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OCCURRENCE OF METALS IN NEPAL: A BRIEF REVIEW

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Abstract

In Nepal, fairly good amounts of different types of minerals have been reported. More than 85 minerals and their varieties have been known in large concentration in Nepal. The minerals which occur in Nepal in sizeable amounts have not been fully exploited. It is believed that there are areas in Nepal which contain plenty of tantalum, niobium, molybdenum, and rare earth metal ores. Nepal may become a major supplier of these metals if their proper execution is made. Alluvial plains of Nepal are known to have placer gold while the middle region contains copper, iron, zinc, nickel, cobalt etc. A few deposits of lead, zinc and iron have been reported in the snow-capped areas. Economic deposits of iron ore are noticed in Phulchoki, near Kathmandu valley. This article gives the summary for the occurrence of most important metals in Nepal. Some important applications of these metals are also included here.

Key Words: minerals, native state, alluvial plains, execution

Introduction

Nepal lies in the central part of 2500km long Himalayan belt. Almost 83% of Nepalese territory is mountainous. It is an underdeveloped country with vast natural resources like Water, Minerals, Forest, varieties of Agricultural products and Medical herbs. Geology of Nepal is very complex. From mineral resources point of view, Nepal Himalaya can be divided into five distinct morpho-geotectonic zones from south to north. The southernmost Terai Plain, Sub Himalaya zone (Churia/ Siwalik foot hills), Higher Himalaya zone, Tibetan Tethys zone and Lesser Himalaya zone (The Mahabharat Range including midlands). Lesser Himalaya zone is promising for metallic minerals mainly Iron, copper, lead, zinc, cobalt, nickel, tin, tungsten, molybdenum, gold, uranium rare metals etc (Kaphle, 2011). Minerals are the nonrenewable natural resources. Sustainable development of such resources helps to strengthen the economy of the country. Metallic minerals are very much used in various purposes in day to day life (Lee, 2007). They are mostly extracted from their respective ores. Gold, platinum, silver and copper also occur as native state (Madan and Satya Prakash, 1994).

The first institutional effort in mining exploration and development in Nepal was establishment of the irrigation and geology office in 1929. In 1941, the geology section was separated and then Bureau of Mines was established.

In 1967, two separate institutions the Nepal Bureau of Mines and the Department of Geological survey were established for mineral resource development and geological studies respectively. In 1976, these two institutions were merged under the department of Mines and Geology. (Shrestha and Shrestha, 1983). A number of metallic ore minerals are known from different parts of Nepal but only the important ores are briefly described.

Iron (Fe)

Iron is the principal metal which is used extensively in infrastructure development works, to manufacture heavy machinery equipment, arms, agricultural tools etc. Iron ores like magnetite, hematite, limonite/goethite occurrences/deposits/prospects are known from more than 85 localities (Sharma and Chaudhary, 2007).

The well-known iron ore deposits are Phulchoki (Lalitpur), Thoshe (Ramechhap), LabdiKhola (Tanahun), Jirbang (Chitwan), Dhuwakot (Parbat), Purnaundi/ Lamunigad (Bitadi), Dahabagar, Kachali, and Ekghar/ Khanigaon (Bajhang). Iron prospects and old workings are also known from different parts of Baitadi, Bajhang, Jajarkot, Rolpa, Surkhet, Myagdi, Baglung, Parbat, Chitwan, Ramechhap, Okhaldhunga, Taplejung etc (Wagley et al., 2012).

A government team that went to Nawalparasi to explore coal mine has instead found the third and possibly the largest iron ore deposit in the country.

The deposit is 20 meters thick and two square kilometers of area. The quality of the ore and economic viability of extracting iron from it are yet to be ascertained (*Milanmani Sharma, republica business and economy, a daily news*).An iron deposit with a potential reserve of 10 million tones has been located at Phulchoki out of which 3.6 million tones have been proved. The estimated ore reserve is 10 million tones with an average grade of 40% iron (Amatya, 1996).

Copper (Cu)

Copper is another important metal which is mainly used in electrical industries to produce electrical and electronic equipments The common copper ore found in Nepal are chalcopryrite, and few malachite, azurite, covellite, cuprite, bornite, and chalcocite.(Sthapit and Pradhananga, 2012). Small scale copper mines were in operation in Gyazi (Gorkha), Okharbot (Myagdi) and Wapsa (Solukhumbu) till to the last decade. Other copper prospects/ deposits like Kalitar (Makwanpur), Dhusa (Dhadhing), Wapsa (Solukhumbu), Bamangaon (Dadeldhura), Khandeshori/ Marma (Darchula), Kurule (Udayapur), BhutKhola (Tanahun), PandavKhani (Baglung), BaiseKhani (Myagdi), ChhirlingKhola (Bhojpur) JanterKhani (Okhaldhunga) are the major ones. Old workings are also known from different parts of Darchula, Bajhang, Bajura, Parbat, Baglung, Myagdi, Gulmi, Tanahun, Gorkha, Makwanpur, Kavre, Ramechhap, Okhaldunga, Dhankuta,

Solukhumbu, Ilam and Taplejung districts. Among them Siddhi Khani (Ilam), MulKhani (Gulmi) Ningre (Myagdi) are the important ones. (Kaphale, 2011).

Out of a great number of prospects investigated during follow up work, 13 have been tested by exploratory drilling to determine the possible extension, tonnage and grade. The estimated ore reserve and grade indicated that these deposits belonged to the sub- economic category. Deposits like Kalitar, Dhusa and Waspa appear to be near marginal economic grade (Shrestha andShrestha, 1983). These deposits are listed in table 1.

Zinc (Zn) and Lead (Pb)

Table 2 shows the occurrences/ prospects/ deposits are reported from more than 54 localities in different parts of Nepal. In most cases their ore minerals e.g. Sphalerite and Galena are associated like in Ganesh Himal area (Rasuwa), Phakuwa (Sankhuwasabha), Labang- Khairang (Makwanpur), Pangum (Solukhumbu), Salimar valley (Mugu/ Humla), DahaGulzar (Darchula), Phulchoki (Lalitpur), SishaKhani and Kandebas (Baglung), Dhuwakot (Parbat), Barghare (Makwanpur), KholaKhani (Taplejung) etc. (Wagley etal., 2012).

Cobalt (Co).

Cobaltite, erythrite and absolite are the common ore of Cobalt. Few old workings for cobalt are known from Netadarling&Tamghas (Gulmi) and Samarbhamar (Arghakhanchi). They are also recorded from Lamadanda (Dhadhing), Nangre (Kavre), Bhorle (Ramechhap), Bauli Gad (Bajhang) etc.

Table 1: Details of Copper mineral deposit sources

Drilled prospects	Estimated ore reserve millionTones)	Average grade in %	Average width (m)	Assumed strike length (m)	Assumed depth (m)	Remarks
Devrali Cu	0.380	0.25	4.27	200	150	Sub-economic
Dhusa Cu	1.080	0.65	3.50	500	200	Sub-economic
Kurule Cu	0.300	1.00	1.00	NA	NA	Sub-economic
Kalitar West Cu	0.270	0.50	1.50	350	175	
Kalitar East Cu	0.400	1.00	3.00	3.00	150	Marginal economic
Waspa Cu	0.556 1.740	1.54 0.88	10.18 14.40	120 270	150 150	Marginal economic
Bamangaun Cu-W	0.160	0.43	11.00	125	60	Sub-economic
Bhutkhola Cu	2.600	0.24	NA	NA	NA	
Pandavkhani Cu	0.038	0.50	22.00	120	10	Sub-economic
Okharbot Cu	NA	NA	NA	NA	NA	Sub-economic
Chhirlingkhola Cu	NA	0.50	30.00	100	NA	Un-economic
Bhorle Cu	NA	0.30	1.50	NA	NA	Un-economic
Ningre Cu	NA	0.50	1.50	NA	NA	Un-economic
Rukumkhani Cu	NA	NA	NA	NA	NA	Sub-economic

Source: Department of Mines and Geology (DMG) reports

Table 2: Details of Zinc and Lead mineral deposit sources

Drilled prospects	Estimated ore reserve (million tons)	Average grade %	Average width (m)	Assumed strike length (m)	Assumed depth (m)	Remarks
KandebasPb - Zn	NA	NA	60.00	200	NA	Un-economic
KhairangPb + Zn	2.000	4.00	1.60	900	450	Sub-economic
Pangum Zn	0.160	0.79	5.99	56	175	Un-economic
Ganesh Himal Zn + Pb	0.698	15.88	NA	NA	NA	Economic/Nepal metal corporation
PhulchokiPb-Zn_	o.110	337	1.00	300	NA	Sub-economic
DamarPb-Zn	NA	NA	NA	NA	NA	Drilling unsuccessful

Source: Department of Mines and Geology (DMG) reports

At least three mineralization zones have been identified. The proven plus probable reserves now stand at 698000 tones with a grade of 13.57% zinc and 2.31% lead. An additional possible tonnage of 154,000 with grade 12.08% zinc and 1.41% lead have been inferred. (K.M.Amatya-an overview).

Nickel (Ni)

Occurrences are reported from few polymetallic deposits like in Bamangaon (Dadeldhura), Bering Khola (Ilam), Bauligad (Bajhang), KhopreKhani (Sindhuli) and oldworkings from Nangre, Nigre and Bhorle (Kavre) area. The main ore of this metal is niccolite and pentlandite which are mainly associated with chalcopyrite, pyrrhotite and pyrite. (Madan and SatyaPrakash, 1994).

Gold (Au)

Gold is widely used in making coins, ornaments, jewelry, dental appliances, electroplating, metal coating and many other purposes. In Nepal alluvial/ placer gold are frequently mined by local dwellers (Botes) from the river gravel/ sediments deposited by the rivers like Mahakali, Chamliya, Jamari Gad, Seti, Karnali, Bheri, Rapti, LungriKhola&PhagumKhola (Rolpa), Kaligandaki, MyagdiKhola, Modi, Madi, Marshyangdi, Trishuli, Budhigandaki, and Sunkoshi along their high and low flood plains as well as in their terraces. Primary gold occurrences are known from LungriKhola area (Rolpa); Bangabagar, Gorang& Jamari gad (Baitadi); Bamangaon (Dadeldhura). (Sthapit and Pradhananga, 2010).

According to indication gold in hard rocks has been traced laterally to continue over 30 KM, occurring at different horizons of about 4 meter thickness. The maximum grade obtained is 6.7g/t in a single sample. Generally auriferous zone is of low grade with Au 0.1gm/t and is considered to be an uneconomic source(Amatya, 1996).

Silver (Ag)

It is generally associated with zinc-lead ore and in gold. In Nepal minor amount of silver is reported in the zinc and lead ore of Ganesh Himal (Rasuwa), Barghare (Makwanpur), and polymetalsulphide of Bering Khola (Ilam), cobalt ore in Netadarling (Arghakhanchi) and Samarbhamar (Gulmi).

Tin (Sn).

Cassiterite is the main ore which is recorded mainly at Meddi and Ganera (Dadeldhura); and ManduKhola area (Makwanpur). In-situ cassiterite mineralization and cassiterite rich floats are seen in MeddiKhola.

Tungsten (W)

It is a very important element which is used in electric bulbs, making hard high speed cutting and Wolframite. (K. N. Upadhaya 1995) In Nepal tungsten ores like scheelite occurrences are known from Bamangaonpolymetalsulphide deposit and few other places in Dadeldhura and Makwanpur districts.

Molybdenum (Mo)

Minor occurrences of Mo are reported from Khari Khola (Solukhumbu), Bamangaon (Dadeldhura), Bauli Gad (Bajhang), LungriKhola (Rolpa), Samarbhamar (Arghakhanchi) and ChauKhola (Makwanpur). Molybdenite is the chief ore.

Titanium (Ti)and Chromium (Cr).

Minor amount of Chromium (Cr) and titanium (Ti) are detected from the Iron ore of Thoshe (Ramechhap) and Bauligad (Bajhang).

Uranium (U) and Thorium (Th)

They are the two known radioactive elements in Nepal. Radioactive minerals like autonite are recorded from Thumki, Jagat, Panchmane, Gagalphedi and Chunikhel in Shivapuri area in Kathmandu. Few other ores of uranium like uranite, tyuamunite, carnotite and coffinite are known from Tinbhangale, ChandiKhola and ChiruwaKhola (Makwanpur); BukaKhola (Sindhuli); MardarKhola and PanpaKhola (Chitwan); Jamari Gad, Bangabagar, Bagoth, Gorang (Baitadi);

Bismuth (Bi)

It is reported from Bamangaon polymetal sulphide deposit in Dadeldhura; and Baraghare and ManduKhola area in Makwanpur district. It is mainly used to make alloys with antimony, lead, tin and cadmium, in medicine and cosmetic items.

Mercury (Hg)

It is reported from TirchePani/ Taruka and Khimti River in the form of cinnabar.

Lithium (Li)

Its occurrences are known from the pegmatites of Hyakule and Phakuwa (Sankhuwasabha). Petalite and Spodumene are the main ores of lithium.

Beryllium (Be)

It can be extracted from beryl and aquamarine which are known from the pegmatites of Khaptad, and different parts of Manang, Kathmandu, Nuwakot, Rasuwa, Phakuwa, Hyakule, Ilam and Taplejung districts.

Arsenic (As)

Arsenopyrite and realgar is the main sources of arsenic which occur mainly in polymetal sulphide deposits e.g. in Bamangaon and Bering Khola.

Conclusion

For the economic development of the country exploitation and proper use of mineral resources is very important. Continues efforts are extremely necessary to find out more mineral deposits, timely exploitation of these known resources and make multiple uses of these mineral commodities for the benefit of the people Government of Nepal should give high priority to explore, evaluate and sustainable development of industrial minerals, high price metals, base metals, fuel minerals, precious and semi-precious stones. It should also invite potential investors/companies (national and International) to invest in mineral

and mining sector and establish mineral based industries by giving some incentive in the beginning. Mineral resources play vital role in industrial development and overall increase in the national gross domestic products (GDP). Present contribution to national GDP from minerals and mine is about 0.5% and on the whole from Minerals mines and mineral based industries sector is just around 2.4 % which is not encouraging but could go above 10% or more if we can utilize existing mineral resources.

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