Diamondiferous microxenoliths from the Diavik Diamond Mine (Canada): lherzolitic hosts for harzburgitic diamonds?

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Garnets from concentrate from the A154 South kimberlite at Diavik reveal a strongly peridotite dominated (>90%) mantle sample, in accordance with diamond inclusion data suggestive of a largely (>80%) peridotitic diamond population. Gurney [1] related the diamond grade of kimberlites with peridotitic diamond populations to the presence of highly depleted harzburgitic sources in the subcratonic lithospheric mantle, thereby establishing G10 garnets as the principal diamond indicator mineral during exploration. Based on garnet inclusion chemistry, the source rocks of peridotitic diamonds at A154 South also were overwhelmingly of harzburgitic paragenesis, thus conforming with the G10 paradigm.

We recently obtained a number of diamond bearing microxenoliths (in part pure diamond-garnet intergrowths) from Diavik A154 South pipe. Out of nine garnets with Cr_2O_3 ≥1 wt% (i.e. excluding the eclogitic suite), eight classify as lherzolitic garnets (G9) and one falls into the wehrlitic field in a Ca-Cr diagram but classifies as a G11 (high-TiO_2 peridotitic) following the scheme of Grütter et al. [2]. Despite the currently small number of samples, the complete absence of subcalcic garnets (G10) is striking.

To maintain the concept of largely harzburgitic diamond sources for A154 South, one would need to assume that diamondiferous harzburgitic microxenoliths are far more friable than their lherzolitic counterparts. This appears to be an unlikely scenario. To reconcile the strong predominance of the harzburgitic paragenesis among inclusions in diamonds from A154 South with the exclusively Ca-saturated nature of diamondiferous garnets we propose that metasomatic conversion of diamondiferous harzburgite to lherzolite occurred. This may lead to the presence of originally harzburgitic diamonds in lherzolitic host rocks. If the diamondiferous microxenoliths at Diavik indeed reflect the typical peridotitic diamond source rocks beneath Lac de Gras, then the absence of diamondiferous samples of harzburgitic paragenesis constitutes a challenge to the G10 paradigm.

References

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