Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01588, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01588
EGU General Assembly 2008

Lithosphere-asthenosphere structure, mantle anomalies and magmatism in the Western Mediterranean: implications for geodynamics

A. Peccerillo (1), G. Panza (2), C. Doglioni (3), M.L. Frezzotti (4), A. Audia (5)

(1) Department of Earth Sciences, University of Perugia, Italy

(2) Department of Earth Sciences, University of Trieste, Italy

(3) Department of Earth Sciences, University of Rome, Italy

(4) Department of Earth Sciences, University of Siena, Italy

(5) The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

The western Mediterranean has been the site of a complex Oligocene to Present volcanic activity, with eruption of a wide variety of magmas, from arc-type calcalkaline and K-alkaline to intraplate tholeiitic to Na-alkaline products. Radiogenic isotopes and trace element signatures reveal anomalous and strongly heterogeneous mantle sources, whose understanding represents a challange for petrology, geophysics and geodynamics.

Shear-wave tomography for the lithosphere-asthenosphere system (LAS) along transects across Western-Central Mediterranean area, reveals highly heterogeneous lateral and vertical mechanical characteristics. A 50 km thick low S-waves velocity layer (V_S $\sim$ 4.0-4.2 km/sec) is observed at about 70 - 120 km of depth from Provence to Sardinia and the central Tyrrhenian Sea. This low-V_S layer (LVL) rises to a depth of about 30-40 km below the presently active Neapolitan (Ischia, Campi Flegrei, Vesuvio) and Aeolian arc volcanoes.

In the Balearic Sea-Sardinia-Central Tyrrhenian section the depth of the LVL corresponds to pressure conditions of minimum temperature of peridotite+CO_2+H_2O

solidus, suggesting it is genetically related to mantle contamination and melting behind the eastward retreating Adriatic-Ionian subducting plates from Oligo-Miocene to present. The shallow depths of LVL in the Southern Tyrrhenian Sea is a combined effect of the strong extensional tectonics affecting this sector of the Tyrrhenian basin, and of eastward mantle flow.

These data support the hypothesis that orogenic Oligocene to Quaternary volcanism in the Western Mediterranean area is the effect of shallow mantle processes, and argue against a role of deep mantle plumes. The unique in Europe EM1-type (moderately radiogenic Sr-Nd and unradiogenic Pb) anorogenic Plio-Quaternary magmatism in Sardinia, which has been believed to represent a deep mantle plume, is instead suggested to be generated in the lithosphere, which show peculiar mechanical characteristics beneath this area. Finally, the presence of a deep plume is also unlikely along the northern margin of the African foreland from the Sicily Channel to the Ionian Sea area, representing the northern border of the African foreland. There is no evidence of LVL beneath this area, except for very narrow lenses beneath the Graham-Ferdinandea and Etna region. It is suggested that the magmatism along the northern margin of the African foreland (i.e. Sicily Channel, Iblei, Etna) is related to decompression melting, locally affecting the upper mantle above strike-slip faulting along the collision zone.