



Minerals in Afghanistan



The Fluorite potential of Afghanistan

Introduction

Afghanistan is situated on the junction between the Indian and Eurasia crustal plates and is composed of a series of terranes (Figure 1) that broke away from the main Gondwana supercontinent before colliding with and being accreted onto the Eurasian plate. The accretionary events started in the Cretaceous and have continued until recent times.

The fluorite potential of Afghanistan has not been studied in great detail but the best known occurrences are located in Uruzgan Province, Southern Afghanistan. Additional small occurrences are found in Bamyan, Badakhshan and Baghlan Provinces.

Local demand in Afghanistan for fluor spar is currently very low but if the country is to develop its large resources of iron ore and create a integrated iron and steel industry it will require a local source of metallurgical grade fluor spar. This brochure outlines the

potential for the discovery of economic deposits of fluor spar in the country which may be suitable for the production of metallurgical grade and, with further processing, chemical grade fluor spar.

Geology of the Uruzgan area

The main fluor spar occurrences occur in Uruzgan Province and are situated within the Helmand Block (Figure 1), which is composed of sedimentary and igneous rocks ranging in age from the Precambrian to the Oligocene. The fluorite occurrences are hosted by Triassic-Jurassic platform carbonate rocks, which overlie unconformably Precambrian and Paleozoic metasediments of the Helmand Block. The Triassic-Jurassic carbonate rocks stretch in a southwest-northeast direction from Helmand towards Wardak Province, and host the known fluorite occurrences and, further to the north, the stratiform Pb-Zn carbonate-hosted occurrence Tangi, which can be classified as Mississippi-Valley Type (MVT) mineralisation.

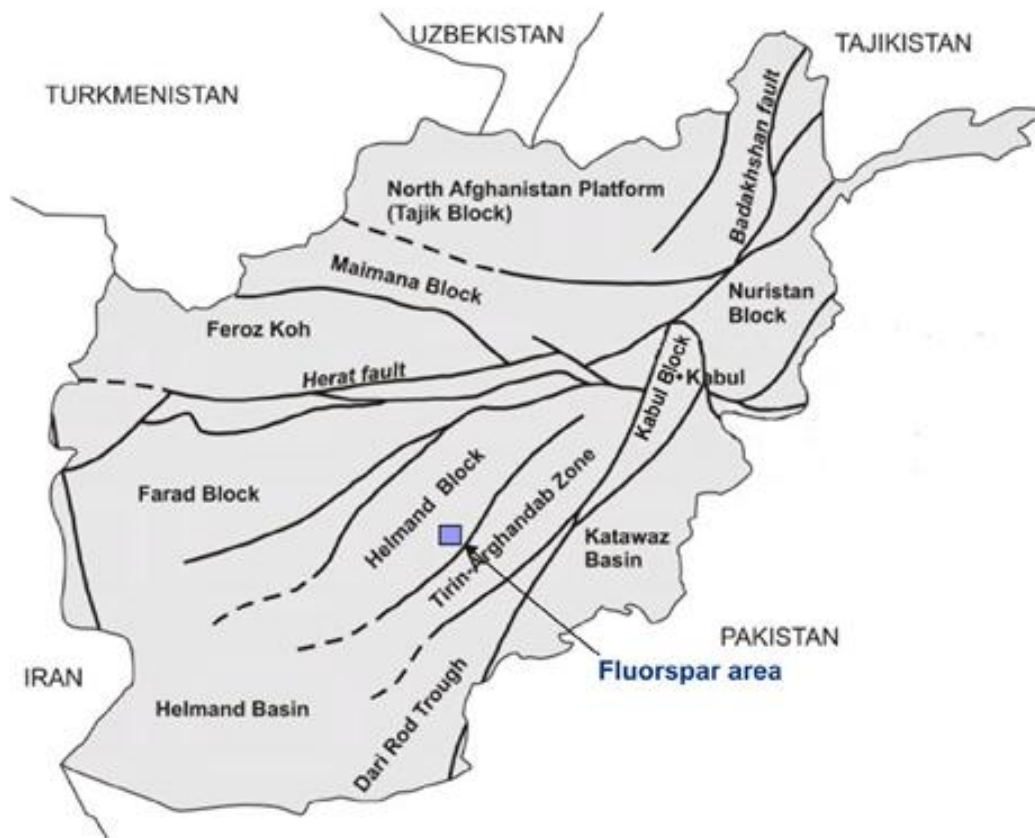


Figure 1. Tectonic sketch of Afghanistan showing the location of the Uruzgan fluor spar area

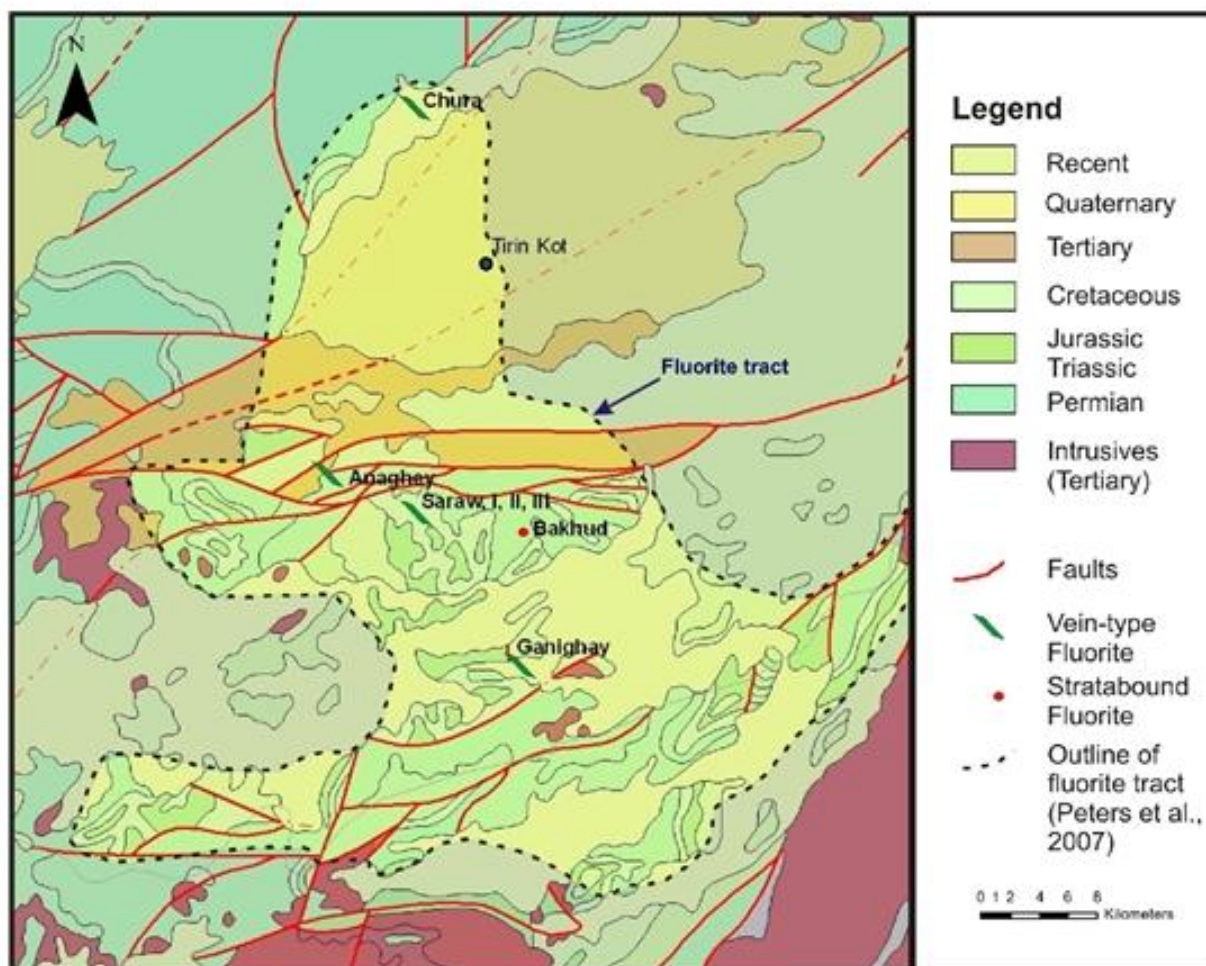


Figure 2. Simplified geology of the fluorite occurrences in Uruzgan province.

Exploration history

Exploration work for fluorspar was conducted from 1969 to 1975 in Uruzgan Province by Afghan and USSR geologists (Avtonomov et. al., 1975). The work carried out during this time covered an area of nearly 500 km². It included detailed regional and geological mapping, sampling, trenching, geochemical surveys, exploratory drilling, comprising 27 drill holes, and estimation of resources. In addition, some metallurgical testing of fluorite and lead was conducted.

Peters et al., (2007) outlined a prospective tract for fluorspar around Bakhud on the basis of fluorite occurrences, geology and aeromagnetics (Figure 2).

Bakhud

Bakhud is a stratiform fluorspar occurrence, whereas the remaining are vein-style occurrences. A summary of the fluorspar occurrences is given in Table 1.

The ore bodies of Bakhud are located within a fault breccia at the base of an angular unconformity between Late Triassic dolomitic limestone of the Alamghar Formation and Late Triassic to Middle Jurassic marl sediments of the Arghasu Formation. The fluorspar mineralization consists of a number of tabular flat-lying ore bodies. There are four discontinuous mineralized zones in the Bakhud area, the Eastern, Western, Northern and Southern area. The ore zones have lengths between

Table 1: Summary of the characteristics of the fluorspar deposits in the Uruzgan Province

Name	Coordinates		Host Rock	Mineralization style
	Latitude	Longitude		
Bakhud	32° 27' 16.92"	65° 53' 57.84"	Late Triassic Limestones	stratiform
Chura	32° 42' 57.96"	65° 49' 09.84"	Triassic Limestones	vein-type
Anaghey	32° 29' 07.8"	65° 46' 00.12"	Triassic Marbles	vein-type
Saraw I, II, III	32° 28' 59.16"	65° 49' 05.52"	Late Triassic to Upper Jurassic Limestones	vein-type
Ganighay	32° 22' 58.44"	65° 53' 14.64"	Late Triassic to Upper Jurassic Limestones	vein-type

80 and 860 m, widths between 10 to 200 m, and thicknesses from 1.1 to 2.8 m.

Fluorspar mineralization consists of abundant calcareous fluorite associated with lead and zinc sulphide minerals and less abundant siliceous fluorite. Alteration consists of recrystallized dolomite with silicification that is restricted to limestone in the basal Alamghar Formation.

The calcareous fluorite occurrences constitute 60-70% of the ore and are found in all four areas. The predominant structures are massive or thin-bedded veinlets, or stockworks in brecciated zones. This fluorspar type typically grades between 34 to 64%, averaging 47% CaF₂. The fluorite is colourless, pale to dark violet or almost black. The mineralization consists of variable amounts of fluorspar in a calcareous matrix, associated with sulphide minerals such as sphalerite, galena, chalcopyrite, tennantite, and molybdenite. Gangue minerals are pyrite, baryte, ankerite, dolomite, and quartz. The less abundant, irregular siliceous

fluorite occurrences are restricted to the flat contacts with the underlying Alamghar Formation, and occur mainly in the southern area. They are found as replacement bodies and as cementing material in the matrix of the brecciated calcareous fluorite. The gangue minerals are chalcedony, chlorite, calcite, ankerite and baryte. The siliceous fluorite occurrences grade on average about 37% CaF₂.

Total resources of the Bakhud fluorite occurrence are about 8,800,000 tons averaging 47% CaF₂. Table 2 provides details of the mineral resources and grades of the Bakhud occurrence.

Beneficiation tests, done on both the calcareous and siliceous fluorspar ores yielded acid grade quality (> 97% CaF₂). According to a rough economic assessment based on available information (GTZ-IS/Projekt Consult, 2008) the Bakhud occurrence has a Net Present Value (NPV) of more than 60 million US\$ and an Internal Rate of Return (IRR) of about 50%.

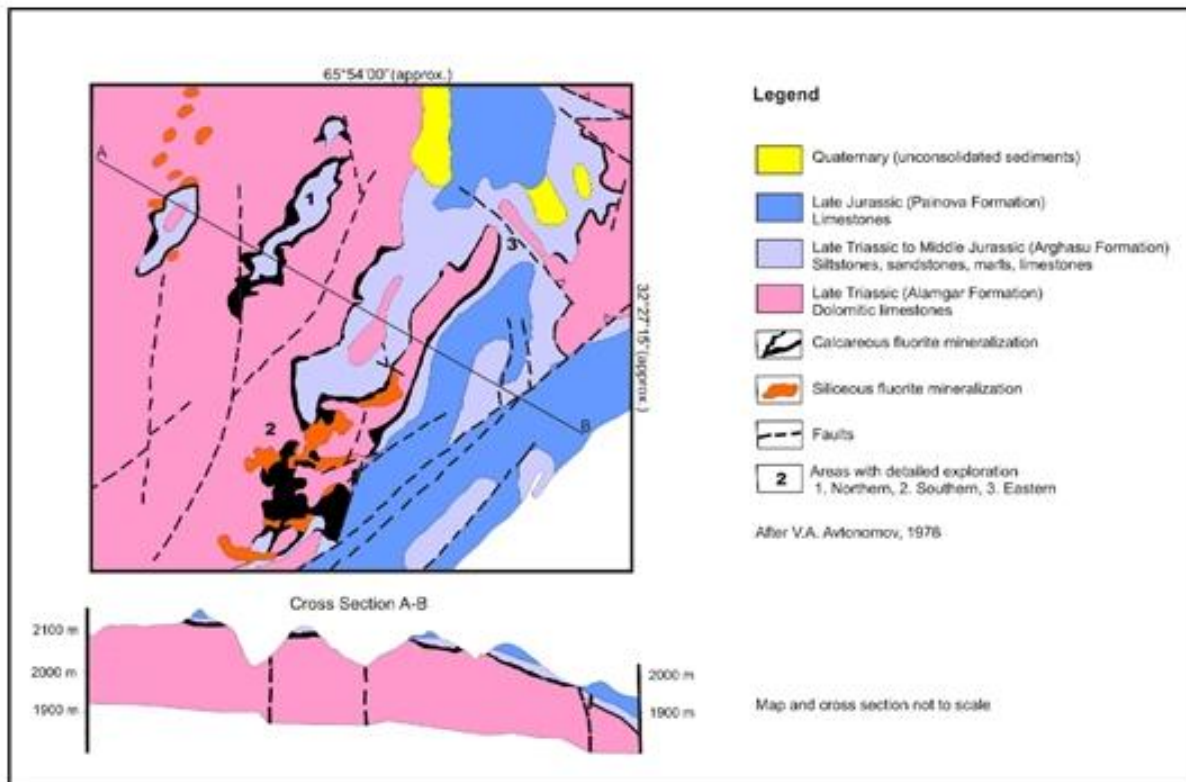


Figure 3. Geological map and cross-section of the Bakhud fluorite occurrence

Table 2: Summary of the resources of the Bakhud fluorspar deposit

Resources/Reserves		Tons	Grade (% CaF ₂)	% of total
USSR	JORC/CIM*			
B	Proven Reserves	3,322,600	44.8	38.0 %
C1	Probable Reserves	1,028,300		11.5 %
C2	Indicated Resources	4,441,000	48.5	50.5 %
Total		8,791,900		100.0 %

* Australasian Joint Ore Reserves Committee Code (JORC) and Canadian CIM classification (NI43-101)

Metallogenesis

With the current information it is quite difficult to assign a mineral deposit model to the fluor spar occurrences in the Uruzgan Province. The most important characteristics of the fluor spar occurrences are:

1. They are confined to an unconformity between Late Triassic dolomitic limestone and Late Triassic to Middle Jurassic calcareous sediments
2. The sediments had been deposited in a shallow water environment
3. The mineralization is either stratiform and/or vein-type, and occurs massive or in veinlets, stockworks and disseminations
4. The mineralization is associated with faults, joints, breccias and mylonites
5. In some places the fluor spar, particularly the stratiform mineralization, is associated with sulphide minerals such as sphalerite and galena
6. The mineralization is not associated with igneous activity
7. The fluor spar occurrences are associated with Pb-Zn anomalies.

Peters et. al. (2007) decided that the fluorite occurrences in Uruzgan match the fluorite vein model (Orris and Bliss, 1992), although they do not rule out that also other mineral deposit models may be applicable. As the fluor spar occurrences are situated within the southwest-northeast trending carbonates, which coincide largely with MVT tracts and are associated with Pb-Zn anomalies typical of MVT deposits, the fluor spar occurrences can be tentatively catalogued as Mississippi Valley Type (MVT) mineralization.

References

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Figure 4. Fluorite from the Bakhud deposit.

Summary of the potential of the Bakhud Fluorspar deposit

- Proven reserves (Soviet B category) of 3.3Mt at 44.8% CaF₂
- Total of proven, probable and indicated resources (category B+C1+C2) of 8.8Mt at 46.7% CaF₂
- Flat-lying stratiform bodies of 1.1 to 2.8 m thickness

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