ORIGIN OF A LEUCOGRANITIC GNEISS (GNEISS CHIARI) FROM THE OROBIC ALPS (N ITALY)

Bergomi M.A. (1) and Boriani A. (1)

(1) Dipartimento di Scienze della Terra, Università degli Studi di Milano

The Orobic basement (Southern Alps) mainly consists of pelitic and psammitic metasiliciclastic rocks with minor metagranitoids. A peculiar orthogneiss occurs at the top of Southalpine basement near the contact with Permo-Mesozoic cover rocks: the Gneiss Chiari del Corno Stella (or Gneiss Chiari). The Gneiss Chiari show a very homogeneous chemical composition similar to that of tourmaline leucogranites. They show a restricted silica range (75-80 wt%), high Al2O3 (>13 wt%) and alkali contents. They are poor in CaO (<0.35 wt%), MgO (<0.3 wt%), Fe2O3t (<0.60wt%) and TiO2 (<0.05 wt%).

Several characteristic and discriminant trace elements, such as Rb, Ba, Sr, Y and Zr have been chosen to underline the exceptional chemical composition and homogeneity of the granitic protolith of Gneiss Chiari. Although K2O is only 20 to 30% higher than in normal biotite granites, Rb is enriched more than 10%, reaching even 500 ppm. Rb is probably related to muscovite as well as to Kfs. The Gneiss Chiari are also characterized by high K/Rb and Rb/Zr ratios, low Ba, Sr and HFSE.

In the Qtz-Ab-Or system, the Gneiss Chiari plot very close to the minimum in the range between 0.5-1.0 Kb, suggesting that they may have crystallized from a near 100%-liquid magma under water-saturated conditions at very high crustal levels. The deviation of some samples away from the minimum is probably a result of fractionation and therefore some samples do not represent the true bulk composition of the original granitic melt. In this system liquidus temperatures of these compositions ranges between 750-700 °C. The same range is obtained from Zr saturation temperatures (Watson & Harrison, 1983).

Fractionation is dominated by Kfs and the best evidence for crystal fractionation consist of: (1) enrichment in Rb, Cs and depletion in Ba, Sr and Eu; (2) Sr and Ba both increase; (3) Rb/Sr ratios increase with decreasing Ba; (4) TiO2, LREE, Th, Ba, Sr,
Y and Ce/Y decrease with decreasing Zr, whereas Rb/Sr and Sr/Ba increase. These trends also suggest that disturbance by late- or post-magmatic hydrothermal alteration is minimal.

Y abundances are unusually high, though unevenly distributed. This element may be bound to apatite and to a smaller extent to tourmaline.

All the samples exhibit low total REE and negative Eu anomaly, more pronounced with increasing Rb/Sr ratios. This features are consistent with the scarcity of zircon and monazite and suggest feldspars fractionation.

The highly peraluminous and low-Ca composition of the Gneiss Chiari is typical of pelite-derived anatectic magma. The enrichment of the Gneiss Chiari in the incompatible elements K, Rb and Th strongly supports their crustal source.

LILE (Rb, Sr and Ba) abundances in the Gneiss Chiari are compatible with their derivation by partial melting of pelites under fluid-absent condition implying dehydration melting of muscovite. A fluid-saturated melting regime, in which sufficient fluid was available to produce the maximum possible melt would produce a Sr enriched melt, which is not observed in Gneiss Chiari. It is important to emphasize that the critical melt fraction (>20%) does not represent the lowest melt fraction at which a melt may migrate, as small-degree partial melts may be efficiently separated from source by deformation-enhanced processes rather than their buoyancy alone.