

Identification of the geographical origin of exotic wood species using $^{87}\text{Sr}/^{86}\text{Sr}$ isotope amount ratios

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Rosewood species constitute only a small amount of the Dalbergia genus, however this wood is highly sought after for use in expensive cabinetry, flooring, musical instruments, and decorative objects. As a result, rosewood is an over-exploited resource and three species of the Dalbergia genus are currently controlled by the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Because some rosewood species are threatened with extinction, trade for commercial purpose is illegal. Despite the efforts of international trade officials to prevent illegal export of this wood species, it is still common to hear about new investigations taking place. The goal of this study is to use strontium isotopic composition to aid in the determination of the geographical origin of wood samples in an effort to prevent the illegal trade of exotic timber.

The $^{87}\text{Sr}/^{86}\text{Sr}$ isotope amount ratios in 120 wood samples were analyzed by thermal ionization mass spectrometry. Samples were identified by species and country of origin. Isotope amount ratios varied from 0.704174 to 0.790101 with external repeatabilities typically on the order of 20 ppm (2s). Many regions exhibited a distinct isotopic fingerprint.

Magma dynamics beneath the ancient Mt. Etna: Clinopyroxene isotopic and thermobarometric constraints

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Early stages of volcanism associated with Mount Etna, Europe's largest and most active volcano, began at ~0.5 Ma [1] and are now preserved around the perimeter of the modern-day edifice [2]. Magmatic products of these early centers, including those of ancient alkali centers active between ~200 and ~100 ka, generally have mantle-derived isotopic signatures consistent with contributions from both enriched and depleted source components. More recent Etna volcanics exhibit tell-tale signs of assimilation, but the degree to which this affected the early products is debated. Here we use an approach combining clinopyroxene (cpx) thermobarometry with an investigation of Pb, Hf and Nd mineral-whole rock isotopic (dis)equilibrium to constrain the depths at which magmas crystallized beneath these alkali centers and to gain insight into the nature of the source of ancient Etna lava isotopic signatures. The advantage of using these three isotopic systems together lies in coupling two slowly diffusing elements (Hf and Nd) with a more rapidly diffusing one (Pb), thereby providing the potential to infer any links between the timing of magma mixing (or assimilation) and eruption [cf. 3].

We have applied detailed single-cpx and cpx-liquid thermobarometric modeling based on back-calculated liquids from whole rock compositions [4] and the models of Putirka [5]. Crystals from two mafic flows from ancient alkali centers yield temperatures of 1140-1180 °C and 1090-1130 °C. Calculated initial crystallization depths lie at or below the Moho [6], consistent with polybaric fractionation and shoaling crystallization depths over time. Hf-Pb-Nd isotopic data from cpx phenocryst separates of ancient alkali lavas indicate no difference between whole rock and cpx values. Accordingly, we infer that the isotopic signatures of these magmas were locked in at pressures, at minimum, corresponding to early cpx crystallization. The lack of isotopic disequilibrium also suggests that the magmas were relatively well-mixed by the time they ascended to the depths at which cpx crystallization began.

Taken together, our results support the interpretation that observed isotopic systematics in ancient Etna lavas result from mixing between MORB-like and enriched mantle sources, with volatile-bearing peridotite and pyroxenite components preferentially melting to generate ancient alkaline volcanism. Shallower crystallization depths recorded in some phenocrysts correspond to the current location of a high-velocity body in the upper crystalline basement [7], indicating that this may be a long-lived feature.

[1] Gillot et al. (1994) *Acta Volcanol.* **5**, 81-87 [2] Tanguy et al. (1997) *JVGR*, **75**, 221-250 [3] Bryce and DePaolo (2004), *GCA* **68**, 4453-4468 [4] Armienti et al. (2007) *GSA Sp. Paper*, **418**, 265-276 [5] Putirka, (2008) *Rev. Mineral.*, **69**, 61-120 [6] Nicolich et al. (2000) *Tectonophys.*, **329**, 121-139 [7] Patané et al. (2003) *Science*, **299**, 2061-2063.