Melt Stagnation in Peridotites from Godzilla Megamullion

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The Godzilla Megamullion (GM) Massif is the largest known example of an Oceanic Core Complex (OCC) or the exhumed footwall of a low angle-large offset oceanic detachment fault. It lies on the extinct Parece Vela Rift spreading center within the Parece Vela back-arc basin of the Philippine Sea. This has thus allowed for sampling of a young back-arc mantle section. Sampling of the massif has returned a dominantly ultramafic lithology, divided petrographically into depleted, fertile, and melt-percolated groups. Petrographic analysis of the extant peridotite thin-section collection found that 44% of all GM peridotites (71 out of 161) exhibit evidence of plagioclase impregnation compared to the worldwide abyssal peridotite average of 20%. The mullion is divided up into three regions, the proximal region (closest to termination of spreading), the medial region, and the distal region (furthest from the termination of spreading). Observations by region show that 53% (62 out of 116 samples) in the proximal region (15 dredges), 12% (2 out of 17 samples) in the medial mullion (3 dredges), and 25% (7 out of 28) in the distal mullion (5 dredges) show evidence of plagioclase impregnation. Major element analyses of spinels were completed using the Cameca SX-50 Electron Microprobe facility at the University of Houston. The Cr# [100 x Cr/(Cr + Al)] ranges from 10 to 65 with TiO_2 concentrations ranging from less than 0.01 up to 1.6 wt%. When the Cr#s of the samples are plotted along the massif, a pattern of melt depletion exists that is consistent with the degree of plagioclase impregnation. In the distal region, Cr#s start at around an average of 35 and range up to 65 for melt percolated samples. In the medial region, a drop-off in Cr# of about 1 Cr# per kilometer is observed with the trend bottoming out at around a Cr# of 10. In the proximal region, Cr#s closer to the medial region are observed as having more fertile values of around 20 but are found amongst melt-impregnated samples with values ranging up to 50. This range is seen as having increasing minimum and maximum values with distance away from the medial section until it reaches its peak at a base Cr# of 30 with a maximum of 65. From this trend, a general model for the secular evolution of the GM mantle section can be established. The ridge segment experienced normal mid-oceanic ridge growth with robust mantle melting during the time period represented by the distal region. At the boundary to the medial region, a steep drop-off in melt productivity was experienced, leading to minimal mantle melting during the time period represented by the medial region. Soon thereafter, melting began again, but was trapped in a thickened and cooling lithosphere, causing the melt to pool and react with its host peridotite. ■