

## Mantle degassing rates and gas loss from atmosphere: A view from xenology

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To understand evolution of gas species of the Earth - atmosphere system, <sup>244</sup>Pu-<sup>238</sup>U-Xe systematic is crucial and must be included in any model related to gas loss / gain by the Earth reservoirs. The initial <sup>244</sup>Pu/<sup>238</sup>U = 0.01 in meteorites and terrestrial zircons [1] is known; correspondingly the closed-system <sup>136</sup>Xe (Pu)/<sup>136</sup>Xe (U) = 40. These ratios, bulk silicate earth [<sup>238</sup>U] = 38 ppb, present day <sup>136</sup>Xe (Pu) / <sup>136</sup>Xe (U) ≤ 0.2, proposed for the mantle [2, 3], and amount of <sup>136</sup>Xe (Pu) ≤ 0.05 tmol in the atmosphere, constrain the evolution of terrestrial volatiles.

(1) The MORB-source mantle (one reservoir model is considered) has been degassed severely, so that only about 0.01% of the initially available Xe has survived 4.5 Gyr long degassing [4, 5]). Recent degassing models based on U-Th-He and K-Ar systems, e.g. [6], postulate a low degassing and are inconsistent with this constraint. (2) This model predicts a late time for the atmosphere closure to Xe loss, about 4 Gyr ago, and simultaneous loss of other gases, which seems highly improbable. Introducing into the deep earth an early, small, less-degassed, nearly-isolated reservoir allows reconciliation of observed and modelled noble gas abundances in the Earth [5].

[1] Turner *et al.* (2007) *EPSL* **261**, 491–499. [2] (Kunz *et al.* (1998) *Science* **280**, 877–880. [3] Caffee *et al.* (1999) *Science* **280**, 877–880. [4] Tolstikhin & Marty (1998) *Chem. Geol.* **147**, 27–52. [5] Tolstikhin *et al.* (2006) *Chem. Geol.* **226**, 79–99. [6] Gonnermann & Mukhopadhyay (2009) *Nature* **459**, 560–564.

## Albitite related to iron oxide mineralization: Melt inclusion evidence for a magmatic origin

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Albitite is an uncommon rock present in very different geological settings. The dominant mineralogy consists almost entirely by albitite and quartz with some other accessories but, despite its simple mineralogy, this rock is of unclear origin. A metasomatic source is dominantly proposed, especially for the albitite related to iron oxide, W-Sn and Nb-Ta-Zr-REE-rich mineralization. There are only few studies that propose a magmatic origin for this rock, usually in ophiolitic complexes. In this study we describe some large intrusive mesozonal bodies of porphyritic albitite related to magnetite mineralization in the Ossa Morena Zone (SW Spain) and we report the existence of true silicate melt inclusions in this type of rocks. These melt inclusion data indicate that the rocks are primary and not metasomatic in origin.

Crystallized silicate melt inclusions in phenocrysts of quartz in both fresh or slightly altered albitite were analyzed by LA-ICPMS. Melt inclusion show an 'albitic' composition with SiO<sub>2</sub> (72%), Al<sub>2</sub>O<sub>3</sub> (13%) and Na<sub>2</sub>O (8%) as major elements. In agreement with the compatibility model, trace elements such as Sr, Ba, V, Zr, P and other major elements like Ti and Mg are compatible with the bulk-mineralogy of the rock whereas incompatible elements as well as ore metals stay in the residual melt represented by the melt inclusions. The quartz phenocrysts also show some sporadic magnetite blebs coexisting with the silicate melt inclusions, suggesting the existence of an iron oxide melt phase segregated from the silicate melt and related to the formation of the mineralization.

This melt inclusion study together with the field relationships and the petrography demonstrates that not all the albitite related to iron oxide mineralization is a consequence of the pervasive sodic alteration of previous plutonic rocks but also product of highly differentiated felsic magmas. We also address the possible link between these melts and the formation of magmatic and hydrothermal magnetite mineralization.