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EXPLORATION AND MINING TREND OF LEAD AND ZINC, RAJPURA-DARIBA, RAJASTHAN, INDIA

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***Abstract*— The prospecting and mining of base metal in India dates back to 3000 B.C. All the base metal deposit of India has surface manifestations in various forms. From 19th century to the middle of the present century, certain European companies started a modern phase of base metal exploration and development. Earlier, the search for base metal was confined to the close study of surface features. In 1940 ground geophysical survey work has been introduced in order to search the mineral deposits. The total world production of lead and zinc metals are about 3.9 and 11.4 million tonnes respectively in 2009. The leading producing countries for lead is China (41% of world production), followed by Australia (15%), USA (10%), Peru (8%) and Mexico (4%). The Indian production of lead and zinc ore is 7.10 million tonnes in the year 2009-10, it includes 136095 tonnes of lead concentrate and 1224077 tonnes zinc concentrate. In India, the Western Indian Craton (Rajasthan) is the main provider of base metal to the country. It contributes nearly 85% of the estimated lead and zinc. In Western India Craton, the main metallotect of lead and zinc from an elongated NE – SW trending polygon, this covers an area of about 20000 sq. km. It comprises three metalliferous belts mainly, the Pur-Banera belt, the Rajpura-Dariba- Bethumni belt, and the Sawar belt and two metalliferous enclaves namely; the Agucha and the Kayar enclave.**

The 20 km. long crescent shaped, Rajpura-Dariba-Bethumni belt striking N-S to NNE-SSW. The ancient mining and smelting activities have been noticed at both ends of the belts. Towards the southernmost part of the belt, the typical gossan is exposed in the form of hill. B.C. Gupta, Geological survey of India (G.S.I) first reported Dariba – Bethumni belt, in the year 1934. The systematic exploration of the belt was initiated by G.S.I in 1962 and continuing till present. In the Rajpura-Dariba-Bethumni belt Rajpura and Dariba blocks are under active production since 1983, whereas in the Sindesar Khurd block the production was started in 2007, under the ownership of Hindustan Zinc Limited of Vedanta Group. Recently the exploration activity is going on in the Sonariya Khera block, Chittor block and Bethumni block under the possession of Hindustan Zinc Limited.

***Index Terms*— Prospecting, Exploration, Mining, Geophysical Survey, Craton, Metallotect, Metalliferous, Gossan, Lead, Zinc, Rajasthan, India.**

I. INTRODUCTION

Rajasthan is endowed with a continuous Geological sequence of rocks from the oldest Archaean, Metamorphites, represented by Bhilwara Super Group to sub-recent, are exposed chiefly in the central plains, existing between the Aravalli and Vindhyan range[1]. The sedimentary rock includes the rocks of Aravalli Super group, Delhi Super group and upper Vindhyan Super group. The southeastern extremity of the state is occupied by a pile of basaltic flows of Deccan Traps. Several mineral deposits of economic importance occur in association with the above rock units. The geological sequence of the state is highly varied and complex, revealing the co-existence of the most ancient rocks of Pre-Cambrian age and the most recent alluvium as well as wind- blown sand. The Archaean rocks consist of the Bhilwara Super group (Bundelkhand Gneiss and the Banded Gneissic complex).

In Rajasthan, the base metal mineralization is found to be confined to the three successive geological time domains, which are identified as the three geo-synclinal basins[2], namely:-

1) Bhilwara basin – 2500 – 3000 million years (Archean)

2) Aravalli basin – 2000 – 2500 million years (Lower Proterozoic)

3) Delhi basin – 1600 – 2000 million years (Mid. Proterozoic)

The Rajpura – Dariba – Bethumni belt has been grouped under the Rajpura – Dariba group, which is a part of Bhilwara super group. The area comprises of medium to high grade meta–volcano–sediment of Rajpura Dariba group, occurring as the cover sequence. The cover sequence is underlain by basement rock (Gneisses and Schists) of Mangalwar complex. The area exhibits three phases of deformation giving rise to complicated structural geometry to the litho unit and mineralized zones. In the area, mineralization is confined to the calc – silicate dolomite and Graphite mica schist of Rajpura – Dariba group. The lead – zinc mineralization occurs in the form of Galena and Sphalerite. The other common sulphides are Pyrite and Pyrrhotite [3].

Gossan designate the oxidized out cropping cellular mass of the limonite and gangue overlying aggregated sulphide. Deposits and point to what lies beneath the surface. Gossan at Rajpura-Dariba extending over a length of 4.5km from Dariba in the South to Rajpura in north has been formed due to intensive chemical weathering of complex sulphide ore body. Depth of oxidation gradually varies from 40km in the south 400m in the north [3].

II. CHARACTERISTICS DESCRIPTION OF GOSSAN

Rajpura –Dariba Gossan

Colour Dark brown, bright reddish yellow vermillion, brick red, reddish brown, purple, pale green, bluish green, azure blue, grey and white. Indicate the presence Goethite, Lepidocrosite, Jasper malachite, Azurite, Hematite, Pyrolusite and clay mineral.

Boxwork structure Cubic, cellular and honeycomb box works, Diamond shaped globular to rounded voids-dense-

limonite, Relict galena and various stage of pseudomorphism after sulphide.

B.C Gupta (1934) first recorded old working and ferruginous breccias in Rajpura-Dariba area and placed them in the Aravalli group. The entire area displays high grade metamorphic rocks of Aravalli and Pre- Aravalli age (Pre - Cambrian). Later, the area was classified as metavolcano-sedimentary rocks of this belt as Rajpura – Dariba group under Bhilwara super group. These rocks lie unconformable over the gneisses and migmatites of Mangalwar Complex (Banded Gneissic Complex). The rocks of Rajpura- Dariba group (metavolcano-sediment) uncoformably overlay the rocks of Mangalwar complex [4].

Dariba – Bethumni Belt The Dariba – Bethumni metallogenic belt, extending North – South for about 19 km, comprises an assemblage of medium to high grade metamorphic equivalents of ortho-quartzites, carbonates and carbonaceous facies rocks belonging to Bhilwara Super-

Group. This cover sequence is underlain by basement rocks (gneisses and schist) of Mangalwar complex [4]. The Proterozoic meta-volcano- sedimentary cover rocks of Rajpura-Dariba-Bethumni Belt are exposed in crescent shape from South of Dariba to Surawas in the North where it is cross cut by a ENE-WSW trending fault and further north it continue in narrow strip up to Bharak.

General lithology/mineral assamblages of the Carried out exploration work in the block of the area. 9. Quartz vein 8. Dolerite dyke 7. Carbonaceous schist (+/-, Staurolite, Kyanite) with marble/dolomite and sulphide bands. Rajpura-Dariba 6. Mica schist and tuffaceous schist with the bands of cherty quartzite. Group 5. Tuffaceous mica schist/carbonaceous schist (+/-, graphite, kyanite, staurolite) with calcareous schist and calc-silicate marble/dolomite and sulphide (Pb+Zn) bands 4. Dolomitic marble, mica schist, metamarl, amphibolites 3. Quartzite, psammite and amphibolites. 2. Conglomerate --- Unconfirmity--- 1. Feldpathic and psammitic gneisses with migmatites and schist.

III. Conclusion :

The western India craton is metallogenitically one of the most productive Pre-Cambrian shield area of base metals. The Rajpura-Dariba-Bethumni belt is a part of this belt, comprises metavolcanic and sedimentary rock of Rajpura-Dariba group. At southern part of the belt, near Dariba village, well developed Gossan and oxidizing zones are exposed on surface, but there is not such oxidizing evidence is reported on northern part. The area depicts three phase of deformation. The mineralization is confined to the Dolomite and Graphite-mica-schist of Rajpura-Dariba group as vein and dissemination form with chief minerals as- Sphelarite, Galena with minor mineral including Pyrite, Pyrrhotite, Arsenopyrite, Chalcopyrite and Silver.

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