Recycled eclogite as the fertile component of the depleted MORB source

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The average composition of the mantle that is complementary to continental crust is much less depleted than the source of depleted MORB, and corresponds precisely with the average mantle composition estimated from the mean composition of ocean ridge basalts (including, those influenced by hot spots). Enriched and depleted mantle sources are then created by addition and removal of low degree melts during plate recirculation and mantle convection. Enriched basalts are generated by addition of low degree melts. Depleted sources are the residues of low degree melt extraction. Sr-Nd-Hf isotope systematics as well as highly incompatible trace elements require this model, and are inconsistent with the recycled eclogite model for enriched sources. The low degree melting event could be <1% melting of peridotite, or 2-5% melting of eclogite. Because about 350 Ma are required for the isotopic differences between enriched and depleted MORB, extraction of low degree melts from the asthenosphere during return flow to the ridge is problematic. Low degree melting of eclogite at depth in subduction zones, or subsequently during convective flow in the upper mantle, is able to produce enriched sources of the right age. The depleted eclogite is then fertile in major elements, and depleted in trace elements—just the characteristics needed for the fertile component of depleted MORB. Direct evidence of low degree eclogite melting is found in back-arc volcanics, where very recent eclogite melts have created “OIB-like” trace element sources with no enriched isotopic signature.