

SEG 2022 Conference: Minerals For Our Future

Towards a Genetic Model for the Cu-(Te-Au-Ni-PGE) Sulfide Deposits of the Curaçá Valley, Brazil

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The Curaçá Valley hosts a suite of Cu-rich sulfide deposits hosted by ultramafic/mafic intrusions, within the Itabuna-Salvador-Curaçá Orogenic Belt, Brazil. The origin of the deposits is contentious, with Cu-rich fractionated magmatic sulfide, hydrothermal/metamorphosed magmatic sulfide, alkalic magmatic sulfide and iron-oxide-copper-gold (IOCG) origins all suggested. Key aspects that set the Curaçá Valley deposits aside from other ultramafic-mafic hosted sulfide deposits are: the very high Cu/Ni ratios of most of the deposits; the extreme Te enrichment; the intimate association of the sulfides with volatile phases, in particular, phlogopite; and the depth of preservation (deep, lower crust). We rule out an IOCG origin based on geochemical characteristics of the ores, in particular, the low Cu/Te ratios and high PGE contents compared with IOCGs, and prefer a magmatic origin. The depth of preservation opens up the possibility the sulfides may represent magmatic Ni-Cu-PGE sulfides generated from ultramafic/mafic melts that have undergone lengthy and extensive fractionation in a 'Goldilocks zone' or 'temperature window'; producing extreme Cu-Te-Au-rich end members, and implying Ni-PGE-rich end members elsewhere in the system. Alternatively, or in addition to, the presence of abundant volatile phases (phlogopite, apatite, carbonate) along with the high Te content and chalcophile metal concentrations and ratios, is also entirely consistent with an alkalic magmatic signature, where the parental magma was sourced from low degree partial melts of an enriched mantle source. Here we utilise a combination of mineralogical, isotopic and geochemical techniques to interrogate these models and, by comparing to other analogous deposits worldwide, aim to define a sub-class of magmatic sulfide deposits that may be characteristic of lower crustal magmatic systems