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Petrogenesis and fluid inclusion study of Bismuth mineralization from Betul Belt, India.

Pradeepkumar T[1]., Shareef M[1]., Nagar R. P[1]., Ajaz Ahamed[2] Hemraj S[3] and Shrivastava H.S[2]
[1.] Geological Survey of India, NCEGR, Bengaluru, India; Email: pradeepkumart@hotmail.com
[2.] Geological Survey of India, Bhopal, India
[3.] Geological Survey of India, Central Headquarters, Kolkata, India

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Bismuth is a common element in many epithermal type mineral occurrences and it bears important genetic implications on ore formation. Yet, the hydrothermal conditions associated with bismuth mineralization remain poorly constrained. In this paper we are reporting fluid inclusion data from mineralized quartz veins to understand the genetic aspects of bismuth deposition, and in particular to formulate future strategy for exploration in the Proterozoic Betul belt.

Secondary hydrothermal quartz veins along a shear zone host Fe-Bi-Cu-Ni-Co-±Zn bearing mineral phases such pyrite, native bismuth, bismuthite, bismuthinite, chalcopyrite and skutterudite. Strike continuity along this shear zone hosts metamorphosed Zn-dominated VHMS-type base metal mineralization in bi-modal volcanic suites. These lithological units are bordered by abundant granitic rocks with geochemical signatures of "A "type affinity.

Two stages of mineralization were recognised based on detailed petrography followed by EPMA and SEM-EDX studies. Early mineralizing events consist of sphalerite, chalcopyrite, pyrrhotite, pyrite followed by galena and bismuth-bearing minerals. Native bismuth occurs as small grains a few microns in size at the boundary of sulfides and as minor inclusions in galena.

In the studied samples highly saline H_2O-NaCl±CO_2 (up to 16.14 wt. % eq. NaCl), moderate temperature (up to 310°C) fluids are responsible for bismuth transportation. This is confirmed by petrographic evidence, that shows a clear association of this type of fluid inclusions with native bismuth grains in the quartz veins. These fluids may be related to the emplacement of numerous syn-tectonic granites reported along the shear zones; fluids generated during felsic igneous activity can transport bismuth [1]; in these case bismuth complexes with sulfide ligands may be important [2].

Fluid immiscibility is a common phenomenon in association with base-metal mineralization in a variety of hydrothermal deposits. Therefore, a decrease of sulfur fugacity through sulfide precipitation and H_2S loss, with decreasing solubility of metals, may have induced bismuth precipitation through destabilization of bisulfide complexes. The precipitation

of bismuth in the quartz veins could also be affected by reducing conditions arising from the precipitation of pyrite.

References:

[1] Dongbok Shin, Hee-In Park and Insung Lee (2004) Can. Mineral. 42: 1465-1481
[2] Skirrow R. G. and Walshe, J. L., (2002), Eco. Geol.97:1167- 1202