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# Lithostratighrapy of the Kurram Group rocks along Mirali-Miran Shah road, North Waziristan Agency, NWFP, Pakistan

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ABSTRACT: *This study focuses on the identification and description of a thick Mesozoic sequence exposed along Mirali-Miran Shah road in North Waziristan Agency, previously named as Kurram Group. The detailed field investigation have resulted in establishing six distinct lithostratigraphic units, ranging in age from Late Triassic to Late Cretaceous with dominant lithologies being limestone, sandstone, shale, and siltstone. The oldest rocks i.e. Triassic of the area is named as Spalga Formation. The contact between the Triassic and base of the Jurassic is marked by a thrust fault in the entire mapped area. The Jurassic rocks are represented by a thick sequence of limestone and shale, which are divisible into two formations named as Sarobi Formation and Isha Formation. These rocks are disconformably overlain by the Cretaceous sequence, which includes Chashmai Kharsai Formation, Marsi Khel Formation and Zerghar Formation. Except the Triassic, all the rock assemblages have yielded fossils of their respective age. The fauna and lithology of the area is broadly correlative with the Mesozoic rocks of Samana- Kohat area towards north and Baluchistan Province in the south.*

## INTRODUCTION

The study area includes a part of the North Waziristan Agency along the Mirali-Miran Shah road and encompasses 273 $Km^2$ areas. It lies between Latitudes 32°53' 30" N to 33° 01' 30" N and longitudes 70° 00' 00" E to 70° 15' 00" E (Fig.1) and is underlain by a thick sedimentary succession of Mesozoic rocks previously named as Kurram Group (Meissner et al., 1975).

The first geological observations in the North Waziristan Agency can be attributed to Stuart (1922), who for the first time reported the presence of Jurassic and Cretaceous rocks in the area. Fatmi and Khan (1966) named the Mesozoic rock of the Orakzai Agency and Waziristan Agency as Kurram Group. Hemphil and Kidwai (1973), for the first time put the rocks of Waziristan area in chronological order, with excellent columnar sections and faunal description of the region. Miessner et al. (1975) prepared a geological map of the Parachinar Quadrangle and named the Mesozoic rocks of the area as Kurram Group. Beck et al. (1995,1996) prepared regional sketch map of the area from landsat images and have mentioned the presence of the Mesozoic rocks in the region. This study aims to describe the stratigraphy of the Kurram Group rocks in detail.

## STRATIGRAPHIC FRAMEWORK

Six lithostratigraphic units have been identified and mapped in the area, ranging in age from Late Triassic to Late Cretaceous (Fig. 2). The base of this sequence is marked by an alternate sandstone and shale succession of Late Triassic age. The Triassic rocks have a faulted contact with the

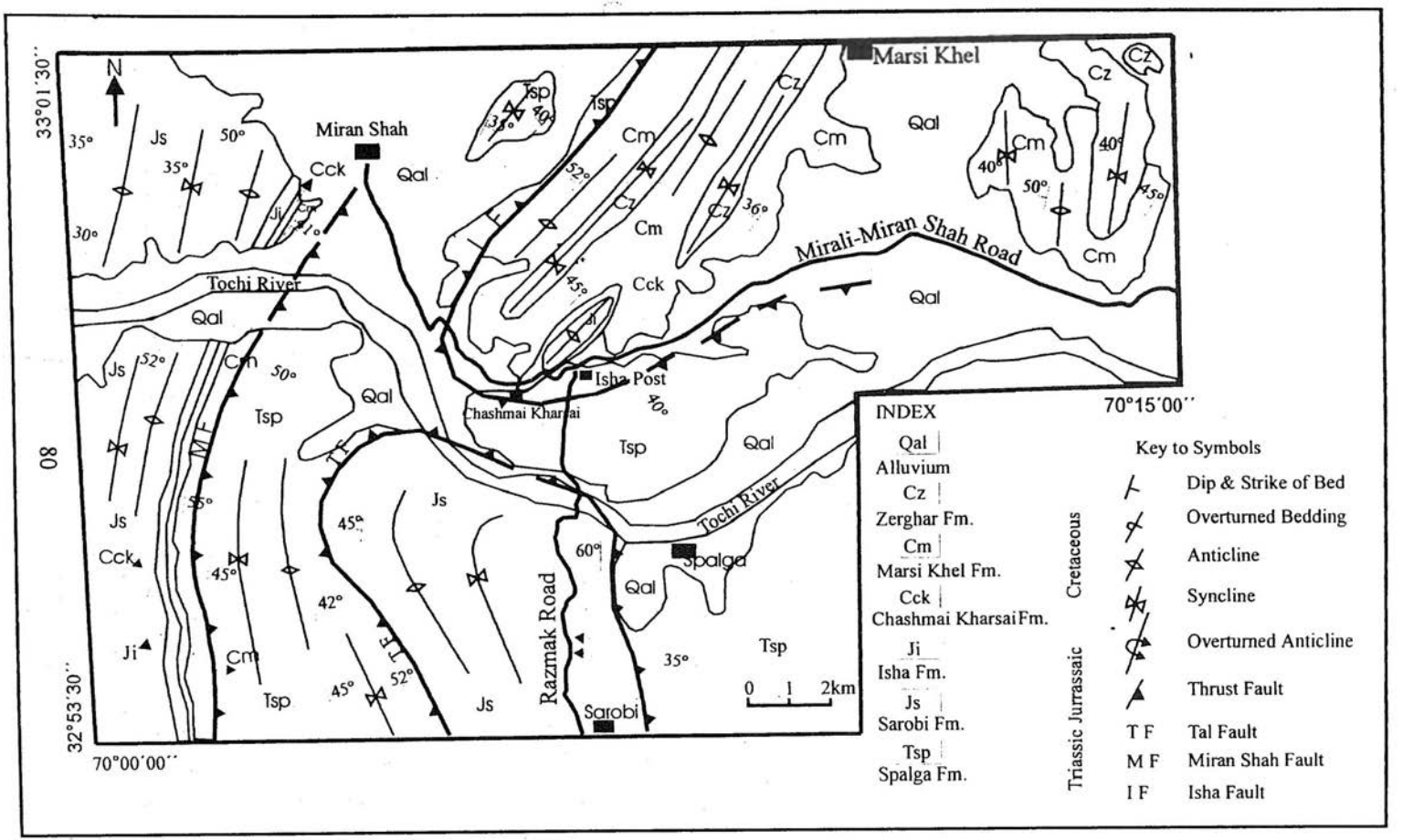


Fig. 1. Geological map of North Waziristan Agency along Mirali-Miran Shah road, N.W.F.P, Pakistan.

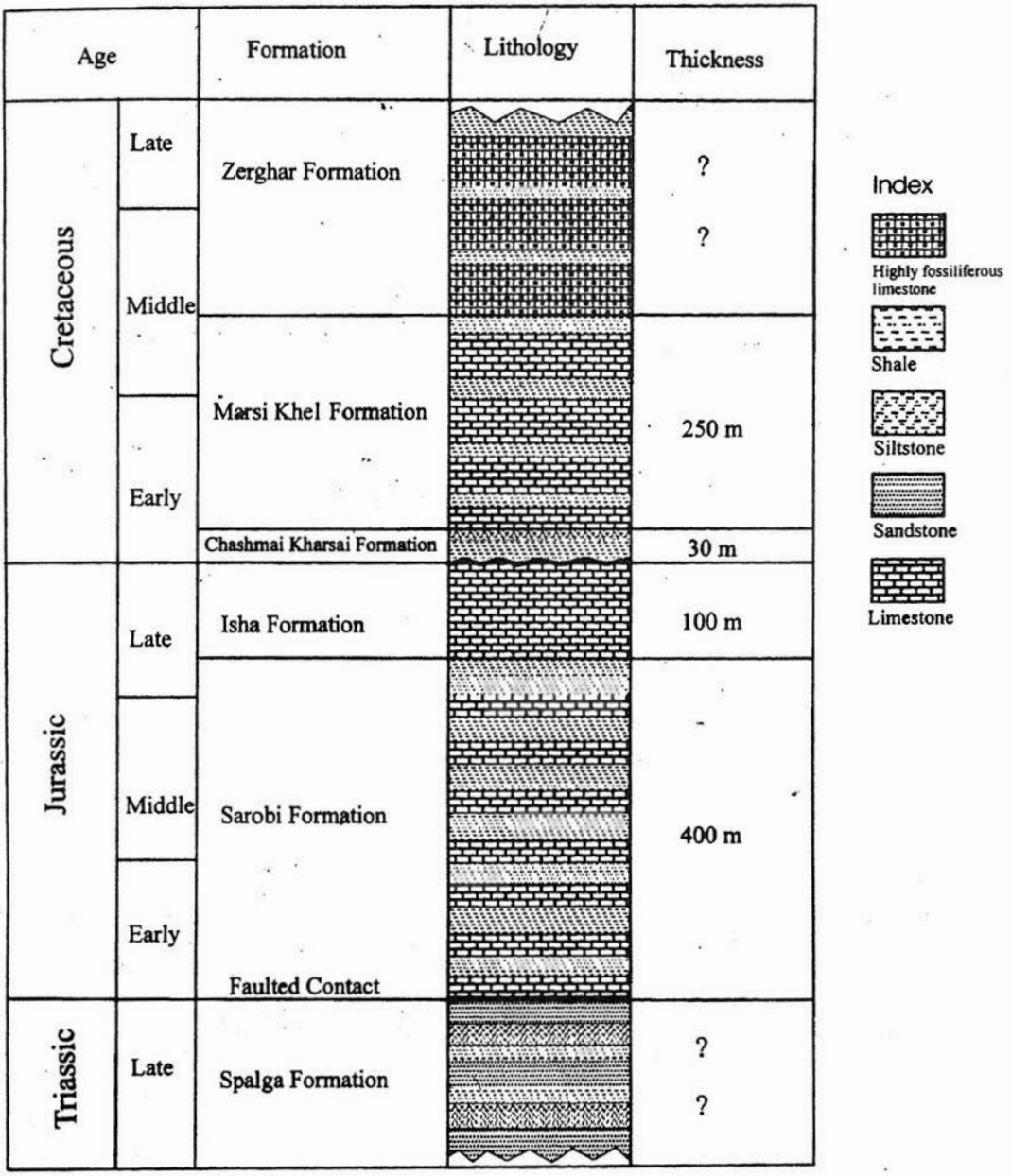


Fig. 2. Composite stratigraphic column of the study area.

overlying Jurassic sequence, which is represented by a thick succession of limestone, and alternating shale. The upper boundary of the Jurassic sequence is disconformably overlain by Cretaceous succession of belemnite rich shale and fossiliferous limestone. All these lithologies are arranged chronologically and new formational names are assigned to the rocks after local villages.

## TRIASSIC SEQUENCE

A thick sandstone and shale sequence mark the base of Mesozoic strata along the Mirali-Miran Shah road and lies in the form of a large overthrust sheet above the younger rocks underneath (Fig.1). This sequence is named as Spalga Formation.

### Spalga Formation

The name Spalga Formation is introduced herein for a sequence of sandstone and shale exposed near the village Spalga which is 17 Km southeast of Miran Shah and lies between Latitude 32° 55' 45" N, and Longitude 70° 07' 45" E.

Lithologically, the formation mainly consists of sandstone, siltstone, and shale. The sandstone is light to dark gray on fresh surfaces and weather to rusty brown color. It is fine to medium-grained, thin to medium-bedded and exhibits circular rims, due to color variation called as lisengang. Slump structure and worms burrows are commonly found in the sandstone beds. The shale is greenish gray and weathers to brownish gray with well-developed fissility palnes. The silt stone is greenish gray to dark gray on fresh surfaces and weathers to rusty brown in color. It is fine grained and occurs as thin interbeds within the sandstone beds. The thickness of the formation is not known because its base is not exposed in the investigated area. The lower contact of the formation is not exposed in the investigated area while its upper contact with the Sarobi Formation is faulted (Fig.1).

Lithologically it bears some similarities with the middle unit of the Wulgai Formation of the axial belt, which consists of interbedded shale, limestone and sandstone. It can also be correlated with the Datta Formation exposed in Kohat -Samana area, which consists of interbedded shale, sandstone and limestone (Table 1). No fossils have been found in the formation. However, Triassic age is assigned to the formation based on its stratigraphic position and lithological similarities with the Late Triassic rocks in the Baluchistan Province.

## JURASSIC SEQUENCE

The Jurassic rocks of North Waziristan Agency are present in the area between Sarobi and Isha, ranging in age from Early to Middle Jurassic (Fig.1). These rocks are arranged chronologically as under;

### Sarobi Formation

The name Sarobi Formation is given to an alternating sequence of limestone and shale, which is exposed north of Sarobi village along Isha-Razmak road about 35-Km southeast of Miran Shah town. The Sarobi village lies between latitude 32° 54' 20" N and Longitudes 70° 06' 35" E (Fig.1).

In the type locality, the formation consists of thin to thick-bedded limestone and shale. The lower part of the formation is predominately limestone, while the upper part is shale. The limestone is thin-bedded, micritic and gray to dark gray on fresh surface, weathering to brownish gray color. However, at some places the formation consists of medium to thick-bedded limestone with shale. This limestone is also micritic and light gray to dark gray on fresh surfaces and

weathers to yellowish brown colour. Towards the top, the limestone lithology is dominated over the shale. Generally the limestone is very hard and forms ridges throughout the study area. It is finely crystalline to fairly coarse-grained, with shelly, oolitic, pellitic, and pisolitic interbeds . It also contains numerous calcite veins. The shale is flaky, slaty, splintery, papery and black on fresh surfaces and weathers to greenish gray, dark gray brownish gray colors. The thickness of the formation at its type locality is found to be 400 meters. It has a thrust contact with the underlying Spalga Formation, whereas its upper contact is gradational with Isha Formation and is marked by a change of intercalation of thin - bedded limestone and shale to a thick-bedded limestone horizon.

On the basis of lithology, stratigraphic position and fauna, it can be correlated with Spingwar and Loralai member of the Early to Middle Jurassic Shirinab Formation in axial belt of Baluchistan Province and Shinwari Formation of the Samana and Kohat area in the north (Table 1). The formation has yielded bivalves, crinoids, belemnites, gastropods, bryozons and corals (Tabular Corals). Based on fauna Early to Middle Jurassic age is assigned to the formation.

**Isha Formation**

The name Isha Formation is introduced here in for a limestone sequence well exposed at the Check post named Isha which lies 8.5 Km east of Miran Shah at the junction of Razmak-Miran Shah road along the Mirali-Miran Shah road. The type locality lies between Latitude 32° 58' 14" N, Longitude 70° 06' 18" E.

The Formation typically consists of massive - to thick - bedded limestone with minor shale intercalations. At the type section, it is mostly dark gray to blue and weathers to light gray and to brownish colors. The limestone is thin to thick-bedded, hard and contains some secondary calcite veins and chert nodules. In addition it consists of coated grains such as ooids, pisolite and pellets. Its texture varies from fine-grained, sub-lithographic to oolitic, reefoid and shelly. The limestone gives fetid smell. Due to its hardness the limestone forms high ridges throughout the surveyed area. In upper parts the limestone is fairly jointed, fractured and numerous calcite veins are formed in these joints and fracture zones. The thickness of the formation at the type locality is 100 meters. It has gradational contact with underlying Sarobi Formation, while its upper contact with Chashmai Kharsai Formation is disconformable.

It can be correlated with the Chilton Limestone of Sulaiman and Kirthar Ranges and axial belt on the basis of lithology and fauna. It is also correlative with the Samana Suk Formation of the Samana - Kohat area on the basis of fauna and lithology. The fossils found within the formation are mainly beleminite, algae, corals, orbidites, bryozones, brachiopods, crinoides and fragments of mollusks. On the basis of fauna Middle to Late Jurassic age has been assigned to the formation.

## CRETACEOUS SEQUENCE

The Cretaceous rocks of the area are divided into three formations namely Chashmai Kharsai Formation, Marsi Khel Formation and Zerghar Formation.

**Chashmai Kharsai Formation**

The name Chashmai Kharsai Formation has been given to the belemnite-rich shaley horizon above the Isha Formation. The type locality i.e. Chashmai Kharsai lies between Latitude 32° 58' 36" N, and Longitude 70° 05' 30" E, along Mirali-Miran Shah road.

It is dominantly composed of shale, which is dark green to grey on fresh surface while weathers to rusty brown with purple tint. It contains alteration of harder and softer shale with phosphatic nodules commonly present. At places, glauconatic sandy layers are also observed. The shale is highly fossiliferous and is full of the Belemnites. The thickness measured at the type locality is 30 meters. It has disconformable contact with the underlying Isha Formation and grades into the overlying Marsi Khel Formation.

Based on the belemnitic fauna and lithology, it can be correlated with the Chichali Formation in the Samana-Kohat area and Sember Formation of the axial belt and the Sulaiman Kirthar province (Table 1). The formation got abundant belemnites, which suggest an Early Cretaceous age.

**Marsi Khel Formation**

The name Marsi Khel Formation is assigned to an alternate succession of belemnitic shale and limestone, best exposed near Marsi Khel village in North Waziristan which lies between Latitude 33° 02' 30" N, and Longitude 70° 10' 30" E.

It consists of light gray to dark gray, thin to medium bedded limestone and greenish gray shale. In the lower portion the limestone is micritic and arenaceous at places. Ferruginous and calcareous sandstone is also present near the base. Within the limestone alternate layers of light green shale are present. The shale is rich in belemnites. The formation is found to be 250 meters thick at the type locality. It has conformable contact with the underlying Chashmai Kharsai Formation and the overlying Zerghar Formation in the area of investigation.

The formation can be correlated with the Goru Formation of axial belt Sulaiman and Kirthar province on the basis of fauna and lithologic characters. It can also be correlated with the Lumshiwal Formation of the Samana - Kohat area on the basis of its stratigraphic position, however there is considerable facies variation between the two formations (Table. 1). The Marsi Khel Formation has abundant belmenites and also contains Forams. The age assigned to the formation is Early to Middle Cretaceous.

**Zerghar Formation**

The term Zerghar Formation is introduced herein for a limestone sequence after the name of Zerghar mountain, located about 5-6 Km northeast of Miran Shah town. It lies between Latitude 32° 59' 41" N, Longitude 70° 08' 22" E.

At the type locality the formation mainly consists of limestone and subordinate shale. The formation is mainly limestone and varies in color from brown to yellowish grey on fresh surface and on weathered surface it is dull brown. The yellowish coloration is because of the presence of iron oxide. It is fine-grained and thin to thick-bedded. On weathered surface it gives a petted appearance while on broken surface the impurities of iron oxide are visible as cementing materials. The limestone is highly fossiliferous and worm burrows are also present. The shale also contains belemnites and is greenish gray to rusty brown in color. Bouctherchop weathering phenomenon is common in the limestone. The thickness is not known because its upper contact is not exposed in the investigated area. Its lower contact with the underlying Marsi Khel Formation is conformable while its upper contact is not exposed.

It can be correlated with Fort Munro Formation of Kirthar and Sulaiman ranges on the basis of lithology and stratigraphic position. It can be correlated with the Kawaghar Formation of the Samana-Kohat

area on the basis of its stratigraphic position and fauna (Table 1). The formation is highly fossiliferous and contains fossils like corals, algae, formonefera, bryozones, belmenites, gastropods, brachiopods and fragments of mollusks. On the basis of the above-mentioned fossils Middle to Late cretaceous age is assigned to formation.

TABLE 1. CORRELATION OF THE MESOZOIC ROCKS OF NORTH WAZIRISTAN AGENCY WITH AXIAL BELT, SULAIMAN-KIRTHAR PROVINCE & SAMANA-KOHAT AREA

| Age | Lithology | North Waziristan | Axial belt | Sulaiman–Kirthar Province | Samana–Kohat |
|---|---|---|---|---|---|
| Middle to Late Cretaceous | Yellowish gray, fossiliferous, thin to medium-bedded limestone | Zerghar Formation | | Fort Munro Formation | Kawaghar Formation |
| Early to Middle Cretaceous | Light gray, thin to medium-bedded limestone with dark green shale interbeds | Marsi Khel Formation | | Goru Formation | Lumshiwal Formation |
| Late Jurassic to Early Cretaceous | Greenish gray, belemnitic shale with thin glauconitic sandy layers | Chashmai Kharsai Formation | | Sember Formation | Chichali Formation |
| Early to Middle Jurassic | Light gray to dark gray,. thick bedded to massive, fine grained, fossiliferous limestone | Isha Formation | Chilton Formation | | Samana Suk Formation |
| Early Jurassic | Gray, Flaggy limestone interbedded with dark green shale | Sarobi Formation | Spingwar and Loralai member of Shirinab Formation | | Shinwari Formation |
| Late Triassic | Gray to dark gray thick-bedded sandstone interbedded with greenish gray to dark gray shale and greenish gray siltstone | Spalga Formation | Wulgai Formation | | Datta Formation |

## CONCLUSIONS

The Mesozoic Kurram Group strata of North Waziristan Agency are dominantly composed of limestone, shale and sandstone. Six distinctive formations can be recognized and easily utilized by the field geologist. Except Triassic, the rest of the rocks yielded fauna, which shows an age range from Early Jurassic to Late Cretaceous. The Late Triassic age is tentatively assigned to the sandstone and shale sequence, which lies in the form of overthrust sheet above the Jurassic and Cretaceous strata of the region.

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