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Title of article Timing of structural events in the Himalayan foothills
of Northwestern Pakistan

Author(s) Robert S. Yeats and Ahmad Hussain

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adjacent Kala Chitta Range

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To accompany "Timing of
Structural Events in the Himalayan Foothills of
Northwestern Pakistan,
by Robert S. Yeats and Ahmad Hussain

Lithology of rock units in Attock-Cherat Range
and adjacent Kala Chitta Range

NORTHERN BLOCK

Shekhai Formation: Medium- to thick-bedded and massive,
light-gray limestone with subordinate quartzite and
argillite at its base. Contains diabase intrusions and
quartz veins. Maximum thickness 150 meters.

Utch Khattak Formation: light gray to yellowish gray, thin-
to thick-bedded limestone with dark gray argillaceous
streaks and laminations, algal stromatolites, and sub-
ordinate interbeds of light gray to buff thin-bedded
shale. Near the old Attock bridge contains intra-
formational conglomerate with subangular fragments of
slate, sandstone, and Shahkot limestone. Contains dia-
base intrusions. Maximum thickness 80 meters.

Shahkot Formation: light yellowish-gray to brownish-gray
limestone and interbedded dark greenish gray argillite
overlain by dark greenish gray thinly laminated argil-
lite. Contains diabase intrusions. Limestone near top
of formation south of Utch Khattak village yielded
fossils tentatively identified as bryozoans of early

Paleozoic age, probably late Ordovician to Silurian (Tahirkheli, 1970). We have been unable to find fossils at this locality or elsewhere in the formation. Maximum thickness 75 meters.

Manki Formation: dark gray to black thin-bedded argillite, sericite-bearing slate, and phyllite with subordinate lenses of yellowish-gray limestone, and quartzite. Contains diabase intrusions. Thickness > 950 meters.

- Khairabad Fault -

CENTRAL BLOCK

Murree Formation: Red, purple, and greenish gray sandstone, siltstone, and shale. In Potwar Plateau, basal Fatehjang member is early Miocene based on vertebrate fossils (Shah, 1977). Maximum thickness 120 meters.

- Unconformity -

Patala Formation: Alternating dark greenish-gray, thin-bedded to fissile shale, dark gray to yellowish-gray, thin- to medium-bedded limestone, and brownish-gray thin-bedded sandstone with poorly preserved cross bedding, and local red shale and coal seams. Late Paleocene to early Eocene based on foraminifers, molluscs, and ostracods. Laterite locally preserved at base. Maximum thickness 75 meters.

- Unconformity -

Lockhart Limestone: light gray to dark gray hard, nodular, medium-bedded to thick-bedded to massive limestone with fetid odor on fresh surfaces, and minor intercalations of dark gray to black thinly laminated shale. Paleocene age based on foraminifers, algae, corals, molluscs, and echinoids. Laterite locally preserved at base. North of Cherat, laterite overlain by thin-bedded carbonaceous sandstone with coal seams, possibly correlated with Hangu Formation of Kohat plateau. Maximum thickness 175 meters.

- Unconformity -

Unnamed Limestone: light gray, thinly bedded and highly sheared. In Shekhai stream, about one kilometer south of Cherat Cement Plant (Figure 6), top is in fault contact with Shekhai Limestone; base not exposed, but presumed to overlie the Dakhner Formation. Contains a rich but rather poorly preserved foraminiferal and molluscan fauna of early Late Cretaceous (Cenomanian) age (R. Mawson and J.A. Talent, letter commun., 1976). Fossils recognized by Mawson and Talent include: Astacolus sp. (Permian-Holocene), Aulotortus sp. (Triassic-Late Cretaceous [?Turonian]), Coskinolinella sp. (Early Cretaceous-middle Eocene), Dicyclina sp. (Cenomanian), Iraquia sp. (Early Cretaceous [Aptian/Albian] to Late Cretaceous),

Mangashtia sp. (Cenomanian-Turonian), Nodosaria sp. (Permian-Holocene), Orbitolina concava (Lamarck) (Cenomanian), Orbitolina cf. O. raoi Sahni and Sastri (?Cenomanian), Rhapydionina sp. (Jurassic-middle Eocene), nereneid gastropod with a single spiral palatal fold (late Mesozoic). Maximum thickness 6 meters.

Dakhner Formation: dark gray to greenish-gray shale and argillite with subordinate siltstone, sandstone, and quartzite with cross bedding, ripple marks, and graded bedding locally present. Light gray to yellowish-gray limestone near base. A low-spined opisthobranch and a high-spined nereneid gastropod with simple internal structure of the chambers, found in a limestone lens on the ridge north of Hissartang village by Tahirkheli (1970), may be from a downfaulted lens of Cretaceous or Paleocene limestone rather than be part of the Dakhner as interpreted by Tahirkheli (1970). We have not found any fossils in the Dakhner limestone or any other part of the Dakhner, and there is no evidence of trace fossils. Diabase intrusions absent except for one occurrence in limestone east of Indust River. Maximum thickness 1,000 meters.

- Cherat Fault -

SOUTHERN BLOCK

<u>Murree Formation</u>	Similar to occurrences in
<u>Patala Formation</u>	central block; each formation
<u>Lockhart Limestone</u>	separated by an unconformity.

- Unconformity marked by laterite, which fills small caves locally developed in Inzari Limestone at Mir Kalan.

Inzari Limestone: light yellowish-gray to light greenish-gray, finely crystalline and thin- to thick-bedded limestone. Upper part is traversed by numerous wavy fillings and stylolites of calcareous material. Maximum thickness 650 meters.

Hissartang Formation: In lower and upper parts, white to light gray, fine-grained, well-sorted, thin- to thick-bedded quartzite with locally preserved cross bedding. Ferruginous specks and coatings common. Middle part consists of dark gray to black, fine-grained, thin- to medium-bedded argillite with poorly developed slaty cleavage parallel and oblique to bedding. Maximum thickness 760 meters.

Darwaza Formation: In upper part, red, maroon, dark gray, thin-bedded shale and argillite gradational upward to Hissartang Formation. In lower part, white to light grayish-green, thin- to medium-bedded limestone and

dolomite with pronounced fractures and joints. Contains diabase intrusions. Thickness 280 meters, base cut out by Hissartang fault.

- Hissartang Fault -

KALA CHITTA BLOCK

Patala Formation: light to dark brownish gray to dark gray limestone, silty near base, nodular, medium- to thick-bedded, abundant fossils. Local dark shale and coal. Late Paleocene (Landenian) age according to Fatmi (1973). Maximum thickness 75 meters.

Lockhart Limestone: upper part light brownish-gray to dark gray, very fine-grained, very thick bedded cliff-forming limestone; lower part light brownish-gray to dark gray limestone, in part argillaceous grading to calcareous clay, aphanitic to coarse crystalline, generally a slope former. Lower unit described as Hangu Formation by Meissner and others (1974). Early? and middle Paleocene age according to Fatmi (1973). Maximum thickness 260 meters.

- Unconformity -

Kawagarh Formation: yellowish-gray to brownish-gray thinly bedded marl with subordinate interbedded limestone, gray to yellowish-gray, hard, nodular, and argillaceous. Late Cretaceous (Coniacian to Campanian) age based on foraminifers. Maximum thickness 110 meters.

- Disconformity -

Lumshiwal Formation: gray to brownish hard quartzose sandstone with subordinate silty partings, overlain by greenish-brown to greenish-gray, medium-grained, flaggy, glauconitic sandstone, overlain by yellowish-gray to brownish-gray, thin- to medium-bedded limestone with subordinate marly beds. Uppermost meter of limestone is glauconitic with phosphate nodules. Middle Cretaceous (Aptian-Albian) age (Fatmi, 1973) based on nautiloids and molluscs. Maximum thickness 100 meters.

Chichali Formation: dark gray to black and greenish-gray sandstone and shale; sandstone is medium grained and glauconitic; shale is sandy, silty, and glauconitic and occurs as thin beds. Phosphatic and pyritic nodules common. Sharp upper contact with Lumshiwal Formation. Late Jurassic to Early Cretaceous (Oxfordian-Neocomian) age (Fatmi, 1973) based on belemnoids, ammonoids, and molluscs. Maximum thickness 27 meters; only locally present.

Datta, Shinawari and Samana Suk Formations, undivided: Gray to dark gray, yellowish medium- to thick-bedded limestone, locally oolitic, pelletal, and shelly, and subordinate calcareous brownish gray, hard medium to coarse-grained, glauconitic sandstone, laterite at base. Early

to Middle Jurassic age based on brachiopods, gastropods and crinoids. Maximum thickness 227 meters.

Kingriali and Tredian Formations, undivided: light to dark gray, medium- to coarse-grained, medium- and thick-bedded dolomite and dolomitic limestone, subordinate micritic limestone. Middle to Late Triassic age based on poorly preserved molluscs, crinoidal debris, and brachiopods (Fatmi, 1973). Maximum thickness 167 meters.

Mianwali Formation: Light gray to yellowish gray, fine grained, thin- to medium-bedded limestone and subordinate greenish gray to yellowish thin-bedded marl with poorly preserved ammonites indicating Early Triassic (Scythian) age (Fatmi, 1973). Thickness 30 meters; base not exposed.