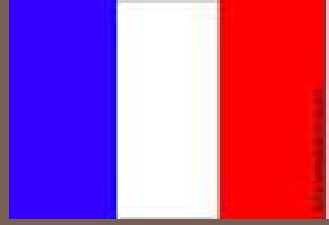


Mineral Resources of Afghanistan

Driver for Regional Economic Development

Atiq Sediqi, Ph. D

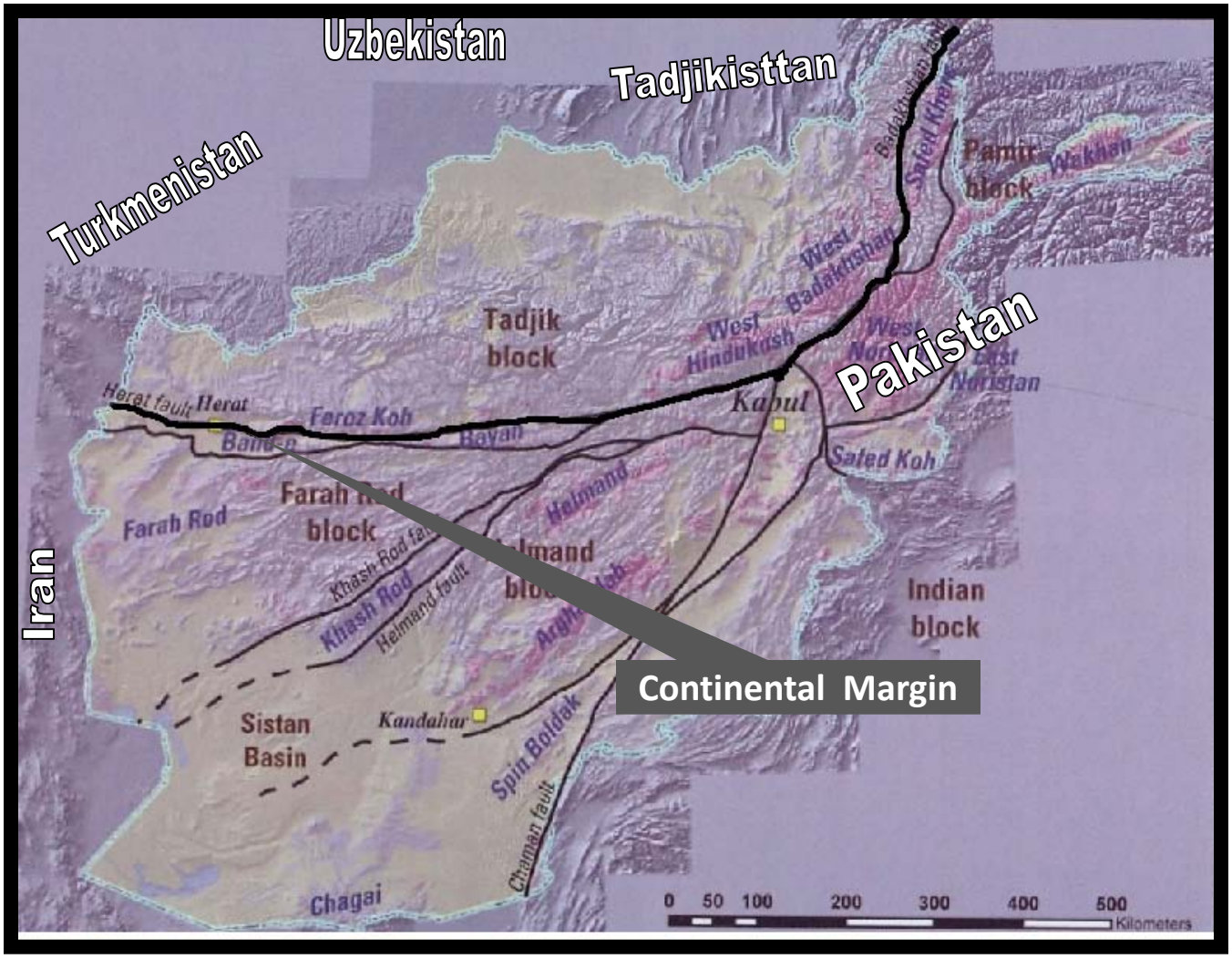
Director General

Afghanistan Geological Survey (AGS)

http://www.mom.gov.af

Paris, November 2011

geological Evaluation of Afghanistan



Afghanistan has complex geology

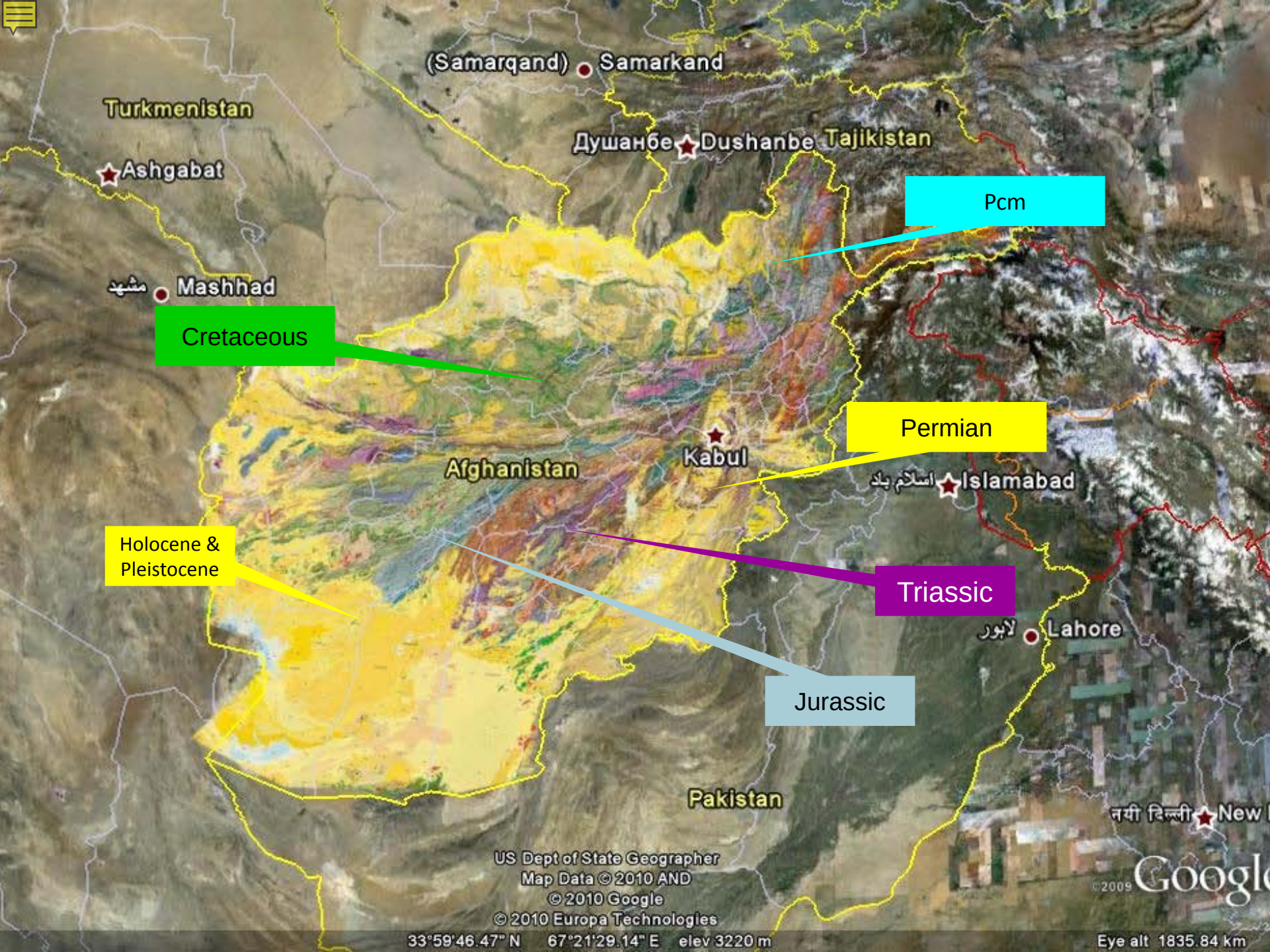
Northern part belongs to Eurasia

The south is made up of accreted fragments of Gondwana Land

Each block is separated by deep seated faults

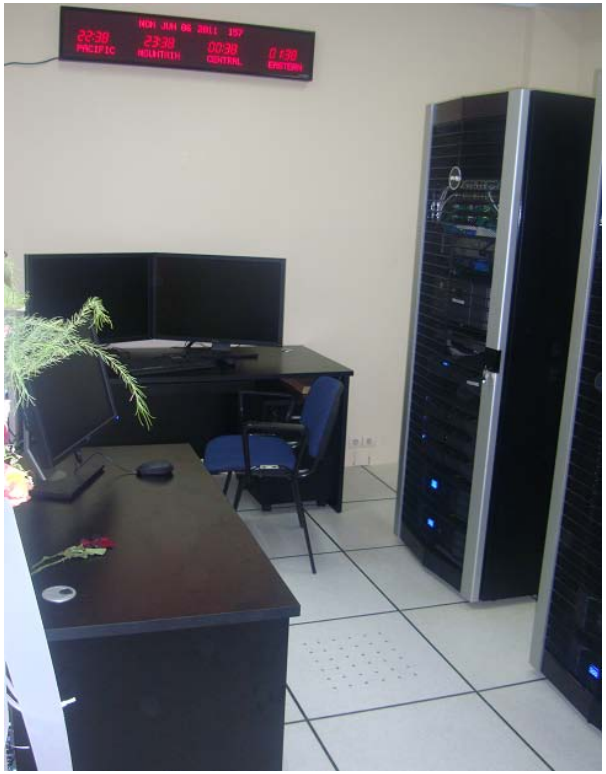
There were different geological activity in each zone which resulted in formation of very rich mineral assemblages

Coal and oil/gas are found on the Eurasian plate or its margin


(Samarqand) Samarkand
Turkmenistan
Душанбе Dushanbe Tajikistan
Ashgabat
Pcm
مشهد Mashhad
Cretaceous
Permian
Kabul
Afghanistan
اسلام باد Islamabad
Holocene &
Pleistocene
Triassic
لاہور Lahore
Jurassic
Pakistan
नयी दिल्ली New
US Dept of State Geographer
Map Data © 2010 AND
© 2010 Google
© 2010 Europa Technologies
33°59'46.47" N 67°21'29.14" E elev 3220 m
Eye alt 1835.84 km

Status of Geological Studies

- No recent systematic and detailed geologic studies have been conducted
- Most interpretations are based on 30-40 years old Soviet geological and exploration findings and recent reevaluations of data
- In spite of many hurdles, world class deposits of iron, copper, molybdenum, nickel, gold, lithium and other minerals are know to exist in Afghanistan
- In 2010 the AGS assessed 286 billion dollars worth of mineral resources in Afghanistan
- A data center with initial storage capacity of 92 TB has been established at the AGS for storage/dissemination of geoinformation



AGS Assessed Resources in 2010

Area	Resources	Price per unit	Total in situ value $
Sya Dara Iron	500 million ton	$160	80 billion
Bamyan Granite	36 billion m^3	$5 /$m^3$	180 billion
Zenda Jan Limestone	1.5 billion ton	$4/ton	6 billion
Takhar Gypsum	2 billion tons	$10/ton	20 billion
Total, $			286 billion

Areas Identified for Mineral Potential

- Recent USGS/AGS joint evaluation of Afghanistan mineral resources identified large areas of mineral potential for a diverse range of mineral commodities. These are included in the following set of slides
- The preliminary In Situ Gross value of mineral resources is estimated at trillions of dollars

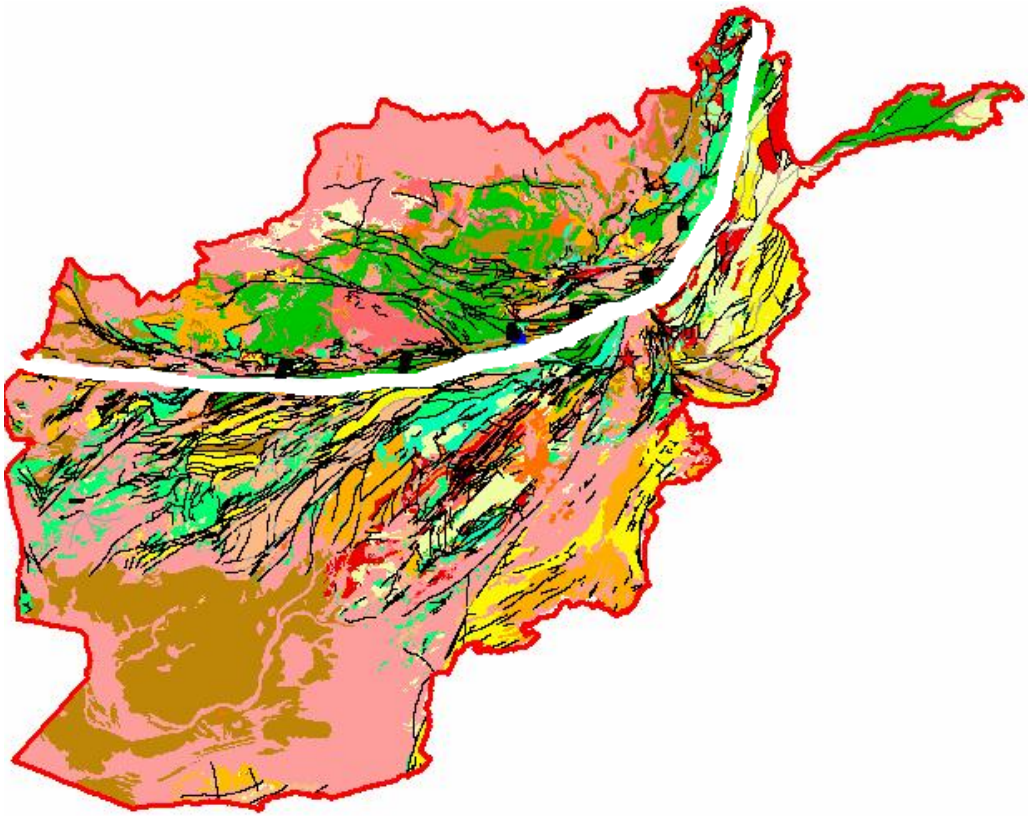
Mineral Resources

- Li, Be, precious stones, and rare metals in the pegmatite fields of NE Afghanistan
- Porphyry Cu with Mo and Au in central , southern, and western Afghanistan.
  - Potential for discovery of 60 million ton

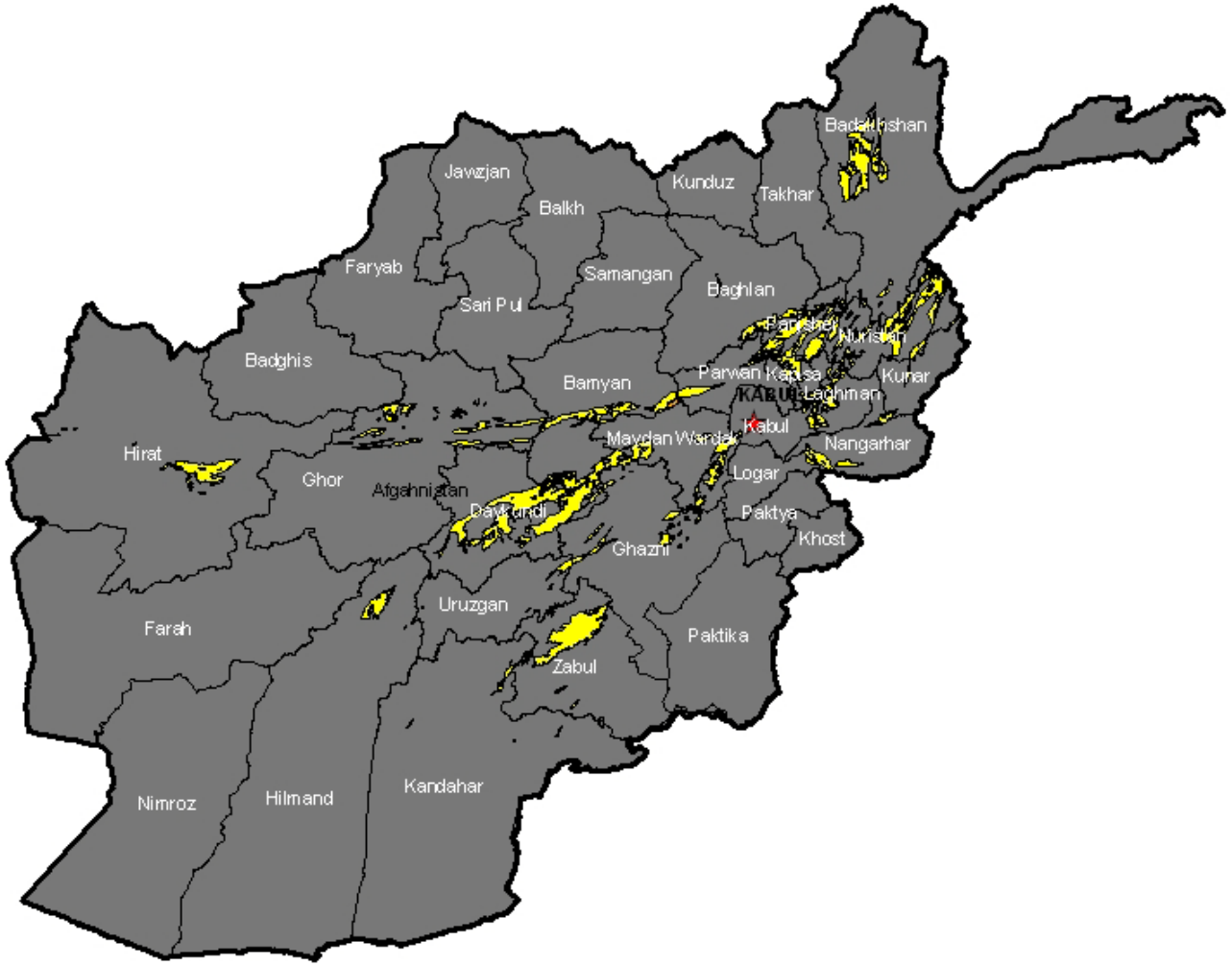
    additional copper is probable
- Rare Earth Elements (REE) and Nb in southern Afghanistan
- Lead and zinc in central Afghanistan
- Gold in the north, and southern regions (the price of gold is 1700/oz)
- Lithium (Li) in salars of central, SW, and western Afghanistan
- Oil and gas in the north, potential for gigantic discoveries exists
- Coal in Central Afghanistan

Iron Mineralization

- Iron deposits occur along a line from Badakhshan to Herat
- Extends several hundred km (from borders of Tajikistan to Iran)
- Resources are estimated at billions of tons of high quality iron containing a very attractive mixture of elements, Mo, Ti, and V, in some areas

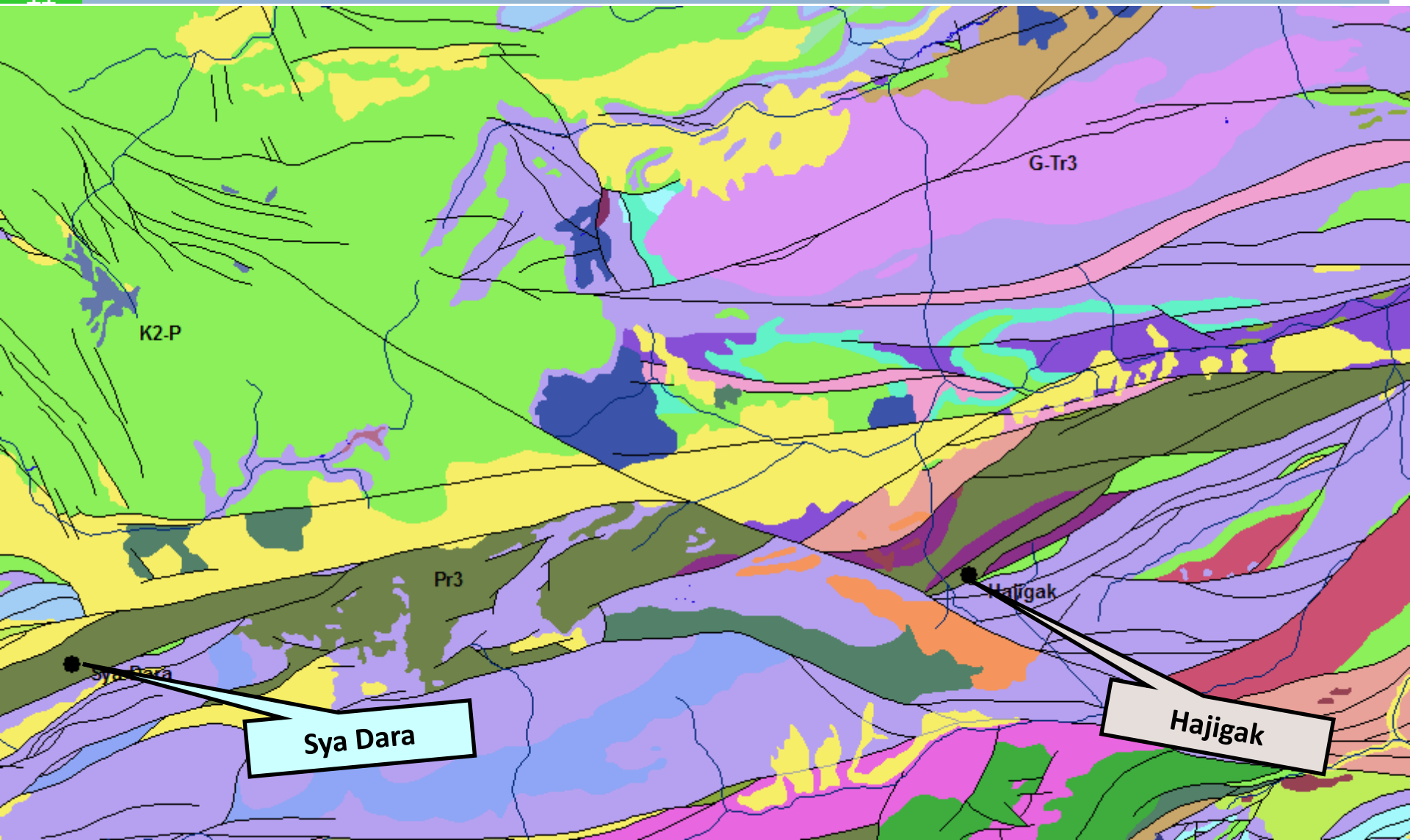


Sedimentary Iron



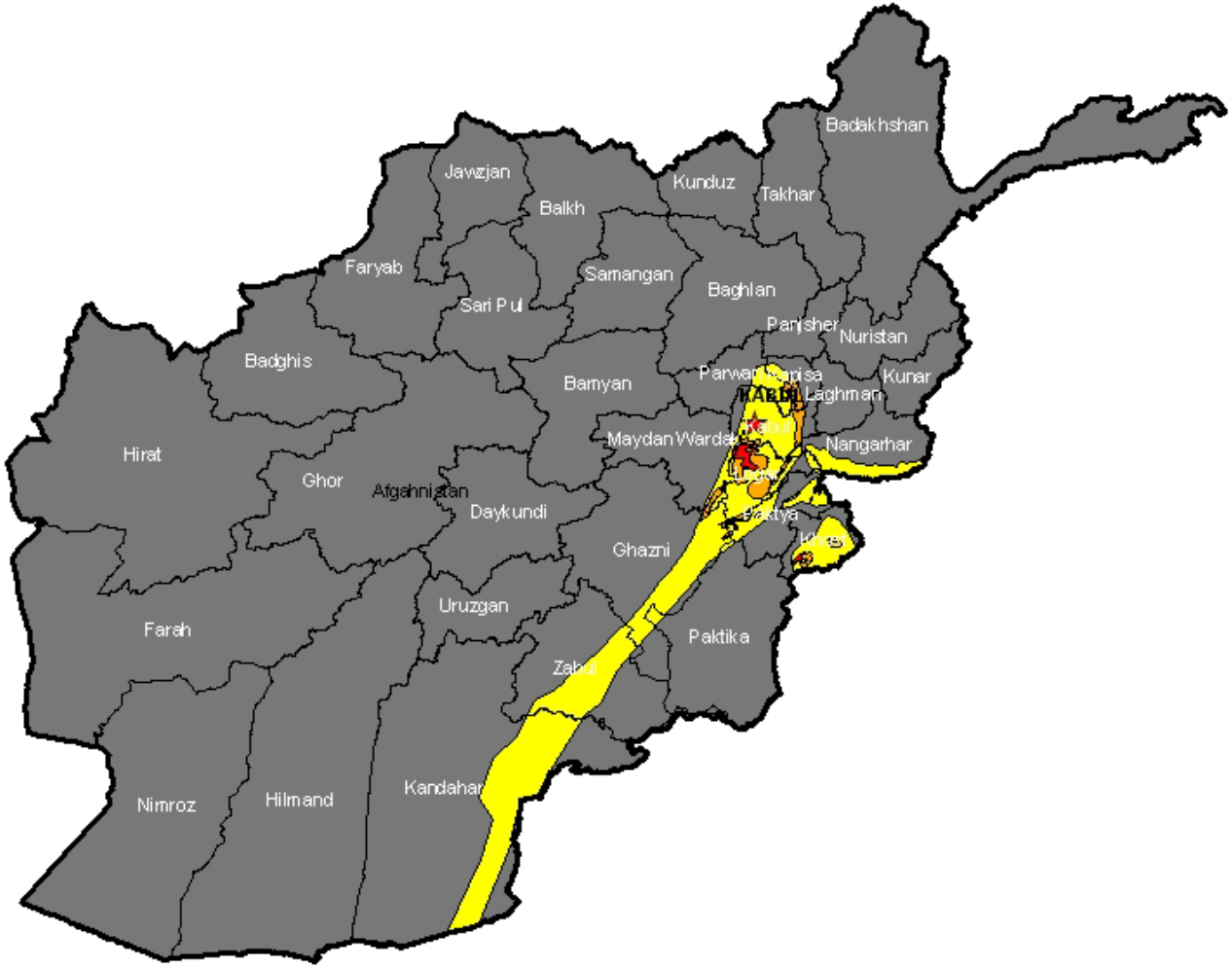
Hajigak and Sya Dara Iron

Hajigak 2B, Sya Dara 500M tons

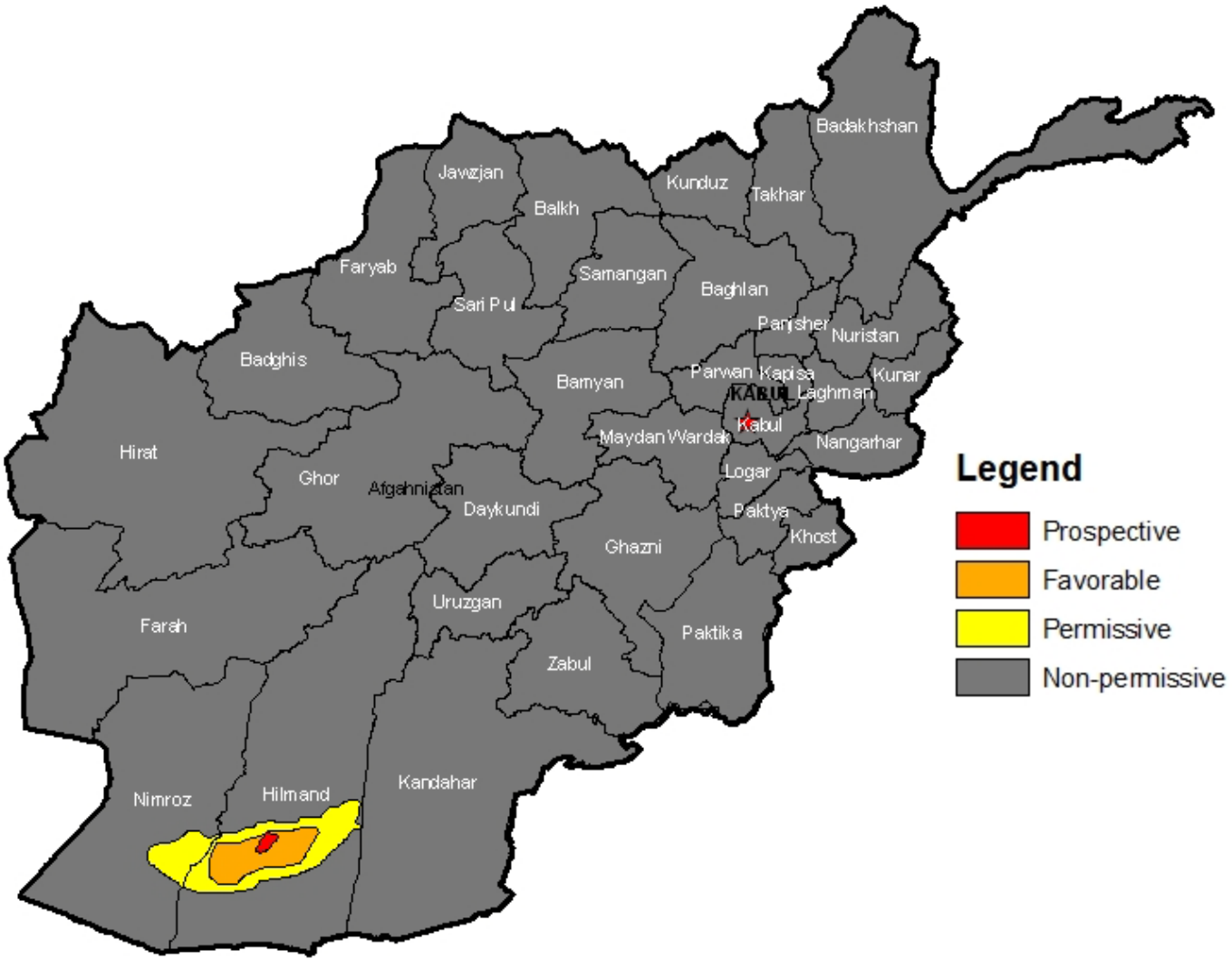


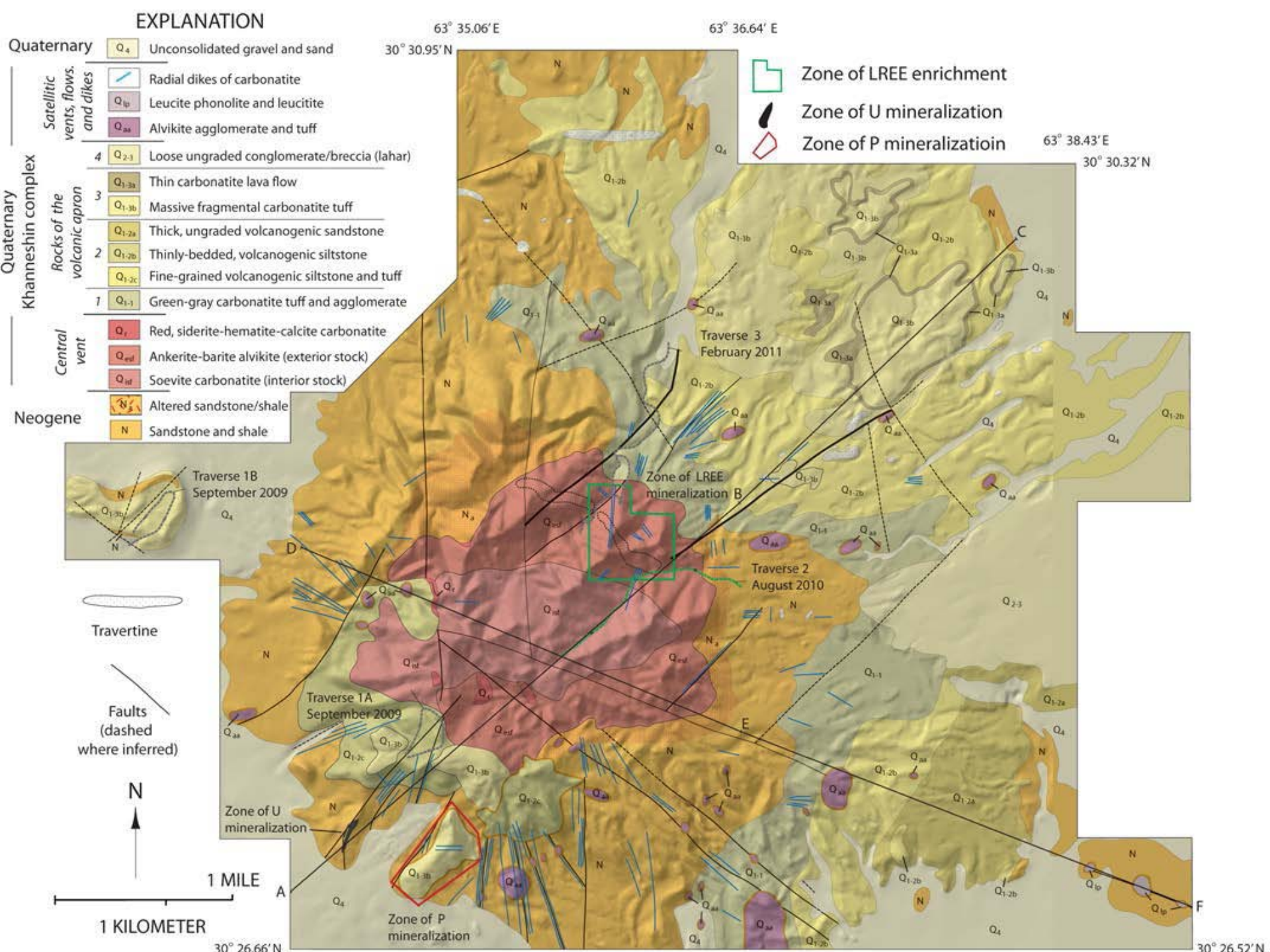
A View of Hajigak from Space

Chromite, Talk-Magnesite



Carbonatites with REE and Nb




EXPLANATION
Quaternary
Unconsolidated gravel and sand
Satellitic vents, flows, and dikes
Radial dikes of carbonatite
Leucite phonolite and leucitite
Alvikite agglomerate and tuff
Quaternary Khanneshin complex
Rocks of the volcanic apron
4
Loose ungraded conglomerate/breccia (lahar)
3
Thin carbonatite lava flow
Massive fragmental carbonatite tuff
2
Thick, ungraded volcanogenic sandstone
Thinly-bedded, volcanogenic siltstone
Fine-grained volcanogenic siltstone and tuff
1
Green-gray carbonatite tuff and agglomerate
Central vent
Red, siderite-hematite-calcite carbonatite
Ankerite-barite alvikite (exterior stock)
Soevite carbonatite (interior stock)
Neogene
Altered sandstone/shale
Sandstone and shale
Travertine
Faults (dashed where inferred)
N
1 MILE
1 KILOMETER
63° 35.06′ E
63° 36.64′ E
63° 38.43′E
30° 30.95′ N
30° 30.32′N
30° 26.66′N
30° 26.52′N
Zone of LREE enrichment
Zone of U mineralization
Zone of P mineralizatioin
Traverse 3 February 2011
Traverse 1B September 2009
Zone of LREE mineralization
Traverse 2 August 2010
Traverse 1A September 2009
Zone of U mineralization
Zone of P mineralization
A
B
C
D
E
F

REE Prices and Production

Price $/Kg

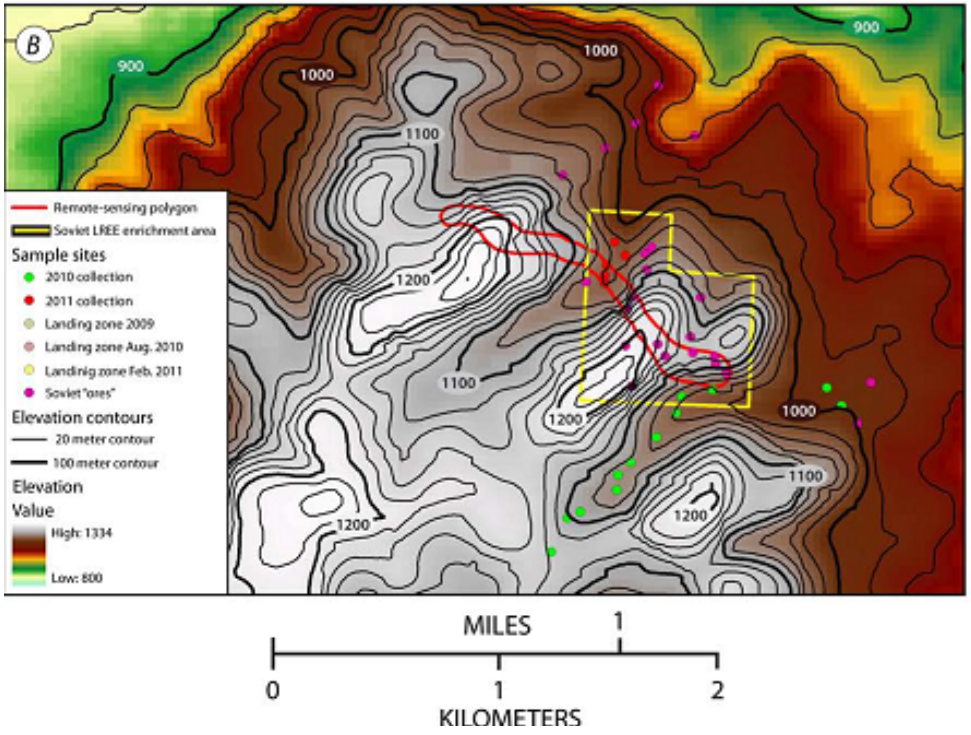
Rare Earth Oxide	Mt Weld Distribution	2008	2009	2010	Q1 2011	Q2 2011	17-oct-11
Lanthanum Oxide	25.50%	8.71	4.88	22.4	75.87	135.02	80
Cerium Oxide	46.74%	4.56	3.88	21.6	77.52	138.29	72
Neodymium Oxide	18.50%	31.9	1 and 9.12	49.5	130.23	256.15	265
Praseodymium Oxide	5.32%	29.48	18.03	48	119.65	220.08	220
Samarium Oxide	2.27%	5.2	3.4	14.4	72.75	125.6	110
Dysprosium Oxide	0.12%	118.49	115.67	231.6	412.9	921.2	2300
Europium Oxide	0.44%	481.92	492.92	559.8	719.2	1830	3800
Terbium Oxide	0.07%	720.77	361.67	557.8	717.6	1659.2	3220
Av. Mt Weld Composition		14.87	10.32	31.35	92.84	173.2	140.64

World REE Production, 1000 tons

Country	2006	2007
China	119	120
India	2.7	2.7
Brazil	0.73l	0.73
Malaysia	0.2	0.2
Thailand	-	-
Australia	-	-
USA	-	-
Others	-	-
Total	123	124

Ore Geochemistry and Resources

Geochemistry



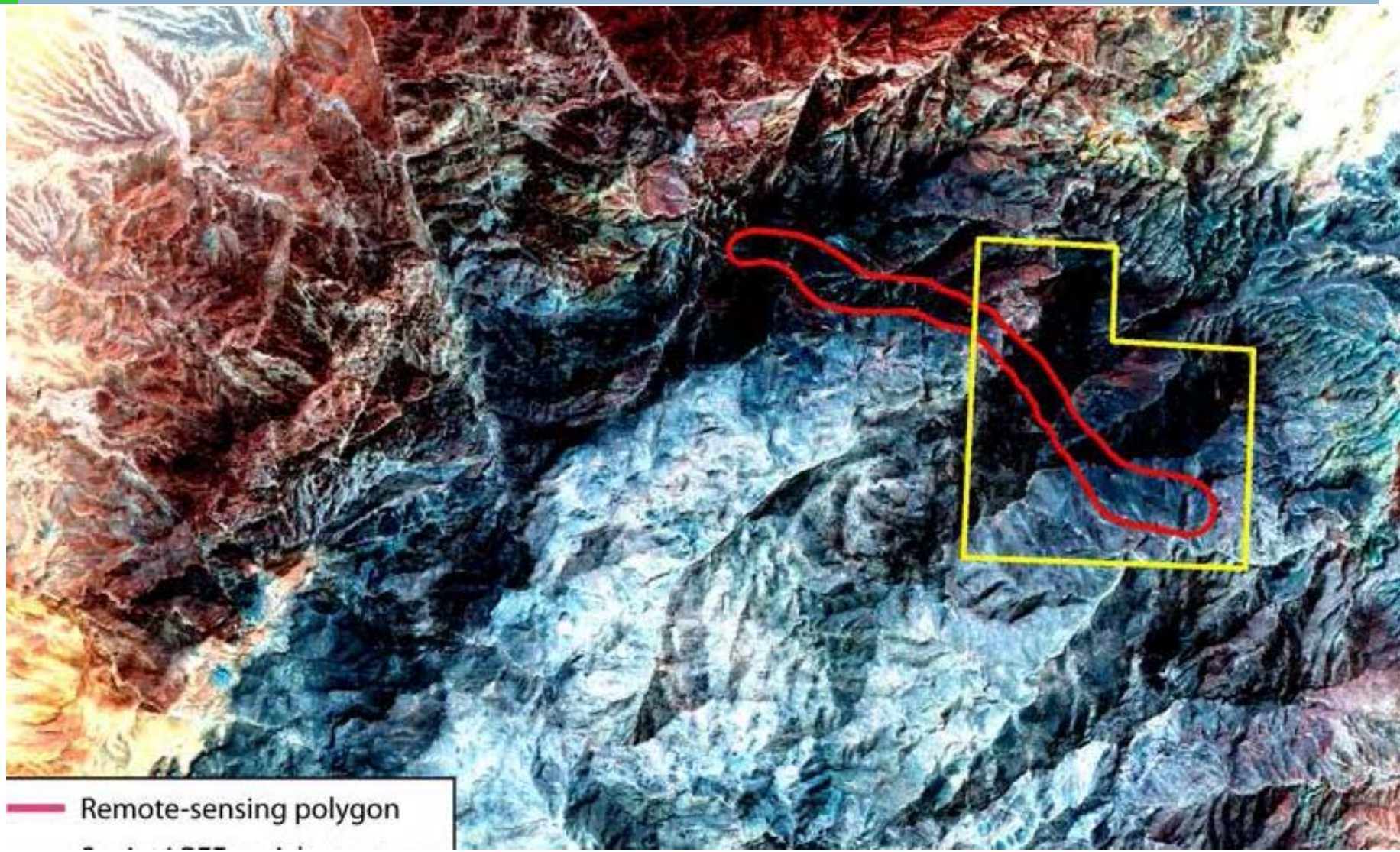
Resources Estimates

Khanneshin Resources Calculation

Area	LREE Grade	MT REE Before Dilution REE	MTREE after Dilution REE
Concordant Veins and Seams (Dikes)	2.775	6.058	0.606
Discordant Veins and Seams (Dikes)	3.282	-	0.507
Total		-	1.113

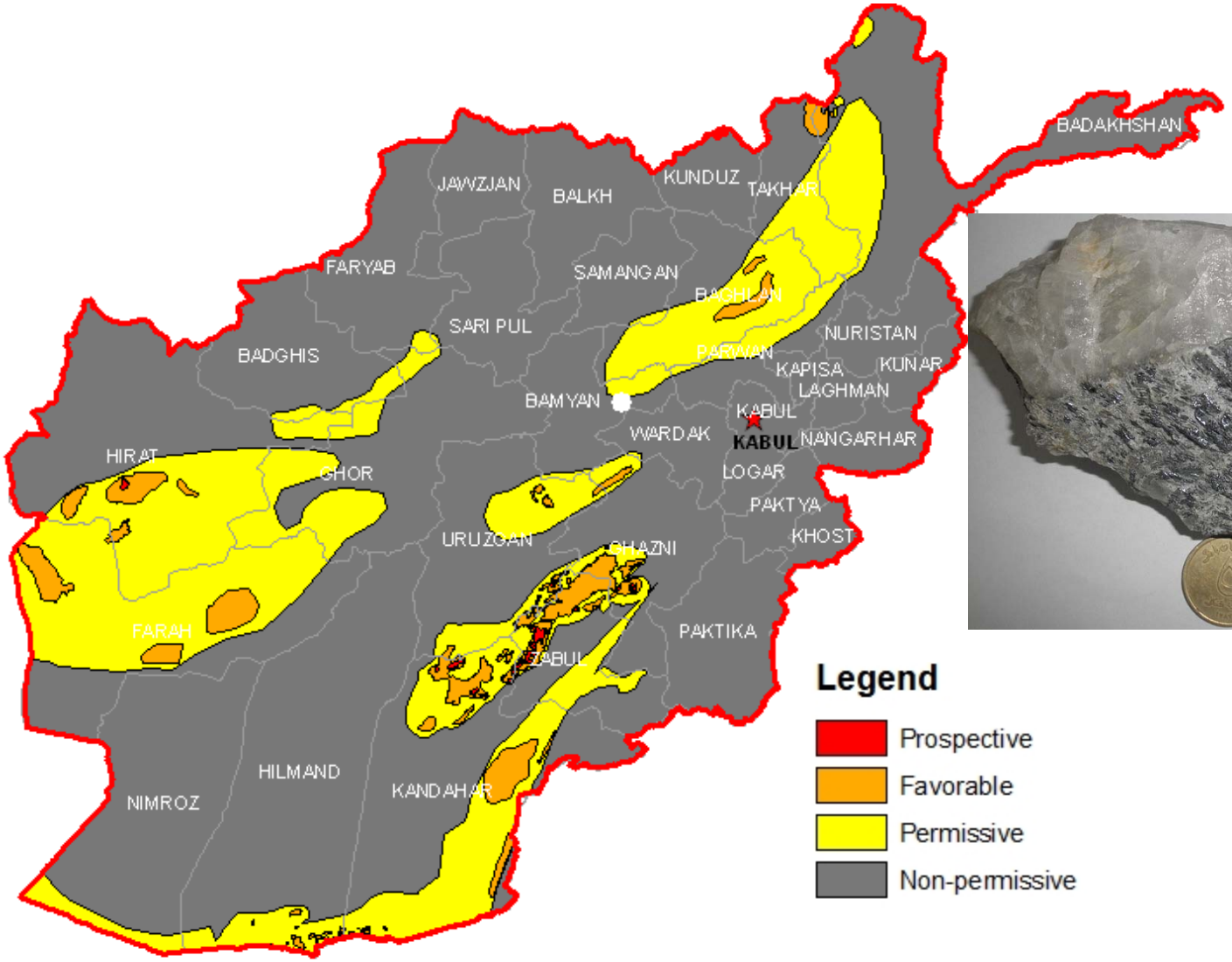
Areas of Enrichment	REE Grade	Mt before 1/10 dilution	Mt before 1/10 dilution
NW Zone	2.775	5.807	0.581
Within Zone of Enrichment	2.775	5.966	0.597
Total Remote Sensing			1.178

Remote Sensing Data

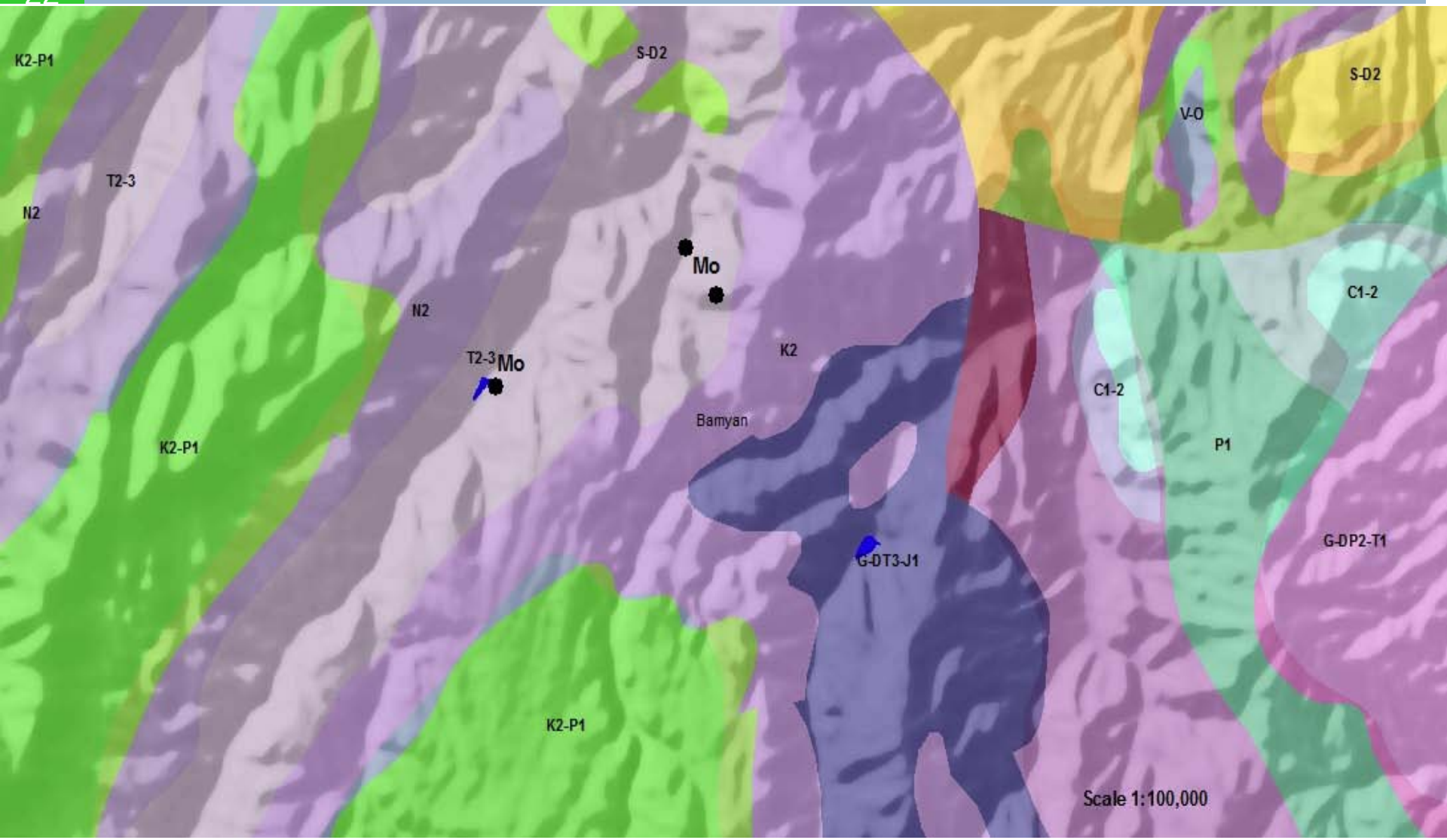


Sedimentary Copper

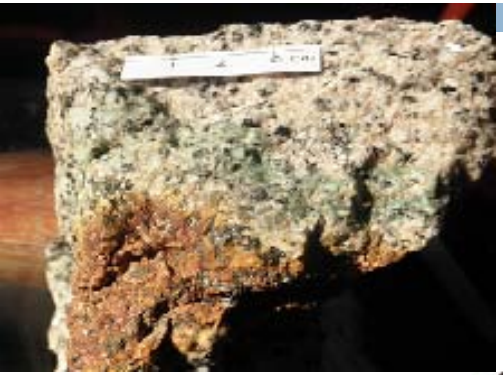
Porphyry Copper



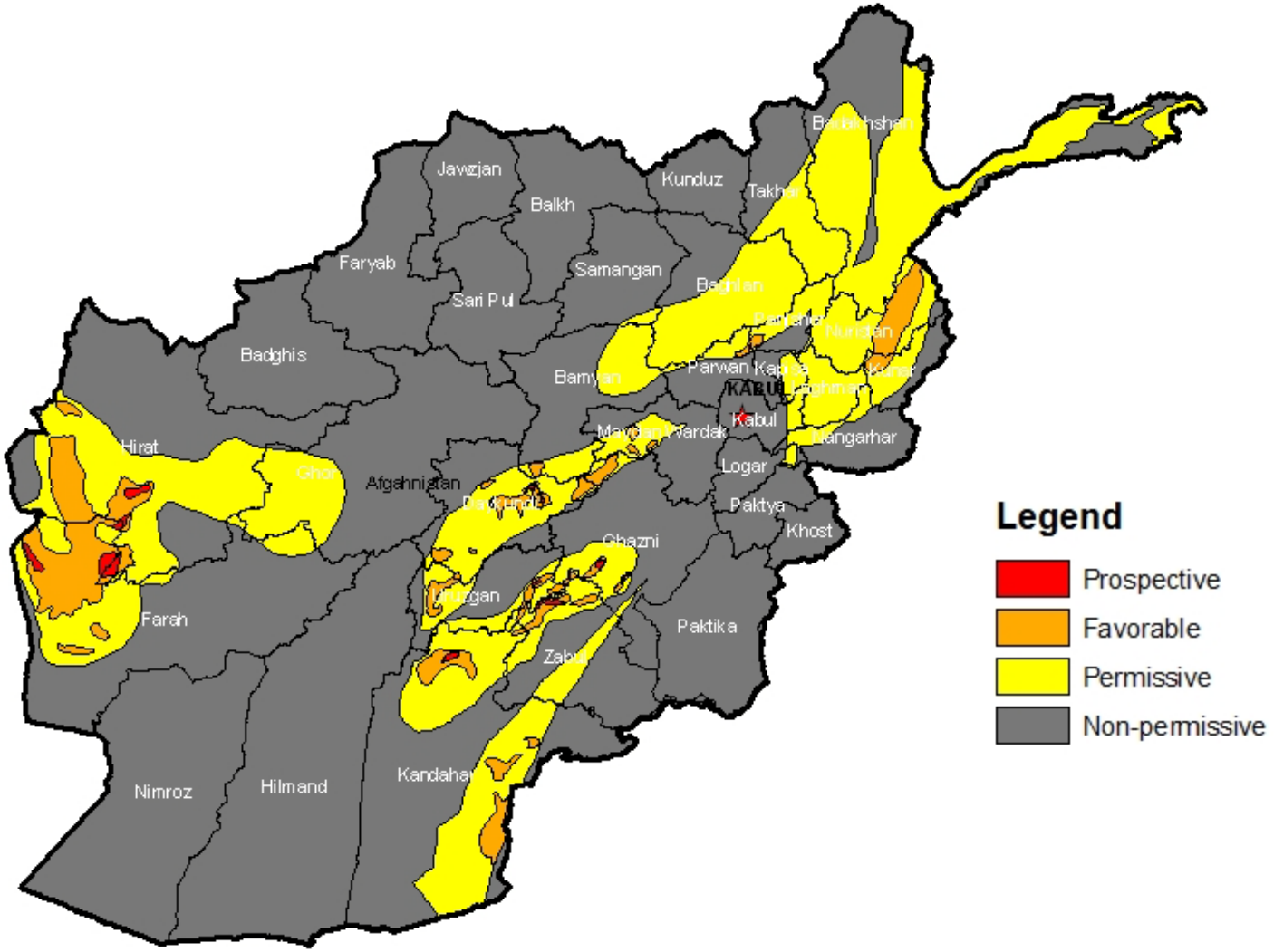
Major Porphyry Cu-Mo Discovery



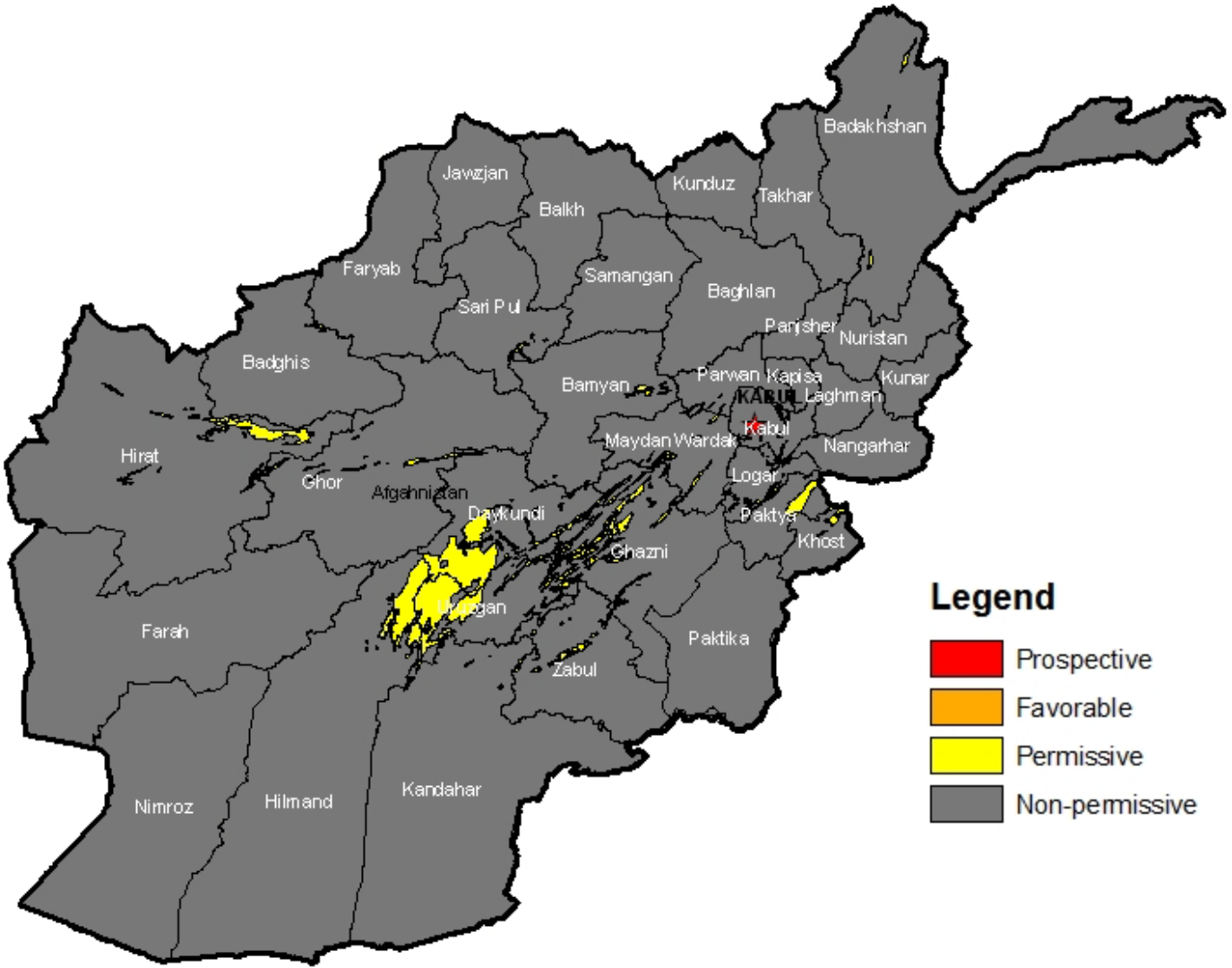
Cu-Mo Mineralization



Tin and Tungsten



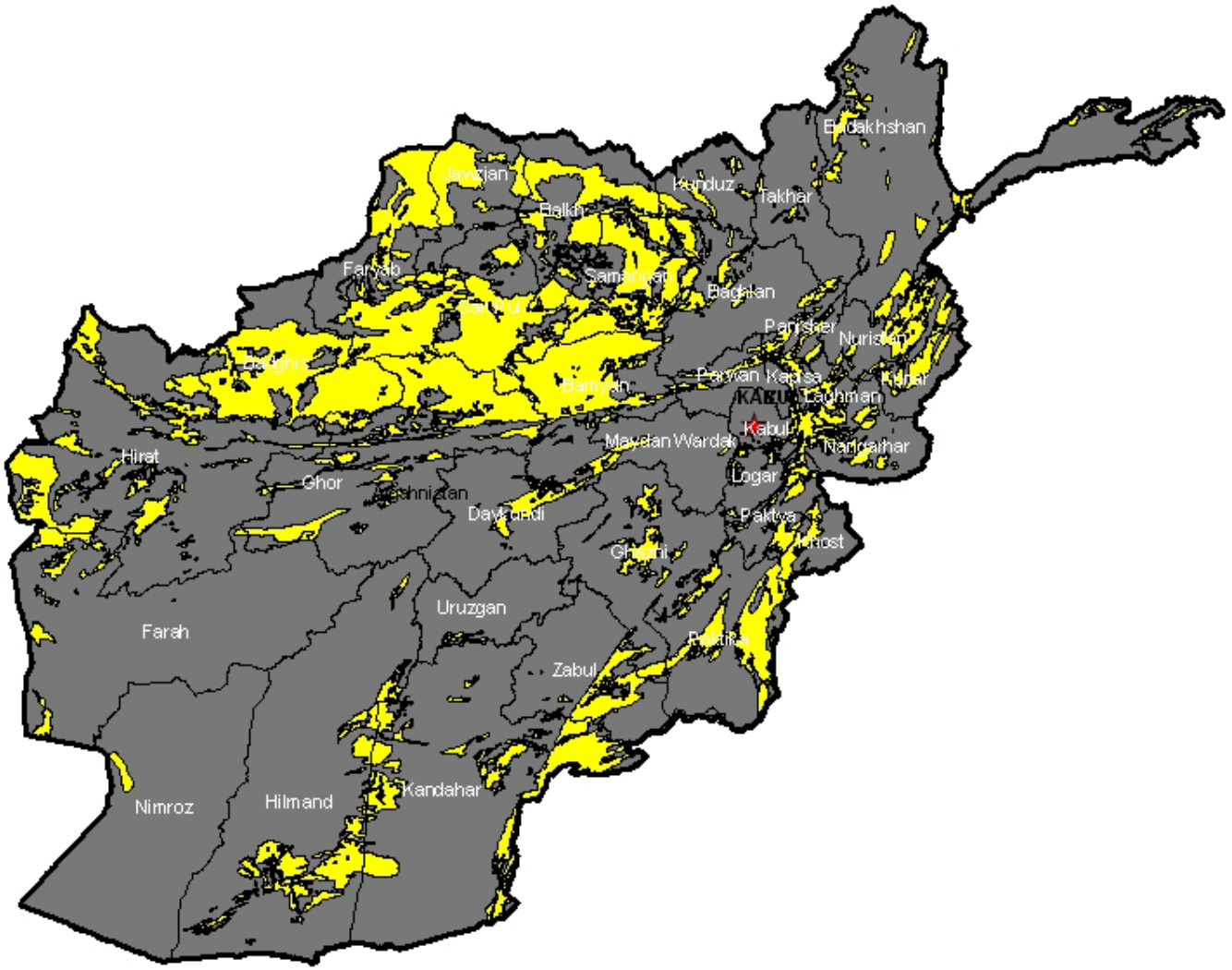
Bauxite (Aluminum)



Barite


Badakhshan
Jawzjan
Kunduz
Takhar
Balkh
Faryab
Samangan
Baghlan
Sari Pul
Panjsher
Nuristan
Badghis
Bamyan
Parwan
Kapisa
Kunar
KABUL
Laghman
Kabul
Maydan Wardak
Nangarhar
Hirat
Logar
Ghor
Afghanistan
Daykundi
Paktya
Khost
Ghazni
Uruzgan
Farah
Paktika
Zabul
Nimroz
Hilmand
Kandahar

Borates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Takhar
Balkh
Faryab
Samangan
Badakhshan
Panjsher
Nuristan
Parwan
Kapisa
Kunar
Laghman
Kabul
Maydan Wardak
Nangarhar
Hirat
Ghor
Logar
Paktya
Ghazni
Uruzgan
Farah
Zabul
Nimroz
Hilmand
Kandahar

Fluorite


Badakhshan
Jawzjan
Kunduz
Takhar
Balkh
Faryab
Samangan
Baghlan
Sari Pul
Panjsher
Nuristan
Badghis
Bamyan
Parwan
Kapisa
Kunar
KABUL
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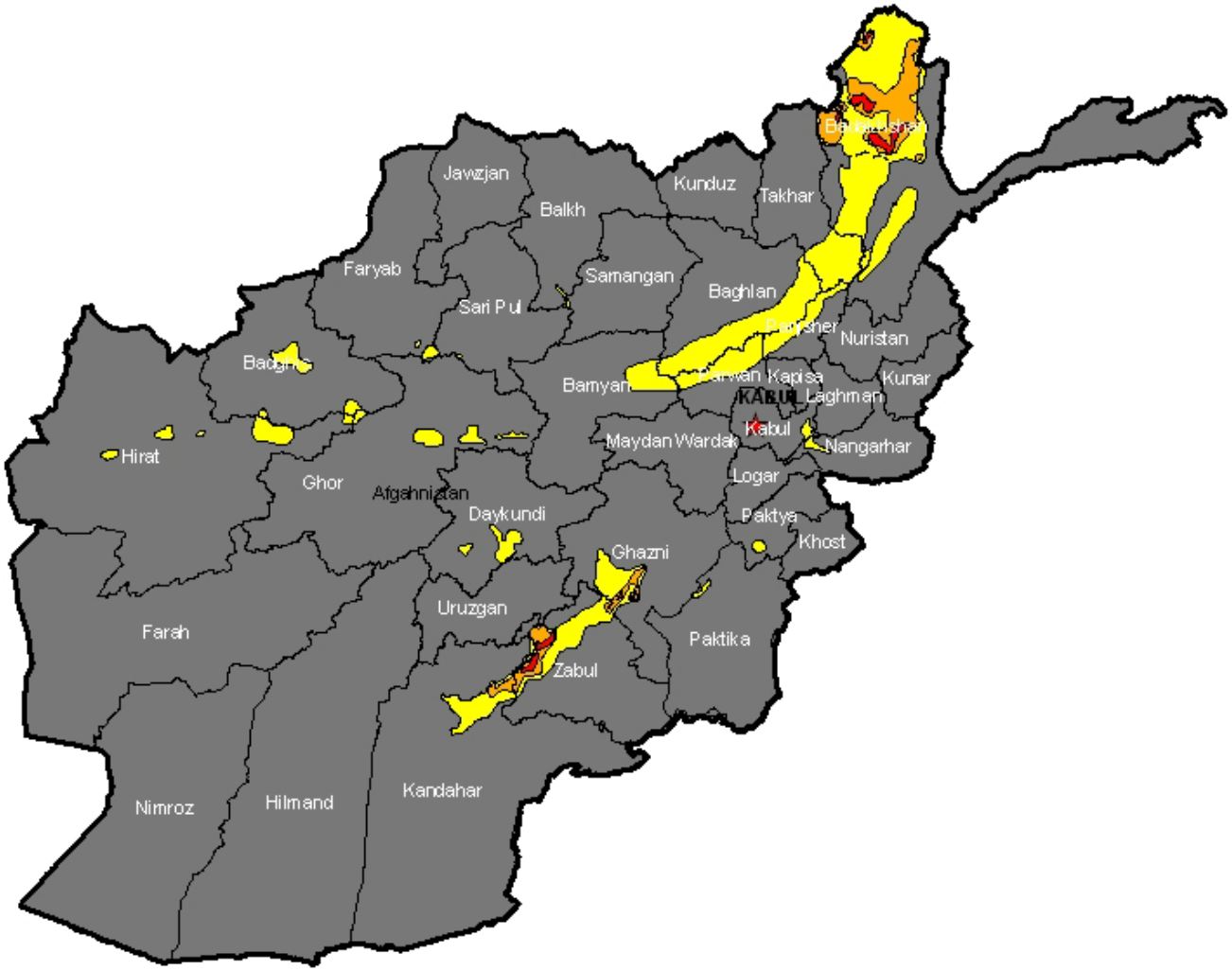
Logar
Ghor
Afghanistan
Daykundi
Paktya
Khost
Ghazni
Uruzgan
Farah
Paktika
Zabul
Nimroz
Hilmand
Kandahar

Gold-Lode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Hirat
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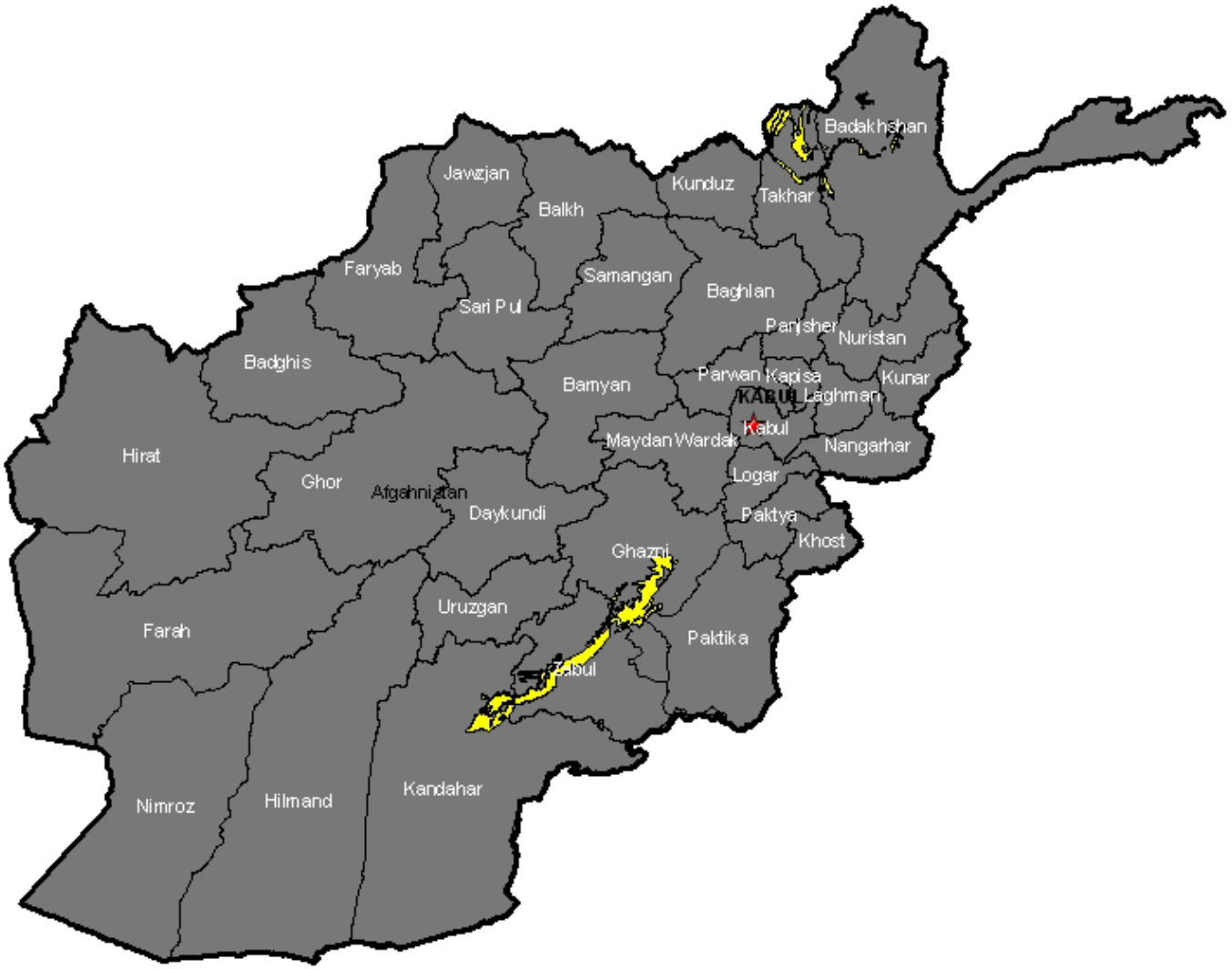
Ghor
Afghanistan
Daykundi
Paktya
Khost
Ghazni
Uruzgan
Farah
Paktika
Zabul
Nimroz
Hilmand
Kandahar

Placer Gold


Badakhshan
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Badghis
Parwan
Kapisa
Kunar
Bamyan
KABUL
Laghman
Kabul
Maydan Wardak
Nangarhar
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Ghor
Afghanistan
Daykundi
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Khost
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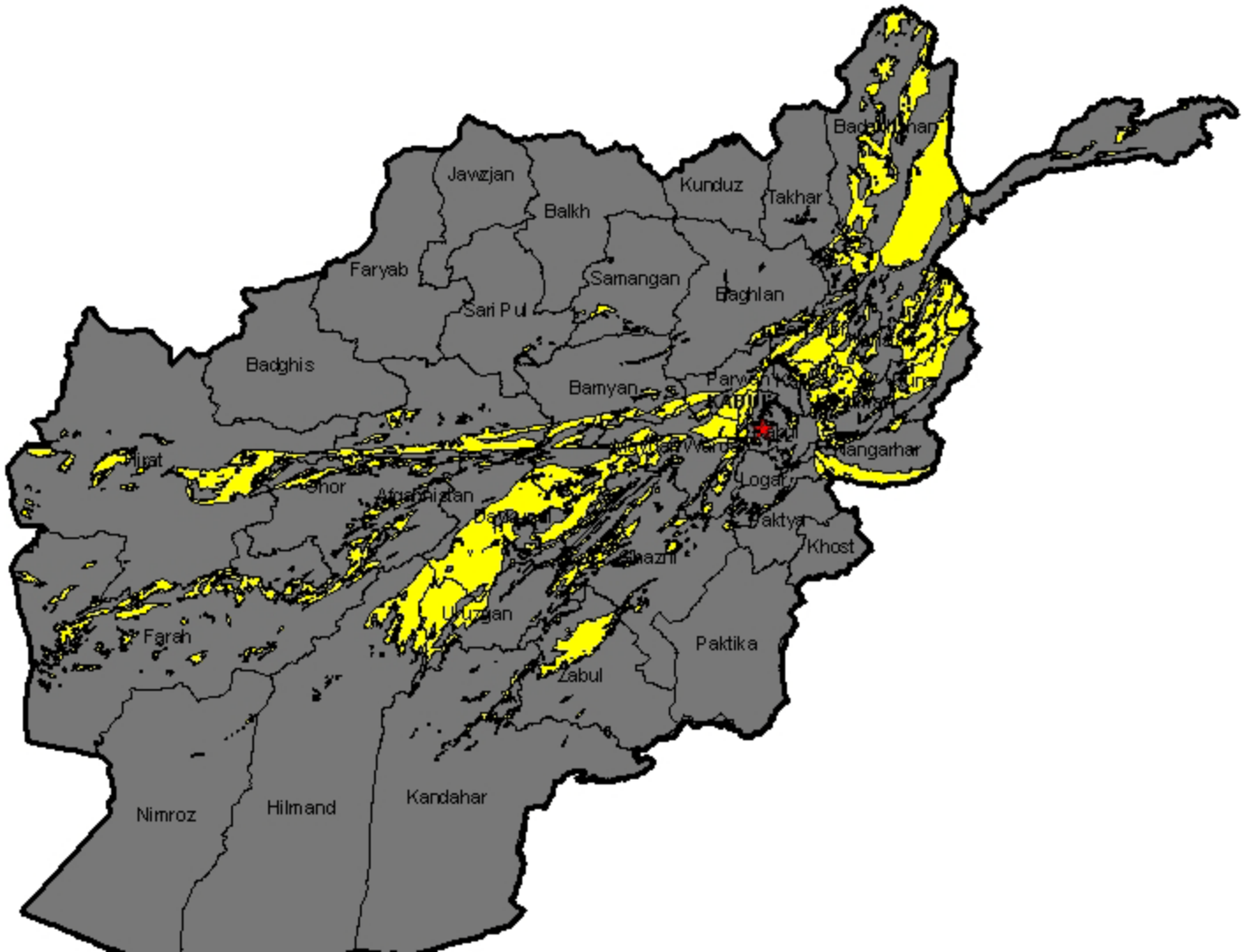
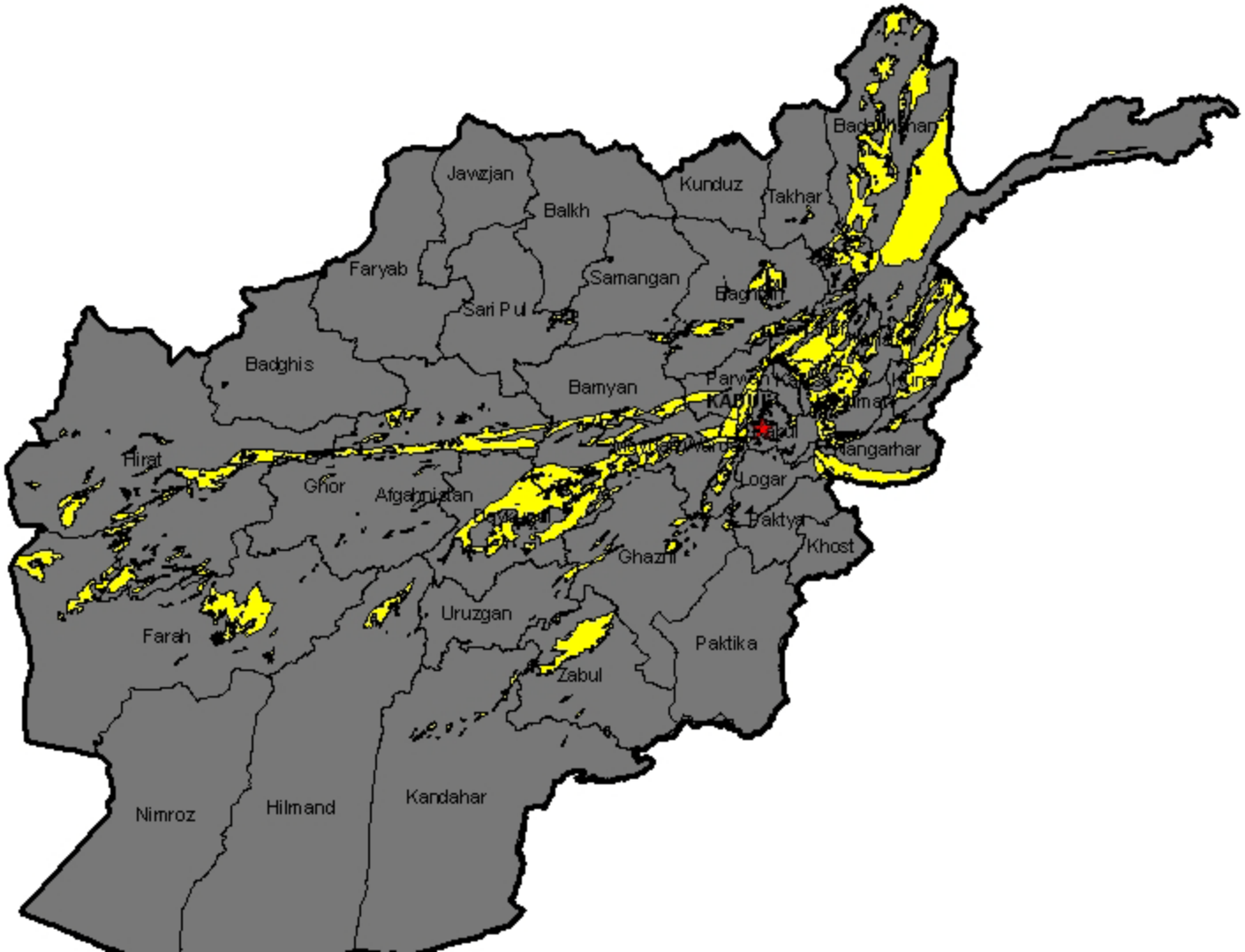
Uruzgan
Farah
Paktika
Zabul
Nimroz
Hilmand
Kandahar

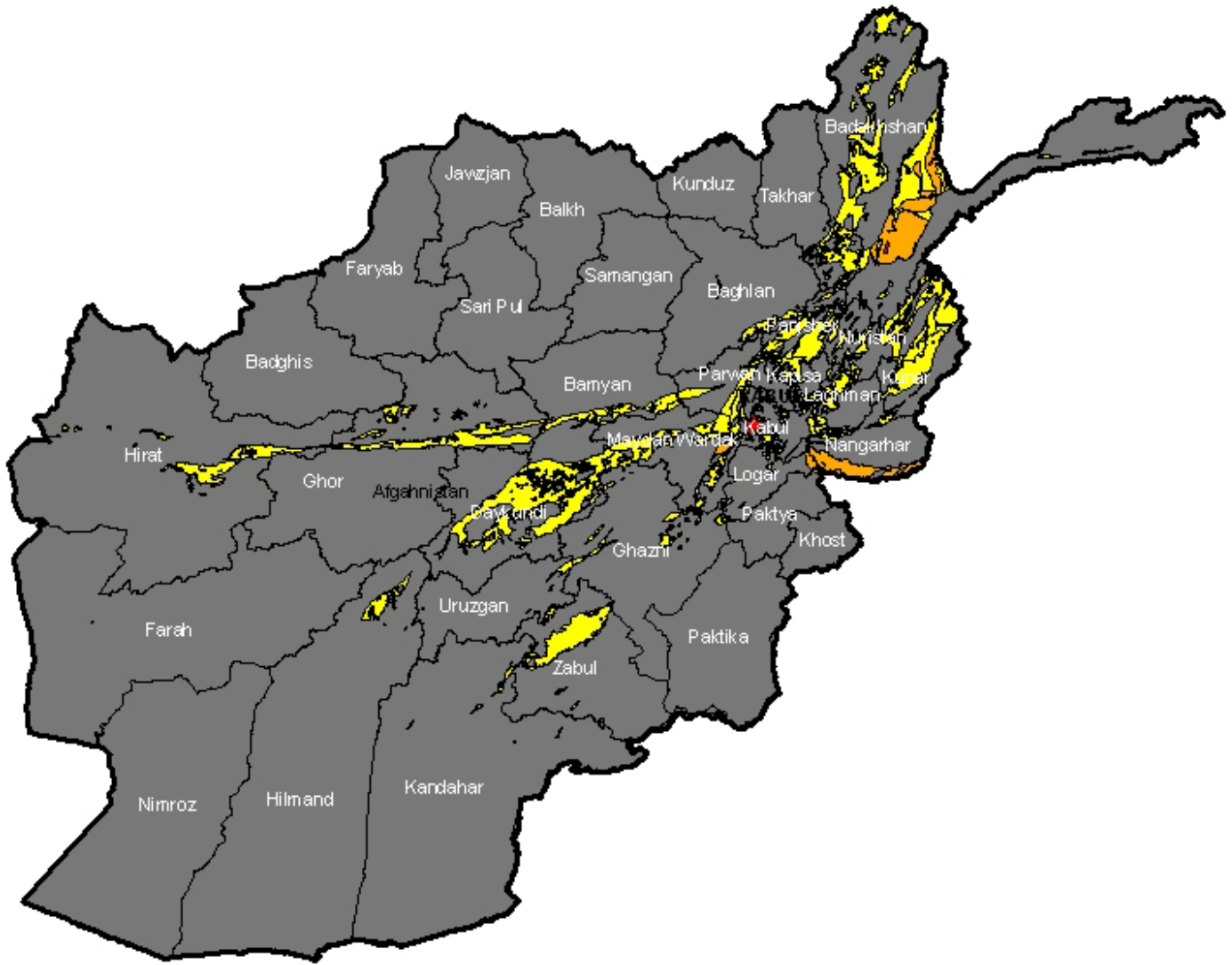
Lead and Zinc



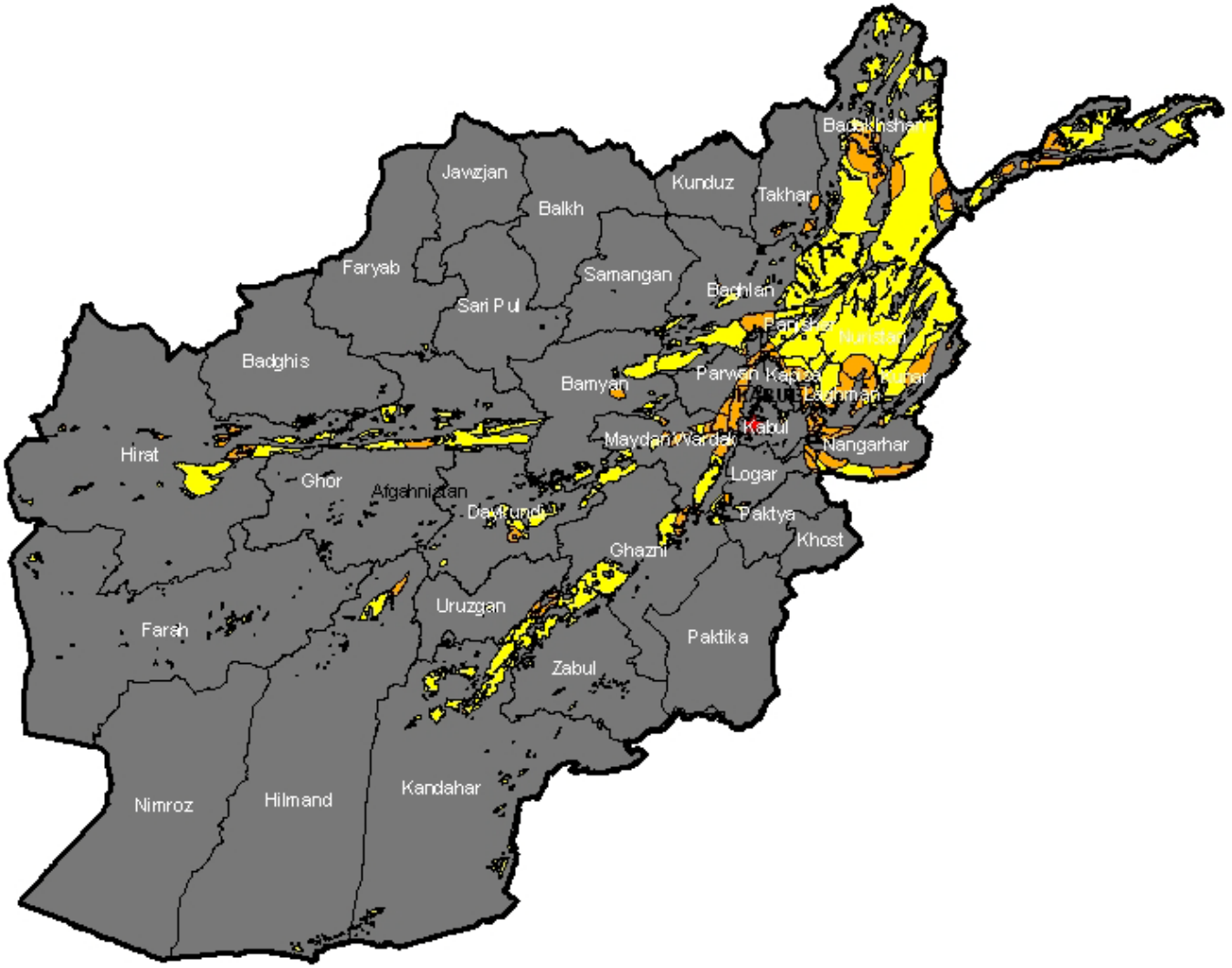
Volcanogenic Massive Sulfide



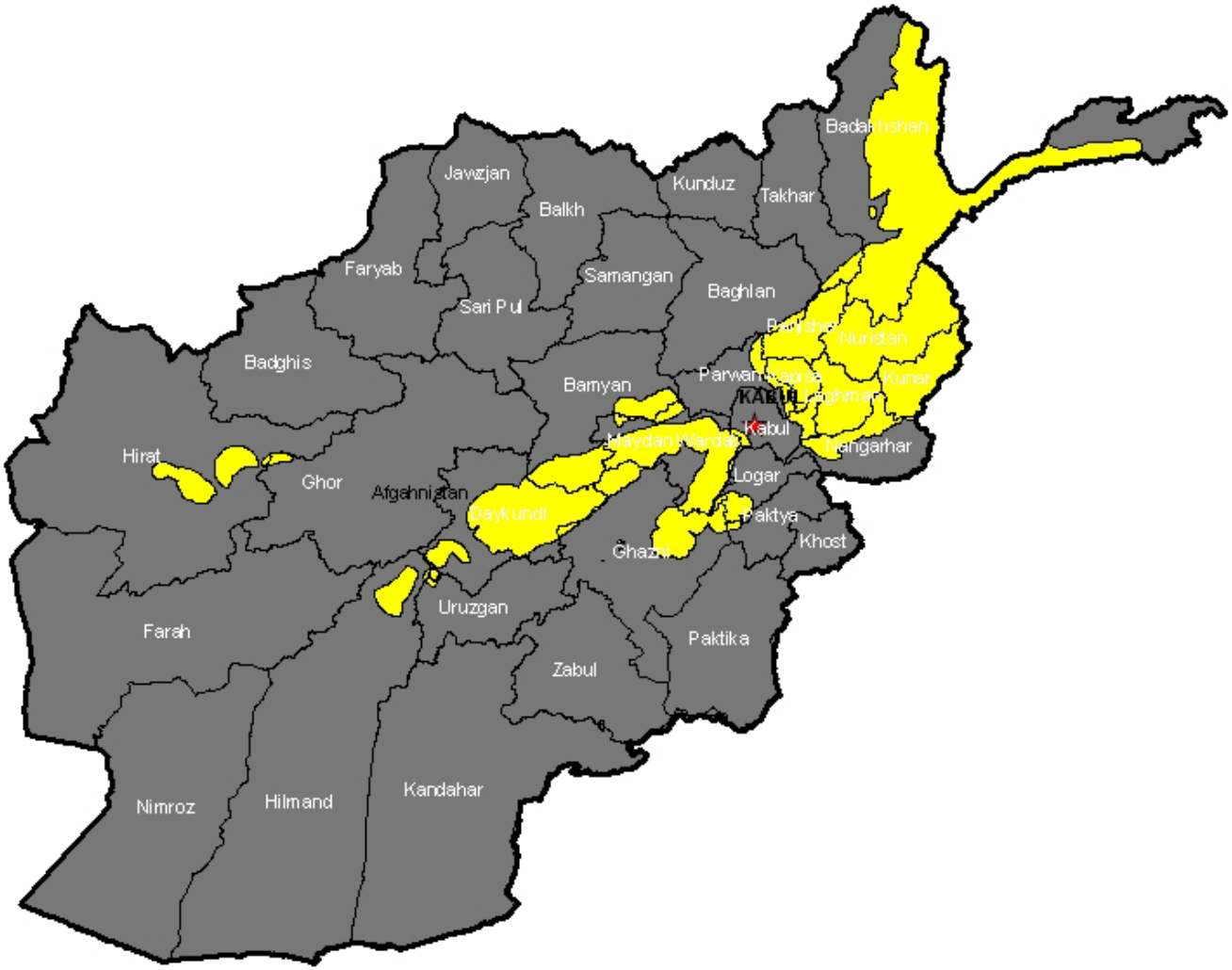
Graphite Disseminated



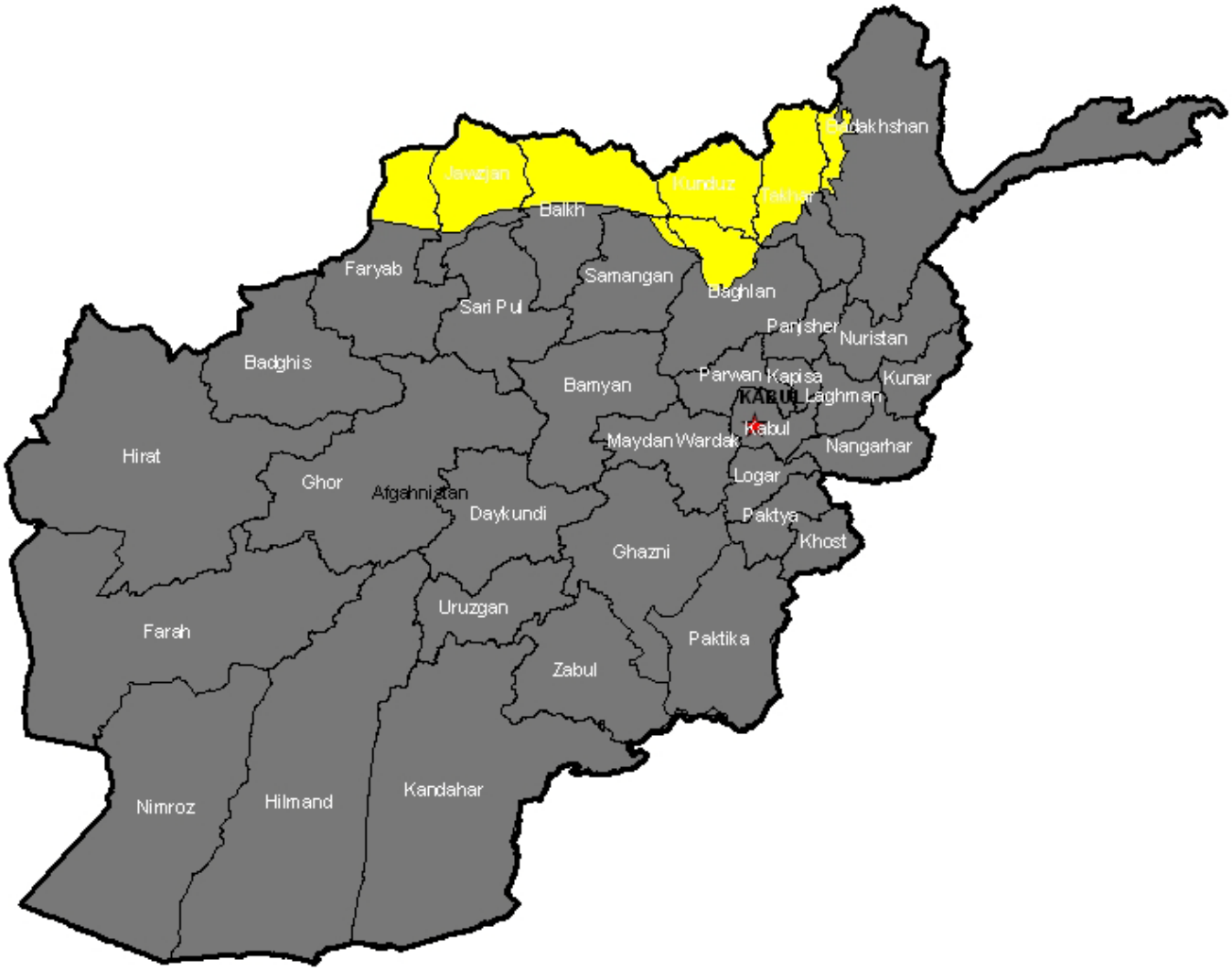
Graphite Microcrystaline



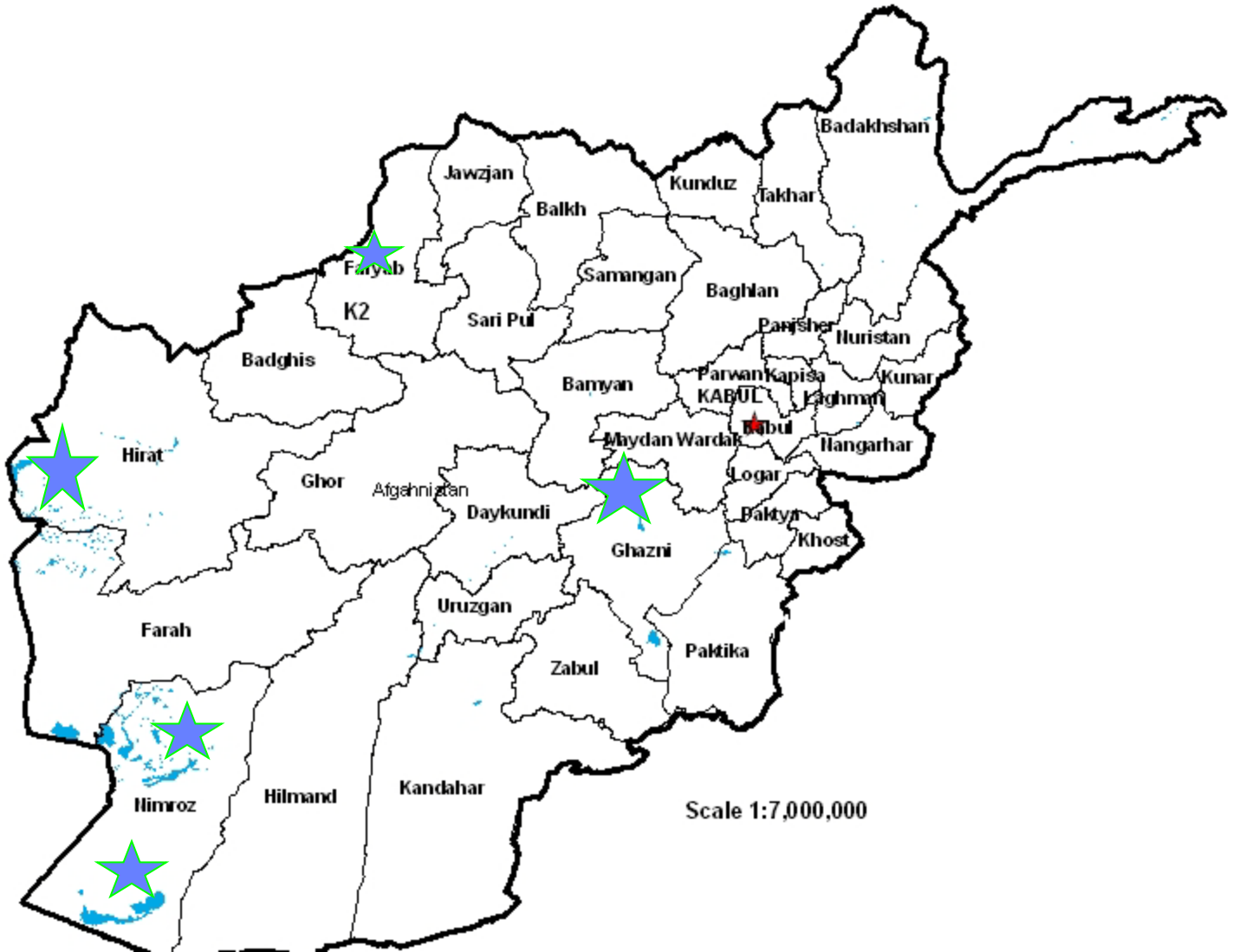
Pegmatites with Nb,Ta, Be and Li



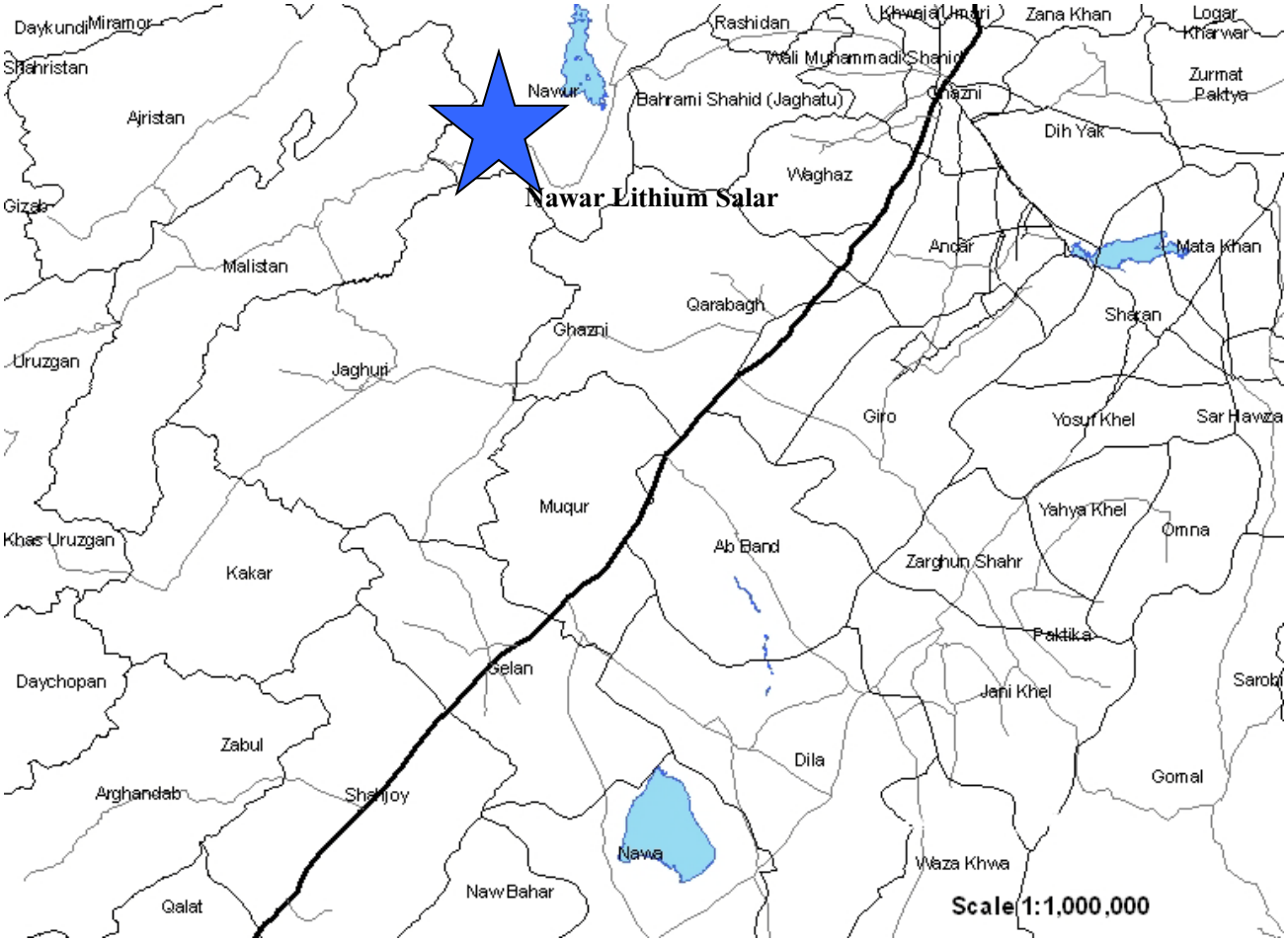
Potash and Salt



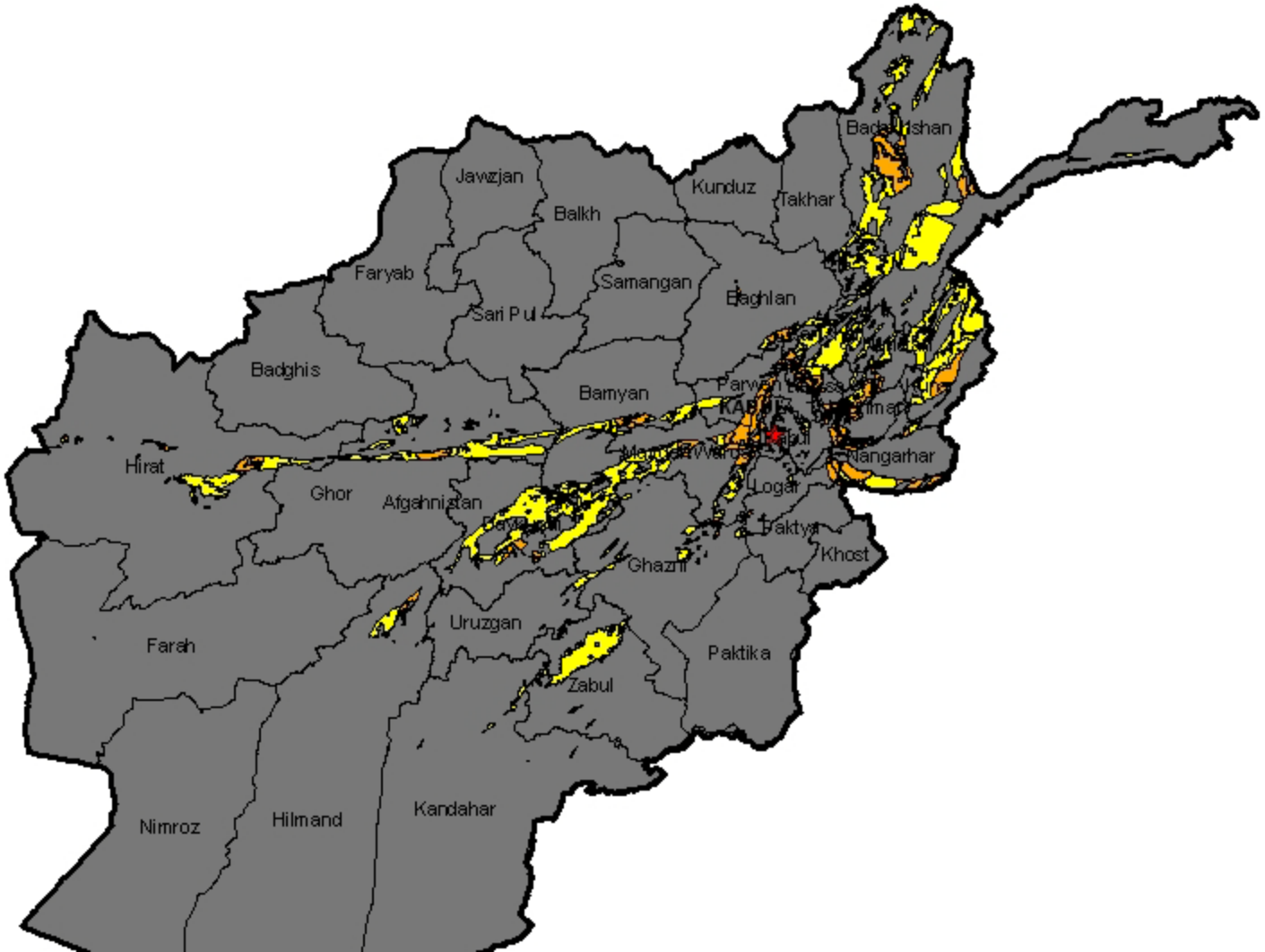
Lithium in Salars



Li in Ghazni Salars



Marble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Kunduz
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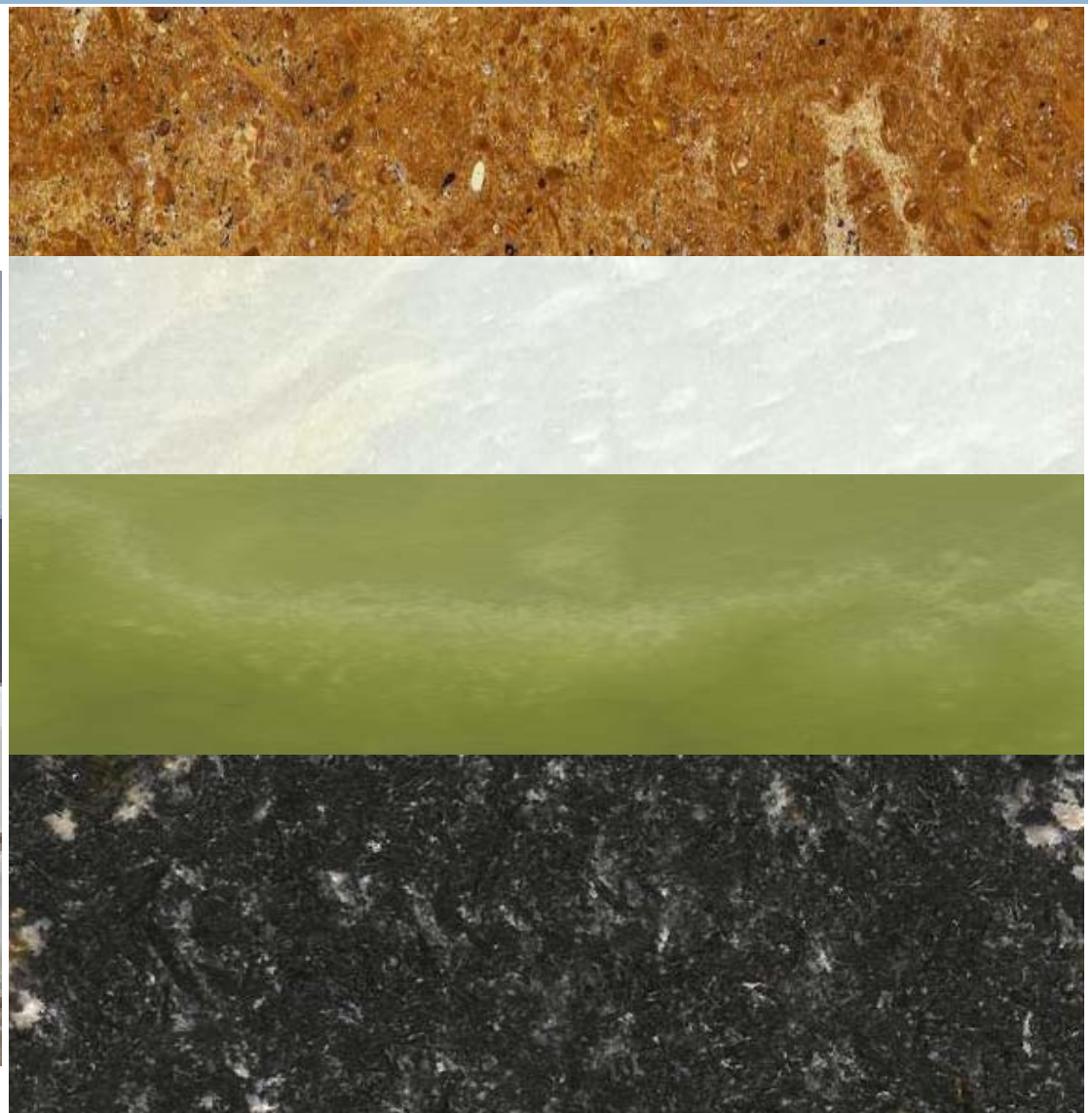
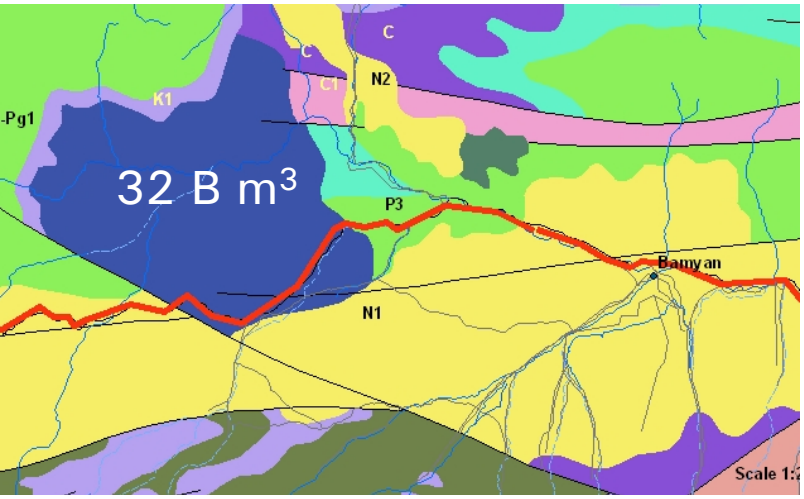
Paktya
Khost
Ghazni
Uruzgan
Farah
Paktika
Zabul
Nimroz
Hilmand
Kandahar

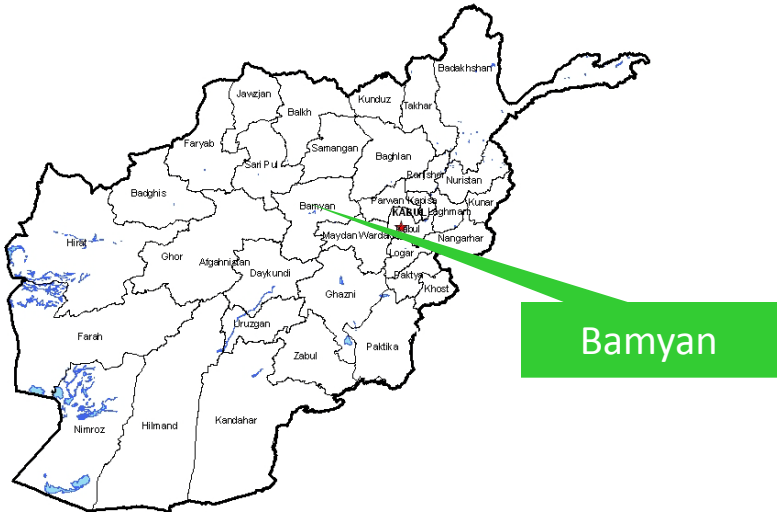
Afghan Marble Varieties

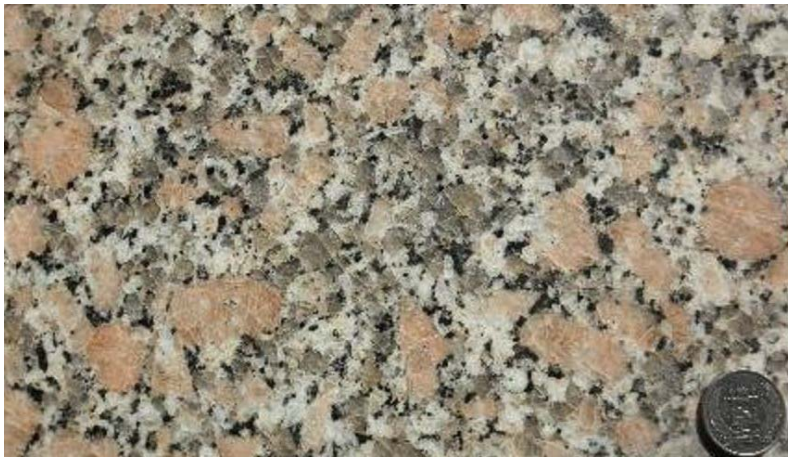
- 34 Colors
- 40 varieties
- Billion tons Resources



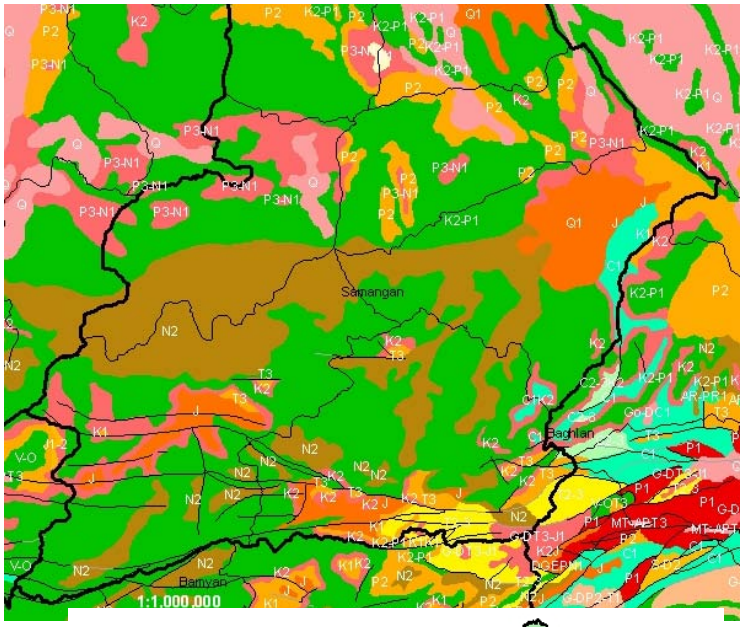
Bamyan Granite

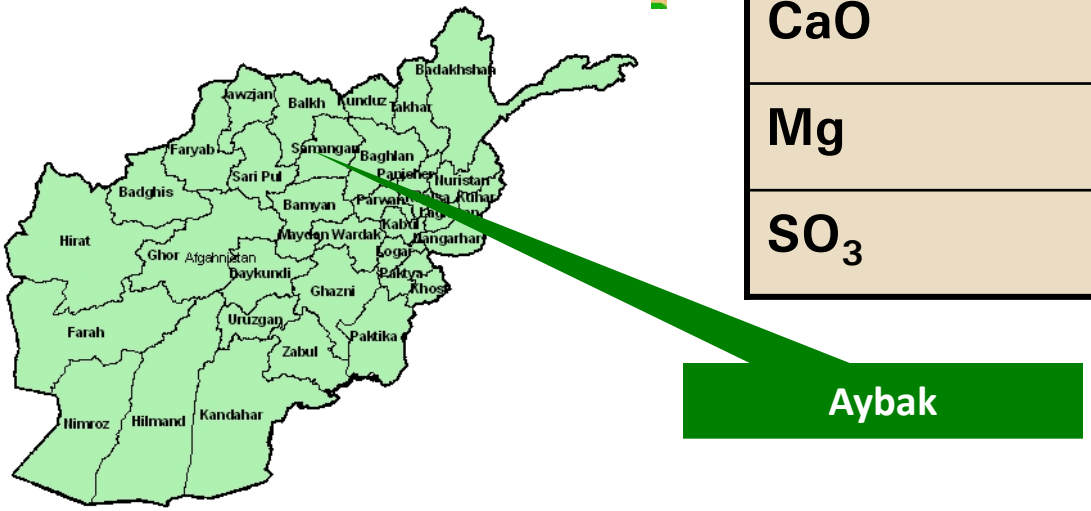






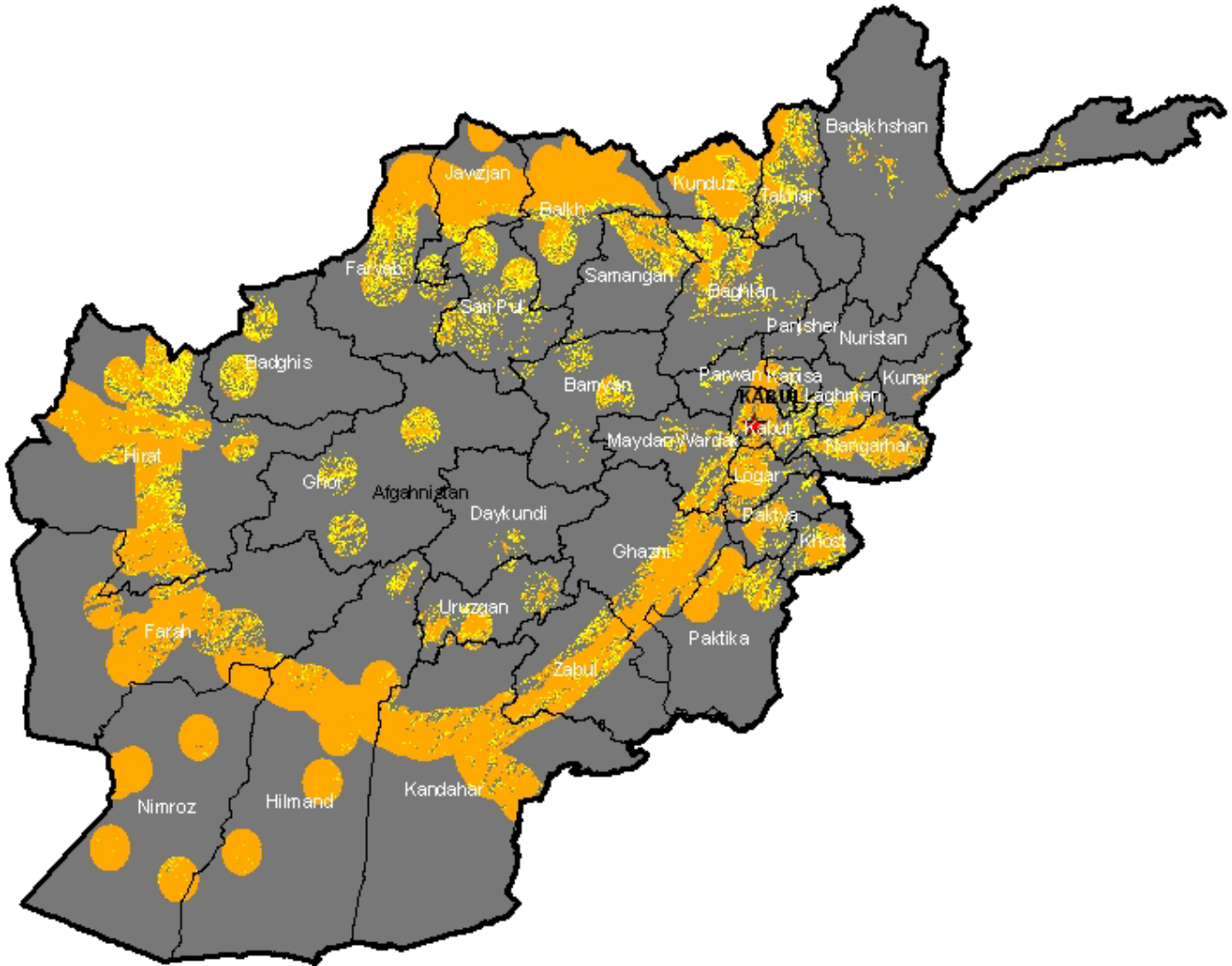
Limestone and Marl for Cement



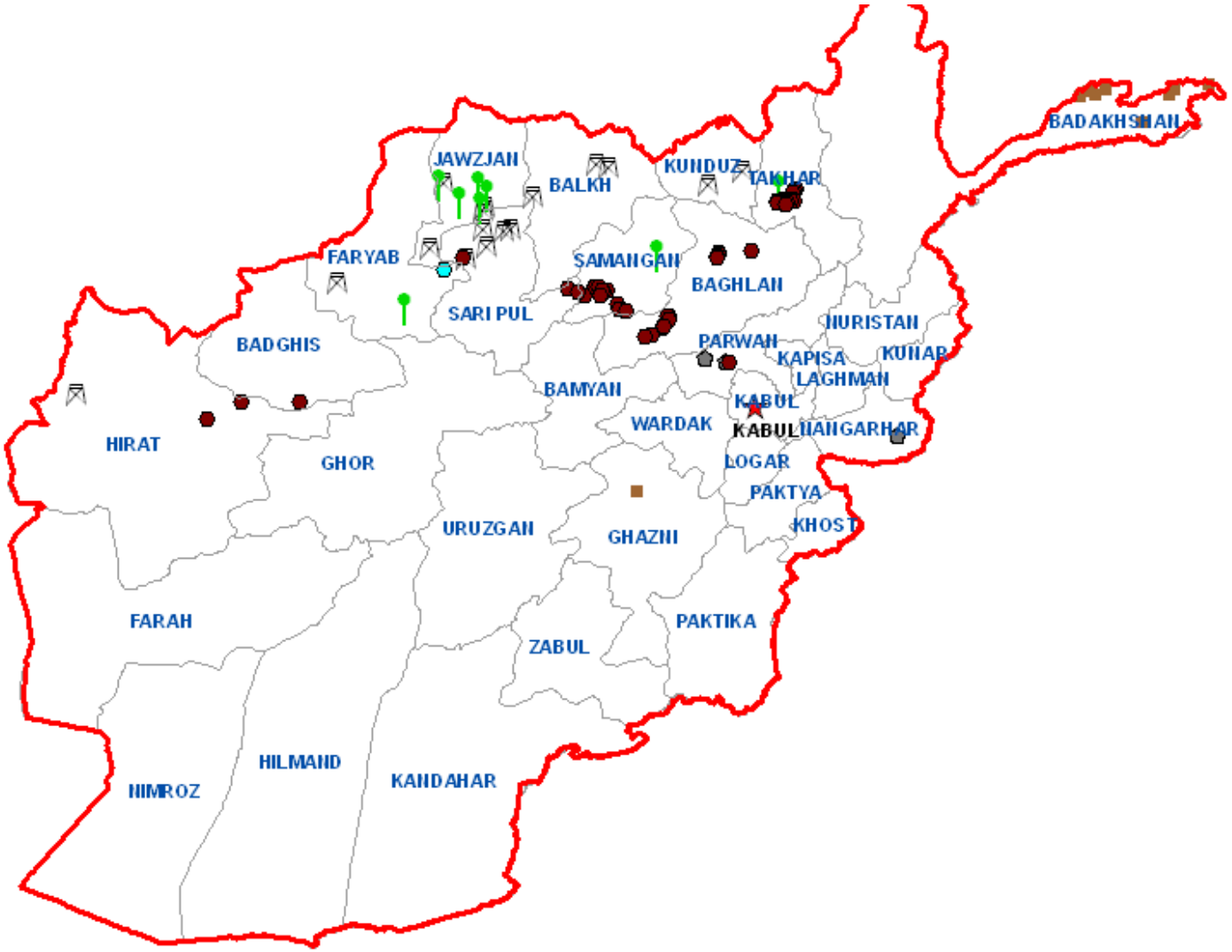


Chemical Composition	%
$CaCO_3$	97.25
SiO_2	0.65
Al_2O_3	1.27
Fe_2O_3	0.88
CaO	56
Mg	0.25
SO_3	0

Sand and Gravel



Oil, Gas, Coal, Lignite, and Peat



Oil and Gas Resources

- Two proven basin
  - Afghan-Tajik Basin
  - Amu Darya Basin
- Three potential Basins
  - Katawaz Basin
  - Helmand Basin
  - Herat Basin
- Most of these basins are filled with several Km of sediments an ideal geological setting for hydrocarbon generation

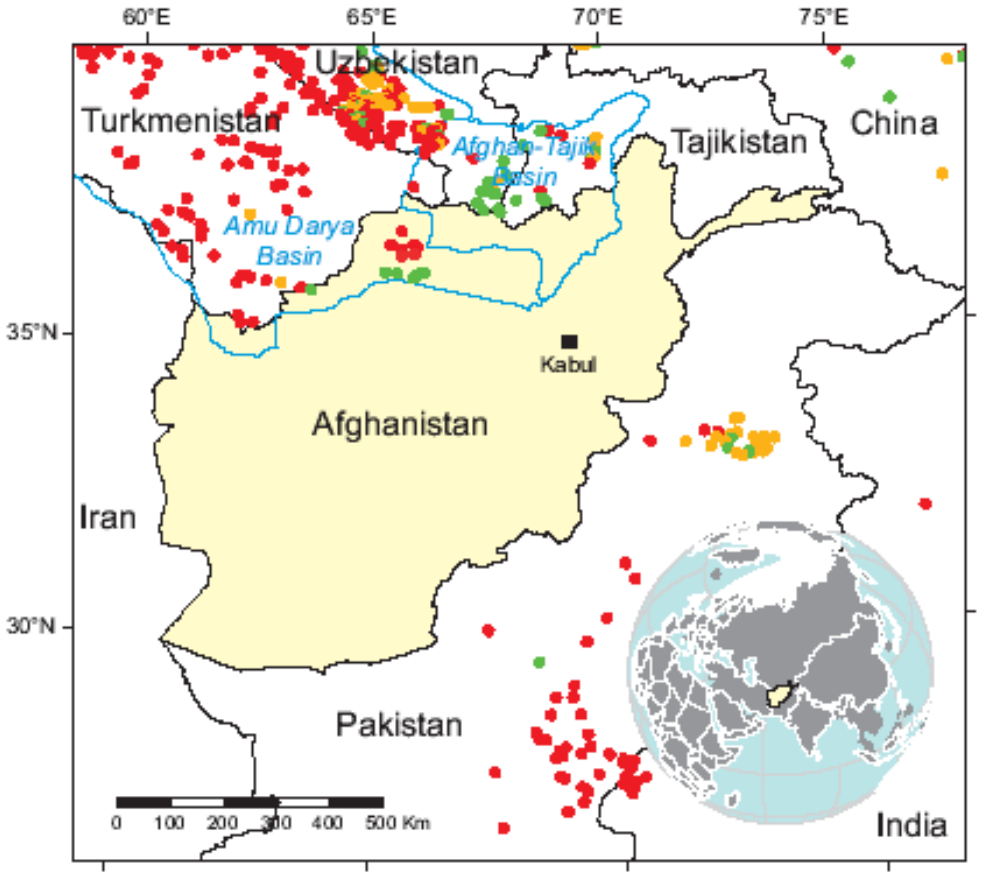
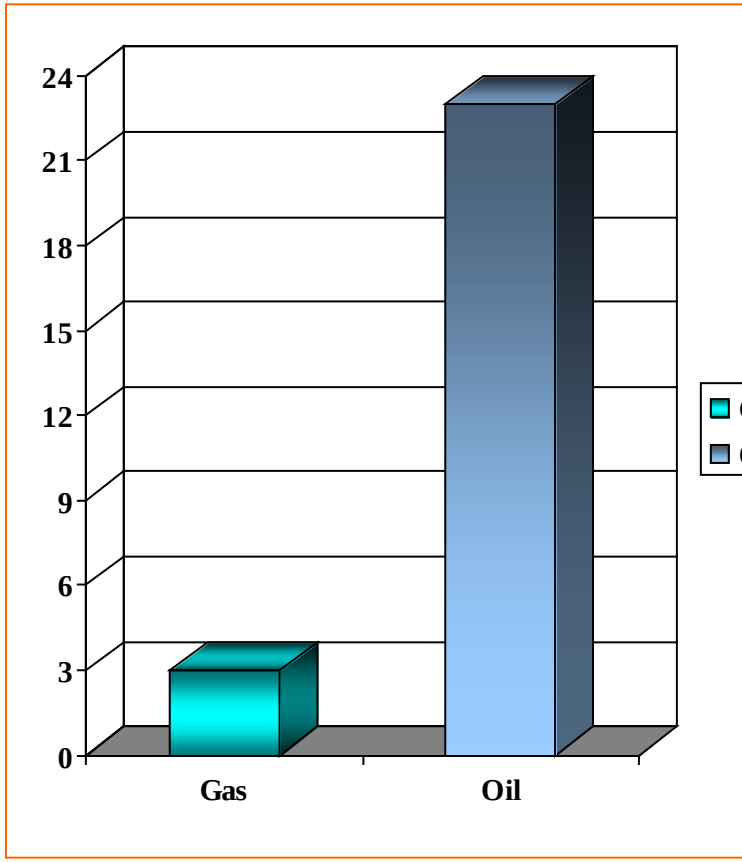


Figure 1. Map of Afghanistan showing location of Amu Darya and Afghan-Tajik Basins, and approximate locations of fields and discoveries that contain primarily crude oil (green), natural gas (red), and both (orange). Field and discovery locations from IHS Energy (2005).

USGS and AGS Assessments

- Estimates have increased the oil resources by 23 times and more than tripled the natural gas resources
- Undiscovered gas reserves range from 3.58 to 36.46 trillion cubic feet (cf) with a mean of 15.69 trillion cf
- Undiscovered oil reserves range from 391 million barrels to 3.56 billion barrels with a mean of 1.60 billion barrels
- Undiscovered liquid gas condensate reserves range from 126 million barrels to 1.33 billion barrels with a mean of 562 million barrels

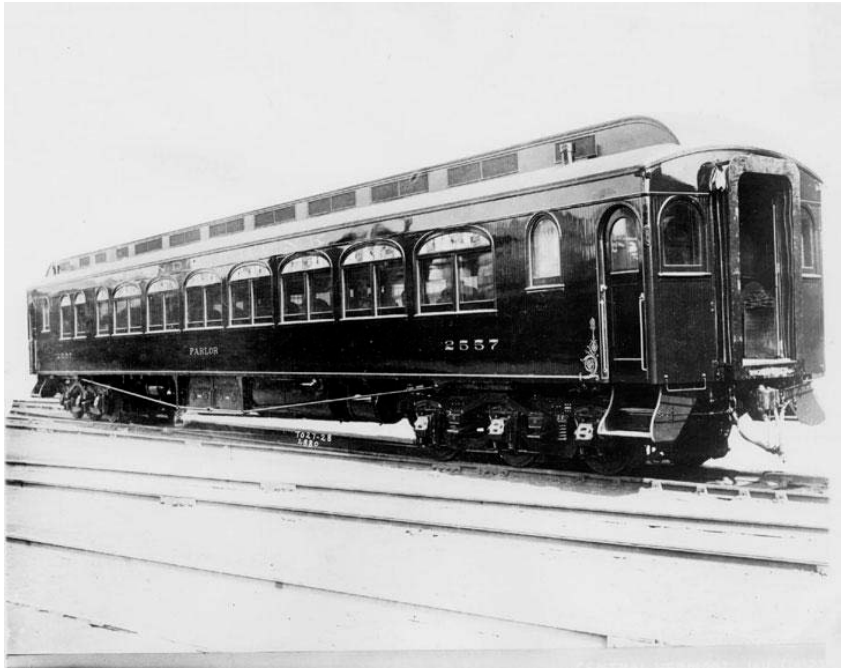


MoM Current Major Projects

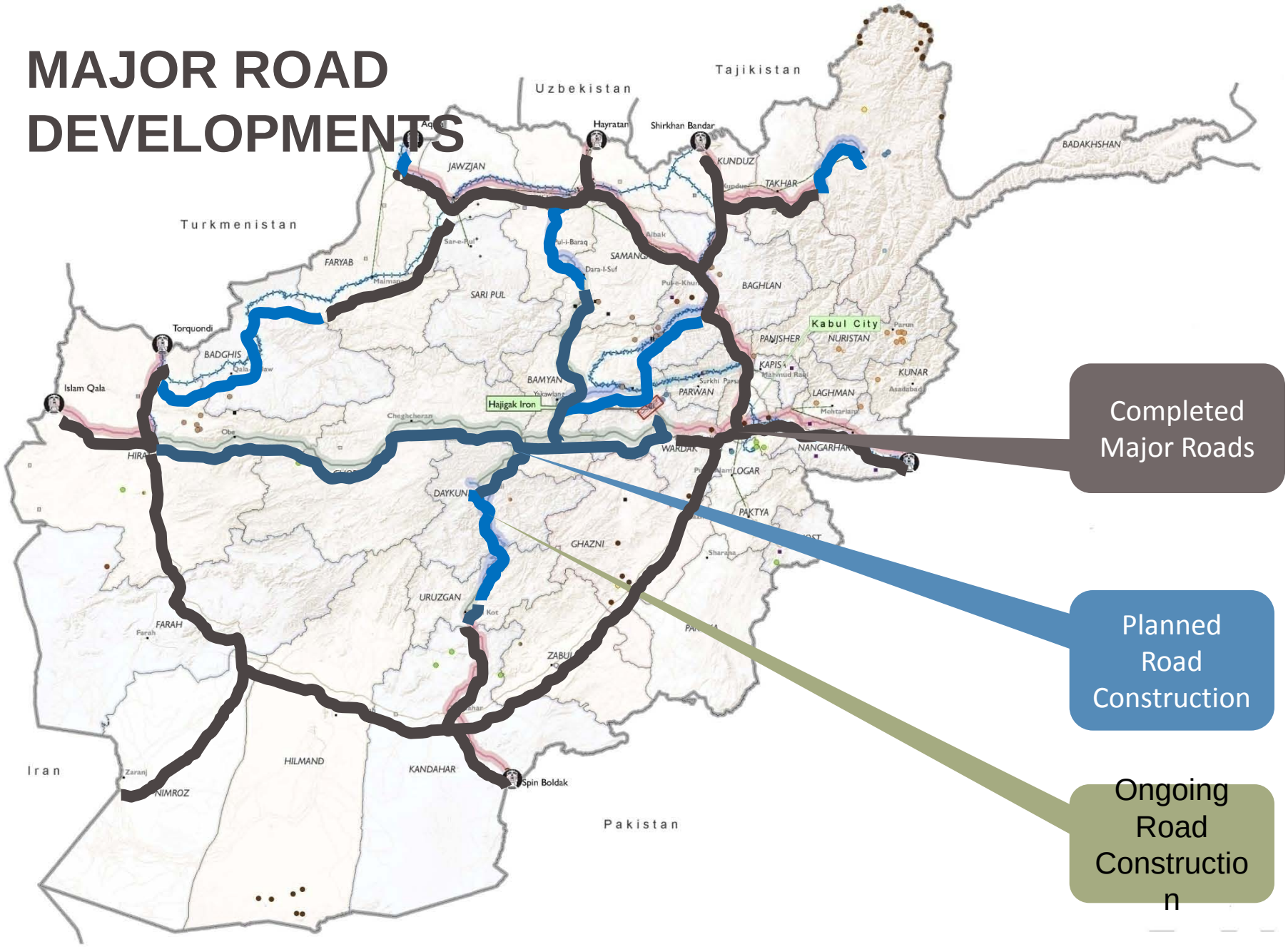
- Supervision of World class Aynak Copper Mining Contract, capital expenditure, $5 billion, 35 km South-East of Kabul. Production will start in 2 yrs. The project will bring hundreds of millions of dollars annually to the state treasury
- World class Hajigak Iron $288 billion In Situ gross value, 20,000 jobs, 130 km west of Kabul. Tendering is in progress. There are several additional prospects close to Hajigak that will extend the life and quantity of production
- Sya Dara Iron 140 Km west of Hajigak, 500 million tons estimated resources
- Gold in the banks of Amu Darya
- Oil and gas development in Northern Afghanistan
- Assessment of prospective areas for porphyry Cu, Au, Mo, and raw material for cement.

Large Mining Projects Require

- Railroad and highways for export of ore, ore concentrate or final metal products (copper, steel, construction materials, and import of machinery and equipment)
- Access roads
- Power supply (hydro, coal
- fired, or gas fired)
- Water supply (for industrial and domestic needs)
- Community development projects: hospitals, schools, shopping centres, etc
- Most of the coal, iron, and other mineral reserves occur in Central Afghanistan



MAJOR ROAD DEVELOPMENTS

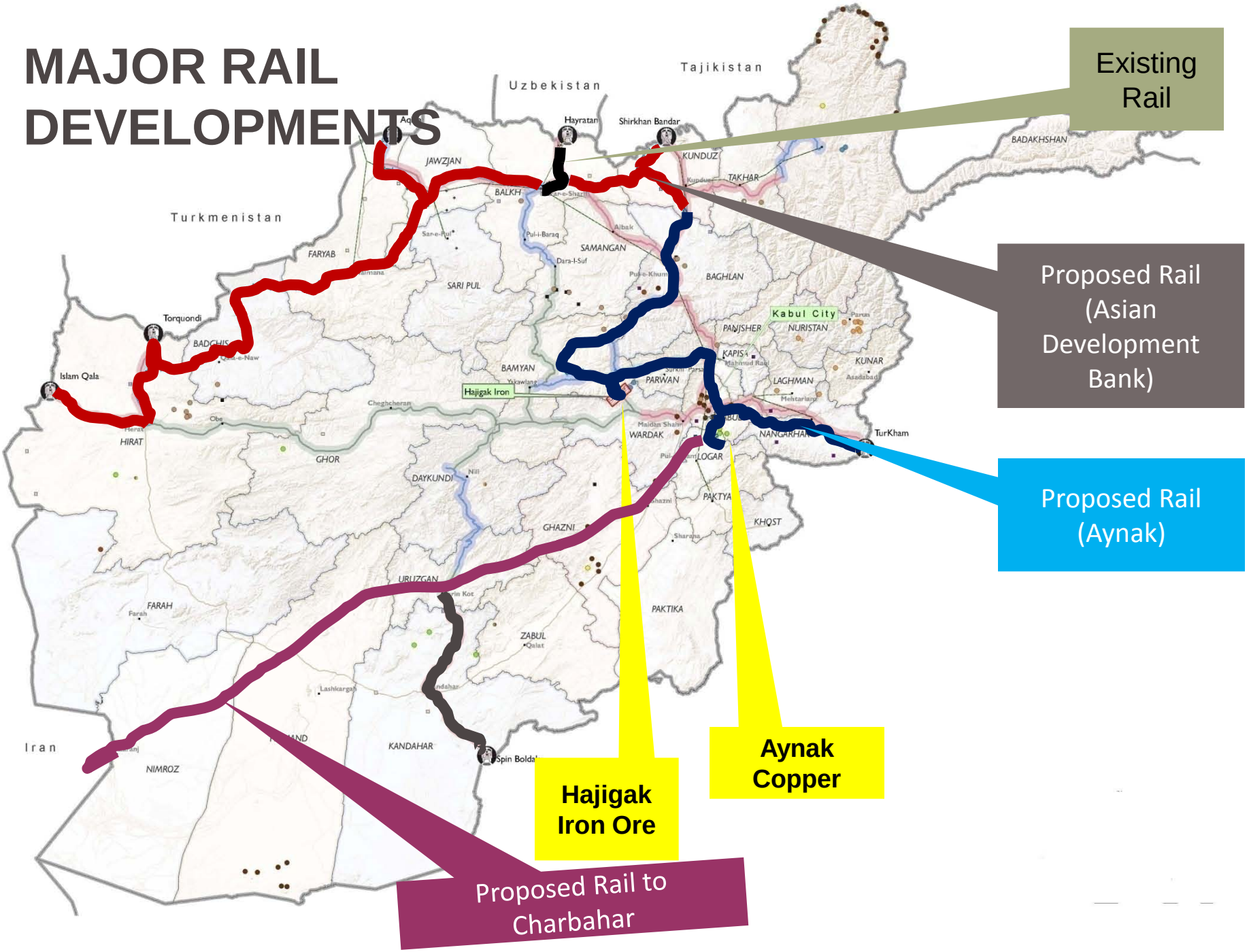


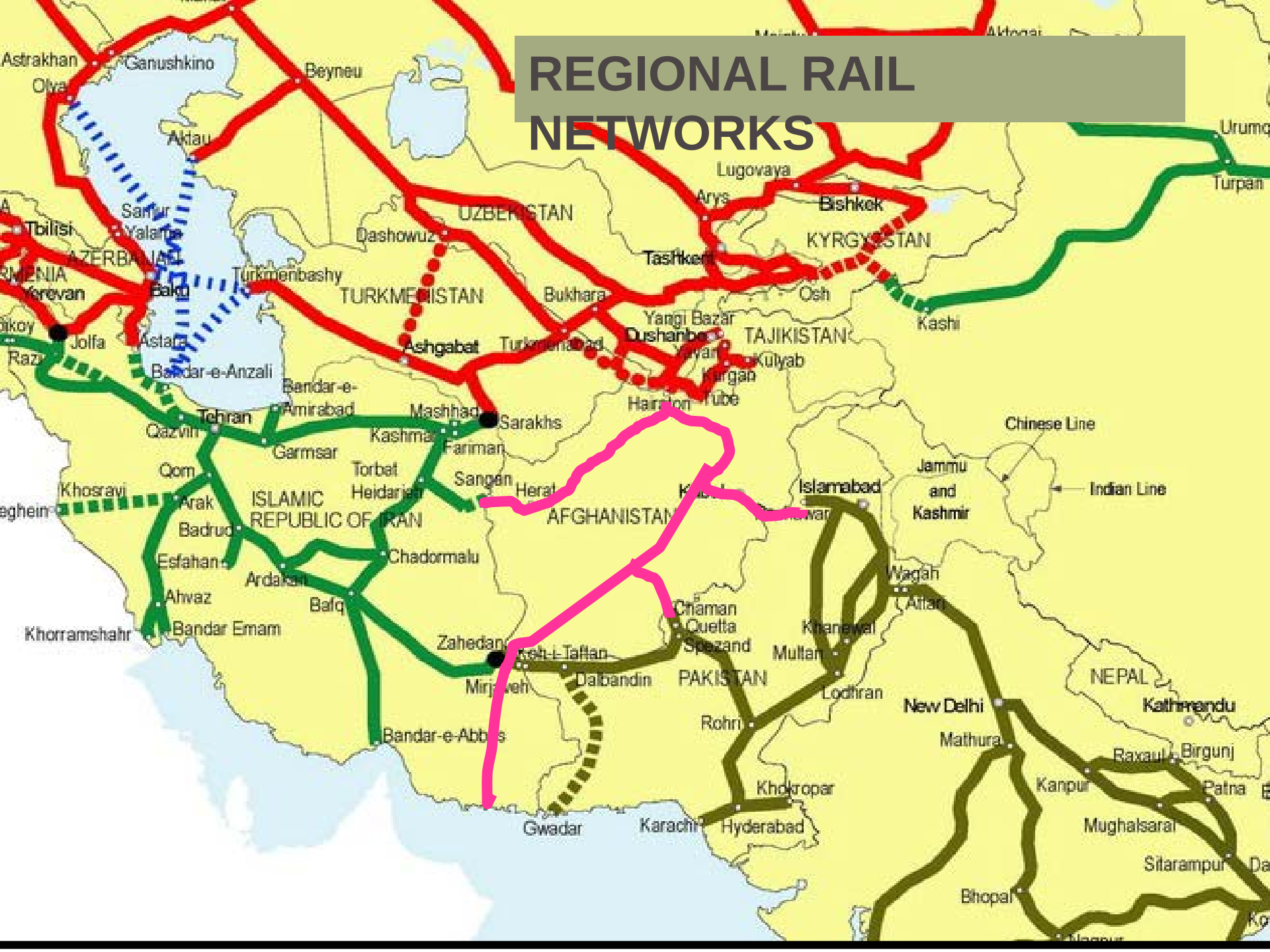
Completed Major Roads

Planned Road Construction

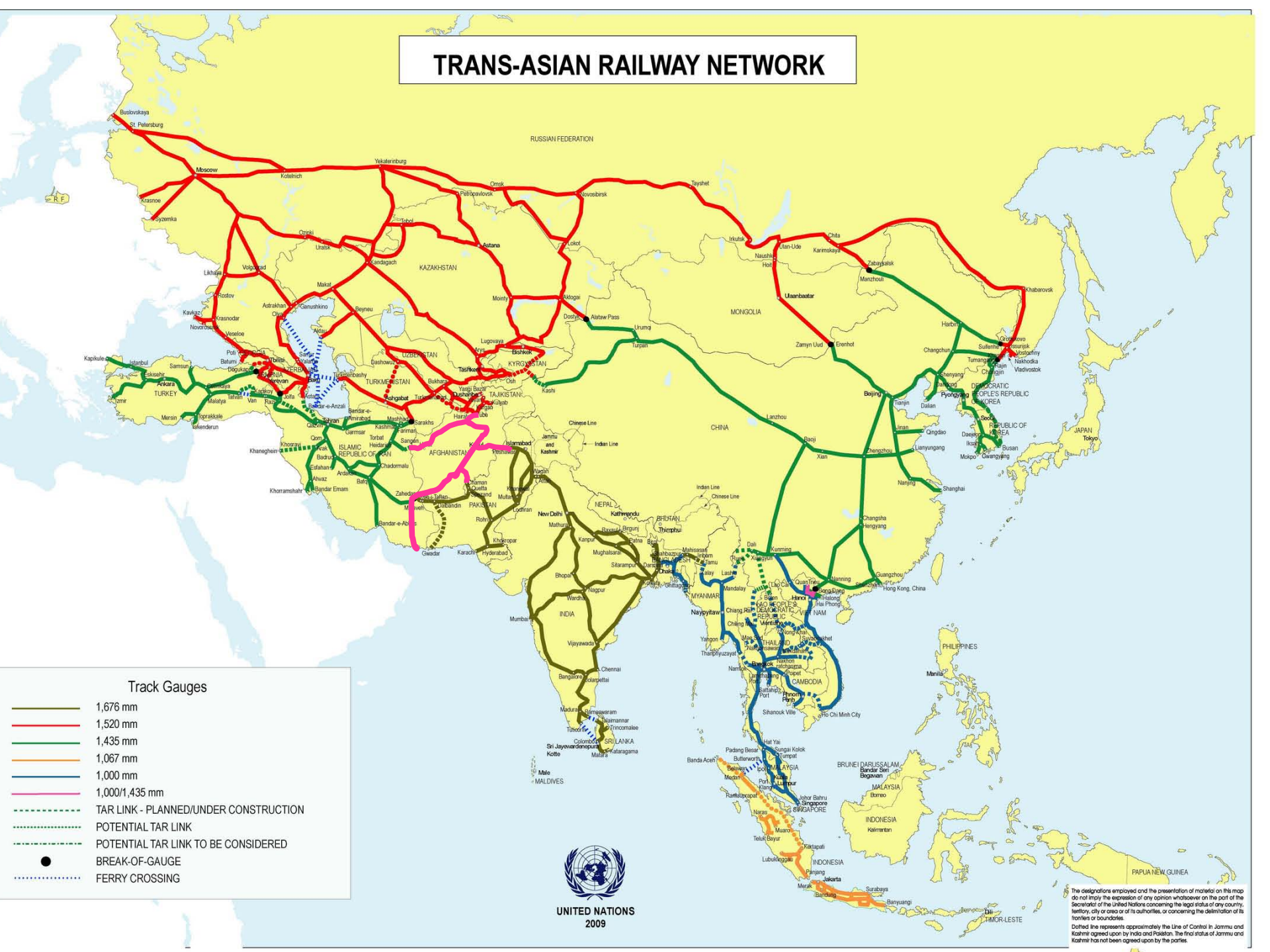
Ongoing Road Constructio n

MAJOR RAIL DEVELOPMENTS




REGIONAL RAIL NETWORKS
Astrakhan
Ganushkino
Beyneu
Aktau
Lugovaya
Arys
Bishkek
KYRGYZSTAN
Turpan
Tbilisi
AZERBAIJAN
Baku
Turkmenbashy
TURKMENISTAN
Dashowuz
Ashgabat
Bukhara
Tashkent
Osh
Kashi
Yangi Bazar
Dushanbe
TAJIKISTAN
Kulyab
Kargan Tube
Jolfa
Bandar-e-Anzali
Bandar-e-Amirabad
Tehran
Qazvin
Garmsar
Mashhad
Sarakhs
Kashmar
Fariman
Torbat Heidarian
Sangan
Herat
AFGHANISTAN
Chinese Line
Jammu and Kashmir
Indian Line
Islamabad
Qom
Khosravi
Arak
ISLAMIC REPUBLIC OF IRAN
Badrud
Esfahan
Chadormalu
Ardakan
Ahwaz
Balq
Khorramshahr
Bandar Emam
Bandar-e-Abbas
Zahedan
Mirjaveh
Dalbandin
PAKISTAN
Chaman
Quetta
Spezand
Khanewal
Multan
Lodhran
Wagah
Attari
Rohri
New Delhi
Mathura
NEPAL
Kathmandu
Raxaul
Birgunj
Kanpur
Patna
Khokropar
Hyderabad
Karachi
Gwadar
Mughalsarai
Sitarampur
Bhopal

TRANS-ASIAN RAILWAY NETWORK



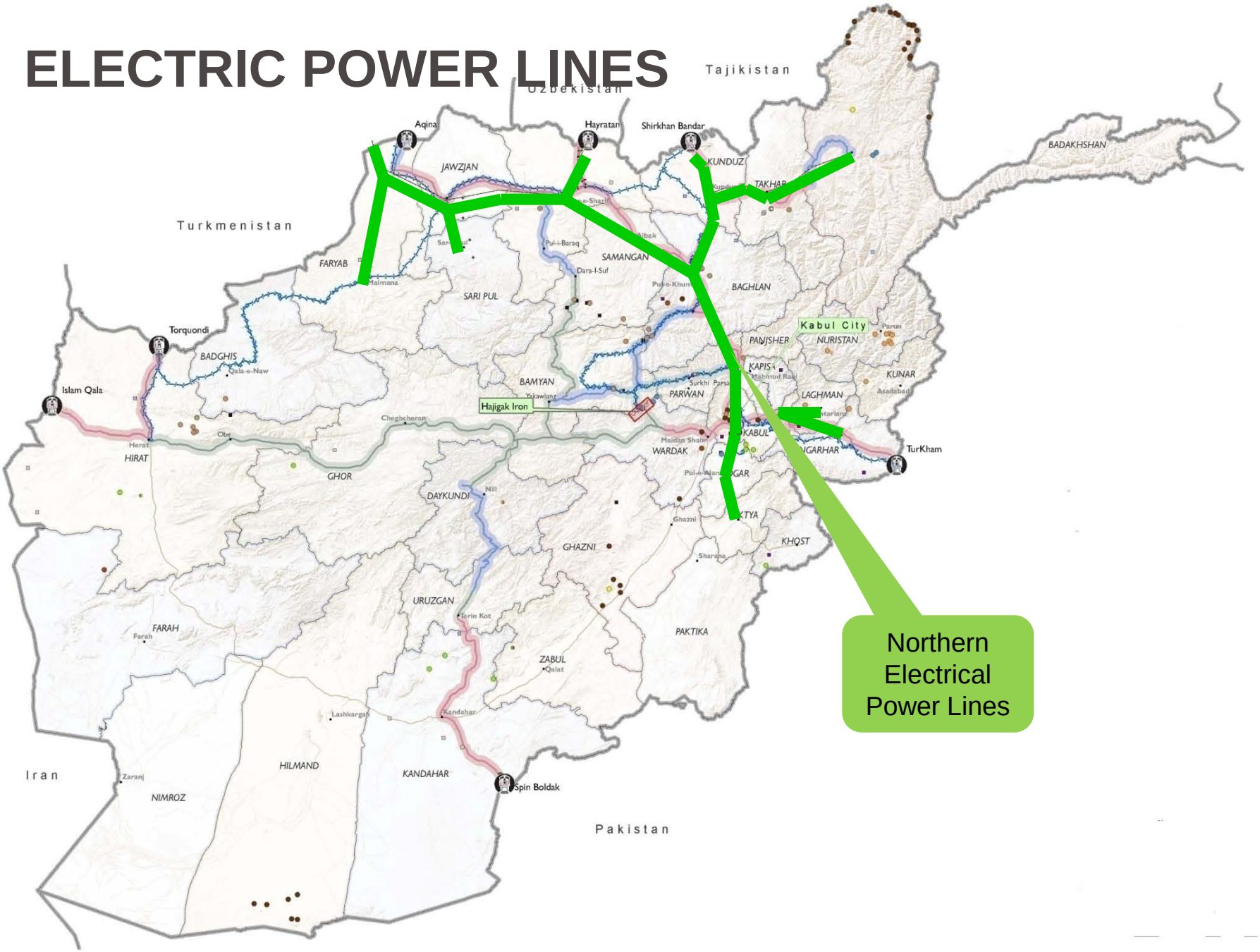
The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not been agreed upon by the parties.

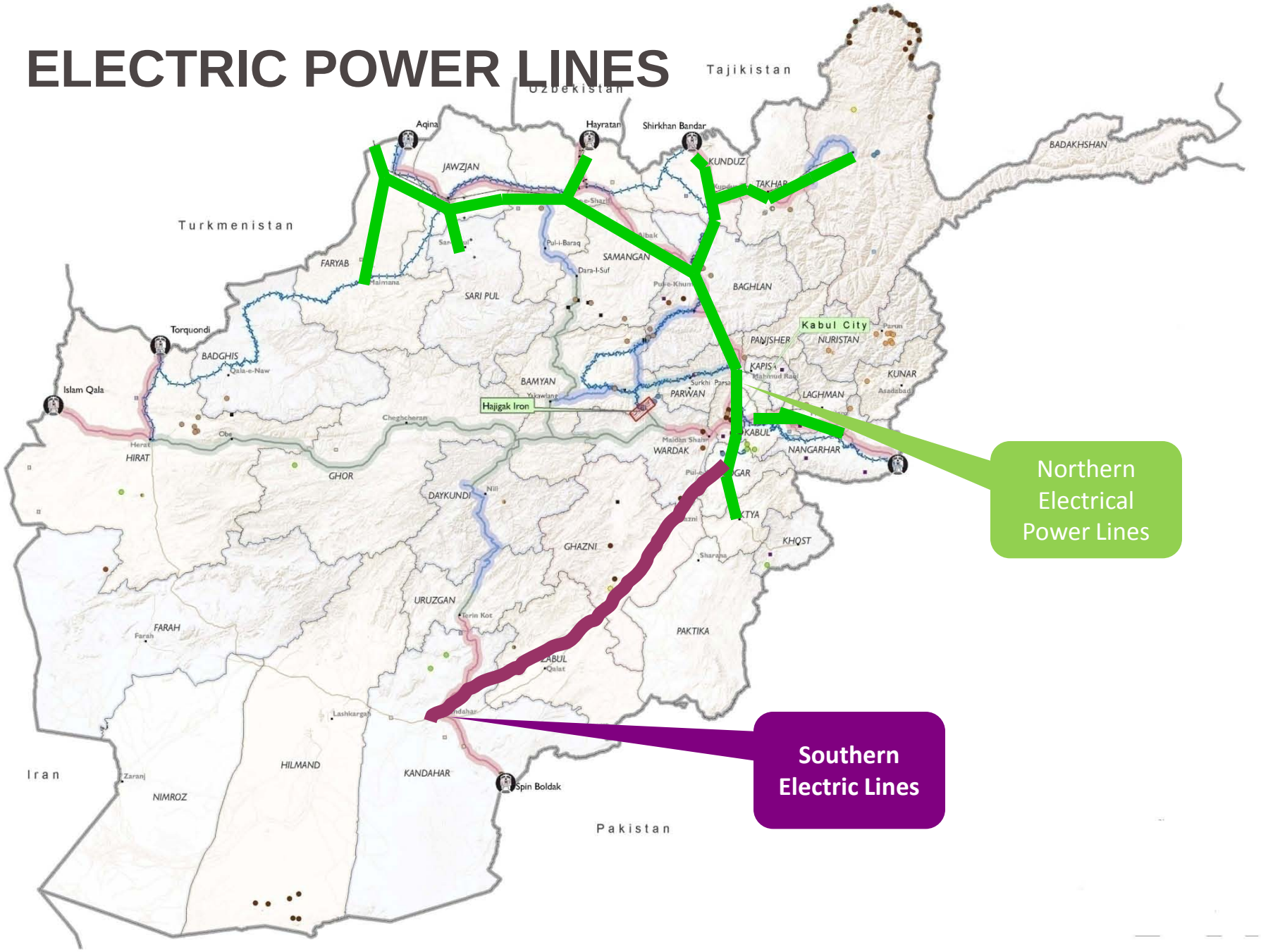
Baseline Power Needs

- To develop the vast mineral resources of Afghanistan, tremendous amounts of electric power is needed
- A chemical plant can not afford to have power interruptions, because forced startup and shutdowns can result in enormous product losses, considerable financial losses and significant environmental pollution
- A stable and reliable base-load power supply is needed
- The coal resources of Central Afghanistan or the natural gas from Amu-Darya Basin can be used as a reliable fuel source for large electric generation plants to meet the need of the mining projects. In addition, it would create thousands of additional jobs
- More exploration is needed to commercialize these resources

ELECTRIC POWER LINES



ELECTRIC POWER LINES



Regulatory Framework

- Guarantee of tenure from exploration to exploitation

- Royalty regime in line with international standards
- Simplified licensing process
- Guaranteed profit repatriation
- Clear and transparent dispute resolution mechanisms
- Commitment to transparency in awarding contracts (EITI)

Mineral and HC Bid Prioritization

Bids are prioritized based on:

1. **Technical capacity**
2. **Financial strength**
3. **Revenue to the government**
4. **Level of Socio-economic benefit to the people**
5. **Dimension of newly built infrastructures**
6. **Stringency of socio-environmental commitments**

Taxes

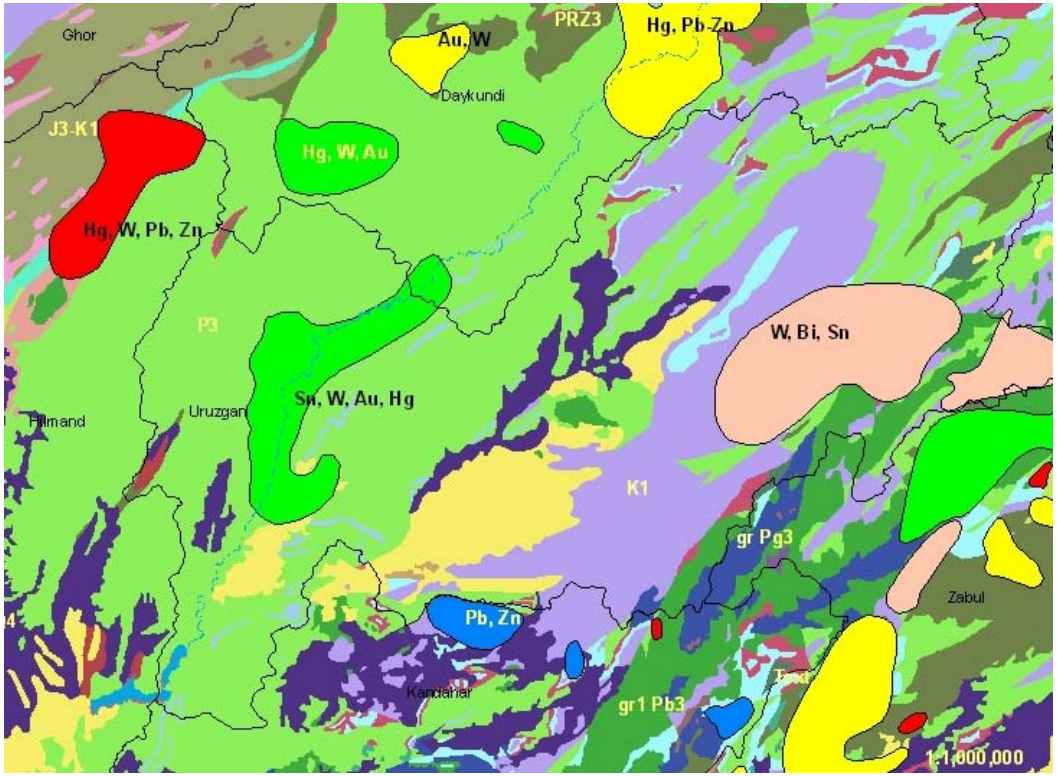
- According to the law, companies that are engaged in a mining contract with the government of Afghanistan, pay the following taxes:
- Royalty from the gross product
- Surface usage fee
- Income Tax around 20%

Duration of Mining Contracts

- 30 years for large projects
  - Can be extended every five years until reserves completely exhausted
- 10 years for small mines
  - Can be extended every five years

Security of Investment

- The Constitution and the Minerals Law of Afghanistan provide the following:
- The government guaranties that the private investment is not nationalized



Thanks