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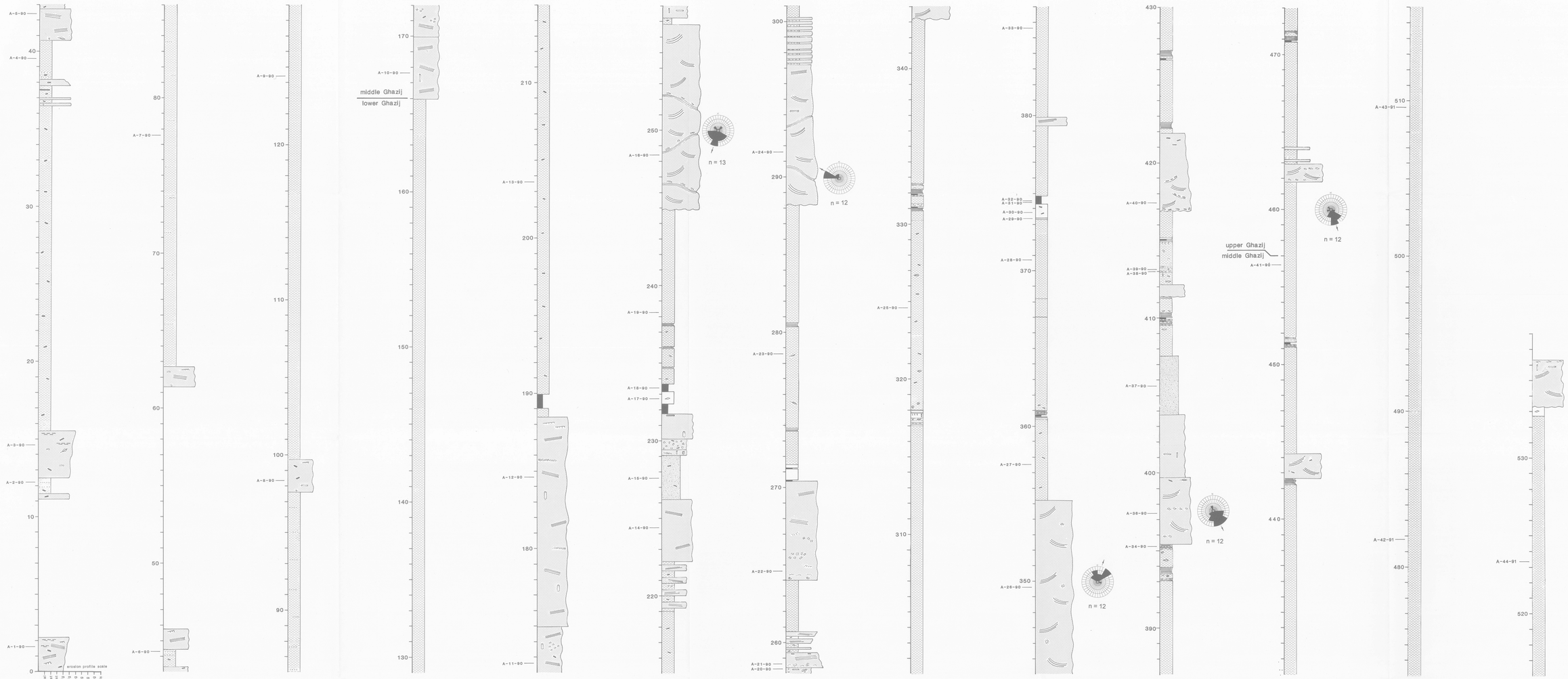

Vertical scale in meters

- Plant fragments as scattered debris or in laminae
- Rooting
- Bivalves
- Gastropods
- Ripple laminae
- Mudrock clasts
- Secondary gypsum
- Leaves
- Wood
- Sharp or gradational contact separating lithologic units
- Relief on a sharp contact separating lithologic units
- Surface separating amalgamated bodies
- Internal erosion surfaces
- Mudrock partings
- Sandstone interbeds
- Small- to medium-scale, planar cross-stratification
- Small- to medium-scale, trough cross-stratification
- Simple vertical or horizontal burrows
- Simple branching burrows
- Ophiomorpha-type vertical or horizontal burrows
- Bioturbation
- Blocky weathering
- Sole marks
- A-1-90 Sample number
- Rose diagram of paleocurrent directions -- corrected for strike and dip of enclosing strata; long arrow, vector mean azimuth; n, number of measurements

n=13

PRINCIPAL REFERENCE SECTION FOR PART OF THE EOCENE GHAZIJ FORMATION, ABRAHAM MARRI MINE AREA, PIR ISMAIL ZIARAT COAL FIELD, BALOCHISTAN, PAKISTAN

By

Edward A. Johnson[1] and Intizar H. Khan[2]

1994

[1] U.S. Geological Survey
[2] Geological Survey of Pakistan

INTRODUCTION

The information presented on this sheet was collected as part of a joint U.S. Geological Survey-Geological Survey of Pakistan program sponsored by the U.S. Agency for International Development. As a project within this program, the coal-bearing Ghazij Formation (Eocene) was investigated in the northeastern part of Balochistan east and south of the provincial capital of Quetta. Strata exposed in this area range in age from Permian to Holocene and crop out as a belt of folded and thrusted rocks that form a southeast-facing orocline. In this region of Pakistan, the Ghazij can usually be divided into three parts. The lower part is the thickest (probably more than 1,000 m) and consists of gray-weathering calcareous mudrock (shale, mudstone, and impure claystone) and a few tabular bodies of fine- to medium-grained calcareous sandstone. The middle part (27-300 m) consists of gray-weathering calcareous mudrock and tabular to lenticular bodies of fine- to medium-grained calcareous sandstone; beds of carbonaceous shale and coal are common. The upper part (as thick as 533 m) contains reddish-weathering calcareous mudrock that contains scattered lenticular bodies of fine- to medium-grained calcareous sandstone. Fossil plant debris is common in mudrock of the lower and middle parts of the Ghazij, and bivalves and gastropods are common in the middle part of the formation; the upper part of the Ghazij is usually unfossiliferous. Underlying the Ghazij are the carbonate rocks of the Paleocene Dungan Formation (or its equivalent), and overlying the Ghazij are the mostly carbonate rocks of the Eocene Kirthar Formation (or its equivalent). Both contacts can be conformable or unconformable. All of the pre-Neogene rocks in Balochistan are greatly deformed by the collision of India and Asia. The Ghazij is especially susceptible to regional compressional tectonics because it contains a large amount of shale and is sandwiched between two thick carbonate units. As a result, bedding-plane faults and isoclinal folds are common.

As part of our study of the Ghazij Formation, five stratigraphic sections were measured: one near Pir Ismail Ziarat, one in the Sor Range, two in the vicinity of Mach, and one near Johan. Each area's section is published separately.

ABRAHAM MARRI STRATIGRAPHIC SECTION

In the fall of 1990, we measured our stratigraphic section near the Abraham Marri mine located about 2 km northwest of the village of Pir Ismial Ziarat, which is located about 45 km southeast of Quetta. At this location, the Ghazij Formation is well exposed and relatively undeformed. The contact between the lower and middle parts of the Ghazij is located at the base of the lowest significant sandstone body (166 m), and the contact between the middle and upper parts of the formation is located at the base of the lowest significant sequence of reddish mudrock (about 457 m). Mudrock in the lower and middle parts of the Ghazij weathers various shades of light gray and contains abundant fossil plant debris. The upper part of the Ghazij mudrock is light brown, maroon, or light gray, and appears to contain a larger amount of clay than mudrock lower in the section. Sandstone in the middle part of the Ghazij contains subangular to subrounded grains of quartz, light-colored carbonate rock fragments, and green lithic fragments. The sandstone is light gray and weathers light brown. Exceptions to this are the sandstone bodies located between 343 and 355 m, and between 395.5 and 407.5 m; these rocks are light green and weather medium brown, probably because of a higher content of green lithic fragments. Some sandstone bodies, such as the one located between 166 and 188.5 m, have characteristics associated with marine deposition, while other sandstone bodies, such as the one located between 288 and 300 m, have characteristics associated with fluvial deposition. Bivalve and gastropod fossils are common in the middle part of the Ghazij in amounts varying from isolated shell fragments to coquina beds. Some bivalves are recognizable as oysters. At the Abraham Marri mine, subbituminous A coal is mined from the coal bed located between 374 and 375 m. The coal bed between 189 and 190 m, and the coal zone at about 232 to 234 m are also occasionally mined.

The scaled horizontal line at the base of the stratigraphic columnar section (grain size generally increasing to the right) is a crude erosional profile. Mudrock (mudrk) includes shale, mudstone, and impure claystone. Sandstone is very fine grained (vfg), fine grained (fg), medium grained (mg), coarse grained (cg), and very coarse grained (vcg). Other abbreviations are "carb sh" for carbonaceous shale, "claystone" for claystone, "siltst" for siltstone, "cong" for conglomerate, "frst" for ironstone, and "ls" for limestone. Some of the lithologies shown on the horizontal scale might not be present in the columnar section because they are not present along the line of section. Samples collected along the section for future reference are indicated by letter-number annotations to the left of the column. Contacts between similar lithologies indicate change in grain size, color, or sedimentary or biogenic structures. Those parts or the section that lack data represents covered intervals.

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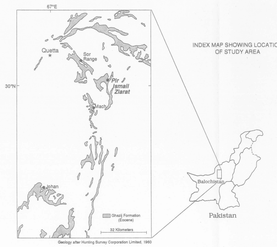

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INDEX MAP SHOWING LOCATION OF STUDY AREA

EXPLANATION

- Sandstone
- Siltstone
- Mudrock (shale, mudstone, or impure claystone)
- Carbonaceous shale
- Claystone (pure)
- Coal
- Coquina

Manuscript approved for publication February 1, 1994

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INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1994

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