Superfast exhumation and retrograde melting events in the Brossasco-Isasca unit (Dora-Maira massif, Western Alps)

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Résumé

The Dora-Maira massif is a nappe stack of polymetamorphic continental crust that metamorphozed at high and ultrahigh pressure conditions during the final stages of Alpine subduction. The Brossasco-Isasca unit of this massif reached ultrahigh pressure conditions of _˜ 4 GPa and 730∘C until at least 34.6 ± 0.1 Ma. Early geochronological studies suggested exhumation rates as high as 3 cm/yr. We report the discovery of a previously undocumented felsic dyke and the identification of migmatitic textures in orthogneiss, both of which offer new constraints on the magmatic and metamorphic evolution of the unit.
Detailed structural and microtextural analyses, integrated with thermobarometry and in-situ U–Pb geochronology by LA-ICP-MS of zircon and allanite, were performed to determine the timing and conditions of these events. The felsic dyke exhibits a plagioclase-bearing assemblage consistent with rapid emplacement of a differentiated (originally mafic) melt at _˜1.1 GPa and 550∘C into paragneiss. U–Pb dating yields an emplacement age of 33.9±0.1 Ma. In parallel, the migmatitic textures in orthogneiss reflect fluid-assisted partial melting at temperatures exceeding 550∘C, dated at 32.5±0.3 Ma.
These results reveal syn-exhumation magmatism within the Brossasco-Isasca unit, indicating exhumation rates exceeding 10 cm/yr. The close temporal relationship between this magmatic activity and the Periadriatic magmatism along the Insubric Line suggests an orogen-scale episode of fluid and magma mobilization, potentially driven by slab breakoff during the transition from subduction to continental collision.

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