High-precision Pb isotope measurements discriminate different subduction components along the Solomon island arc

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Along the Solomon island arc, SW Pacific, the Indian plate is subducting beneath the Pacific plate. Geophysical evidence indicates the presence of a fossil slab of Pacific oceanic crust that was subducting until ca. 6 Ma [e.g., 1]. To assess the influence of subducted oceanic crust and Ontong Java Plateau material along the arc, we determined Pb isotope compositions of representative arc magmas covering the complete southern island arc chain (ca. 1000 km). Most of their Hf-Nd isotope compositions overlap with those of the Australian-Indian mantle domain, indicating that the active trench does not mark the boundary between the Australian-Indian and Pacific mantle domains [2]. In contrast to Hf-Nd, Pb isotope compositions of the lavas are dominated by subduction components. To achieve sufficient analytical resolution, Pb isotope compositions were obtained using MC-ICP-MS and normalization to Tl that was added prior to measurement.

High-precision Pb isotope data for silicate reference materials obtained by Tl normalization using MC-ICP-MS are in good agreement with previously published data, supporting the reliability of the analytical method. An external reproducibility of better than ±130 ppm (2σ) can be achieved. The measured $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ in the Solomon arc magmas range from 18.351 to 18.853, 15.479 to 15.564, and 38.105 to 38.462, respectively, indicating the absence of significant amounts of subducted pelagic sediments. The high-precision Pb data clearly reveal a bimodal distribution, reflecting the presence of two distinct types of subduction component, originating from either the currently subducting Australian plate or the fossil Pacific plate. Notably, domains with Australian-Indian type Pb isotope signatures are confined to the central New Georgia group, where the active Woodlark spreading center is being subducted. Due to a lower geothermal gradient, all other segments of the subarc mantle have apparently not yet been fluxed by subduction components from the Australian-Indian plate that has been subducting since ca. 6 Ma.

Lead isotope compositions of some samples show evidence that material from the Ontong Java Plateau was subducted together with the Pacific plate, consistent with geophysical evidence [e.g., 1].

References

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Ultrastructure of bone: Hollow apatite crystals, solution chemistry and organic inhibitors

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The utrastructural nature of bone is a matter of long debate. While all studies confirm that an apatitic mineral component makes up at least 60 wt % of bone, the morphology and even the composition of this phase is uncertain, due to the small size of the crystals (10's of nm in maximum dimension).

TEM analysis of ion-milled and focused ion-beam milled sections of bone reveals that most of the apatite in bone is in the form of apparently hollow fibers 5 to 10 nm in diameter and several hundred nm long, which are oriented parallel to collagen fibers. Lesser amounts of apatite occur in the gap zones spaced at 67 nm along collagen fibrils. The core of the apatite fibers is assumed to be filled with a protein, probably collagen, making up c. 5% of the total collagen in bone. The fibers are constructed of single crystals of apatite, with their c-axes oriented parallel to the fibers. Boyde (1974) found similar structures in dentine.

Although bathed in an extracellular fluid (ECF) which is supersaturated with respected in apatite, the crystals have remarkably uniform dimensions, implying that, after initial formation, further deposition of apatite is strongly inhibited. Osteopontin (OPN) and other molecules in the ECF (e.g., Pampena *et al*. 2004) are known to inhibit apatite growth.

Both Ca and PO_4 ions are essential to the vital activity of all metazoans. The ECF of invertebrates is also supersaturated in hydroxyapatite (HA), with saturation index values up to 10^{12}. The relative scarcity of apatite as a biomineral suggests that strong inhibition of HA formation must occur in the ECF of invertebrates as well.

References

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