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Volcanic-Hosted Massive Sulphide Deposits in mainland SE Asia: Their Potential and Prospectivity

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Volcanic-hosted massive sulphide (VHMS) deposits are formed during the rifting of oceanic ridges or back-arc basins. The SE Asia region is characterised by an assembly of crustal plates or microcontinents that rifted off from northern margin of Gondwana during the Phanerozoic. These microplates or terranes drifted northwards on the Tethyan Oceans and accreted or collided with the Eurasian margin. Throughout the long history of Gondwana supercontinent break-up and subsequent accretion of these crustal terranes, amalgamation and assembly phases of mainland SE Asia, various rifting, subduction, opening and closure of backarc basins, ophiolitic obduction and arc-continent/continent-continent collisions have occurred (Khin Zaw et al. [1, 2, 3 and references therein]). The associated complex and multiple tectono-magmatic-metamorphic-hydrothermal interactions among the SE Asia continental fragments have generated many mineralised fold belts at most of the terrane margins, and the formation of major types of mineral resources in the region. These include porphyry-related skarn deposits, epithermal deposits, sediment-hosted/orogenic gold deposits, gem deposits, Sn-W and REE deposits and VHMS deposits (e.g., Duc Bo deposit in Vietnam, Tasik Chini deposit in central Malaysia and Bawdwin deposit in Myanmar) (Khin Zaw et al. [1, 2, 3]).

The Cu-Pb-Zn Duc Bo deposit is located about 10km from the Coast and 9km south of Tam Ky, the Capital City of Quang Nam Province in central Vietnam. The deposit is hosted in Ordovician-Silurian mafic-felsic volcanic and metavolcanic rocks such as metadacite and matabasalt and strongly deformed and metamorphosed to Amphibolite facies. The Tasik Chini district in central Malaysia has a long history of iron-manganese-barite mining and hosts the Bukit Botol and Bukit Ketaya VHMS ore lenses (Mohd Basril Iswadi Basori et al. [4]). These ore lenses were formed within weakly deformed felsic-dominated Permian volcanics that are part of a mixed volcano-sedimentary rock succession. Four mineralization zones were identified in both deposits: (1) stringer sulphide/zone; (2) massive sulphide zone; (3) barite zone; and (4) Fe-Mn and Fe-Si zones. The stringer and massive sulphides generally define the lower mineralized zones, whereas the barite, Fe-Mn, and Fe-Si layers define the stratigraphically upper mineralized zones. The main sulphide phases are pyrite, chalcopyrite, sphalerite, rare galena, and trace Sn-, Au-, and Ag-bearing minerals, with the latter two confined to the massive sulphide and barite zones. LAICP- MS U–Pb zircon dating of rhyolites from the Bukit Botol deposit yields Early Permian (286 ± 4 to 292 ± 3 Ma) ages. Similarly, the zircon U–Pb age results for the Bukit Ketaya rhyolites reveal Early Permian (286 ± 2 to 288 ± 4 Ma) ages (Mohd Basril Iswadi Basori et al. [4]). The Bawdwin deposit in northern Myanmar is the largest producing Pb-Zn-Ag VHMS deposit in SE Asia and occurs in Cambro-Ordovician volcaniclastic pile, Numtu Township, northeastern Myanmar and the deposit is relatively undeformed and metamorphosed. Formation of these VHMS deposits in SE Asia is related to the protracted history and development of Paleo- to Meso-Tethyan Oceans and there is a significant potential for future discovery of these deposit types in SE Asia. Further research are required to improve understanding of the basic geology (particularly to establish time-space relations of magmatic, tectonic

and hydrothermal alteration history) for better targeting of the potentials and prospective grounds in the region for mineral exploration.

References:

[1] Khin Zaw et al. (2014a) Gondwana Research 26: 1–4

[2] Khin Zaw et al. (2014b) Gondwana Research 26: 5–30

[3] Khin Zaw et al. (2015) Miner Deposita 50: 25-39

[4] Mohd Basril Iswadi Basori et al. (2016) International Geology Review
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