Pakistan. J.Sci.Ind.Res., Vol. 27, No. 5, October, 1984

MOLYBDENITE OF KOHISTAN, HAZARA DIVISION

Fazal A. Siddiqi, M.A. Qaiser, Kamin Khan and M. Amin

PCSIR Laboratories, Peshawar

(Received April 28, 1983; revised, July 15, 1984)

Chemical, mineralogical and X-ray analyses data of molybdenite of the Kohistan area are being presented for the first time. This ore contains subordinate amounts of tremolite, calcite, pyrite and quartz.

INTRODUCTION

Molybdenite is the source of the rare element molybdenum. Other most common minerals are wulfenite and molybdite. Molybdenum is finding increasing use in stainless steel and in high-temperature alloys for gas turbines and jet aircraft engines[1].

Molybdenite is frequently found with other minerals in quartz veins associated with granitic rocks. Pb-Zn-Mo mineralisation associated with Lahor Pegmatite/granite was first reported by Ashraf *et. al*[2] and later examined in the light of new data on ore minerals by Butt[3]. Recently a British Economic Geologist has submitted a very encouraging report on Pb-Zn-Mo and Cu deposits of Kohistan area in the surroundings of Lahor and Pazang. SDA is also carrying on further work on the lines suggested by the British expert.

GENERAL GEOLOGY OF THE AREA

Besham Kohistan area lies on both sides of the Karakoram Highway at a distance of about 150 km from Abbottabad and has a high relief and rugged topography Fig. 1.

In this geologically complex area igneous and metamorphics are the main rocks exposed. Igneous rocks consist of granite-gneiss and ultramafics. The granitic rocks include Lahor granite/pegmatoid complex of possible Precambrian age, Shang granite gneiss and Mansehra granite gneiss. Metamorphics are composed of schists and marbles.

Lahor granite is generally medium grained and gnessic. The granite is greyish white, grey and light grey, whereas the weathered rock is brownish grey and grey in colour.

Graphitic granite was also observed in Pazang area. Lead and zinc mineralisation is associated with granite and the metamorphics exposed in Lahor-Pazang area in Kohistan.

Molybdenum occurs as molybdenite in areas where lead/zinc mineralisation is prominent. Ashraf *et. al*[2] describe the mineralisation of molybdenite in three types of rocks.

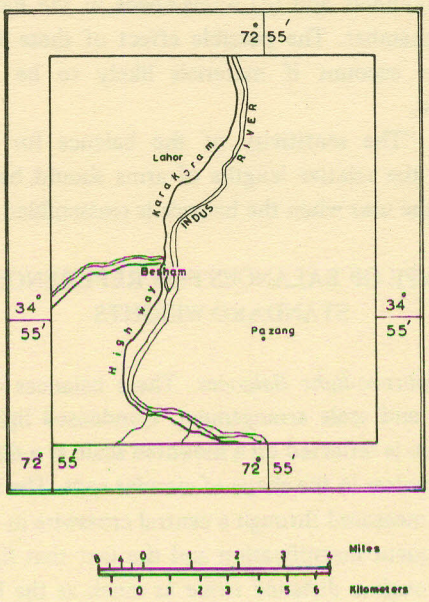

Fig. 1. Location map.

1. Silicified Skarns: It is present in Serai area as disseminated flakes in an area of about 0.9 x 7.5 m.

2) Altered Granite: This is general has abnormal back ground values of molybdenum. A part of skarn body of Derai/Pazang area is composed of altered granite containing molybdenite. Molybdenite occurs as flakes 0.10-3 mm across.

3) Pegmatites of Pazang, Derai and Maidan contain a small quantity of molybdenite. The maximum size of flakes is 7 x 2.5 cm.

The samples from Lahor and Pazang were studied petrographically. The mineralogical assemblage generally found

in quartz, amphibole, pyroxene, epidote, garnet, sphene, biolite, chlorite, limonite etc. The associated metallic minerals in addition to molybdenite are mainly galena, pyrite, sphalerite and chalcopyrite.

RESULTS AND DISCUSSION

Chemical Composition. Different ore samples from Lahor and Pazang areas were analysed by conventional as well as instrumental methods. Results of the analyses are given in Table 1.

Table 1. Chemical analyses of samples.

% Composition	Lahor-1	Lahor-2	Pazang-1	Pazang-2
SiO_2	42.60	43.50	45.00	44.98
R_2O_3	20.00	21.12	26.00	25.33
MgO	13.00	11.50	12.00	13.01
CaO	19.60	20.65	12.60	11.99
NaO	0.67	0.73	1.00	1.03
K_2O	1.55	1.43	1.24	1.39
Mo	0.50	0.75	0.3	0.45
Pb	0.25	0.33	0.46	0.25
Cu	0.19	0.15	0.17	0.16
Zn	0.01	Traces	0.07	0.06
	98.37	100.24	98.84	98.65

The analyses indicate that the ore contain different impurities such as iron, aluminium, lead, zinc copper etc.

X-ray Diffraction Studies. The XRD data of the powder pattern of the samples from Lahor and Pazang are given in Table 2a. Debye – Sherrer Camera (dia. 114 mm) was used and the samples were exposed to Ni-filter Cu-radiation for 6 hours at 35 KV and 20mA. Paste of the samples was made with a drop of collection and moulded to a tiny cylinder of dia ½ mm and length of 1 cm approximately.

The reflections of the two samples are comparable to tremolite (d=8.42, 3.13, 2.71), calcite (d=3.02, 2.27 , 2.01), pyrite (d=1.62, 2.72. 2.52) and quartz (1.36, 4.24, 1.82).

The summary of the minerals identified in each sample is given in Table 2b.

The graphitic metallic portion was separted from the samples of Lahor and Pazang. The chemical analyses and XRD data of the powder pattern of the samples are given in Tables 3a and 3b. All the reflections of Lahor and Pazang samples are comparable to those of the standard molybdenite. However, the reflection (d= 3.30) in Pazang samples could not be identified.

Table 2a. Data for rock samples.

X-ray powder diffraction

Lahor		Pazang	
dA°	I	dA°	I
8.42	5	8.42	20
4.48	5	4.55	5
3.78	5	4.24	5
3.30	5	3.78	–
3.13	20	3.36	5
3.02	100	3.13	100
2.71	10	2.97	30
2.59	5	2.59	1
2.52	5	2.52	10
2.33	5	2.33	5
2.28	5	2.27	5
1.90	5	2.16	5
1.86	5	2.08	5
1.75	5	2.01	5
1.64	2	1.91	30
1.62	5	1.86	2
1.53	2	1.82	2
1.50	2	1.76	2
1.43	5	1.71	1
		1.65	1
		1.62	30
		1.54	1
		1.50	2
		1.44	10

Table 2b. Summary of the results of X-ray diffraction analyses of rock samples

Mineral Identified	Rock Samples	
	Lahor	Pazang
Tremolite	++	+
Calcite	+	++
Pyrite	+	+
Quartz	+	+

*Indicates presence of the mineral.

**Indicates presence in major amount.

The hexagonal cell dimension has been calculated a= 3.16 Å and c = 12.309 Å.

Table 3b. X-ray powder diffraction data of the black metallic part of host rock

Lahor		Pazang	
d(Å)	I	d(Å)	I
6.10	50	6.10	100
2.73	5	3.30	30
2.67	2	3.02	40
2.49	2	2.73	60
2.27	40	2.66	50
2.40	20	2.49	50
1.91	15	2.28	100
1.82	25	2.04	50
1.66	5	1.82	90
1.57	15	1.63	10
1.53	15	1.57	40
1.33	1	1.53	60
1.29	2	1.47	5
		1.40	1
		1.36	5
		1.33	30
		1.29	30
		1.25	25
		1.22	3
		1.19	30

Physical Properties. The density was estimated by chemical formula MoS_2 (molecular wt. M = 160) and the volume of the unit cell (106.37 Å^3). If the unit cell contains 2 formula unit, then the density,

$$D_x = (1.66x2x160)/106.37=4.98 \text{ g/cm}^3$$

This was found to be in good agreement with the density calculated by hydrostatic balance, which is 4.85 g/cm^3

Table 3a. Analysis of metallic part.

% Composition	Lahor	Pazang
Mo	56.38	54.85
S	37.68	36.65
Fe_2O_3	1.00	1.25
Al_2O_3	0.66	1.01
CaO	2.05	2.45
MgO	0.15	0.28
SiO_2	1.50	1.93
	99.42	98.42

CONCLUSION

In this geologically complex area igneous and metamorphics are the main rocks exposed. The chemical, mineralogical and XRD analyses show that Pb-Zn-Mo and Cu minerals are mainly present in the forms of sulphides with subordinate amounts of tremolite, calcite, pyrite and quartz.

The Mo content varies from 0.3 to 0.75%, Pb from 0.25 to 0.46%, Zn from traces to 0.07% and Cu from 0.15 to 0.19%.

Acknowledgement. The authors are indebted to Mr. Bahrawar Khan, Chief Geologist, Sarhad Development Authority, for providing the samples for this investigation.

REFERENCES

1. C.S. Hurlbut, *Dana's Manual of Mineralogy* (John Willey & Sons Inc. London).
2. M. Ashraf, M.N. Chaudhry & S.S Hussain, General Geology and Economic Significance of the Lahor Granite and rocks of Southern Belt in Allai Kohistan area, Geol. Bull. Univ. Peshawar, **13**, 1980.
3. K.A. Butt, Hydrothermal Phenomenon Associated with Lahor Pegmatoid/Granite Complex, Kohistan, Geol. Bull. Univ. Peshawar , **14**, 1981.