



The Ordovician igneous record of the Ligurian Alps: U/Pb and geochemical constraints through time and microplates

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The Paleozoic remnants in the Ligurian segment of the Alps are referred to different domains in the pre-alpine palaeogeography (Briançonnais, Prepiedmont and Piedmont respectively from present west to east).

In the Briançonnais and Prepiedmont domain, the basement is made of Cambrian–Ordovician bimodal effusive products (tholeiitic to transitional basalts, acidic calc-alkalic volcanites), associated with pelitic and pelitic-psammitic sediments. Huge volumes of metarenites, mostly graywackes, allow to infer turbiditic deposits, with scarce mantle-derived ultramafic bodies (olistoliths). The acidic metavolcanites yield U-Pb igneous zircon ages as old as 506.9 ± 4.7 and 494 ± 5 , -3 Ma (isotopic dilution and TIMS).

A Mid-Ordovician igneous event is represented A) in the Prepiedmont domain, by peraluminous S-type granitoids emplaced between 473 ± 1 and 467 ± 0.9 Ma (isotopic dilution and TIMS) and by localised gabbros and rare basic to intermediate dykes. B) In the innermost Prepiedmont domain (Torrente Visone Unit), by a gneiss complex of augen orthogneisses with a 461.8 ± 1.4 Ma rhyolitic protolith (U-Pb zircon age by LA-ICP-MS), interfingering with continental clastic deposits (paragneisses grading into quartzitic schists), pre-dating the carbonatic - metapelitic sequence (silicate marble complex). Metamorphosed MORB-type tholeiites and subordinate ultramafic rocks are inferred as flows and dykes across the sedimentary complex. Its pre-alpine, amphibolite facies overprint is largely obscured by the eclogite-facies alpine event.

The Cambrian–Ordovician sequence may indicate a continental rift phase, at the threshold of ocean floor spreading, characterized by flysch deposition likely fed by dismantlement of an arc. A similar environment was proposed for the Aiguilles Rouges in the Helvetic Western Alps (von Raumer et al., 1990). Basic volcanites, often showing MORB and also alkalic affinity, are commonly associated with acidic volcanics (“Leptyno-amphibolitic” complexes Auct.), sometimes with ultramafic rocks, between the Upper Cambrian and the Lower Ordovician; they occur in the western Penninic and Helvetic Alps, in the Vanoise and in the Internal French Alps, and are widespread in most of the pre-Variscan terranes from Spain to the Bohemian massif (Paquette et al., 1989; Santallier et al., 1988; Briand et al., 1995; Bellot et al., 2003).

In accordance with the regional frame, a probable ocean-continent collision, associated with the subduction of the embryonic Rheic ocean (von Raumer et al., 2003) caused a short-lived Mid Ordovician orogenic cycle.

Lithostratigraphic and radiometric investigations suggest that from Early to Mid Ordovician the Ligurian Briançonnais, Prepiedmont and Piedmont domains depicted the paleogeography of inner to outer zones with respect to the inferred Variscan thrust front.

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