Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19725

In situ U–Pb and Rb–Sr dating applied to Pb–Zn–Ag mineralizations of the Western Alps

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The Western Alps display a myriad of polymetallic mineralizations in varied lithostructural contexts. The lack of data on geochronology, ore mineralogy, thermodynamics and composition of associated paleofluids restricts our ability to establish with confidence the origin and geodynamic context of the metal deposition during the successive orogenic cycles (Variscan/Alpine). In this work, we have conducted a multithematic approach combining field work investigations, microstructural characterization, geochronological analyses, and thermobarometric data to constrain the metallogenic models at the origin of Pb–Zn–Ag deposits. In particular, U–Pb monazite/allanite dating and in situ Rb–Sr dating of white mica were used for cross-comparison on their potential and limits in this Pb-rich open system. The selected mineralizations are located (1) in the basement of the external crystalline massifs, and (2) in the sedimentary cover of the external Briançonnais domain. These mineralizations are stratoid and located in mylonitized host rocks in the vicinity of major lithological or tectonic contacts. The new geochronological dataset indicates only Alpine ages with no geochronological evidence of Variscan inheritance. The Rb–Sr ages (34.6 ± 4.7 Ma and 18.5 ± 3.6 Ma) shows good agreement with U–Pb ages (35.1 ± 4.7 Ma and 14.9 ± 7.6 Ma). Furthermore, the in situ Rb–Sr dating of white mica also allows discriminating fluid circulation events (e.g. 19.3 ± 2.05 Ma) not recorded by REE-rich accessory minerals (37.1 ± 0.7 Ma) which demonstrates the potential for dating mineralizations and fluid-rock interaction processes.