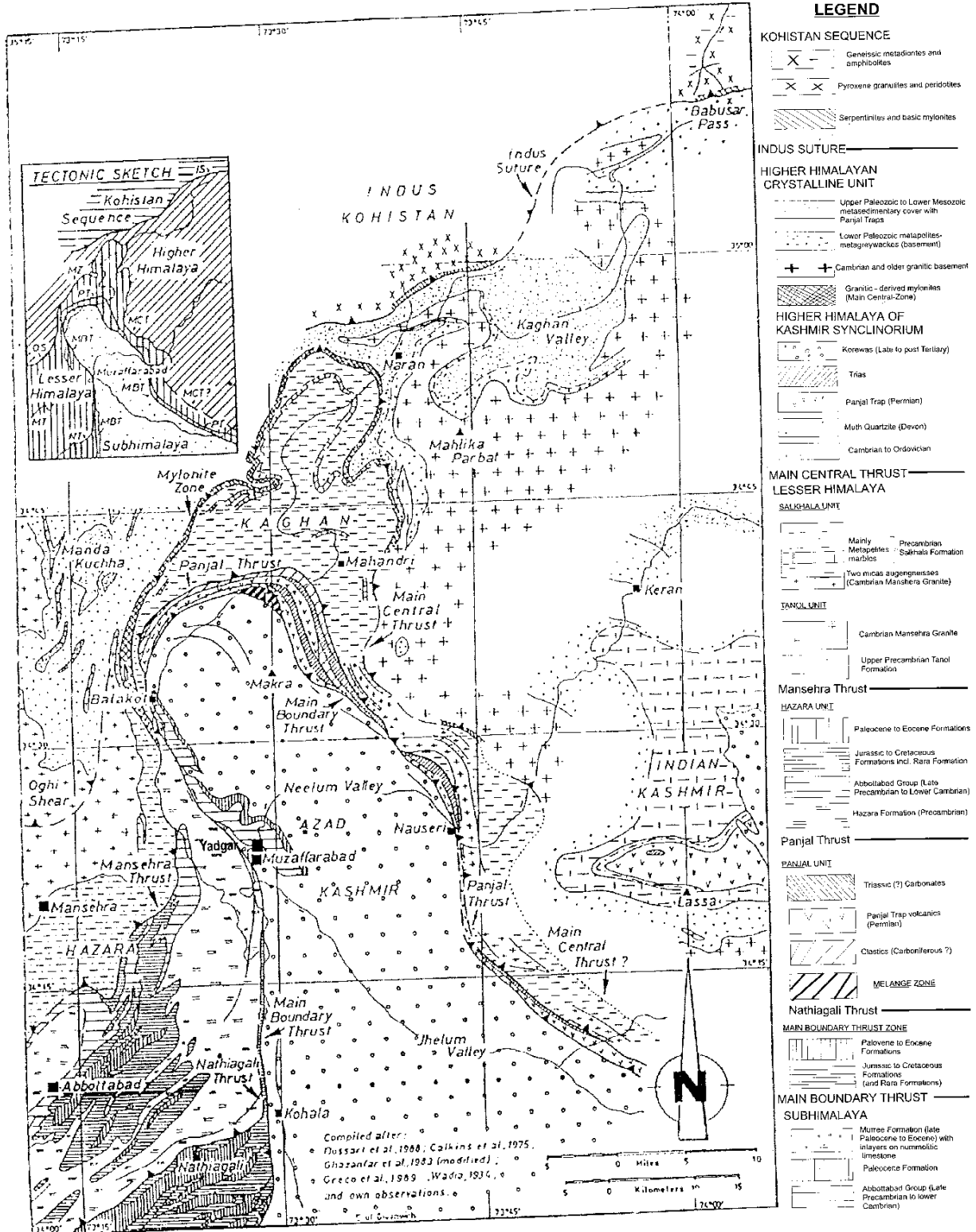


Figure 1- Geological Map of Hazara-Kashmir Syntaxis showing Paleocene-Eocene Sequence in Hazara and Yadgar Area, Muzaffarabad Azad Kashmir, Northwest Himalaya, Pakistan (Modified after Greco, 1991).

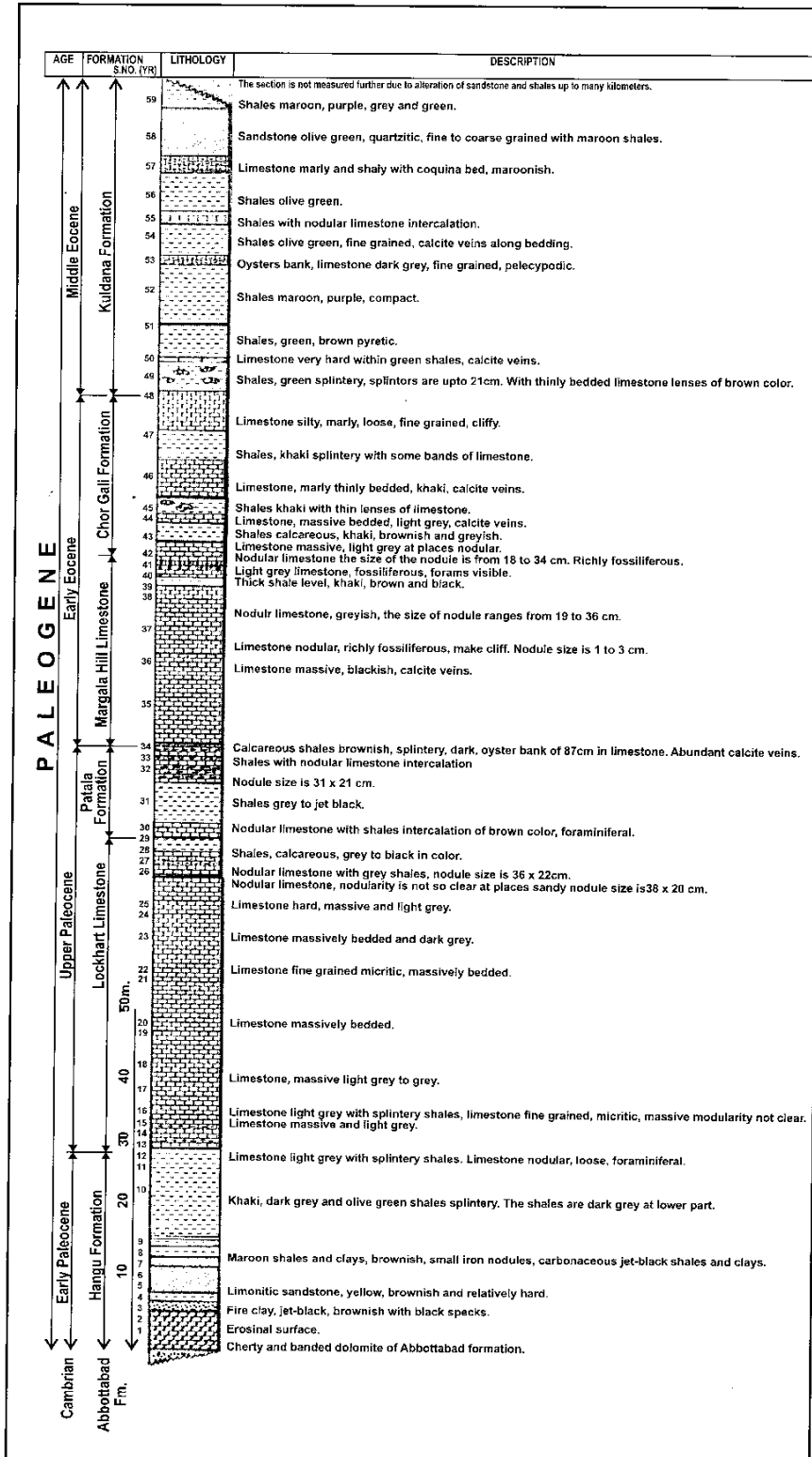


Figure 2- Lithostratigraphic Section of The Yadgar, Muzaffarabad, Azad Kashmir.

section. The distribution of the 59 rock samples includes 11 from the Hangu Formation, 17 from the Lockhart Limestone, 6 from the Patala Formation, 8 from the Margala Hill Limestone, 6 from Chor Gali Formation and 11 from the Kuldana Formation (Figure 2). Samples are mainly from limestones and shales. The foraminiferal species are good index fossils for age determination. These species are quite common in equivalent geological deposits of northern Pakistan and other parts of the world. This is the good criteria for the regional and inter-regional correlation of the strata using the age diagnostic species of foraminiferas. For the finer biostratigraphic resolution, the larger foraminiferal genera such as *Miscellanea*, *Operculina*, *Ranikothansis*, *Lockhartia*, *Assilina* and *Nummulites* have been studied from the Yadgar area.

LOCKHART LIMESTONE

The Lockhart Limestone yielded foraminiferal species such as *Operculina salsa* (Davies and Pinfold), *Operculina subsalsa* (Davies and Pinfold), *Lockhartia haimeii* (Davies), *Lockhartia tipperi* (Davies), *Lockhartia conditi* (Nuttall), *Miscellanea miscella* (d'Archiac and Haime), *Ranikothalia sindensis* (Davies) and *Ranikothalia sp.* (Plate 1 and 2).

The foraminiferal genus *Ranikothalia* characterizes the upper Paleocene succession of Pakistan as well as in the world at many places. It sometimes extends into the Lower Eocene. In addition, *Miscellanea miscella* (d'Archiac and Haime), *Daviesina langhami* (Smout), *Lockhartia haimeii* (Davies) and *Operculina subsalsa* (Davies and Pinfold) also indicate the Upper Paleocene age for the Lockhart Limestone.

PATALA FORMATION

The formation contains foraminiferal assemblages such as *Operculina salsa* (Davies and Pinfold), *Operculina subsalsa* (Davies and Pinfold), *Lockhartia haimeii* (Davies), *Lockhartia tipperi* (Davies), *Lockhartia conditi* (Nuttall), *Miscellanea miscella* (d'Archiac and Haime), *Daviesina langhami* (Smout), *Ranikothalia sindensis* (Davies) and *Ranikothalia sp.* (Plate 1 and 2).

MARGALA HILL LIMESTONE

The Margala Hill Limestone is highly fossiliferous. The formation contains foraminifera, Mollusks and Echinoids. The authors have carried out detailed work on the foraminiferal assemblage of the unit. For this purpose thin sections were studied from the Yadgar area. The cumulative study of the thin sections has indicated the occurrence of the following foraminifera:

Nummulites atacicus (Leymerie), *Nummulites mamillatus* (Fichtel and Moll), *Assilina granulosa* (d'Archiac), *Assilina spinosa* (Davies and Pinfold), *Assilina laminosa* (Gill), *Assilina subspinosa* (Davies and Pinfold), *Ranikothalia sindensis* (Davies), *Operculina patalensis* (Davies and Pinfold), *Lockhartia tipperi* (Davies) and *Lockhartia conditi* (Nuttall).

On the basis of above mentioned microfossil assemblage, the Lower Eocene age is assigned to the Margala Hill Limestone (Plate 1 and 2).

CHOR GALI FORMATION

The Chor Gali Formation is fossiliferous particularly in the lower part. The foraminifera have been studied in detail from the formation. Their preservation is poor in many other places. The following foraminifera are reported from section of the Yadgar area.

Assilina granulosa (d'Archiac), *Assilina spinosa* (Davies and Pinfold), *Assilina subspinosa* (Davies and Pinfold), *Assilina laminosa* (Gill), *Nummulites atacicus* (Leymerie), *Nummulites mamillatus* (Fichtel and Moll), *Lockhartia conditi* (Nuttall) and *Lockhartia tipperi* (Davies).

On the basis of this foraminiferal assemblage, a Lower Eocene age is assigned to the Chor Gali Formation (Plate 1 and 2).

KULDANA FORMATION

The following foraminifera are recorded from this formation which includes:

Assilina granulosa (d'Archiac), *Assilina spinosa* (Davies and Pinfold), *Nummulites atacicus* (Leymerie) and *Nummulites mamillatus* (Fichtel and Moll).

On the basis of above mentioned faunal assemblage a Middle Eocene age is assigned to the Kuldana Formation.

CONCLUSIONS

- 1 The following age-diagnostic species have been recorded in the Yadgar section which are *Miscellanea miscella*, *Dictyokathin simplex*, *Lockhartia haimeii*, *Ranikothalia sindensis*, *Ranikothalia nuttalli*, *operculina jiwani*, *Operculina subgranulosa*, *Nummulites atacicus*, *Nummulites mamillatus*, *Assilina dandotica*, *Assilina spinosa*, *Assilina granulosa*, *Assilina laminosa*
- 2 The foraminiferal assemblage is indicative of the shallow marine environment of deposition of the Paleocene and the Lower Eocene Succession.

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PLATES DESCRIPTION

PLATE 1

- Figure # 1: External view of *Operculina salsa* (Figure # 2: YR 16)
 Figure # 2: Vertical view of *Operculina salsa* (Figure # 2: YR 23)
 Figure # 3: Equatorial section of *Miscellanea miscella* (Figure # 2: YR 23)
 Figure # 4: Vertical section of *Nummulites atacicus* (Figure # 2: YR 41)
 Figure # 5: Vertical section of *Nummulites mamillatus* (Figure # 2: YR 40)
 Figure # 6: Vertical section of *Ranikothalia sindensis* (Figure # 2: YR 17)
 Figure # 7: Vertical section of *Ranikothalia sindensis* (Figure # 2: YR 32)
 Figure # 8: Vertical section of *Assilina subspinosa* (Figure # 2: YR 32)
 (All Figure # X 40)

PLATE 2

- Figure # 1: Vertical section of *Assilina subspinosa* (Figure # 2: YR 40)
 Figure # 2: Vertical section of *Assilina laminosa* (Figure # 2: YR 41)
 Figure # 3: Vertical section of *Lockhartia tipperi* (Figure # 2: YR 33)
 Figure # 4: Vertical section of *Lockhartia conditi* (Figure # 2: YR 23)
 Figure # 5: Vertical section of *Lockhartia conica* (Figure # 2: YR 33)
 Figure # 6: Vertical section of *Lockhartia sp.* (Figure # 2: YR 23)
 Figure # 7: External view of *Lockhartia sp.* (Figure # 2: YR 22)
 (All fig. X 40)

PLATE 1



PLATE 2



