Melt generation and evolution in Ophiolite Mantle and the development of mantle heterogeneities

Stephen J. Edwards
Department of Earth Sciences, Memorial University of Newfoundland
St. John's, Newfoundland A1B 3X5

Mantle-derived melts are processed through a highly complex system prior to their consolidation in the crust and consequently, primary magmas are unlikely to be preserved. Preliminary studies of the segregations found in the tectonized mantle harzburgites of the Lewis Hills and Table Mountain massifs, Bay of Islands Ophiolite, indicate that they occur as bodies of dunite, orthopyroxenite, clinopyroxenite (containing native Cu and Fe-Ni sulphides), websterite, lherzolite, harzburgite, wehrlite and gabbro. These bodies exhibit cumulate textures with a tectonite overprint and are assumed to represent totally or partially crystallized melts of fairly primitive composition; some dunites are, however, residues left after partial melting. Primary magmas should exist as totally crystallized in situ partial melts, but will only be preserved if they acted as closed systems contained within low strain domains of ascending diapirs. Low strain domains are rarely preserved and segregations are frequently boudinaged and enveloped by mylonitic harzburgite. Consequently, the melts must have solidified to relatively rigid bodies during on-going mantle flow, with the result that the segregations were transported within high strain domains away from their original regime of formation. Within the mantle sequence, four types of lherzolite are distinguishable: (i) primary lherzolite, (ii) melt-infiltrated harzburgite or dunite, (iii) deformed and recrystallized olivine-, orthopyroxene- and clinopyroxene-bearing segregations, and (iv) harzburgite metasomatized during ophiolite obduction and emplacement. Only types (i), (ii) and (iii) can be considered as source rocks for basalt production in the ocean basins, and although initial primary magmas might be generated from mantle which may be homogeneous, later generations of primary magma will be produced from heterogeneous mantle. Banding and layering are both present in this heterogeneous mantle which is charged with pockets of trapped melt.

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