D" anisotropy beneath Central America

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Whilst the majority of the Earth's lower mantle appears to be relatively homogeneous, by contrast the few hundred kilometres above the core-mantle boundary (CMB) are host to large chemical and thermal heterogeneities. Seismic observations of this region (known as D") include a velocity discontinuities and significant seismic anisotropy (the variation of wavespeed with direction). The most recent candidate to explain some of the seismic features of the D" region is the experimentally observed transformation of $MgSiO_3$-perovskite to a post-perovskite structure at near CMB pressures and temperatures. As the phase change has a positive Clapeyron slope, regions where the geotherm is colder than average at the CMB—such as areas of long-term subduction—should show evidence for such a discontinuity and, depending on the alignment of mantle minerals or other structure, should also exhibit seismic anisotropy. We study the D" region beneath the Central America using S and ScS phases from two deep-focus earthquakes with magnitude >M_W 5.6 and depths >550 km. By comparing the splitting parameters of the two phases and thus correcting for anisotropy in the signal introduced in the upper mantle, we obtain measurements of splitting in ScS alone; hence measuring the anisotropy in the lowermost mantle. The S and ScS phases are detected at 430 seismic stations in Canada and the US, yielding over 250 measurements of anisotropy in D". The measurements cover an area ~2,000 km square, centered on the CMB beneath the Caribbean. They show a small but detectable departure from the expected first-order transverse isotropy with a vertical axis of symmetry, which may be explained in terms of a tilted axis of symmetry. Beneath Central America, the sense of dip is to the east by a few degrees; beneath the eastern Caribbean, the dip is to the west, again by a few degrees. Our interpretation (similarly to previous studies) of these features proposes that this is a result of the dynamics of the interaction of slab material with that already present at the base of the mantle, leading to deformation into 'ridges' aligned roughly perpendicular to the direction of palaeo-subduction over short scales (~100 km and less) and the subsequent alignment of the crystals, melt pockets or other features which give rise to the TTI.

Re-Os geochronology of the Iimori Besshi-type massive sulfide deposit in the Sanbagawa Belt, Japan

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Introduction

Besshi-type Cu deposits are tabular, volcanogenic massive sulfide deposits usually associated with mafic volcanic rocks or their metamorphic equivalents. Although numerous Besshi-type deposits occur in the Sanbagawa Belt, Japan, there is no data to constrain the depositional age of Besshi-type deposits due to the Sanbagawa high-P/T metamorphism. In this study, Re-Os data were obtained for the Iimori deposit, one of the largest Besshi-type deposit in the Sanbagawa Belt, to examine robustness of the Re-Os system for dating of sulfide minerals.

Results and Discussions

Re-Os analyses of sulfide ore samples from the Iimori deposit yield a precise Re-Os isochron age of 152.6 ± 2.9 Ma (Fig. 1). Because Re-Os age of the Iimori deposit is much older than a timing of the Sanbagawa peak metamorphism (120 - 110 Ma) and well-defined isochron was obtained, the Re-Os age obtained here is most likely a primary depositional age. As the accretionary age of the Sanbagawa Belt is considered to be 130 - 120 Ma on the basis of radiolarian and radiometric ages, the duration time from the Iimori sulfide deposition on seafloor to accretion at convergent plate boundaries is calculated to be 20 - 35 Myr. As a consequence, a depositional environment of Besshi-type deposits is presumably hemipelagic ~ pelagic.

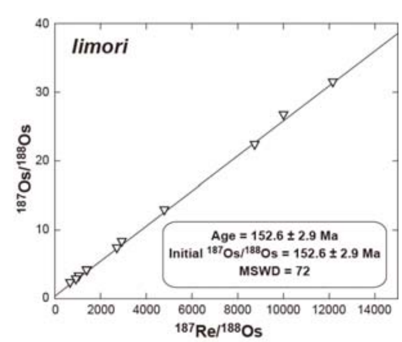

Figure 1: Re-Os isochron diagram for 11 sulfide ore samples from the Iimori deposit.