# Leucosome formation by desequilibrium melting and melt loss: Perspectives from the South Marginal Zone (SMZ) of the Limpopo Belt, South Africa

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This study investigates the details of the anatectic process which result in the formation of dm- to m-scale, markedly low $K_2O$ content leucosomes during biotite incongruent melting.

Two hypotheses exist for the origin of such leucosomes; that they represent the products of fractional crystallization of plagioclase and quartz [1]; and, the redistribution of $K_2O$ and $H_2O$ from the segregated melt back into the residuum [2]. Evidences from metapelites in the SMZ do not support either hypothesis. The peritectic assemblage is well preserved in zones of residua adjacent to leucosomes [3]; leucosomes are characterised by strong positive Eu anomalies, whilst the gneisses from which they were derived have insignificant Eu anomalies; Na:Ca ratios in the leucosomes are similar to those in their source rocks; field-based XRF profiles of $K_2O$ content across leucosomes and their hosting gneisses does not show substantial $K_2O$ enrichment in the gneisses adjacent to the leucosomes. In addition, leucosomes formed by biotite + sillimanite melting are shown to have become rheologically solid prior to the occurrence of biotite melting in the absence of sillimanite at higher temperature.

These findings suggest that the leucosomes formed by biotite fluid-absent melting involving disequilibrium behaviour of plagioclase. Such a mechanism fits with the entire spectrum of field, textural and chemical data from the SMZ and open new perspectives on the role played by disequilibrium processes during S-type granite genesis. The results argue that the melt leaves the source instantaneously, that individual leucosomes are constructed incrementally; that leucosome volumes do not represent the volume of melt present at any time; and the leucosomes in such granulites constitute part of the residuum after partial melting.

[1] Brown (2002), J. metamorphic Geol, **20**, 25-40. [2] Kreigsman (2001), Lithos, **56**, 75-96. [3] Stevens and van Reenen. (1992) Precambrian. Research, **55**, 303-319.

# Changes of magma geochemistry at Mt. Etna during the last 45ka due to sampling of a variegated mantle

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Mt. Etna magmas show long- and short-term variations especially for K contents, some LILEs and HFSEs as well as Sr-Nd-Pb-Hf isotope ratios, a feature increasingly more evident during the last four decades of activity. Nonetheless, magma source characteristics are still debated. Contributions to this discussion arise from focusing the attention on volcanic products of Etna of the last 45 ka of activity, belonging to the "*Ellittico*" and "*Recent Mongibello*" volcanic successions. Incompatible trace elements for mantle-equilibrated compositions of the most basic products reveal that the Etnean magmas under consideration can be produced by rather low partial melting degrees of a peridotite variably enriched by metasomatic phases such as amphibole and/or phlogopite. Sr-Nd-Pb-Hf isotopes suggest that recycled and altered oceanic lithosphere is a dominant component in the Etnean mantle source. A dominant FOZO reservoir has been inferred [1], although not sufficient to satisfactory explain the observed isotopic variations. Addition of variable proportions of an EM1-type component (up to 10%) has been then suggested. Hf isotopes provide further evidence that the enriching component at Mt. Etna could be related to the metasomatizing action of high-T fluids (i.e., silicate melts), which may be frozen in the form of pyroxenite veins at mantle conditions. Our calculations confirm that involvement of variable amounts of this enriched component in magma genesis is able to explain the long- and short-term geochemical and isotopic variations observed throughout the last 45 ka.

[1] Viccaro M., Nicotra E., Cristofolini R., Millar I.L. (2011), *Chemical Geology* 281, 343-351.


DOI:10.1180/minmag.2013.077.5.14