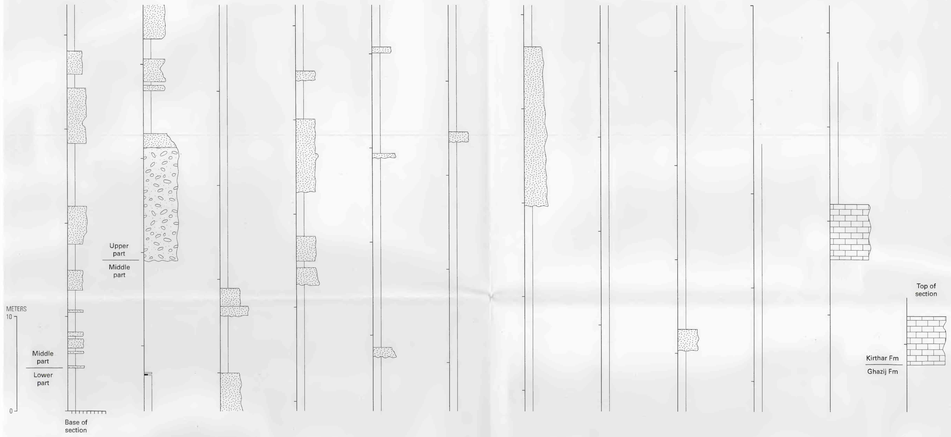
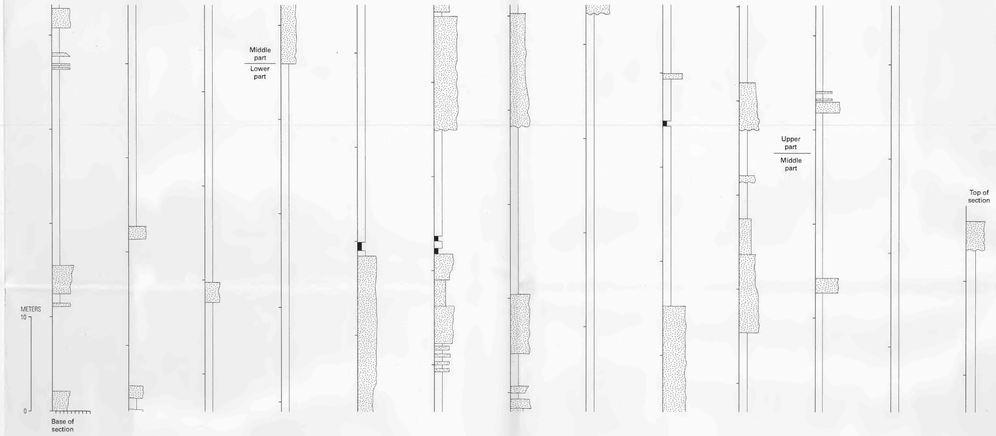
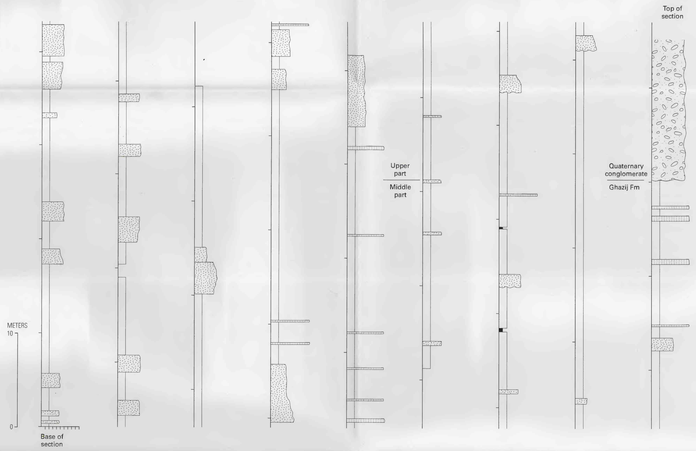
Prepared in cooperation with the Geological Survey of Pakistan



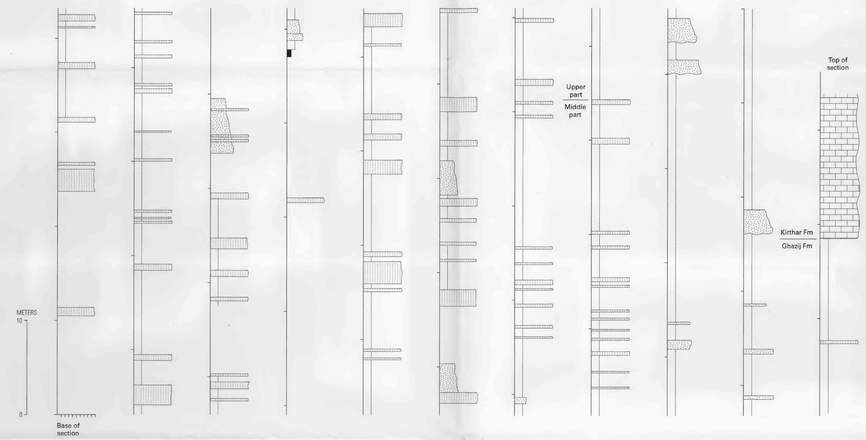
A. Shin Ghwazha Mine



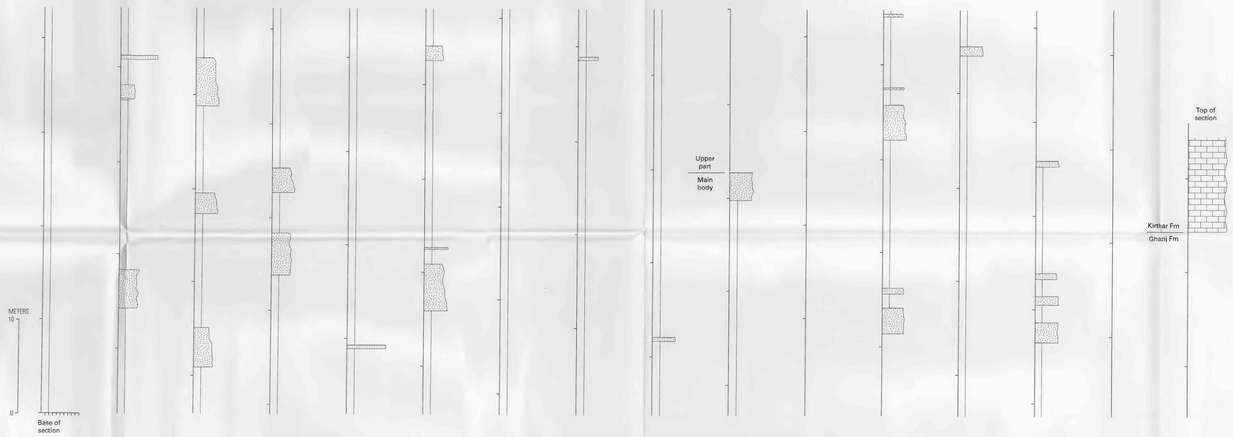
B. Abraham Marri Mine



C. Gishtari Nala



D. Moghal Mine



E. Sarawan River

EXPLANATION

- Limestone, crystalline
- Limestone, muddy
- Conglomerate
- Sandstone and siltstone
- Mudrock (shale, mudstone, and claystone) and carbonaceous shale
- Coal
- Sharp or gradational contact separating lithologic units
- Relief on a sharp contact separating lithologic units

Some thin limestone beds are shown slightly thicker for better visibility at the scale drafted. Likewise, some sandstone and coal beds too thin to be visible at this scale have been included with the mudrock

Principal Reference Sections

Shin Ghwazha Mine

The Shin Ghwazha coal mine is located in the northern third of the Sor Range coal field, about 20 km east of Quetta. Our measured stratigraphic section, located near the mine, comprises 478 m of the Ghazij, and includes the uppermost strata of the lower part of the formation and all of the middle and upper parts of the formation. We placed the contact between the lower and middle parts at the base of the stratigraphically highest significant sandstone unit and the contact between the middle and upper parts at the base of the conglomerate unit. Two coal beds are present in this area, but in the line of our section, these horizons are represented by carbonaceous shale. Of special interest is the presence of the conglomerate unit in the base of the upper part, and an apparent interfingering of the contact between the Ghazij and Kirthar Formations. Details of this section are contained in Johnson and Khan (1994a).

Abraham Marri Mine

This stratigraphic section, containing 536 m of the Ghazij, is located near the Abraham Marri mine. The mine is 2 km northwest of the village of Pir Ismail Ziarat, which is about 45 km southeast of Quetta. Although all three parts of the Ghazij are present in our line of section, only the middle part is complete. We place the contact between the lower and middle parts of the formation at the base of the stratigraphically highest significant sandstone unit, and the contact between the middle and upper parts of the formation at the base of the stratigraphically lowest unit of reddish-weathering mudrock. The depositional facies that characterize the middle part of the Ghazij are particularly well developed in this area of Balochistan. For more details of this section consult Johnson and Khan (1994b).

Gishtari Nala

Our Gishtari Nala stratigraphic section contains 370 m of the Ghazij, and is located just north of a broad dry river bed about 2.9 km west-southwest of the town of Mach, which lies about 48 km southeast of Quetta. Only the middle and upper parts of the Ghazij are present along our line of section, and neither of these are complete. We place the contact between the middle and upper parts of the formation at the base of the stratigraphically lowest unit of massive claystone. The details of this section are contained in Warwick and others (1994).

Moghal Mine

The Moghal mine is located 2.9 km south of Mach. Our stratigraphic section, located near the mine, contains 448 m of the Ghazij. Only portions of the middle and upper parts of the formation are present, and we place the contact between these two parts at the base of the stratigraphically lowest unit of the reddish-weathering mudrock. The middle part of the formation in this area contains numerous thin beds of muddy limestone, and relatively few sandstone units. The crystalline limestone of the Kirthar Formation shown at the top of the section probably represents a slide block of this formation. Details of this section are found in Johnson, Warwick, Khan, and Kazim (1994).

Sarawan River

This stratigraphic section, containing 664 m of the Ghazij, was measured just south of the east-flowing Sarawan River, several kilometers west of the village of Johan. Johan lies about 93 km south of Quetta, and in this area of Balochistan the middle part of the Ghazij is poorly developed and is generally not recognized. Because of this, the formation is usually divided into a main body and an upper part. We placed the contact between the main body and the upper part at the base of the lowest sequence of reddish-weathering mudrock. For a more detailed treatment of this section consult Johnson, Warwick, Khan, and others (1994).

References

Johnson, E.A., and Khan, I.H., 1994a, Principal reference section for part of the Eocene Ghazij Formation, Shin Ghwazha mine area, Sor Range coal field, Balochistan, Pakistan: U.S. Geological Survey Miscellaneous Field Studies Map MF-2263-B.

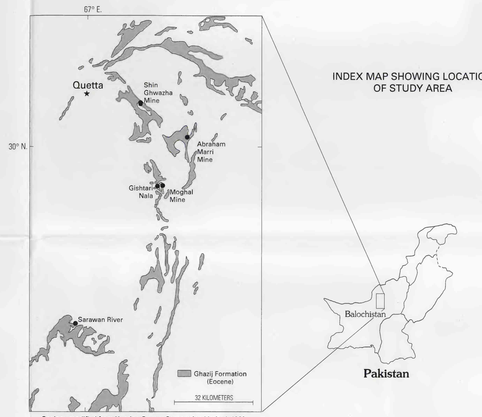
———1994b, Principal reference sections for part of the Eocene Ghazij Formation, Abraham Marri mine area, Pir Ismail Ziarat coal field, Balochistan, Pakistan: U.S. Geological Survey Miscellaneous Field Studies Map MF-2263-A.

Johnson, E.A., Warwick, P.D., Khan, I.H., and Kazim, M.A., 1994, Principal reference section of the Eocene Ghazij Formation, Moghal mine area, Mach coal field, Balochistan, Pakistan: U.S. Geological Survey Miscellaneous Field Studies Map MF-2263-D.

Johnson, E.A., Warwick, P.D., Khan, I.H., Rana, A.N., and Kazim, M.A., 1994, Principal reference section of part of the Eocene Ghazij Formation, Sarawan River, Johan coal field, Balochistan, Pakistan: U.S. Geological Survey Miscellaneous Field Studies Map MF-2263-E.

Warwick, P.D., Johnson, E.A., Khan, I.H., and Kazim, M.A., 1994, Principal reference section for part of the Eocene Ghazij Formation, Gishtari Nala area, Mach coal field, Balochistan, Pakistan: U.S. Geological Survey Miscellaneous Field Studies Map MF-2263-C.

Enlarged version of the scaled horizontal line that appears at the base of the first column of each stratigraphic section. Grain size generally increases to the right forming a crude erosional profile. Mudrock (**mudrk**) includes shale, mudstone, and 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, "**feest**" for feenstone, and "**ls**" for limestone. Some of the lithologies shown on the horizontal scale might not be present in the section because they are not found in the area. Those parts of columns that lack data represent covered intervals



INDEX MAP SHOWING LOCATION OF STUDY AREA

Geology modified from Hunting Survey Corporation Limited, 1960

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1999

PRINCIPAL REFERENCE SECTIONS OF THE LOWER EOCENE GHAZIJ FORMATION, BALOCHISTAN, PAKISTAN

By
Edward A. Johnson
1999

Printed on recycled paper

USGS
science for a changing world