Reassessment of deep sediment recycling from U-Series isotopes in Izu arc lavas

H. FREYMUTH[1*] AND T. ELLIOTT[1]

[1]Bristol Isotope Group, University of Bristol, Queen's Road, Bristol BS8 1RJ, UK (*correspondence: glxhf@bristol.ac.uk)

Studies of volcanic arc magmas suggest the presence of sediment-derived components in arc magma sources and thus indicate a flux of material from the top of subducted slabs back to the surface. Constraining the recycling of subducted sediments into the deep mantle requires a quantification of such sediment-loss from the slabs.

Here we use U-Series data for volcanic arc magmas from the Izu arc to reassess the importance of sediment loss from subducted slabs within subduction zones. Trace element and isotopic compositions of arc magmas are usually interpreted to result from addition of slab-derived fluids and sediment melts to the mantle wedge [1]. Izu arc lavas have previously been shown to be unusually 'sediment-poor' [e.g. 2]. Ironically, this allows us a more detailed look at the flux of this component to the arc lava source. U-Series data from the Izu arc are consistent with the addition of a U-bearing fluid component. Their U-Th systematics also require the addition of a melt component. However, this component is inconsistent with the composition of subducted sediments. Instead, it can be modeled as a mixed slab melt that is dominantly derived from the mafic, altered oceanic crust (AOC) with only a minor fraction of sediment melts. Based on the thermal structure and trace element patterns in the Izu arc, we infer that such mixed slab melts are common in volcanic arcs worldwide but in most cases masked by the dominant influence of subducting sediments on trace element concentrations.

Our observations suggest that the component in arc magmas traditionally identified as a sediment melt is in fact a mixture of sediment melts and more mafic melts of the AOC with up to 95 % mass fraction of the AOC. Commonly observed 'sediment addition' trends in arc lavas are thus caused by the addition of mixed sediment and more mafic AOC sources. This has a major impact on mass balance considerations for subduction zones and requires substantially larger sediment fluxes – and thus loss of sediments from subducted slabs - than previously thought.

We discuss the effects of these observations on the flux of subducted sediments into the deep mantle and availability of this component for deep recycling. Our results emphasize the importance of alternative mechanisms of deep recycling of crustal material such as delamination and subduction erosion.

[1] Elliott (2003) *Geophysical Monograph* **138** 23-48. [2] Taylor & Nesbitt (1998) *EPSL* **164** 79-98