A Lower mantle Origin for the World's Biggest LIP? A High Precision Os Isotope Isochron from Ontong Java Plateau Basalts Drilled on ODP Leg 192

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Basalts drilled on ODP Leg 192 from the Earth's largest igneous province, the Ontong Java Plateau (OJP) yield a Re-Os isochron age of 121.5±1.7 Ma and an initial $^{187}Os/^{188}Os$ ratio of 0.1295±0.0011. The basalts are from four ODP sites located over a 1000 km apart. The generation of such a high precision isochron using the Re-Os isotope system indicates the source of the OJP is remarkable homogenous, with an Os isotope composition very similar to that of the primitive mantle. Their high Re contents (>1000 ppt) and relatively high Os contents suggest that they are produced by melting beyond suphide-out in the mantle. Other trace element data support the conclusion that these basalts are derived by high degrees (~30%) of partial melting of the mantle. Such high degrees of partial melting may assist in homogenising the Os isotopic signature of the source region. The Os isotope data indicate that there is no core signature in the source of the OJP basalts analysed in this study, but that they are more likely derived from entrained lower mantle. Mantle peridotites from the island of Choiseul in the Solomon Islands, which are part of the arc-OJP collision zone, have initial Os isotope compositions that overlap those of the ODP Leg 192 basalts, thus supporting other geochemical data that suggest these peridotites are related to OJP magmatism.

Komatiites: the Subduction Perspective

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We present evidence that komatiites were produced in subduction zones (SZ) and contained high concentrations of magmatic H_2O. Evidence that constrains the H_2O contents of komatiite magmas includes: **1)** The composition of augites preserved in Barberton komatiites, which suggest >4 wt.% magmatic H_2O [*Parman et al.*, 1997]. **2)** The rarity of low-Ca pyroxene [*Parman et al.*, 1997]. **3)** The presence of hydrous pargasitic amphiboles in two komatiites, implying H_2O contents of at least 2 wt.% [*Stone et al.*, 1997]. **4)** Melt inclusions in the Belingwe komatiites that contain 1.1-1.7 wt.% H_2O [*Shimizu et al.*, 2001]. **5)** The unusual spinifex textures [*Grove*, this session].

A SZ origin for komatiites is also indicated by geochemical similarities between komatiites and modern SZ magmas, including: **1)** High field strength element (HFSE) depletions. **2)** A wide variation in $[La/Sm]_N$ ratios from <1 to >1. **3)** High SiO_2 contents (up to 52 wt.% in chill margin samples), given their high MgO contents [*Parman et al.*, 2001]. Field evidence for a SZ origin comes from the close association and interlaying of komatiites with boninite-like magmas; variously termed basaltic komatiite, komatiitic basalt or siliceous high-magnesium basalt.

A plume origin was based on the high MgO contents of komatiites and implied high liquidus temperatures. Yet in Phanerozoic times, the most mafic magmas have been produced in subduction zones (i.e. boninites), by hydrous melting, and not by plumes (e.g. picrites). High CaO/Al_2O_3 also has been used to argue for deep melting in the presence of garnet. Yet anhydrous peridotite melting experiments at high pressures have not reproduced the high CaO/Al_2O_3 found in komatiites, and have been forced to hypothesize elevated CaO/Al_2O_3 in the Archean mantle [*Walter*, 1998]. In modern magmas, high CaO/Al_2O_3 are not present in plume magmas, but are found in arc-related mafic magmas (boninites and ankaramites). HFSE have also been used to argue for a deep origin, based on experimental measurements of majorite garnet/melt trace element partitioning [*Xie et al.*, 1995]. While this is possible, HFSE depletions are also characteristic of hydrous arc magmatism, where the depletions are the result of hydrous slab inputs [*Gill*, 1981].

A Barberton komatiite composition with 25 wt.% MgO is multiply-saturated with an assemblage of ol and opx at 2.2 GPa and 1430°C, with 6 wt.% H_2O [*Grove et al.*, 1999]. Assuming komatiites were made by similar processes as boninites, the experimental data suggest an Archean sub-arc mantle ~100°C hotter than modern boninite-producing mantle.