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Tectonic-thermal constraints on the Pb-Zn ore deposits from southeastern French Central Massif by K-Ar and Pb-Pb dating of illite

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Abstract

Illite-rich size-fractions (<0.2, <0.4, 0.4-1, 0.4-2 and <2 μm) of Cambrian, Permian, Triassic and Jurassic calcschists, shales and dolostones from Pb-Zn ore-district of the southeastern French Massif Central were dated by the K-Ar method, and some by the Pb-Pb method after removal of the Pb external to the illite particles. The combined mineralogical and isotopic determinations show that illitization occurred successively at 285 ± 5, 240 ± 20, 185 ± 15, 140 ± 10 and 105 ± 5 Ma in the district. These tectonic-thermal pulses, which were also reported at a larger regional scale, did not systematically release Pb-mineralizing fluids. The mineralizing episodes seem to have only contributed to contemporaneous illitization and Pb precipitation at 191 ± 41 Ma, by Pb-Pb dating of illite, and at 105 ± 5 Ma in a reactivated fault containing illite mixed with Pb precipitates. The scatter of the Pb-Pb data suggests an incompletely equilibrated Pb isotopic signature when incorporated into the illite structure during crystallization. Pb-isotopic determinations of barren illite-type minerals provide new information about the circulation timing of the mineralizing hydrothermal fluids. The fluid migrations related to recurrent hydrothermal activities occurred within a segment of a continental margin that was located away from main rift zones and far (more than 500 km) from major orogenic zones of Western Europe. The lack of major geodynamic activities near metal deposits needs to hypothesize periodic migrations of hot -fluids in the underneath continental crust. Metals were concentrated at specific places, but not necessarily during each tectonic -thermal pulse recorded by illite. These tectonic-thermal activities confirm local geodynamic re-activations of previously occurring events with effects on local mass and heat transfers in the plutonic basements, as well as in the sedimentary sequences.

Key words: *Pb-Zn ore district, southeastern French Central Massif, illite-type clays, K-Ar and Pb-Pb dating*

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