Pursuing the "original" composition of bone mineral

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Fossil bones and teeth have been widely studied to reconstruct the paleoenvironment and paleoclimate. Appropriate interpretation of the trace-element and isotopic chemistry of fossils requires studies of unaltered material, i.e. what is the relation between the original carbonated hydroxylapatite of bones/teeth and the fossil mineralized material? Bones with a high degree of mineralization would be the best material from which to establish the chemical and physical features of original bone mineral. We chose to study the rostrum of the Blainville's beaked whale, *Mesoplodon densirostris* (family Ziphiidae), which is the densest bone so far recorded [1, 2].

Raman microprobe analyses show that typical areas in the rostrum contain >96 wt.% apatite. Quantitative electron microprobe (EMP) analyses of the apatite, assuming substitution of carbonate for phosphate, translate into the formula:

$$(Ca_{8.54}Mg_{0.25}Na_{0.38})[(PO_4)_{4.99}(CO_3)_{1.01}](OH)_{0.99}$$

This formula indicates ~6.7 wt.% carbonate in the bioapatite of the rostrum, which is approximately what our Raman analyses show. EMP also reveals minor (F) and trace elements (S, Cl, K) in the bone apatite.

Elemental maps (EM) show compositional variations, typically < 1 wt.% abs for each element. For example, EM show elevated S concentration in a concentric pattern around vascular holes (Fig. 1a). Typical areas within the longitudinal section of the rostrum also display banded distribution of S (Fig. 1b). We are exploring whether the S resides dominantly in organic matter or is incorporated into the biologically precipitated mineral. In fossil material, it is important to know if such trace elements were part of the original bone mineral.

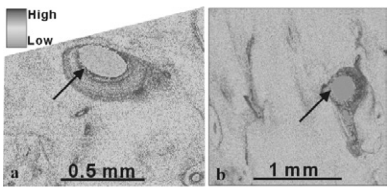

Figure 1: Sulfur maps around the vascular holes (see arrow) in the transverse (a) and longitudinal (b) sections of the rostrum.

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[1] Rogers *et al*. (1999) *J. Mater. Sci. Lett.* **18**, 651–654.
[2] Zylberberg *et al*. (1998) *Bone* **23**, 241–247.

The lithium isotopic characteristics of the Jiajika rare-metal deposit in Sichuan, China

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The eastern part of the Qinghai-Xizang plateau (Tibet plateau) is an important area of pegmatite and its importance is next only to that of the Altay area in Xinjiang. It is also an important concentration area of rare-metal resources, where the Jiajika rare-metal deposit is the largest pegmatite-type Li-polymetallic deposit in China. Nevertheless, few researches have been carried out in the area because of its remote location at high mountains and extremely unconventional traffic. Ar-Ar plateau ages and isochron ages, which indicate that the deposit formed within the period from the Indo-China movement of plate-collision-style to the Yanshanian movement of continental orogeny, are similar to many pegmatite-type rare-metal deposits in China and other countries.

Lithium is a useful trace element for solving controversies such as crust-mantle material recycling, magmatism and fluid (hydrothermal) activity. Samples from Jiajika rare-metal deposit were analysed by MC-ICP-MS in the University of Maryland. Two samples of spodumene contain 33592 and 34264 ppm Li and have δ^7Li values of –0.6 and –0.4. One sample of biotite in granite contains 7350 ppm Li and has δ^7Li value of +0.6. They are consistent in the uncertainty range. Therefore, following interpretations of published data of C, H and O isotopes and fluid inclusions, we consider that spodumenes in the rare-metal deposit may have originated from the granite, suggesting that ore-forming fluids were also derived from the granite.

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