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GEOCHEMISTRY AND THE ECONOMIC SIGNIFICANCE OF ALIKHANZAI OPHIOLITE BODY, ZHOB, BALOCHISTAN

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ABSTRACT

The Zhob ophiolite is divided into Ali Khanzai, Omzha, and Naweoba blocks. Present manuscript is focused on the Ali Khanzai block of Zhob Ophiolite. The Ali Khanzai block of Zhob Ophiolite comprises various lithological units including pillow basalt, gabbro, volcanoclastic, Jasperitic chert (ribbon/ bedded chert) & pelagic sediments, serpentinized dunite, chromitite, serpentinite zone & hyaloclastite mudstone unit. The basalt–chert and hyaloclastite mudstone units consist of thick lava and pelagic sediments. All units make thrusted contacts and are highly deformed whereas Mafic dyke intrusions crosscut mantle rocks of block. The mantle rocks are altered, deformed, and deeply weathered, maybe residual melting of enriched mantle peridotite. The contact relationship of dolerite dykes with peridotite indicate that they are late magmatic intrusions. The Crustal gabbros are partially chloritic and sericitic and occur within mantle peridotite. They may have formed from fractional crystallization in a magma chamber. The volcanic-volcaniclastic pelagic sediments surround mantle and crustal rock units. It might be a melang in nature is much like that of the Bagh Complex found beneath the Muslim Bagh Ophiolite and other ophiolites around the world. Geochemical results of 29 samples were carried out to determine the economic significance of the area. Atomic absorption spectrum (AAS) analysis indicates that Lead (Pb) varies 0 to 38.05, Zinc (Zn) ranges 1.91 to 1540.75, Copper (Cu) values 0.6 to 360.96, Cobalt (Co) fluctuates 11.75 to 129.18, Lithium (Li) differs 14.68 to 55.58 and Chromium (Cr) changes 0 to 1750.61.

Keywords: Ophiolite, Geochemistry, Alikhanzai, Zhob

INTRODUCTION

Ophiolite is a unique sequence of mafic and ultramafic rocks that includes mafic volcanic rocks, gabbroic rocks that often have cumulus textures, and typically serpentinized ultramafic rocks, From bottom to top. Sodic felsic igneous rocks, chromitite masses, and overlying sedimentary rocks made of ribbon chert, thin shale, and minor limestone are examples of outlier-associated rocks.

Oceanic crust that has inexplicably been deposited on the continents is represented by ophiolites. While some deposits, such as lateritic nickel, some iron deposits, and asbestos deposits within serpentinized ultramafic complexes, are the result of weathering and emplacement of ophiolites, other mineral commodities and types of ore deposits that are known to be associated with ophiolites, such as the chromite pods in the ultramafic complex and massive sulfide bodies within the pillow lavas, are likely related to volcanic processes at spreading centers. (Candie K.C., Stern, R.J., 2023).

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LOCATION

The Zhob ophiolite blocks in the Zhob Valley are located in north northeast of the Muslim Bagh ophiolite. The Ali Khanzai Block also named as Badanzai ophiolite body which is situated 16 km south of Zhob City and hosts several types of economic deposits (Ahmed, 1975, Bilgrami, 1964 & Jones, 1961).

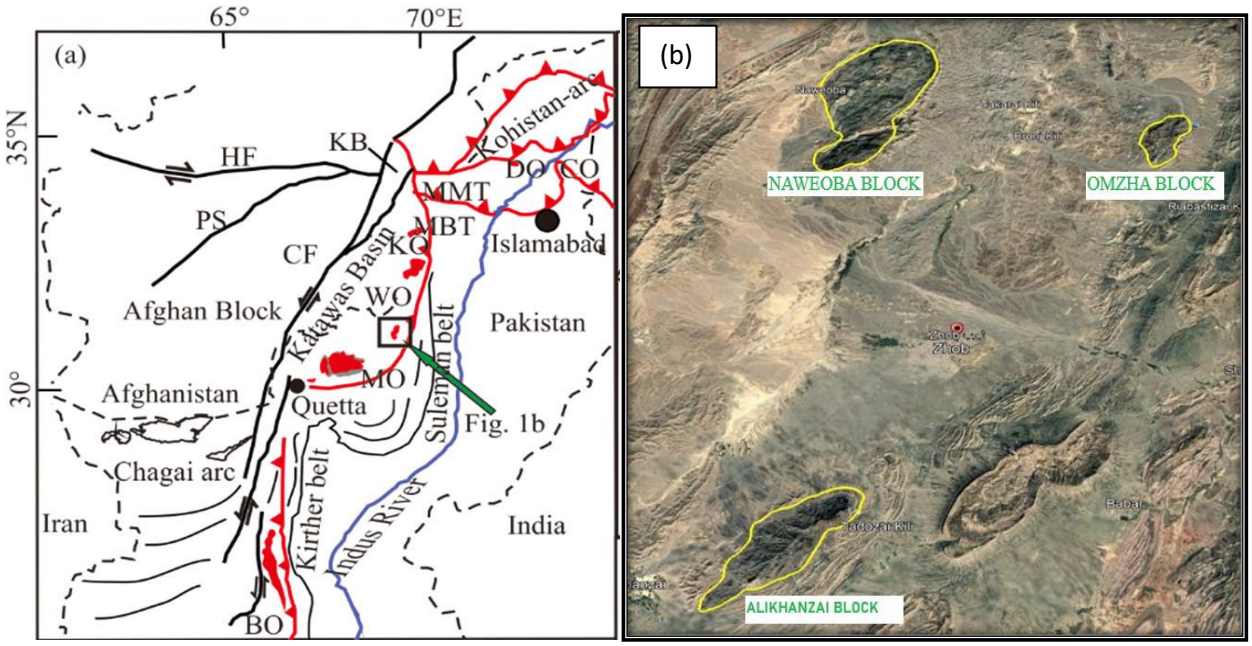

Fig.1: Location map (a) Showing the regional location (b) showing the Zhob ophiolite bodies and study area (modified after Rehman, 2019, Bannert et al., 1992). Whereas: BO. Bela ophiolite; KO. Khanozai ophiolite; MO. Muslim Bagh ophiolite; WO. Waziristan ophiolite; DO. Dargai ophiolite; CO. Chilas ophiolite; CF. Chaman fault; PS. Penjwai suture; HF. Herat ophiolite; KB. Karakorum Block; MMT. Main mantle thrust; MBT. Main boundary thrust.

GEOLOGICAL BACKGROUND OF OPHIOLITE

The majority of the ophiolitic sequences in south-central Asia were later exposed as a result of the Himalayan orogeny, which was caused by the collision of the Indian and Eurasian plates during the Early Paleogene. The majority of Pakistan's basic and ultrabasic rocks are ophiolitic, making them allochthonous bodies together with ocean bottom sediments and volcanic arc materials (Asrarullah et al & Alleman F., 1979).

In Pakistan, the ophiolite complexes are distributed in a straight line and can be separated into two groups: (i) the northern ophiolitic belt, which includes the Dras ophiolites or igneous complexes, the Jijal complex, the Chilas complex, the Sapat complex, the Dargai (Skhakot–Qila) complex, the Shangla–Mingora ophiolite, and the Jijal complex; and (ii) the western ophiolitic belt, which includes the Bela, Muslim Bagh, Waziristan, and Zhob ophiolites, with comparable Khost and Kabul ophiolites exposed in eastern Afghanistan.

Part of the suture zone delineated by the Bela, Muslim Bagh, and Waziristan ophiolite complexes, the Zhob ophiolite is exposed in northwest Pakistan (Şengor, 1987). The calcareous zone, which is made up of a marine sequence (Triassic–Jurassic) of the Sulaiman fold-thrust belt, is thrust over the rocks of the suture zone in the south. On the other hand, the Pishin Katawaz flysch sequence, which includes the Nisai (Eocene) and Khojak (Oligocene) formations, covers the rocks of the suture zone in the north. The Nisai Formation Eocene–Oligocene (Bukhari et al., 2016) at the top and the Jurassic Alozai Group at the base are the rock units that are in direct contact with the Zhob ophiolite.

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METHODOLOGY

The methodology comprises of field investigation which includes field survey, sample collection, laboratory analysis (AAS) and results.

GEOLOGY OF ALI KHANZAI OPHIOLITE BODY

The Ali Khanzai Block lies roughly 16 kilometers south of Zhob City, measuring 12 km in length and up to 3 km in width. Metamorphic rocks, a mantle section, mafic oceanic crustal rocks, and a basalt chert unit make up the Ali Khanzai Block. The Ali Khanzai Block is tectonically disturbed, resulting in abrupt and occasionally irregular contacts between its numerous rock units (Rehman, 2019 & Gansser A., 1979).

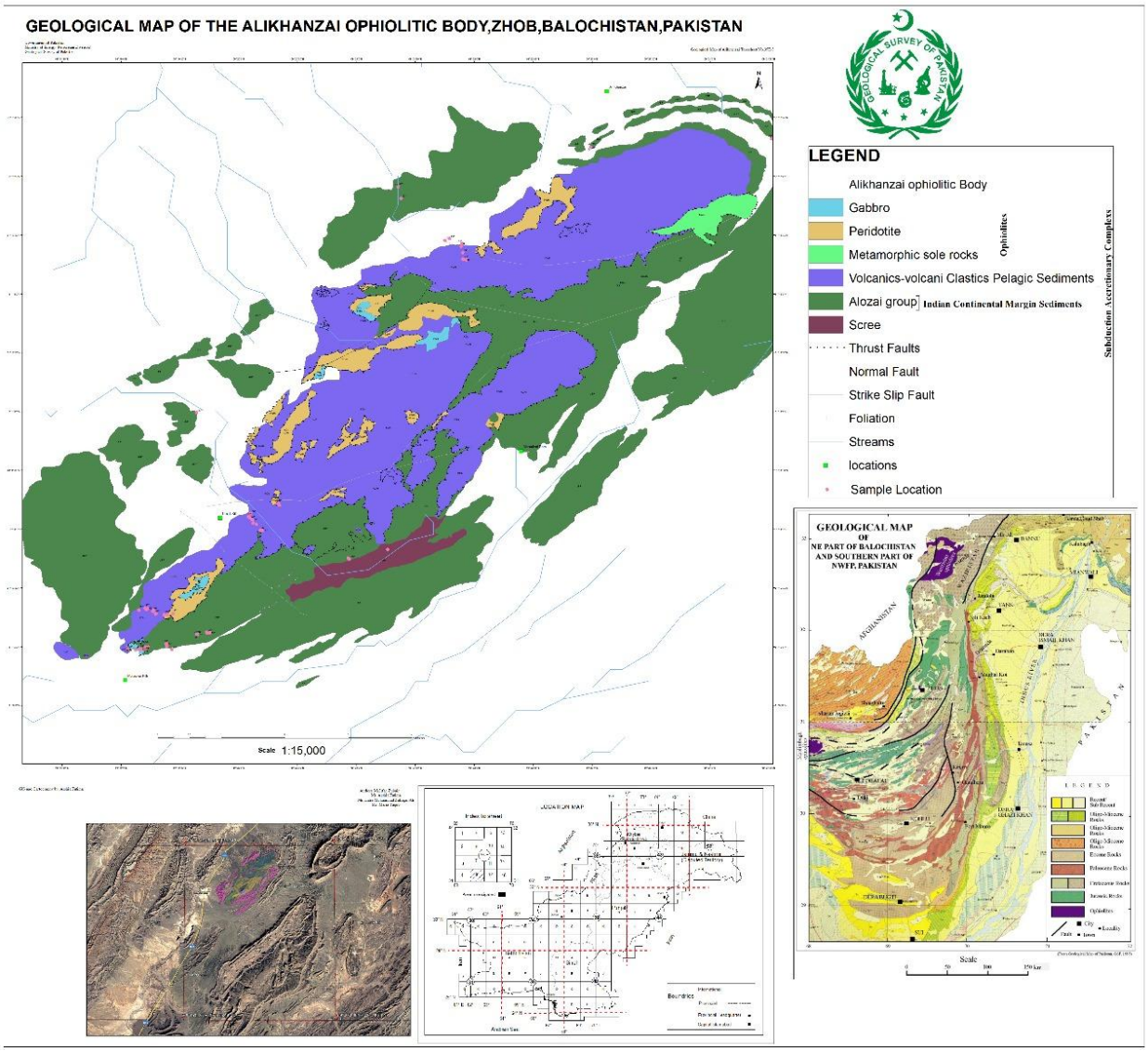

Fig 2: Geological map of Alikhanzai Ophiolite Body, Zhob, Balochistan.

The majority of the sub-ophiolitic metamorphic rocks of the Ali Khanzai body that are located beneath the mantle section include mica schist, greenschist, and amphibolites. The highly serpentinized dunite and harzburgite that make up the mantle part are broken up and dispersed over the block's base. Massive, layered gabbros and a few doleritic dykes that are severely deformed and tectonically disturbed are the principal features of the crustal area. The main unit of the Ali Khanzai Block is the volcano clastic-jasperitic chert unit, which is made up of meta chert, volcanic rocks, and

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volcaniclastic rocks. One important volcanic rock that is frequently found in pillow and sheet forms is basalt. Meta cherts are thin to medium-bedded, crystalline, and fine-grained. They are interbedded with volcanic rocks and have gradational connections with the underlying volcanic rocks. The ophiolite body of Ali Khanzai is heavily folded and flawed.

RESULTS

Table-1: Analysis of Field samples

Sr. No.	Sample ID	Pb (ppm)	Zn (ppm)	Cu (ppm)	Co (ppm)	Li (ppm)	Cr (ppm)
1	PBCM-1	2.58	1431.92	62.97	26.69	44	1421
2	AMGD	9.77	1540.75	53.29	42.18	34.37	93.9
3	VP	0	229.98	32.5	34.76	32.83	31.49
4	FMS	0	1022.82	27.87	15.09	46.51	43.69
5	DMK	23.43	1968.9	15.21	56.55	50.81	14.18
6	GCMK	15.14	132.57	39.68	11.75	36.44	32.73
7	SDP-1	0	283.31	75.83	54.41	34.81	99.52
8	PB	5	103.55	54.51	47.53	36.75	19.33
9	JCHS	10.56	81.6	14.71	16.07	32.54	35.06
10	CAK	0	443.52	4.11	129.18	31.49	436.5
11	SAK-1	0	126.8	31.74	130.7	30.02	1750.61
12	PBCM-2	0	111.75	77.36	61.35	30.53	675.41
13	SDP-2	6.5	125.42	27.73	48.26	27.89	169.4
14	PUK	0	189.99	4.82	25.17	32.8	0
15	C-1	0	208.39	0.6	54.02	48.67	952.87
16	GMK	0	167.01	24.82	40.58	44.9	190.65
17	DTK	18.32	192.66	17.66	33.43	24.35	0
18	CGC	0	143.49	360.96	24.5	24.24	103.1
19	VAK	29.81	1.91	72.25	16.91	25.45	174.4
20	C-2	22.31	10.92	18.61	13.84	17.03	3005
21	DWC	43	5.85	10.39	20.77	23.34	0
22	GTS	23.12	18.43	47.54	17.70	55.58	967.34
23	ANTG	38.05	16.79	28.71	14.63	16.54	84
24	CHRYS-1	2.47	463.65	38.53	26.47	18.81	89.1
25	CHRYS-2	0	483.42	48	34.72	24.26	165.22
26	PSGA	2.1	148.06	1.25	15.12	17.42	0
27	PSGS	0	154.53	12.92	33.26	26.07	36.1
28	ALK	7.32	562.31	10.76	19.11	14.68	0
29	CMPU	6.46	592.99	12.21	23.88	17.34	49.7

DISCUSSION

It's necessary to remember that a variety of elements, including as a deposit's grade, size, shape, depth below the surface, proximity to infrastructure, current metal price, local labor and environmental laws, and many more, affect its economic feasibility. The research area is not cost-effective on a large scale when taking into account all of the previously listed variables (Table -2).

Table-2: Comparative Studies

Elements	Reference Values	Present research (average) ppm
Copper (Cu)	10,000 ppm	42.32

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Lead (Pb)	50,000 ppm	9.17
Chromium (Cr)	15,000 ppm	366.90
Lithium (Li)	10,000 ppm	31.05
Zinc (Zn)	50,000 ppm	378.04
Cobalt (Co)	600 ppm	37.53

CONCLUSIONS

Total 29 samples from different localities of the Alikhanzai ophiolite body were collected which indicates that Lead varies 0 to 38.05, Zinc ranges 1.91 to 1540.75, Copper values 0.6 to 360.96, Cobalt fluctuates 11.75 to 129.18, Lithium differs 14.68 to 55.58 and Chromium changes 0 to 1750.61 (Table -1).

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RECOMMENDATIONS

The project area is recommended for the Geophysical Survey for further investigation in respect of Cu & Cr.

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Field features of crustal rocks of Alikhanzai ophiolite body

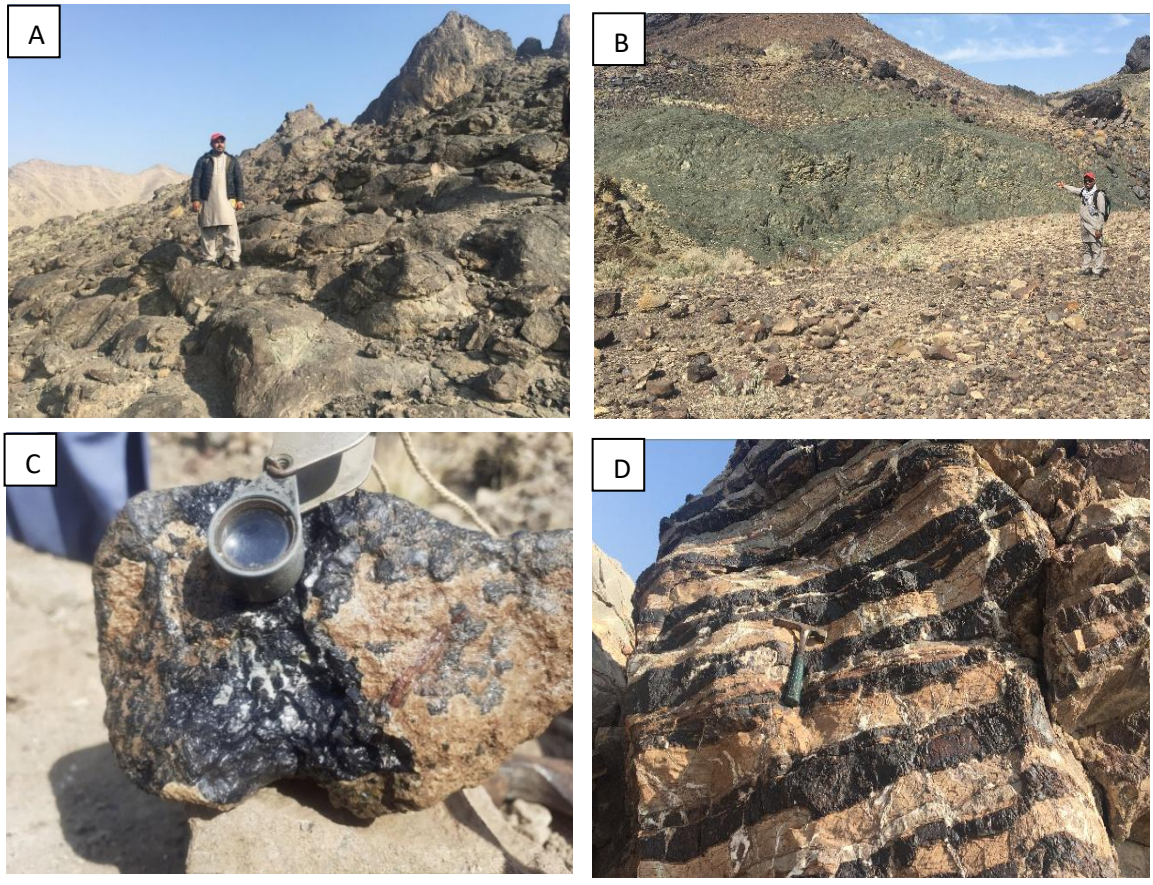

Fig 3. Whereas: A: Pillow Basalt, B: Serpentinite Zone, C: Chromite Sample, B: Bedded chert thrusted over pillow basalt

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