Tracing magmatic sources of ash beds in the Late Permian to Middle Triassic Nanpanjiang Basin (South China): Insights from Hf isotopes on zircons from volcanic ash beds

M. OVTCHAROVA[1], H. BUCHER[2], T. GALFETTI[2], U. SCHALTEGGER[1], A. BRAYARD[2], N. GOUDEMAND[2] AND A. STRACKE[3]

[1]Earth Sciences, University of Geneva, Switzerland (maria.ovtcharova@terre.unige.ch)
[2]Institute and Museum of Paleontology, University of Zürich, Switzerland (Hugo.FR.Bucher@pim.unizh.ch)
[3]Earth Sciences, ETH Zürich, Switzerland

The ammonoid-rich rocks from the Early Triassic Luolou Fm. and Anisian Baifeng Fm. (Nanpanjiang Basin, South China) are well calibrated by U-Pb ages on volcanic zircons [1, 2]. Permian and Early Triassic carbonate-dominated rocks, with reduced sedimentation rate in the Early Triassic, are overlain by a thick, prograding turbiditic complex of Anisian age. This transition indicates a major change of subsidence rate, concomitant with a burst in volcanic activity between latest Early Triassic and early Anisian. Few other volcanic ash layers occur throughout late Permian and Triassic.

The Hf isotopic composition of dated zircons from volcanic ash beds indicate that the source of magmatic liquids is changing together with the sedimentary regime: (1) volcanic zircons from Late Permian up to Late Smithian ash beds have εHf(t) of +1 to -4 (Hf T_{DM} = 1.4 Ga), typical for a mixed magma source; (2) zircons from an early Spathian volcanic ash layer of the Luolou Fm. (250.55 ± 0.50 Ma) up to the early Anisian transition beds (246.83 ± 0.31 Ma) have uniformly low εHf(t) between -4 and -7 (Hf T_{DM} = 1.7 Ga), suggesting a crustal source of magmas; (3) zircons from a late middle Anisian ash bed of the Baifeng Fm. (244.60 ± 0.36 Ma) have εHf(t) values of +2 to +7 (Hf T_{DM} = 0.9 Ga), indicating a significant participation of juvenile material in the magma generation. This drastic change follows the transition of a mixed carbonate-silicilastic outer platform to a terrigeneous trough with high subsidence rate.

The study shows that Hf isotopes in volcanic zircons from stratigraphically well-defined ash beds not only monitor short-lived changes in the tectonic regime of a sedimentary basin, they are also a good tracer for melt transfer from the mantle into the upper crust during orogenic processes.

[1] Galfetti *et al.* (2007) *EPSL* **258**, 593-604. [2] Ovtcharova *et al.* (2006) *EPSL* **243**, 463-475.

Isotopic evidence for a “beheaded” mantle plume in the Western Mediterranean: A new model for Italian volcanism

J.P. OWEN*

Department of Geoscience, University of Calgary, 2500 University Drive NW Calgary, Alberta T2N 1N4 Canada (*correspondence: jowen@ucalgary.ca)

One of the current controversies regarding Cenozoic Italian volcanism is the origin of a geographically widespread, depleted isotopic end-member sampled by a diverse range of mantle-derived magmas. Previous work has shown that this end-member is characterized by low $^{87}Sr/^{86}Sr$ (< 0.7040), high $^{143}Nd/^{144}Nd$ (> 0.5130), and $^{206}Pb/^{204}Pb$ ratios that are similar to those of volcanic rocks associated with deep-seated mantle upwellings. As a result, several authors have proposed the presence of an asymmetric mantle plume located beneath the Western Mediterranean [1]. However, opponents cite tomographic studies that show the presence of a broad, high-velocity anomaly at about 400-600 km depth, interpreted as subducted oceanic lithosphere [2].

The new model presented here reconciles the plume-like isotopic signatures with the apparent roadblock caused by the accumulation of subducted slabs in the transition zone. In this model, a late Cretaceous deep-seated mantle plume head contaminated the upper mantle in the Western Mediterranean and imparted a distinct, depleted isotopic signature. The plume was then “beheaded” (cut off from its source) during the mid-Tertiary by a build-up of lithospheric material subducted prior to and during the Alpine-Betic and Apennine-Maghrebides orogenies. Hundreds of km of oceanic and thinned continental lithosphere were consumed during closure of the Tethyan Ocean and subsequent opening of the Western Mediterranean. These processes resulted in the isolation of a widespread, homogeneous, fossil plume head trapped in the asthenosphere above a thick layer of subducted slabs. This model may explain the absence of strong thermal anomalies and associated flood basalts in the Western Mediterranean. Support for the model comes from rheological and numerical studies indicating the limited ability of a plume tail to penetrate physical boundary zones (such as subducted slabs) in the mantle [3].

[1] Bell *et al.* (2004) *EOS* **85-50**, 541-547. [2] Lucente *et al.* (1999) *J. of Geophys. Res.* **104**(B9), 20307-20327. [3] Davies (1995) *EPSL* **133**, 507-516.