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Clacite U-Pb dating in the Western Alps: State of the art and new perspectives for constraining Alpine geodynamics

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In recent years, calcite in situ U–Pb dating has emerged as a solution for absolute dating of deformation in sedimentary environments not accessible to conventional methods ([1], [2]). In the Western Alps, this method has been successfully applied to dating the structuring of the foreland (between 15 and 3 Ma ; i.e. [3] and [4]), thus constraining the latest stage of Alpine chain construction. Although calcite is a ubiquitous mineral in the peripheral basins of the chain, the challenge is quite different in the crystalline massifs where calcite does not seem to be favourable to the application of this method due to low U/Pb in sampled calcite. Despite this difficulty, obtaining calcite U–Pb absolute age would enable to provide information on the early history of the Western Alps. With this in mind, the present study aims at testing the datability of calcite from different localities of the external and internal Crystalline Massifs of the Western Alps, in order to identify areas where this method could be applied.

Preliminary U–Pb isotope analyses of calcite veins in crystalline basement rocks shows the abundance of crystal domains dominated by common-Pb precluding precise and accurate dating. Nevertheless, dating of calcite vacuoles from spilites are one of the few samples where U/Pb is favourable and where the scatter of analysed calcite domains is sufficient enough. The age obtained provides information on the emplacement and weathering conditions of pre-Alpine volcanic rocks. By providing, for the first time, an absolute constraint on the stratigraphic sequence of the Triassic, this result extends the catalogue of datable geological objects and thus hence broadens the perspectives offered by this developing method.

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[2] Beaudoin, Lacombe, Roberts and Koehn (2018), *Geology* 46, 1015-1018.

[3] Bilau, Bienveignant, Rolland, Schwartz et al. (2023), *Earth Science Reviews* 236.

[4] Looser, Madritsch, Guillong, Laurent, Wohlwend and Bernasconi (2021),*Tectonics* 40.