A GEOLOGICAL TRAVERSE THROUGH TIRAH, KHYBER AGENCY, N.W.F.P., PAKISTAN

R. A. Khan Tahirkheli, M. Qasim Jan, Ihsanullah Mian

ABSTRACT

This short paper presents the results of a geological traverse conducted through the northern part of Tirah in Khyber Agency during the last week of July, 1971. *The rocks encountered between Lala China and the Rajgal area are, Lala China Slaty-shales, Chura Kandao Limestone, Walai Limestone, China Limestone, Spinkai Limestone, Mughalbagh Shales, Paleocene Limestone and Murree sandstones and shales; the latter two units are well developed in the Bara and Rajgal valleys, west of Bazar.*

The Palaeozoic sequences, besides Lala China and Chura Kandao (Khyber Pass), were encountered at two places; in a Khwar about 3 *miles upstream of Mughalbagh and in Baraghat nala in the Rajgal area. Four differentiable mapable units from bottom to top are; Lwarai Mela Limestone, Baraghat Slate, Barai Quartzite and Spinkai Limestone, which have been placed as members of the Rajgal Formation.*

Acid igneous intrusions consisting of granite and granite-gneiss with pegmatite and aplite veins lie in contact with the upper part of Spinkai Limestone. Graphite mineralization occurs in the granite and granite-gneiss near the contact of the Spinkai Limestone.

INTRODUCTION

A graphite occurrence, with over forty percent fixed carbon, was reported from the Rajgal area of Tirah. This was the second commercial grade graphite find in Pakistan, the first one being that of Azad Kashmir.

To collect more geological informations, the authors, made a traverse through the northern valleys of the Tirah Territory to reach the graphite deposit; a considerable part of which, so far, has remained unmapped.

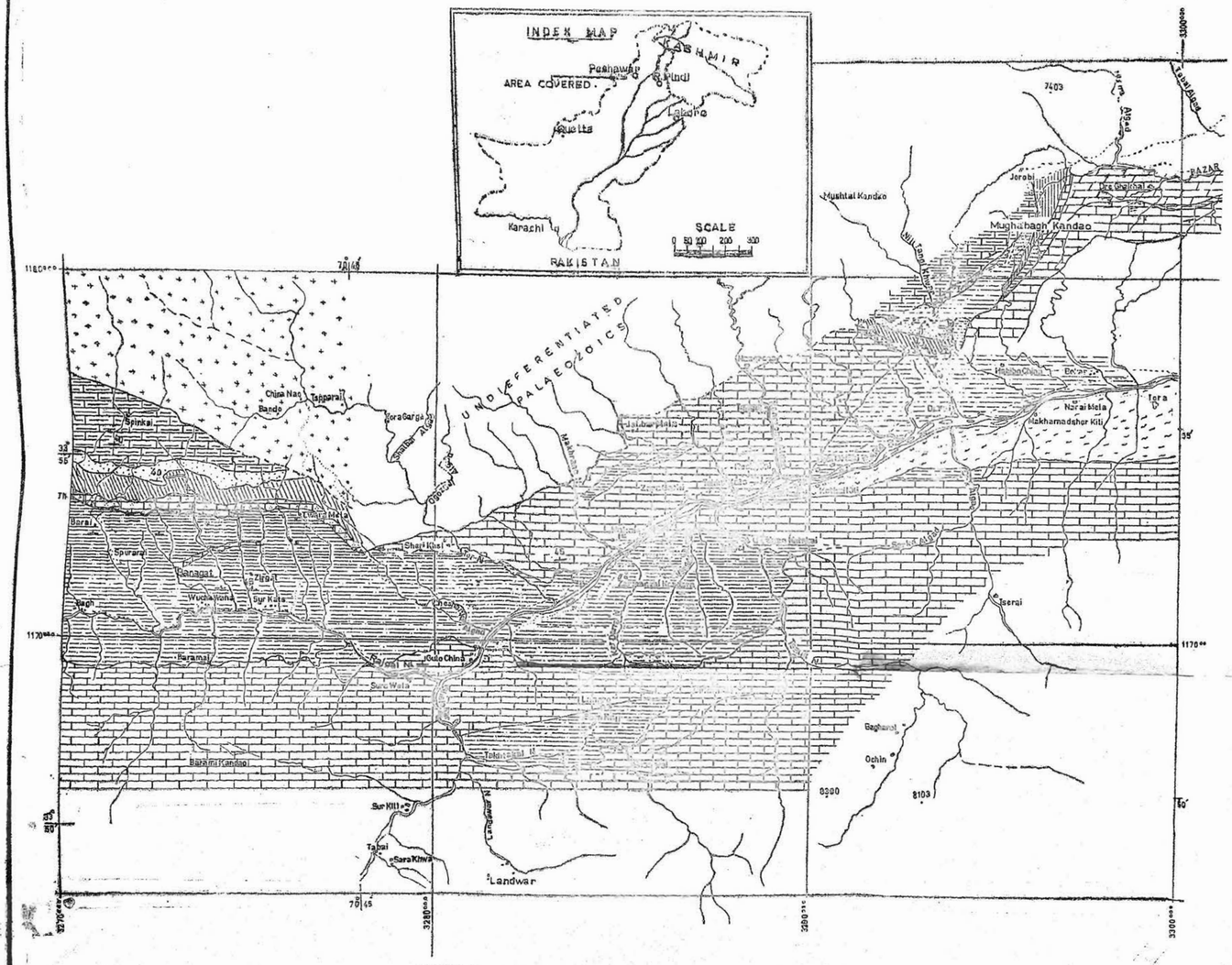
A report (Tahirkheli *et al.*, 1971) on the graphite deposit has already been published. This paper is intended firstly, to introduce the geology of the traverse-route, which was cursorily examined, and secondly to describe in detail the Palaeozoic section of the Rajgal area for correlation purpose.

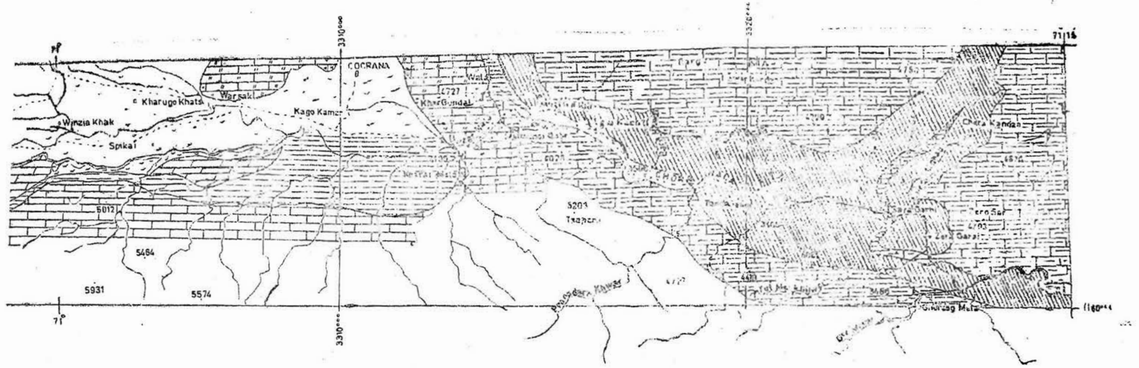
Traverse-route.

The traverse was started from Lala-China village, a small hamlet located at about two miles east of the Shaghai Fort in the Khyber Agency. After crossing Chura Kandao, 3600 feet elevation, the party descended to the Bara Valley which runs roughly in an east-west direction. Beyond Chura the valley was followed upstream for about six miles.

Near Kharai Mela, the party had cut a short detour towards north and ascended the Bazar plain which is thirty to fifty feet high from the Bara bed. This plain is vast and extensive, stretching east-west between Bara river flowing towards the south and its northern extension touching the steep slopes of the tall mountains. The Bazar plain is dry and desolate due to dearth of water. The inhabition is sporadic and except a few small isolated springs, the majority of the population depends upon impounded rain water.

Beyond Bazar the traverse-route was along a pony track which cuts across low rugged hills along the northern bank of the Bara river. East of Darai village the party again descended to the Bara valley. The valley is wide here and agriculturally very produtcive. This valley was followed upstream and after crossing the river at a point downstream of the confluence of Shalobar and Rajgal nalas, the traverse-route was continued upstream along the northern bank of the Rajgal nala till Baraghat village. From this village the graphite-





EXPLANATION

- ALLUVIUM
- MURREE FORMATION
- PALEOCENE LIMESTONE
- MOGHALBAGH SHALES
- CHINA LIMESTONE
- WALAI LIMESTONE
- CHURA KANDAO (SPINKAI) LIMESTONE
- LALA CHINA SLATY-SHALES
- 45 DIP AND STRKE
- BARAGHAT SECTION (PALAEOZOIC)
- GRANITE GNEISS

SCALE

Furlongs 8 6 4 2 0 1 2 3 Miles

GEOLOGICAL TRAVERSE THROUGH TIRAH, KHYBER AGENCY, N.W.F.P. PAKISTAN

occurrence is located near Spinkai village about six miles towards north.

This traverse had enabled the party to bring within the fold of geological investigation a terrain over sixty miles deep into the Tirah Territory, a considerable part of which, beyond Bazar plain, had remained unexplored.

Previous Work:

Among the old workers who covered part of the Tirah territory as members of the British Expeditions during pre-independence period are Griesbach (1891) and Hayden (1897), both belonging to the Geological Survey of India. Both of the geologists concentrated more in the southern part of Tirah. Hayden has also thrown light on the rock exposed around Bazar and Chura.

Besides, some reports have been published by the army personnel during the British time which generally focus upon the geomorphology of the terrain. Except Hayden's report on the geology of Bazar valley no other publication is available to the authors for reference.

PHYSIOGRAPHIC FEATURE

The Tirah territory constitutes about 1,600 square miles of area and is bounded by Peshawar district, Kohat district, and Khyber Agency on the east, south and north, respectively. On the west it borders Afghanistan. As Hayden has also pointed out, the Tirah territory is dominantly mountainous area and consists of four main east-west trending mountain ranges which run parallel to each other and are separated by elongated troughs, locally connected with one another by spurs. The order from south to north is:-

Samana Range
valley of Khanki River
Tsapper Range
valley of the Mastura River
Western portion of Torghar Range
Maidan and Waran valleys

Eastern portion of Torghar Range
Bara valley

Sofed Koh and Surghar Ranges

The ranges usually form steep scarps to the south and gentle slopes to the north. Their elevations range from 6000 to 13000 feet.

During this traverse the authors could make observations along the Bara valley and its tributary, Rajgal nala, and partly covered the northern and the eastern slopes of Torghar Range.

The Bara valley is fertile as plenty of water is available. Most of the agricultural activities are concentrated along the banks of the river, which are covered by thick mantle of alluvium. Terrace cultivation is also common where water is available.

GEOLOGICAL NOTES

Lala China.

Slaty Shales: A monotonous sequence of slaty shales and slates, forming flat-topped low hills are exposed between Lala China and Chura Kandao. The general strike of the rocks is east-west, which locally swings. The shales are folded into tight isoclines, dipping towards south. The slates are fine, thin-bedded, fractured and on weathering yield splintery pieces. Silty bands are common. Colour of the slaty-shales varies from light to dark grey and greenish-grey to yellowish-brown. Thin-bedded, semi-crystalline limestone pockets are also present. Dolerite sills are common.

The limestone has yielded fossils. Hayden also reported silicified remains of many corals and echinoderm. Griesbach has placed these slaty-shales in the Upper Carboniferous.

Chura Kandao.

Limestone: About a mile east of Chura Kandao, the carbonate rocks consisting of limestone and dolomitic limestone, giving a typical look of the Sirbon Limestone, developed in the vicinity of Abbottabad in Hazara, and Shakhai Formation of the Attock-Cherat

Range, overlie the Lala China slaty-shales. The contact is gradational.

The limestone is grey, yellowish-grey and yellowish-brown, thin-bedded to massive, medium to fine-textured and medium crystalline. Slaty-shale partings in the limestone are noteworthy. The Chura Kandao Limestone shows thick development in a ridge east of the Kandao and extends westward along the sky-line with a general east-west strike. Its dip is southerly and forms steep scarps facing the Khyber Pass. The limestone is fossiliferous.

The Chura Kandao Limestone is discussed in detail under Rajgal Palaeozoic section in the following pages.

Walai Limestone: The slaty-shales and the Chura Kandao Limestone extend for 4 to 5 miles upstream of Chura. In the vicinity of Walai, a thick- bedded to massive, light to dark grey, semi-crystalline and siliceous limestone is encountered which shows frequent development of red-iron staining. According to Hayden this limestone has yielded remains of numerous brachiopods and corals.

China Limestone: From Walai, after ascending the Bazar plain, an isolated hillock trending east-west and having the same strike, crops out in the middle of the plain overlooking the China village. This ridge was located off the traverse-route and thus the limestone bed could not be studied in situ. The weathered material derived form this ridge has appearance identical to Walai Limestone. Hayden has also cursorily described this limestone bed and has reported *Eumetria grandicosta* Waag., *Rhynchonella morahensis* Waag, and *Camerophoria Purdoni* Davids.

Spinkai Limestone: This limestone bed was found northeast of Spinkai village, striking east-west and dipping towards south. It is thin to thick-bedded, medium to fine-textured and semi-crystalline. Its colour ranges from light grey to bluish - green. It is fossiliferous.

Mughalbagh Shales: A dominantly shaly bed, 60-80 feet thick, overlies the Spinkai Limestone with irregular and disturbed contact. The shales are soft, friable, light-grey to greenish-grey, thinly laminated with sporadic silty bands. A thick carbonaceous bed occurs near the bottom which has been thoroughly prospected by the locals for coal. Yellowish-brown iron staining in the shales is conspicuous. The Mughalbagh Shales on the basis of lithological characteristics may be correlated with the coal-bearing Eocene Shales of the Salt Range.

Palaeozoic Rocks: A sequence of the Palaeozoic rocks cropping out in a nala about 3 miles west of Mughalbagh was encountered on the way. The sequential order from top (younger) to bottom (older) is as follows:

(iv) Light to dark grey limestone and dolomitic limestone with cherty bands and slaty-shale intercalations.

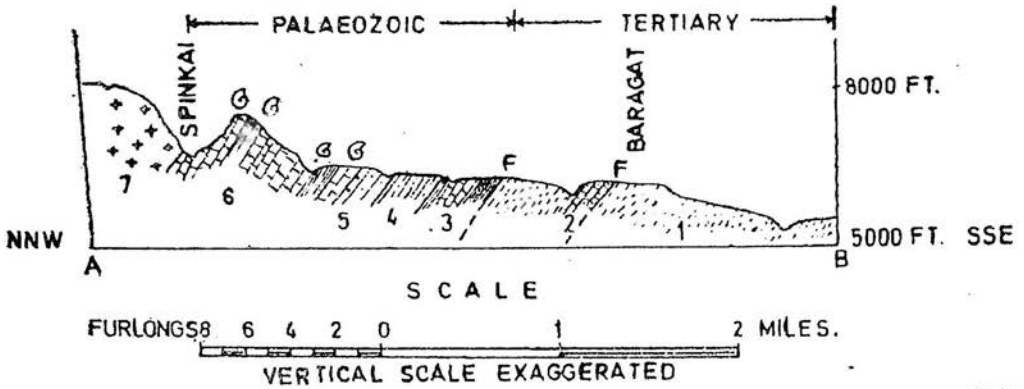
(iii) Thin to thick-bedded, medium to fine-textured quartzite with light grey and yellowish-brown hues.

(ii) Slate, phyllitic-slate and phyllite, light to dark grey and greenish-grey, thin-bedded, siliceous with occasional yellowish-brown iron staining.

(i) Yellowish-brown, argillaceous and siliceous limestone; semi-to medium-crystalline, medium to fine-textured, thin-bedded to massive with slaty-shale intercalations.

The Palaeozoic sequence in this section could not be examined in detail for want of time. More light will be thrown on the Palaeozoic rocks while discussing Rajgal Section in the subsequent pages.

Paleocene Limestone: The Paleocene Limestone was encountered in the Bara valley which extends westward with east-west strike, attaining maximum thickness in the Rajgal area. The limestone is thin to thick-bedded and nodular on weathered faces. It is light-grey to cream-coloured, semi-crystalline and contains yellowish-green friable shale partings.



GEOLOGICAL SECTION ALONG BARAGAT NALA, RAJGAL, TIRAH, KHYBER AGENCY.

L E G E N D

1. MURREE FORMATION
2. PALEOCENE LIMESTONE
3. CRYSTALLINE LIMESTONE WITH INTERBEDDED SLATE
4. SLATE AND PHYLLITE
5. QUARTZITE WITH INTERBEDDED SLATE
6. CRYSTALLINE LIMESTONE WITH INTERBEDDED SHALE
7. GRANITE AND GNEISSES

G INDICATES FOSSILS

FAZAL AHMAD

The Paleocene Limestone is fossiliferous and is correlated with the Cherat Limestone of the Attock-Cherat Range.

Murree Formation: Red, maroon, silty-shales and sandstone with concretionary band usually occur in association with the Paleocene Limestone. It shows a thrust contact with the older rocks. The Murree beds were first encountered in the upper reaches of Bara valley and attain maximum thickness in the Takhtakai mountain and in the Rajgal valley.

Rajgal Palaeozic Section: The Palaeozoic sequence of Rajgal is located in the Baraghat nala, located about eight miles upstream of the confluence of the Rajgal and Shalobar streams. The general strike of the rocks is east-west, with 45° to 55° northerly dip. The sequence is thrust faulted against the Murree Formation at the bottom and the youngest bed called Spinkai Formation has got contact with the acid igneous rocks consisting of granite and granite gneiss.

Four lithological units have been differentiated in the Palaeozoic sequence and the upper two, i.e., the Barai Quartzite and the Spinkai Formation, are fossiliferous.

The sequential order of the Palaeozoic rocks from top to bottom is as follows:

Granite, granite-gneiss and associated meta-sediments

4.	Spinkai Formation	..	300 feet
3.	Barai Quartzite	..	60 feet
2.	Baraghat Slates	..	230 feet
1.	Lwarai Mela Limestone	..	170 feet

———— Thrust ————

Murree Formation

1. Lwarai Mela Limestone is composed of two lithological units; limestone and subordinate slaty-shales.

The limestone is yellowish-brown, grey and greenish-grey, argillaceous or siliceous and thin-bedded to massive. It is medium crystalline, medium to fine-grained and usually occurs in banded form, having yellowish-brown argillaceous, and light-green and cream-coloured calcareous bands.

The associated slaty-shales are thin-bedded, fine-textured and siliceous. They are light to dark-grey, greenish-grey and locally, due to iron impregnation, show yellowish-brown and brownish-pink colouration. Near the contact with the limestone the slaty-shales become calcareous. Dolerite sills occur as intrusions.

2. Baraghat Slates consist of slate, phyllitic-slate and phyllite of light to dark-grey and greenish-grey colours. They are thin-bedded, siliceous, with conspicuous concretionary bands. They have locally developed slaty cleavage which, due to superimposed fractures, have become deformed. Thin, isolated carbonaceous bands occur near the lower horizon. Yellowish-brown calcareous pockets are associated with the slates and have sporadic distribution. Dolerite sills are noteworthy. The Baraghat Slate displays a normal contact with the underlying Lwarai Mela Limestone.

3. Barai Quartzite is white, light-grey and brown, thin to thick-bedded with medium to fine-textures. The binding material is both siliceous and argillaceous.

It has got a thickness of about 65 feet at the section examined in the upper reaches of Baraghat nala. The upper part of the Barai Quartzite, about twenty feet thick, is fossiliferous. According to Rizvi (Personal Communication, 1971), the samples examined by him are full of unsorted, probably derived calcareous fossils. Many of the fragments have been replaced by ferrogenous calcitic material. Among the fossils, tentatively identified are algae, bryozoans, corals, brachiopod fragments, and mollusks. Some fusuline foramenifers could also be identified. According to him the age of the Barai

Quartzites is Upper Palaeozoic. The Barai Quartzites have got a normal contact with the underlying Baraghat slates.

4. Spinkai Formation consists of white, cream-coloured, light to dark-grey, siliceous, dolomitic and cherty limestone with intercalated shale and slaty-shale.

The limestone is thin-bedded to massive, semi-to medium-crystalline and medium to fine-textured. The weathered surface usually shows solution channels. The argillaceous bands are 10 to 20 feet thick, thin-bedded and dominantly calcareous. At places they also contain carbonaceous pockets.

The limestone and shales are fossiliferous. According to Rizvi (1971), who examined some coralline samples from the limestone bed, the age of Spinkai Formation is probably Permian.

The Spinkai Formation is the thickest unit of the Rajgal Palaeozoic sequence and according to the order of superposition is the youngest among them. Its base with the Barai Quartzite is gradational because near the contact the quartzite shows development of calcareous material which replaces fossils. The top contact of Spinkai Formation is with the igneous mass, consisting of granite and granite-gneiss. Dolerite sills are common.

5. *Granite and granite-gneiss*: White to light-grey, medium to very coarse-textured granite and granite-gneiss are found in contact with the Spinkai Formation at the top. The contact is sharp and gneissosity is well developed in the igneous rocks. The feldspar is abundant and mica is sparce. Thin sporadic veins of aplite and pegmatite occur in association with granite. A discussion of the igneous rocks is presented by Jan (Ibid). The hydrothermal graphite mineralization is recorded very close to the contact with the Spinkai Formation (Thirkheli *et al.*, 1971).

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