Dunite channels in the Horoman peridotites, Japan: Textural and geochemical constraints on melt/fluid transport through the lithosphere.

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Dunite channels generated in the lithospheric mantle have been inferred as pathways of basaltic magmas [1]. Besides the porous flow models, a fracture-controlled melt transport has also been proposed for formation of ophiolitic dunite-chromitite channels [2] [3].

Field observations, mineralogical and geochemical data from the Horoman peridotites suggest the following sequence of dunite formation:

1. Initiation of melt migration channels
Fluid-induced fracturing occurs in the layered peridotites during deformation, followed by high temperature melt migration.
2. High T melt flow along the open fracture
A narrow (cm-wide) segregation of dunite-chromitite cumulate formed along the fracture. Opx-dissolution and pargasite crystallization occurs along the reaction front. The channeling melt may become fluid-saturated.
3. Dunite growth
Reaction front becomes more active, producing 10 to 100 cm-wide replacive dunite by a porous flow of fluid-saturated melt with opx-dissolution melt dominant within the channel.
4. Crystallization of olivine megacrysts
Prior to closure of the open fracture, stagnant melt traps within dunite channel. Porous flow of fluid accelerates crystallization of olivine.
5. Fluid+melt channel closed
Opx+cpx+spinel crystallized from segregation melt along active fracture surfaces within the dunite channels, and often cross-cutting the olivine megacrysts. Fluid inclusions trapped.

References

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