

LEGEND

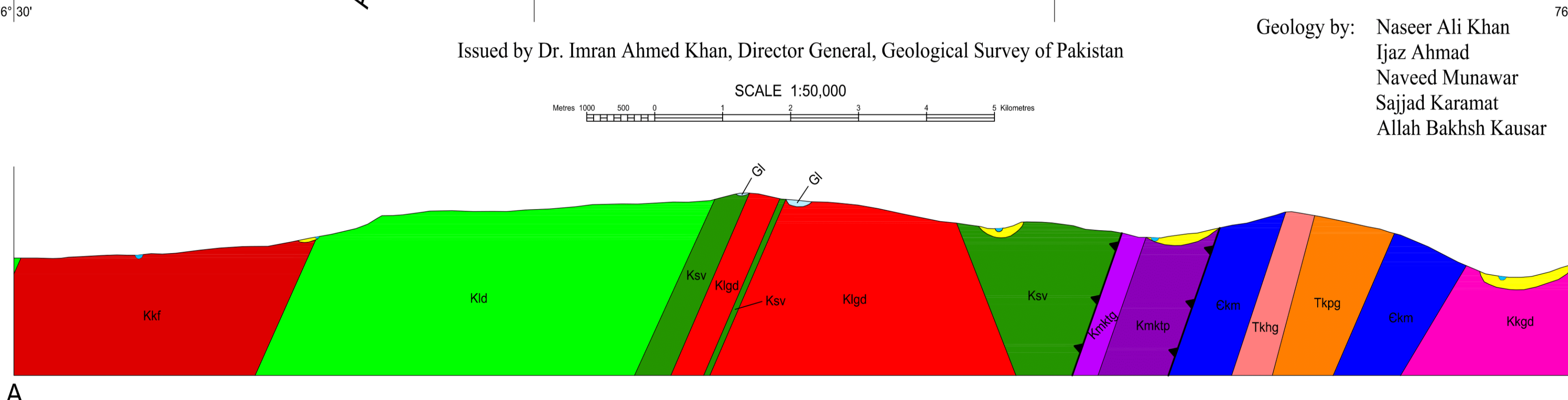
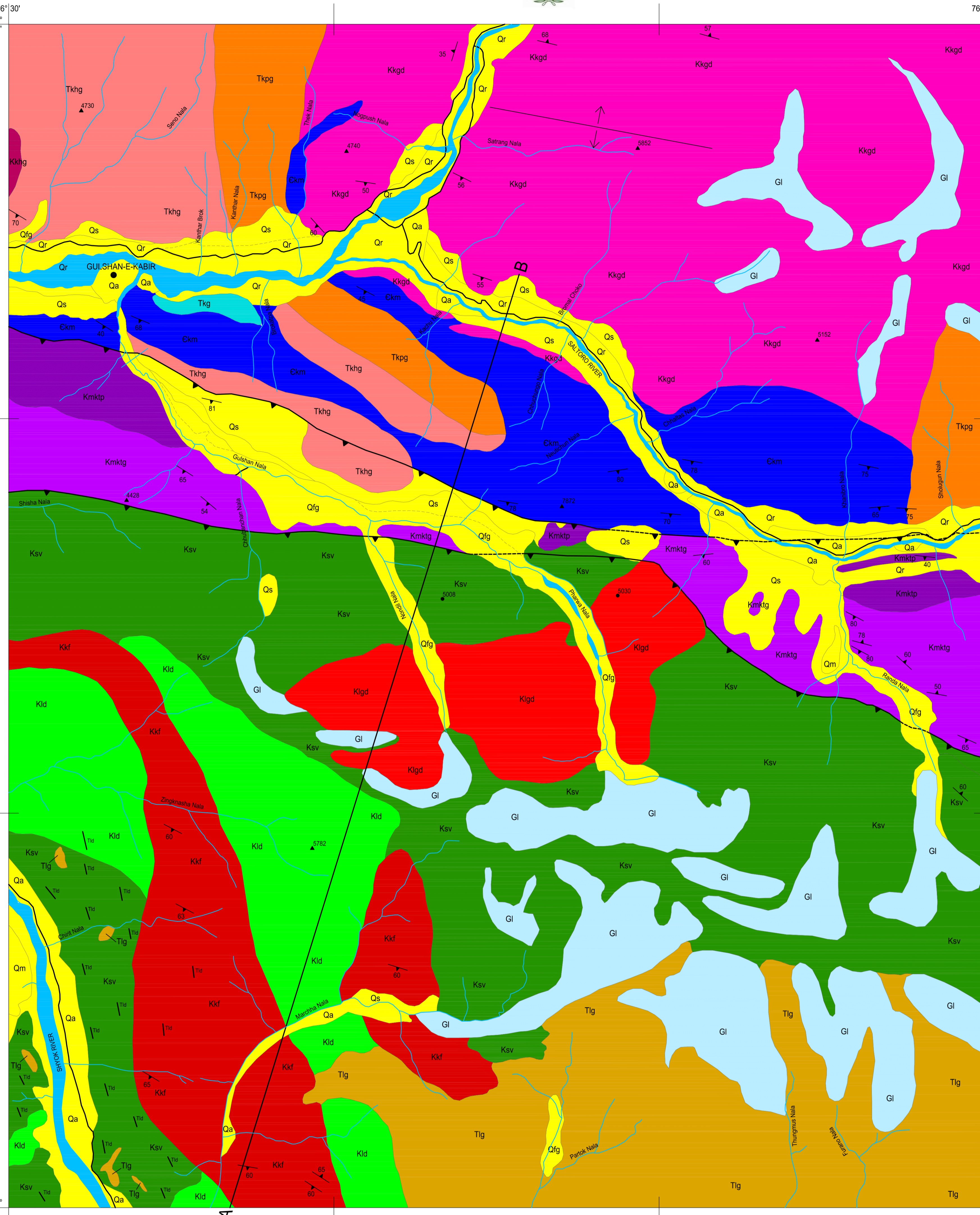
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|------------|------------|-----------|---|---|-------------------|
| Quaternary | Sub-recent | Qa | Alluvium | | |
| | | Qr | River bed deposits | | |
| | | Qs | Screes | | |
| | | Qfg | Fluvio glacial deposits | | |
| | | Qm | Moraines | | |
| Paleozoic | Tertiary | Tld | Dolerite dykes | | |
| | | Tlg | Granite | | |
| | | Klkd | Granodiorite | | |
| | | Kld | Diorites with minor volcanic, mafic, and ultramafic rocks | | |
| | | Ksv | Shigar volcanics consists of basalt, andesite rhyolite | | |
| | Cretaceous | Kkl | Katazara Formation consists of gneisses and schists | | |
| | | Mesozoic | Kmktg | Green Schist | |
| | | | Kmkp | Phyllites with minor serpentines, pyroxinites, gabbros and green schist | |
| | | Paleozoic | Tertiary | Tkpg | Porphyry granites |
| | | | | Tkg | Leuco-Granites |
| Cretaceous | Tkhg | | Hornblende Granites | | |
| | Kkhg | | Granodiorites | | |
| | Kkm | | Hornblende Gabbros | | |
| Cambrian | | Ekml | Metamorphic rocks | | |

GEOLOGICAL SYMBOLS

- Foliation
- Section Line
- Thrust Fault
- Anticline
- Syncline

NON-GEOLOGICAL SYMBOLS

- Glaciers
- River
- Nala
- Road
- Town



GEOLOGICAL MAP OF GULSHAN-E-KABIR QUADRANGLE (52-A/12) DISTRICT GANCHE, GILGIT-BALTISTAN, PAKISTAN
2012

EXPLANATORY NOTES

The Gulshan-e-Kabir quadrangle (52 A/12) is a mountainous region located to the south of Siachen Glacier in the Ladakh range. The study area lies at the confluence of the Saltoro and Gunders rivers. The Saltoro River flows from east to west in the northern part of the quadrangle which contains the water shed area of Gulshan-e-Kabir and Seno Nalas. The Shyok River flowing in the southern part of the quadrangle, contains water shed area of the Zinghnaasha and Marchha Nalas. The Gulshan-e-Kabir town is connected with Hunza and Dum Sum by metalled roads. However the communication network in this region has been greatly improved during the recent past. Glaciers in the area resulted in the wide spread moraines, glaciofluvial deposits and glacio-erosional features. Weather is very cold in winter and pleasant in summer. Due to moderate rate of precipitation, the area falls in semi-arid zone with temperature ranging from -20°C in winter to 30°C in summer.

GEOLOGY

The area consists of three major blocks. These blocks from north to south are the Karakoram Block, the Ladakh Island Arc and the Karakoram Thrust zone.

**KARAKORAM BLOCK
Karakoram Metamorphic Rocks
Cambrian**

The Karakoram metamorphic rocks (Ekm) are exposed on both sides of the Saltoro River along the Main Karakoram Thrust. They consist of gneissic schist, quartz-mica-stauroilite-schist, biotite schist and amphibolite schist. They contain beds of limestone and marble. The rocks are commonly grey and weather to brown colour, well foliated, laminated, locally migmatized and garnetiferous. Boudinage, phenocrysts and augens structure are locally present, while pyramitic folding is common. These rocks are intruded by multiphase plutons of the Karakoram Batholith. Andalusite-grade metamorphism is associated with the early plutons. The age of the Karakoram metamorphic rocks has been controversial issue, as no fossil has been found in Hunza and Shigar areas, due to high grade of metamorphism. The metamorphic rocks along the MKT are considered to be equivalent to Dumordia formation in Hunza area and Darok group or Nialthi metasediments and Chikar migmatite gneisses (Le-Fort and Gaetani, 1998) have been assigned pre early Ordovician age. Similar rocks exposed to the west in Yasin Valley along the MKT has been assigned Cambrian age.

**KARAKORAM BATHOLITH
Cretaceous**

The hornblende gabbro (Kkhg) is exposed on the left side of the Seno Nala. It is medium to coarse grained, dark blue on fresh and dark brown on weather surface. It has intrusive contact with the hornblende granite and a tectonic contact with the metamorphic rocks. It is a deformed composite unit and is equivalent to Hunza pluton of Cretaceous age (Kazmi and Jan, 1997). Its mineral composition is hornblende, biotite, plagioclase and pyroxene. Amphibole is often chloritised and epidotised. **The granodiorites (Klkd)** is exposed at the north eastern part of the quadrangle. It is a heterogeneous pluton and forming a large mass. It is orthogneissified and intrudes the Karakoram metamorphic rocks. It grades into dioritic composition near its contact with the gneissic schist. Dykes of aplite and pegmatite upto several meters run parallel to the contact of the migmatite schist on right side of Dum Sum town. At some places, it is massive and crossed cut the foliation of the schist. Granodiorite is medium to coarse grained and contains xenolith of metasediments. Its mineral composition is plagioclase, feldspar, quartz, biotite and amphibole. It has an intensive contact with the Karakoram metamorphic rocks and tectonic contact with porphyritic granite. **The hornblende granite (Tkhg)** is well exposed in Seno Lungma and north of the Gulshan Lungma. It intrudes the suture zone metasediments. It is mostly medium grained at places and porphyritic near contact. Enclaves of the hornblende gabbro and mica gneiss are frequent near the veins of the pluton. Its minerals constituents are k-feldspar, hornblende and biotite. **The Porphyritic Granite (Tkpg)** is exposed near the junction of the Saltoro and Gunders rivers. It pinches out to the east. The granite is a homogeneous, brownish-grey to pale-grey on weathering surface and grey on fresh surface. The euhedral K-feldspar phenocrysts are very large (upto 6x20 cm). It comprises hornblende, biotite, K-feldspar and plagioclase. It has sharp contact with the Karakoram metamorphic rocks and gradational contact with hornblende granite.

**LADAKH ISLAND ARC
Katazara Formation
Cretaceous**

The name Katazara formation (Kkl) is given by Tahirkheli, (1982). It is well exposed in Marchha Nala and extends to NNW toward Zinghna Nala. It consists of mica schist, gneissic schist, migmatized gneiss, amphibole mica schist, garnet mica gneiss. It is intruded by dolerite dykes and granite apophyses. The paragneiss is a heterogeneous mixture of biotite gneiss, mica schist and minor amphibolites. These are injected by numerous granitic and pegmatite dykes. The gneiss is often deformed by crenulation type folds with NNW-SSE axis gently dip SW. Mica schist and garnet mica are intercalated with green schist or amphibolites. The garnet mica schist is intruded by aplite and granites.

**Shigar Volcanics
Cretaceous**

The Shigar volcanics (Ksv) are well exposed in the upper reaches of the Randa Lungma to Gulshan-e-Kabir town along the MKT on both sides of the Shyok river. They are intruded by small granitic bodies and dolerite dykes, which seems to be a dyke complex. Small bodies of volcanics as xenoliths are present within granitic rocks. The volcanics consists of basaltic andesite and andesite, which are mostly massive in the central part and foliated along the MKT zone. They are metamorphosed to green schist and amphibolite facies. Small bodies and lenses of the marble and gneiss are commonly found along the MKT zone.

MAIN KARAKORAM THRUST ZONE

The Main Karakoram Thrust Zone (MKTZ) is 500 m to 5 km thick lies from Mandick to Gulshan-e-Kabir town which separate the Ladakh terrane from Karakoram terrane. **Main Karakoram Thrust green schist (Kmkgt)** is dominantly exposed south of Mandick on both sides of Romada Lungma, which is in faulted contact with phyllite and arc volcanics. They contain small bodies of phyllite, chlorite talc schist and agglomerates. **Main Karakoram Thrust phyllite (Kmktp)** is dominantly exposed along the northern boundary of the MKTZ and a small block lies south of Mandick along the arc volcanics. It contains small bodies of serpentinites, talc carbonate schist, talc chlorite schist and pyroxinite. The serpentinite is well exposed south west of Mandick village. It is a typical melange, intruded by fine grained granite on right side of the Gulshan-e-Kabir.

**LADAKH INTRUSIVES
Cretaceous-Tertiary**

The diorites (Kld) are exposed in upper reaches of the Zinghnaasha and Marchha Lungmas and small outcrops within the Ladakh arc volcanics on both sides of the Shyok river. It is a heterogeneous unit. They are medium grained and contains biotite and amphibole often chloritised and epidotised. Volcanic xenoliths are commonly found. The diorites are intruded by granite, monzodiorite and gabbros. Small outcrops of pyroxenite are present. **The Granodiorites (Klkd)** are exposed Pharwa Lungma to Chhubanohan Lungma's glacier. Small granodiorite bodies are found within arc volcanics and diorite. They are light grey to pink, weathers to pale-grey, mostly medium to coarse grained and massive. They are composed of plagioclase, quartz, K-feldspar (perthite and microcline) and biotite. **The granites (Tlg)** are well exposed in the southern part of the mapped area between Partok Lungma to Furano Lungma, which intruded the schist and gneisses of the Katazara Formation and granodiorites. Small granitic bodies intruded into diorites and arc volcanics on both sides of the Shyok river. The granites are light grey, medium to coarse grained, and consists of quartz, K-feldspar, plagioclase and biotite. The apatite, sphene and zircon are the accessory minerals. **The dolerite dykes (Tld)** intrude the granites, arc volcanics and metasedimentary rocks mostly in the southern part of the mapped area. They make a complex on both sides of the Shyok river where the dolerite dykes are dominant at places and reached upto about 40% of the total rocks. They are varying in length from few meters upto meters and their thickness ranges from 20 cm to 3 m. They are mostly deformed and composed of variable proportion of plagioclase, hornblende and pyroxene with minor magnetite. Epidote and chlorite are the secondary minerals.

QUATERNARY DEPOSITS

Moraines (Qm): Glacial moraines are widely distributed in the investigated area especially around Dum Sum town. The unconsolidated and semi consolidated moraine deposits are generally buff to brown having boulders, gravels, cobbles, pebbles, with matrix of silts and minor clays. The thickness and extension vary from place to place. **Fluvio-glacial deposits (Qfg):** Stratified to semi stratified, loose to semi compact, ill sorted fluvial deposits are located along the rivers and streams. **River bed deposits (Qr):** River bed deposits include material present in stream channels and nala beds composed of rounded to sub-rounded material of all sizes. These types of deposits are mostly loose due to absence of cementing material. **Screes (Qs):** The scree deposits consist of unsorted, angular to sub angular rock debris, and composed of boulders, cobbles, pebbles, gravels, sand and clays. The lower parts of the mountain slopes are mostly covered by the screes. **Alluvium (Qa):**

STRUCTURAL GEOLOGY

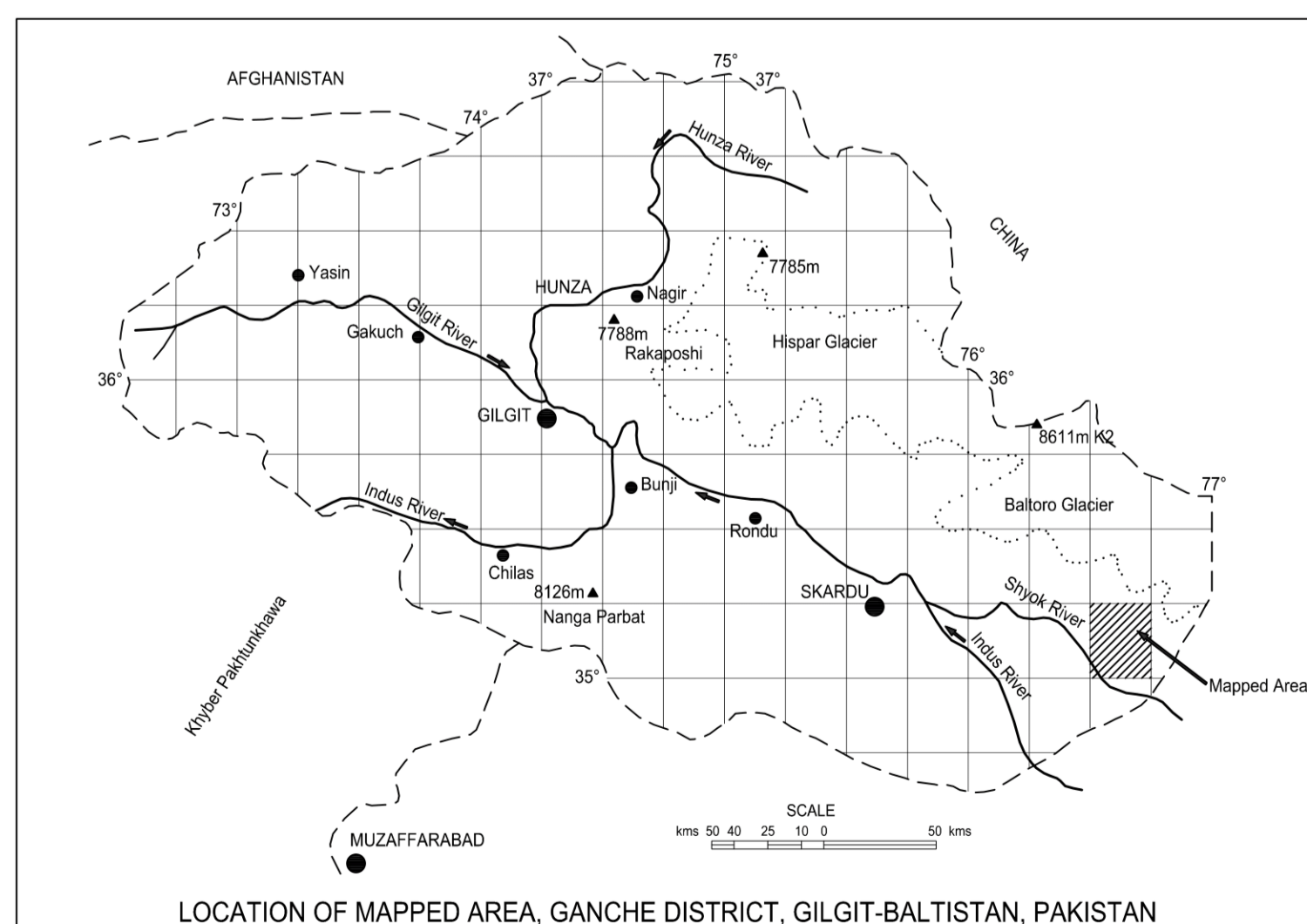
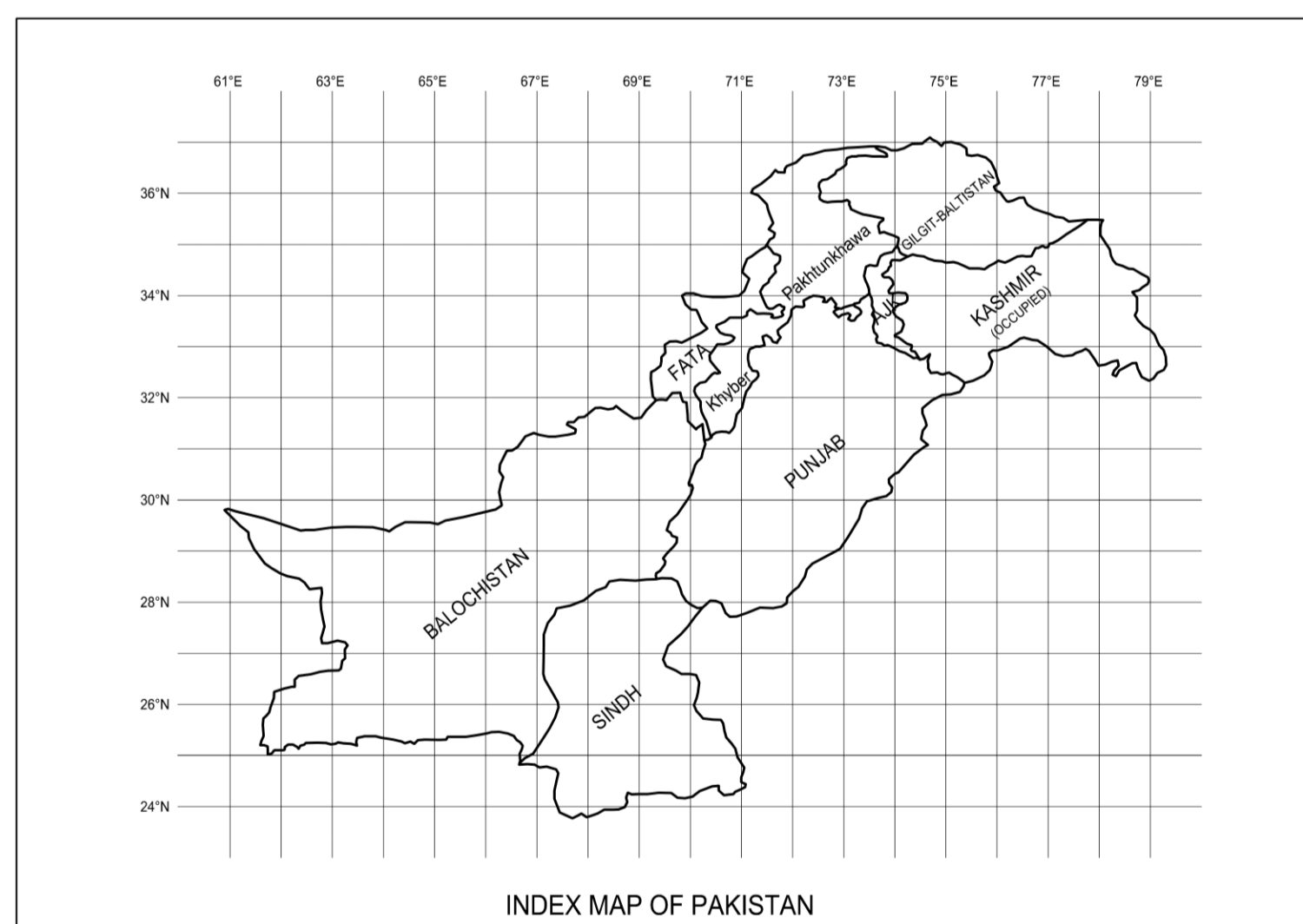
The Main Karakoram Thrust lies between the Ladakh and Karakoram terranes, which is 5 km thick in east and pinched out toward west upto 500 m. In Mandick area, the MKT has faulted contact with the Karakoram metamorphic rocks which comprises phyllites with blocks of these serpentinites, talc carbonate schists and greenstone and greenschists making a typical melange. The greenstone and greenschist are tightly folded. Further south in the Randa Lungma, the arc volcanic and marble are tightly folded. The Karakoram metamorphic rocks are frequently intruded by different phases of plutons in which pyramitic folding is commonly present. The arc volcanics and metasedimentary rocks of the Ladakh are characterized by upright folding along the MKTZ and severally repetition in the Zinghna Lungma area.

ECONIMICS GEOLOGY

The oxidized and silicified zones occur along the MKTZ and range from a few meters to 600 meters. Gold mineralization occurs in Mandick area in different rocks in different localities. The gold values ranges from 2.0 to 5 ppm in the Randa Lungma, which is hosted by chlorite talc schist, siliceous carbonate and greenstone. The gold value is 6.0 ppm in the quartz veins found in the phyllite near Heldi (Khan, et al. unpublished).

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