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Major and Trace Elements Directly Contradict Melt Interaction Interpretations of MARK Area Os Isotopic and PGE Results

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Remarkable claims have been made recently about the ability of melting and melt migration through the mantle to affect both PGE concentrations and Os isotopes, on the basis of peridotites from the MARK area on the Mid-Atlantic ridge. In one study, migrating melts are made responsible for fractionating compatible PGE's in the mantle residues of melting. This is accomplished by melt percolation in the peridotite at high levels in the mantle (4). In another study, an ancient garnet-field melting event was said to produce an isochron-like arrangement of Pt/Os ratio and $^{187}Os/^{188}Os$ in the same Leg 153 mantle, which took place 1 Ga ago, and was not affected by any recent melting beneath the ridge (2). Their final interpretation questioned generally the residual relationship between abyssal peridotites and MORB based on this Pt/Os-$^{187}Os/^{188}Os$ correlation. To test these interpretations we undertook a study of the chemistry of chrome spinels from the same samples studied in (2). The Cr/(Cr+Al) ratios of spinels in residual mantle rocks are widely accepted as being a powerful quantitative indicator of the degree of partial melting through correlations with moderately incompatible trace elements (3). This is true even if spinel is not stable in the source, as Cr is compatible and Al incompatible in the garnet melting regime as well. The Cr/(Cr+Al) values in the samples studied are essentially constant at about 0.3, implying a constant degree of melting, in agreement with previous studies. The ancient melting hypothesis of (1) requires that the samples be related by large and variable degrees of partial melting (5-25%) in order to produce the substantial variations required in Pt/Os and Re/Os. However no such correlation is observed, nor is there any sort of correlation with either $^{187}Os/^{188}Os$ or Pt/Os. Thus, the correlation between these two ratios can not have formed as a result of a partial melting event, recent or ancient. The two different alternative mixing hypotheses presented (1) are for this reason better choices to explain the sum of the observations. There are marked but rare effects on the Cr-numbers due to melt percolation in the Leg 153 cores (4) in the immediate (<1 cm) vicinity of melt veins. Elsewhere there is no effect visible, and none in the samples studied. Unless the samples in (1) came from similar near-vein regions of the core, it is highly unlikely that melt percolation could have played a role in their genesis. In general we need to resist the tendency to ascribe anything we don't understand in residual peridotites to "melt wallrock reaction" without positive independent indicators that such reaction has taken place.

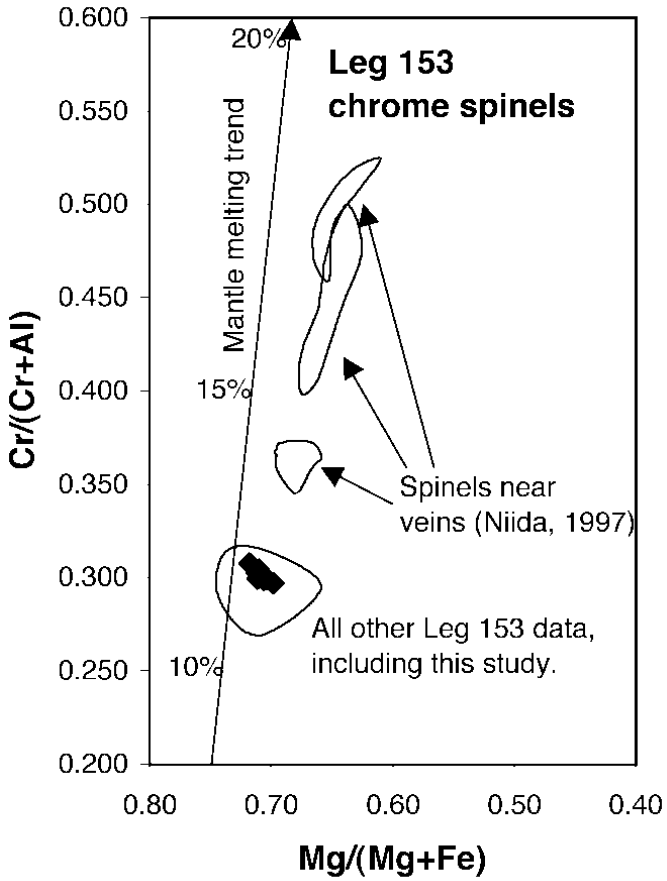

Figure 1: Cr# vs Mg# for Leg 153 chrome spinels. By far the majority of Leg 153 spinels show uniform Cr# between 0.27 and 0.31. The only exceptions are from the immediate vicinity (<1 cm) of rare melt veins (4). Calibration of melting trend from (3).

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