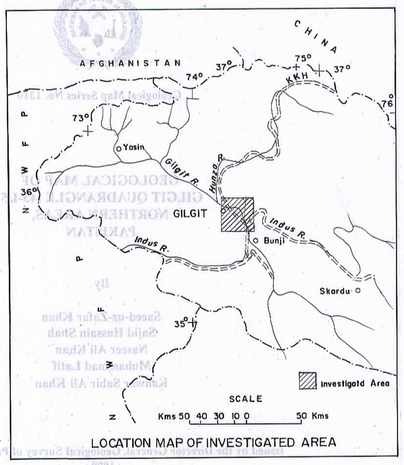
GOVERNMENT OF PAKISTAN
MINISTRY OF PETROLEUM & NATURAL RESOURCES

GEOLOGICAL SURVEY OF PAKISTAN

Geological Map Series No. 1310



LOCATION MAP OF INVESTIGATED AREA

LEGEND

QUATERNARY

Recent to Sub-recent
- Qal — Alluvium
- Qaf — Alluvial fan
- Qfp — Alluvial flood plain
- Qt — River terraces

Pleistocene
- Qm — Moraine

KOHISTAN BATHOLITH

TERTIARY

Miocene to Paleocene
- p a b — Pegmatites (p) acidic (a) & basic (b) dykes/sills
- Tkgd — Granodiorite
- Tkd — Diorite

Late Cretaceous to Early Cretaceous
- Kko — Orthogneiss

THELICHI FORMATION

Early Cretaceous
- Kts — Marble and metasediments, associated with volcanics & volcanosediments.

GREENSTONE COMPLEX

Early Cretaceous
- Kgv — Metavolcanics associated with metasediments and volcanosediments

GILGIT FORMATION

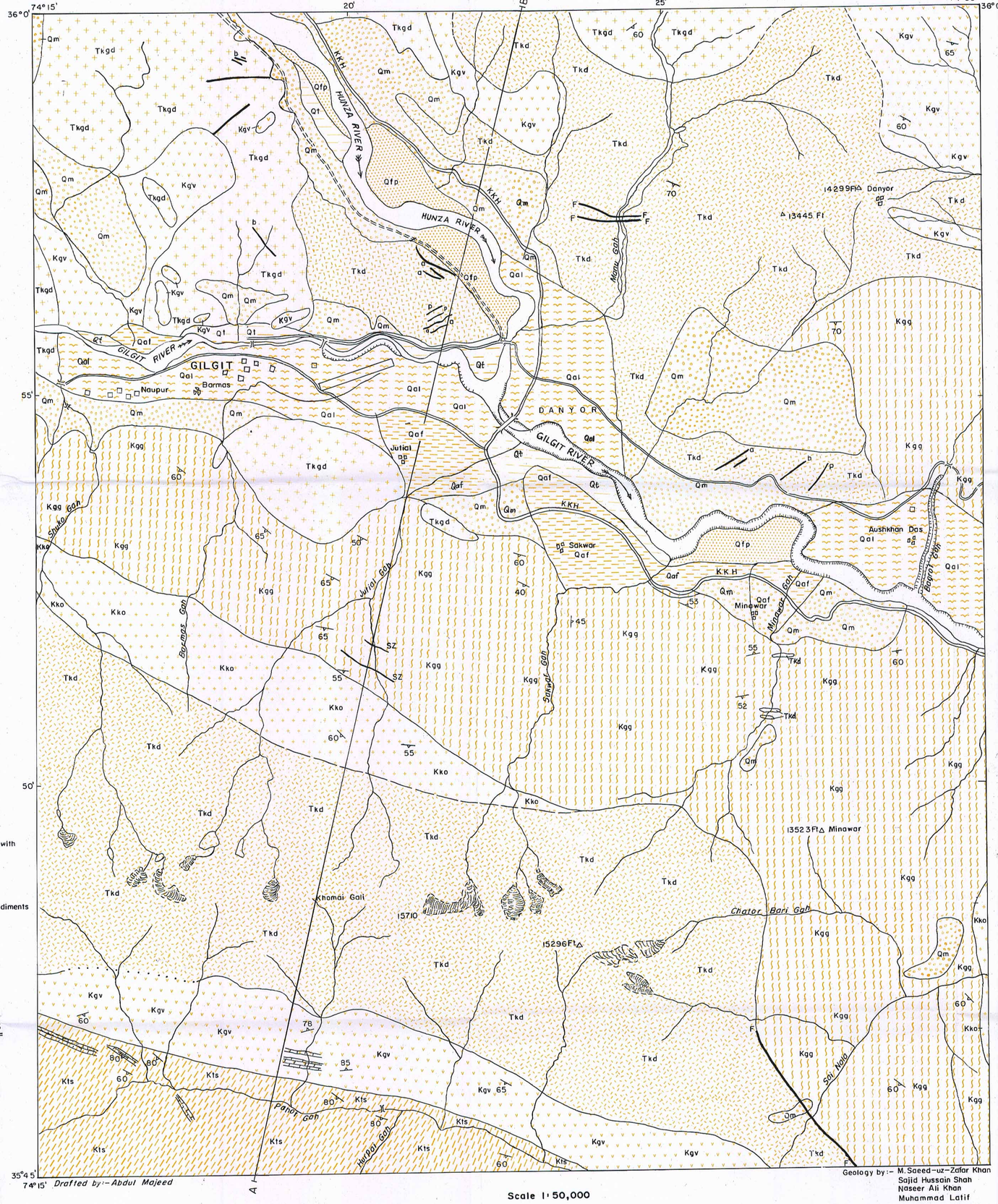
Early Cretaceous
- Kgg — Metapelites & metapsammites—schist, paragneisses & para-amphibolites (Commonly paragneisses)

GEOLOGICAL SYMBOLS

- F——F Fault
- 60 Foliation,
- Contact, dashed where probable
- A——B Cross-section line
- SZ Sulphide zone

NON-GEOLOGICAL SYMBOLS

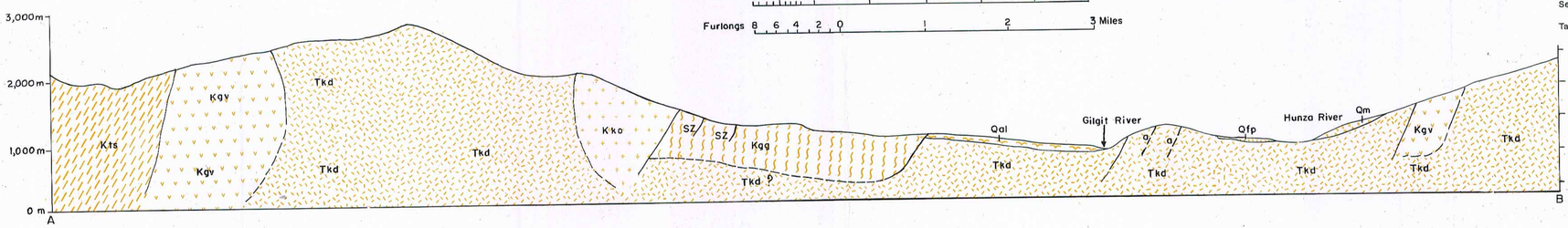
- Metalled road
- Un-metalled road
- Bridge
- River and tributaries
- Glacier
- 15710 Height in feet



Scale 1:50,000

Metres 1000 500 0 1000 2000 3000 4000 5000 Metres

Furlongs 8 6 4 2 0 2 3 Miles



GEOLOGICAL MAP OF GILGIT QUADRANGLE (43-I/5), NORTHERN AREAS, PAKISTAN.

EXPLANATION

The Gilgit quadrangle (43-I/5) comprises the Gilgit Town and its mountainous surroundings. Gilgit lies at a distance of about 600 km north of the Federal Capital Islamabad. The all-weather, Karakoram Highway (KKH), which links China and Pakistan and is the marvellous achievement of Pak-China friendship, passes through the Gilgit quadrangle. Gilgit is linked with Chitral by an un-metalled road, while with Skardu and Hunza by metalled roads.

Gilgit lies within the Kailas Range, which is bordered by the western Himalayas on the southern, and the Karakoram Range on the northern. The gradient varies from 4500' (1350 m) at Gilgit to 15710'(4713 m) at Khomar gali, south of Gilgit.

CRETACEOUS

GILGIT FORMATION

The name has been adopted by Khan et al. (1994), to the metasediments- mostly paragneisses and schists locally interstratified, occurring in the vicinity of Gilgit and between Gilgit and Jaglot. They are metapelites and metapsammites, with subordinate para-amphibolites and calc-silicate rocks and attain an approximate thickness of one km (Khan et al. 1996).

The mineral assemblage of the schists and paragneisses vary from biotite, garnet, staurolite upto kyanite and sillimanite grade. The formation is extensively exposed along the right bank of the Gilgit river, with almost steep dips towards south. The Gilgit formation occupies the core of an anticline in Sai nala near Jagot-Batkas.

The formation is conformably overlain by the Gashu volcanics of Khan et al. (1996), with the type section in the upper reaches of Sai nala. Its lower contact is not clear and probably under-platted by the Chilas Complex (Khan et al. 1994). Probable age of this formation is Early Cretaceous? (Tahseenullah, Personal communication).

GREENSTONE COMPLEX

A mixed heterogenous assemblage of metavolcanics and volcano-sediments has been named as Greenstone complex by Ivanac et al. (1956). The rocks of the Greenstone complex originated as a thick oceanic crust formed in the Tethys, between the converging Indo-Pakistan and Eurasian plates. They are the back-arc basin turbidites with metavolcanics and volcanoclasts.

The rocks of the Greenstone complex are exposed predominantly in the southern part of the quadrangle as a thin belt trending NW-SE, as well as, in the NE and NW corners of the map.

The major rock unit of the Greenstone complex is andesite, with subordinate dacite, hornblendite, greenstone and medium grained epidiorite with occasional rhyodacite and cryptocrystalline basalt. These metavolcanics are slightly metamorphosed producing sheen and foliation. The maximum epidotization and chloritization of these meta-volcanics has given green hue to the formation.

The associated volcanosediments and metasediments include semi-compact volcanic ash, tuff; marble, chlorite schist and paragneiss. They are foliated and thinly laminated. On the basis of fossil discovery in the associated sediments from the Shigar valley and Ghizar valley, this formation has been assigned an Early Cretaceous age (Tahirkheli, 1982).

THELICHI FORMATION

The Thelichi formation consists of a sequence of metasediments, volcanics and volcanosediments. The formation consist of interbedded slate, phyllite, quartzite, semicrystalline limestone, marble, graphitic schist, mica schist, basal conglomerate, associated with greenschist, andesites, rhyodacite, basalt, tuff, tuffaceous slate and agglomerate. Its type section at Thelichi, is marked by a plunging syncline in the marble unit, and extend along the strike towards NW, across the Damot gah, Sai nala, Shinghal gah and Chelili gah (out of map). The eastern extension of the Thelichi formation is cut by the Main Mantle Thrust (MMT), which has influenced its structure. The metasedimentary rock assemblage reflect the turbidite origin. Thick bedded marble occur, in the middle part of the formation. It is exposed in the core of the Jaglot syncline, and is stratigraphically younger than the Gilgit formation.

Khan et al. (1996) assigned a late Early Cretaceous age to this formation.

KOHISTAN BATHOLITH (1 PHASE)

Ladakh granodiorite (Bakr, 1965), and Kohsitan-Ladakh granitic belt (Jan et al. 1981) had been redesignated by Petterson et al. (1985) as the Kohistan batholith, because of its presence in the Kohistan island arc sequence.

These granitoids, covering maximum part of the island arc, intruded during Late Cretaceous to Oligocene and even Miocene, in three different episodes viz. I- Phase: deformed diorites from late Early Cretaceous to early Late Cretaceous; II-phase: HB-gabbro to granite from Paleocene to Eocene; and III phase: dykes and leucogranite from Oligocene to Miocene Petterson & Windley, 1985). The Kohistan-Ladakh batholith is the northwestern component of the Trans-Himalayan Batholith, extending for more than 2700 km along the Himalaya and Karakoram (Petterson and Windley, 1985).

Orthogneiss

Small bodies of orthogneiss are located along the Sai nala and as elongated body towards the upper reaches of the Gilgit river tributaries. It is grantic in composition, whitish to light grey, coarse grained, banded and contains screens, xenoliths, pods and thin linings of dark grey, fine grained amphibolite. The mineral contents are quartz, feldspar, biotite and minor garnet.

TERTIARY

KOHISTAN BATHOLITH (II & III PHASE)

Granodiorite

Granodiorite is the most predominant rock unit of the Kohistan batholith. It is mainly a hornblende-biotite granodiorite with lesser quartz-monzonite. Ferromagnesium minerals are variable in quantity at different places. Xenoliths of the adjacent country rock, mostly the metasediments, commonly occur in the marginal portion of this intrusive body. Exfoliation and spheroidal weathering are common.

Diorite

Diorite ranks the second major rock unit of the batholith. It is developed in the main granodiorite body at the marginal portions which are in contact with the metasediments. The diorite has variations of quartz diorite and hornblende diorite. The gneissic structure in diorite caused the development of hornblende gneiss.

Dykes and Pegmatites

The felsic and mafic dykes, belonging to the III-phase of Petterson and Windley (1985), traverse the whole area, but mostly confined in the outcrops between the Hunza and the Gilgit rivers. They are irregular lenticular bodies and veins of leucogranite, pegmatites, mafic dykes and only rarely hornblendites. These injected bodies are present throughout the area, but dominantly developed near marginal portion of the batholith. The leucogranite dykes are light grey to white, medium grained and inter-mixed with pegmatites and undifferentiated from a distance.

The pegmatites are mostly the simple type, granitic in composition and composed of quartz, k-feldspar, with minor biotite/muscovite and tourmaline. Quartz veins commonly traverse the investigated area.

QUATERNARY

Moraine, tillite and loose glaciofluvial deposits with multidimensional debris are widespread along the valleys. These at high altitudes are semi-consolidated, while those lying at low altitudes along the river banks are loose and scattered.

Alluvium in vast alluvial fans and flood plain deposits are quite prominent along the major valleys. Alluvial fans at Jutial, Sakwar and Danyor show outstanding features of denudation.

Alluvium over the Quaternary deposits is widespread and fertile for agricultural purposes.

TECTONIC SET-UP

During the late Paleozoic (300 to 250 Ma), the greater super continent-the Pangaea began to break up with several smaller plates and these plates started drifting (Searle, 1991). The Indian plate started its northward movement from the Gondwana super continent in Cretaceous, and a new ocean-Tethys was created. The drifting velocity rapidly increased at rate of 15-20 cm during Late Cretaceous and finally collision with the Eurasian continental mass took place during Early Eocene e.g. approx. 50 Ma ago with the closure of the Tethys sea (Searle, 1991).

The intraoceanic Kohistan-Ladakh island arc was formed due to northward subduction of the Neo-Tethyan oceanic lithosphere (Khan et al., 1996). At present it is squeezed between the Karakorarn-Asian and the Indian continental plates and the resulting contacts marked by the megashears - the Main Mantle Thrust in south and the Main Karakoram Thrust in north.

The back - arc basin turbidites (Khan et al., 1996), amphibolite and calc-silicate marble associated with metavolcanics and volcanoclastics of Jurassic (?) to Cretaceous periods were subsequently intruded by multiphase granitoid plutonic activity during Late Cretaceous to Oligocene and even Miocene (Petterson & Windley, 1985).

Structurally, the investigated area is not much complicated and represent probably the limb of the Gilgit anticline (?) with generally a parallel trend of the formations dipping towards south.

ECONOMIC POTENTIAL

The investigated area seems to be economically poor, except for some placer gold washing activity along the Indus, the Gilgit and the Hunza rivers; occurrence of some sulphide deposits in Bagrot valley and Manu gah; and presence of thin marble beds in the Sai nala.

Gold washing has been carried out from the major river beds between Gilgit an Thelichi, since time memorial. Gold potentials of the Gilgit and Hunza rivers was investigated by the Geological Survey of Pakistan (1974) and the Austrominerals and found to be low, with association of uraninite and pyrite. Austrominerals located bed rock sources of gold in Bagrot area, with quartz-carbonate veins and skarns, usually in areas of extensive limonitization (Searle, 1991).

Pyrite veins occur in Jutial gah. Malachite and chalcopyrite showings are present in Manu gah and Jutial gah. Thin white to cream coloured marble beds occur in the Sai nala, but are uneconomical to be transported to roadside.

The building material-sand, gravel, silt and clay are widespread along the river beds, as well as, in the alluvial fans and flood plain deposits.

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