U-Pb and Hf isotopes in zircons from mantle chromitites of the Finero Peridotite (Ivrea Verbano Zone)

T. GIOVANARDI[12], A. ZANETTI[3*], M. MAZZUCCHELLI[2], M. TIEPOLO[3], F.-W. WU[4], A. LANGONE[2] AND R. VANNUCCI[1]

[1]Dip. Scienze della. Terra e Ambiente, Univ. di Pavia, Pavia, Italy
[2]Dip. Sc. Chim. e Geol., Univ. di Modena e Reggio Emilia, Modena, Italy
[3] Istituto di Geoscienze e Georisorse, CNR, Pavia, Italy
[4]IGG, Chinese Academy of Sciences, Beijing, China
(*correspondence: zanetti@crystal.unipv.it)

The Finero Phlogopite Peridotite unit (hereafter Ph-Pd. Ivrea-Verbano Zone, IVZ: Southern Alps) is the unique worldwide example of orogenic mantle massif completely constituted by phlogopite-bearing ultramafics (mainly harzburgites, websterites and dunites) after pervasive to channelled melt migration events. A precious opportunity to provide further constraints on the petrologic and geodynamic evolution of such a mantle sequence is given by the occurrence of zircons in chromitites usually composed by Chromite+Orthopyroxene±Clinopyroxene±Amphibole.

Zircons show low CL emission and are generally homogeneous. Few grains display cores slightly darker than the rims. Zircons have up to 1420 and 800 ppm of U and Th, respectively, with Th/U ratio up to 1.6. U-Pb LA-ICP-HRMS analyses yield most concordant Lower Jurassic dates with a weighted average $^{206}Pb/^{238}U$ age at 187±2 Ma. A few darker cores yield Middle Triassic concordant $^{206}Pb/^{238}U$ ages from 242±7 Ma to 229±7 Ma. Zircons also show $^{176}Hf/^{177}Hf$ ratios in the range of 0.282486-0.282610, which give sub-chondrititic $\varepsilon Hf_{(188)}$ (-6.0 to -1.6). The relatively high U and Th contents and the large Th/U ratios are the evidence that the chromitite zircons crystallised from a melt, which, according to the low $\varepsilon Hf_{(188)}$ values, had a marked crustal signature. This melt is analogous to that at the origin of the phlogopite harzburgites and websterites. The absence of internal zoning in zircon is interpreted as the result of homogenisation after a prolonged residence at high temperature mantle conditions. In this frame, the Lower Jurassic ages are proposed to date the cooling of the mantle sequence during exhumation for the opening of the Alpine Tethys. Conversely, the few Middle Triassic dates could represent the age of mantle metasomatism. As a whole, our data strongly support that the Finero area experienced a different geodynamic evolution with respect to the rest of IVZ.

Use of whole rock geochemistry for ignimbritic unit recognition: An example from the Sulcis area (SW Sardinia, Italy)

G. GISBERT AND D. GIMENO

Facultat de Geologia, Universitat de Barcelona, C/ Martí i Franquès s/n, 08028 Barcelona, Spain. (ggisbertp@hotmail.com, d.gimeno.torrente@gmail.com)

In the Sulcis area (SW Sardinia, Italy) a thick Oligo-Miocene volcanic sequence formed during the drifting and rotation of Sardinia from the European continental margin to its current position. These volcanics originated by the combined effect of oceanic crust subduction under the Corsica-Sardinia microplate and increased extensional tectonics after 18 Ma. The volcanic deposits are over 600 m thick and cover an area more than 40 km in diameter which includes part of the mainland and two minor islands. This volcanic sequence consists of two differentiated halves: a lower one formed by andesitic lava domes and flows, and an upper one formed by a pile of trachytic and rhyolitic up to comenditic ignimbritic mantles, some of which cover the whole studied area. This ignimbritic sequence has been divided over the years into 18 units. The similarities between the various ignimbritic units, both macro- and microscopically in many cases, combined with the large facies variability some units may present, make the correct identification of units and correlation between zones and outcrops difficult in such a wide area, which is divided, moreover, by the sea. To solve this problem a thorough study of the ignimbritic suite was carried out involving the volcanostratographic revision and the whole rock geochemical characterisation of each unit. Whole rock geochemistry was analysed by means of XRF, ICP-MS and ICP-OES. A protocol was developed which allows the identification of the ignimbritic units in the Miocene Sulcis ignimbritic pile based on whole rock geochemistry. It works by projecting geochemical data of problem samples into specially-designed binary diagrams. This tool for the recognition of units using only its whole rock geochemistry has allowed us to solve many cartographic and stratigraphic doubts in the study area, proving its usefulness. From now on it can be also used by other researchers working in the area. Moreover, the methodology followed to elaborate this protocol can be applied elsewhere.

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