Multi-stage antimony mineralization in the Banxi Sb deposit, South China

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Arsenopyrite Re-Os dating of the first quartz-arsenopyrite stage alteration zones, quartz Rb-Sr dating of the second quartz-stibnite stage ores, and stibnite/arsenopyrite Rb–Sr, Sm–Nd and zircon (U-Th)/He dating of the third stibnite stage ores and alteration zones were carried out to constrain the multiple mineralizaiton events at the Banxi Sb deposit, South China. The arsenopyrite Re-Os analysis yielded an approximate isochron age of ~450 Ma (n = 5; ^{187}Re = 0.015–0.51 ppb; ^{187}Os = 0.0012–0.0052 ppb). Six quartz samples show variable Rb (0.02206–3.642 ppm) and Sr (0.5354–2.505 ppm) compositions, with $^{87}Rb/^{86}Sr$ and $^{87}Sr/^{86}Sr$ ratios ranging from 0.119 to 4.93 and from 0.72663 to 0.74002, respectively. The $^{87}Rb/^{86}Sr$ and $^{87}Sr/^{86}Sr$ values of the quartz samples yielded an Rb–Sr isochron age of 196 ± 4 Ma (1σ, MSWD = 0.70), with an initial $^{87}Sr/^{86}Sr$ value of 0.72640 ± 0.00011 (1σ). The Rb–Sr and Sm–Nd isotopic analyses of the stibnite and arsenopyrite yield isochron ages of 129.4 ± 2.4 Ma (2σ, MSWD = 1.3) and 130.4 ± 1.9Ma (2σ, MSWD=1.6), respectively. The $^{87}Rb/^{86}Sr$ and $^{87}Sr/^{86}Sr$ ratios of the sulfides are 0.3016–3.538 and 0.711463–0.717591, respectively for stibnite, and 0.2251–2.214 and 0.711244–0.711565, respectively for arsenopyrite. The $^{147}Sm/^{144}Nd$ and $^{143}Nd/^{144}Nd$ ratios are 0.1174–0.9816 and 0.511942–0.512768 for stibnite, with εNd(t) values (t = 130 Ma) ranging from −12.4 to −6.6, and two-stage model ages (T_{2DM}) ranging from 1457 to 1932 Ma. The (U–Th)/He ages from all zircon crystals are in the range of 101.5–139.9 Ma. Thirteen zircon grains from a ore sample yielded a mean (U–Th)/He age of 126.0 ± 4.9 Ma (MSWD = 1.0), and twenty zircon grains from a alteration zone wall rock yielded a mean (U–Th)/He age of 122.2 ± 5.4 Ma (MSWD = 1.4). The two mean ages are consistent within error, and all the thirty-three zircons combined yielded a mean (U–Th)/He age of 123.8 ± 3.8 Ma (MSWD = 1.2). All of these ages reported in this study are roughly consistent with those of the Sb (Au) deposits within and around the Jiangnan Orogen: 435–380 Ma, 230–200 Ma and 160–130 Ma.

Consequently combined with geochemcal studies, a three-period genetic model has been proposed for the world-class Sb mineralization in the central-western Hunan region, assocaited with the Caledonian (Cambrian-Silurian) Orogeny, Indosinian (Triassic) Orogeny and Yanshanian (Late Jurassic–Early Cretaceous) magatic event, respectively.