Fluid inclusions record a history of melt source, transport and optimum fluid conditions for base-metal mineralization at the Pitarrilla Ag-Zn-Pb deposit, Sierra Madre Occidental, Mexico

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A fluid inclusion study of the ca. 31.6 Ma mineralized (Ag-Zn-Pb) Pitarrilla felsic volcanic centre was conducted using: (1) quartz megacrysts (QM) from quartz-feldspar phyric synvolcanic dyke rocks, and (2) quartz and sphalerite from the high-grade, base-metal mineralized part of the IM sulphide mineralization. The QM are characterized by deeply embayed textures, abundant melt inclusions (MIs) with decrepitate textures and haloes of aqueous fluid inclusions, and planes of secondary L-V±H±S fluid inclusions. Final homogenization of L-V-H inclusions (88 in 17 fluid inclusion assemblages (FIAs)) occurred two ways (L+H→L, L+V→L) with a large variation in Th for phase changes among FIAs (200–500°C), but little variation for changes in FIAs. Using appropriate bulk compositions and projection of the halite liquidus surface in PT space, the data track decompression for the QMs over a 3–4 kbar interval. This conclusion, consistent with geochemical constraints, is supported by the embayed QMs and both decrepitate textures of MIs and inclusion-rich haloes around them. Thermometric measurements (639 inclusions in 93 FIAs) for two phase (L-V) aqueous inclusions in QMs and quartz and sphalerite in the mineralization indicate: (1) trapping of L-and V-rich inclusions (i.e., fluid unmixing) on growth

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zones in quartz with Th = 160° and 275° to 300°C; (2) a continuum of data for FIAs in T-salinity space from 2 wt. % eq. NaCl, 200°C to 18 wt. % eq. NaCl, 380°C. A separate group plots at 140–170°C, 0 wt.% NaCl; and (3) a narrow range of data for FIAs in sphalerite, measured using an IR camera (1100 μm), with 1.7–8.5 wt. % eq. NaCl and 200–300°C. These data indicate two processes: (1) generation and unmixing of a magmatic fluid with 18 wt. % eq. NaCl; and (2) mixing of this fluid with meteoric water. The limited window in T-salinity space for sphalerite-hosted FIAs reflects the optimum physio-chemical conditions for its formation.