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Multiple fluid sources and severe thermal gradients during formation of the Jílové orogenic gold deposit, Bohemian Massif, Czech Republic

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Numerous gold deposits and gold showings are located in the central part of the Bohemian Massif, at terrane boundary of two crustal blocks (the Teplá-Barrandian and the Moldanubian) that was intruded by granitoids of the Variscan Central Bohemian Plutonic Complex (CBPC) at 355 to 335 Ma.

The historical Jílové deposit (estimated past production ∼11 t Au) is an orogenic-type gold deposit, represented by massive quartz veins and by quartz stockoworks hosted by Neoproterozoic, mostly volcanic rocks of the Jílové Belt and various dykes related to the CBPC. Occurrence of carbonate minerals in all six mineralization stages at this deposit, allowed trace isotope composition of ore-bearing fluids and temperatures of ore formation in great detail.

Stable isotope data and mineral and isotope thermometry indicate gangue and ore mineral formation between cca 350 ˚C and <100 ˚C. Scheelite-bearing assemblages (mineral stage 3) precipitated at 300 ˚C from a fluid with $\delta^{18}O_{fluid}$+4.2 ± 0.5 ‰ SMOW and $\delta^{13}C_{fluid}$-11± 1 ‰ PDB. Gold precipitation (stage 5) occurred at 230±30 ˚C from a fluid with variable values of $\delta^{18}O_{fluid}$(+2.5 to +5 ‰ SMOW) and of $\delta^{13}C_{fluid}$(-9 to -13.5 ‰ PDB). Both fluids were dominated by $H_2CO_{3ap.}$, some gold, however, precipitated even at ≤100 ˚C from bicarbonate dominated fluids. Detailed sampling across single gold-bearing veins (about 50-70 mm thick) revealed thermal gradients of 50 to 100˚C during vein formation and gold precipitation.

Sulfur isotope compositions of sulfides indicate remobilization of sulfur from Neoproterozoic rocks and Neoproterozoic stratiform mineralizations of the Jílové Belt by Variscan hydrothermal fluids. Similarly, isotope composition of Sr in carbonate minerals, indicate several switches between relatively primitive ($^{87}Sr/^{86}Sr$ = 0.7055) and more evolved ($^{87}Sr/^{86}Sr \sim 0.7090$) source fluid compositions, indicating fluid exchange with the Jílové Belt and the CBPC rocks, respectively.

The mineralization is essentially coeval with late intrusive phases of the CBPC and with large-scale tectonic movements at boundary between the two terranes.

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