

Ocean Drilling Program Leg 209: MAR Peridotite and Gabbro

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Ocean Drilling Program (ODP) Leg 209 was performed from May to July, 2003 to drill mantle peridotites and associated gabbroic rocks along the Mid- Atlantic Ridge (MAR) from 14N to 16N. In this area, a series of outcrops of residual mantle peridotite on both sides of the rift valley has been observed for over 100km along the ridge strike. Primary aim of Leg 209 was to characterize the special variation of mantle deformation patterns, residual peridotite composition, melt migration features, plutonic rocks, and hydrothermal alteration along axis. During Leg 209, 19 holes were drilled and cored at 8 sites (Sites 1269 and 1275) including six basaltic holes and one RAB-C hole at which logging while drilling was conducted for the first time not as a test. Six basaltic holes from two sites (Sites 1269 and 1273) yielded very poor core recovery rates from 1.4% to 4.8%, giving no continuous sections. At other six sites, a total of 1075m of sections composed of a mixture of residual peridotite and gabbroic rocks intrusive into peridotite was drilled, and a 354m of core was recovered, having recovery rates from 10.6% to 53.3% with three holes exceeding 40% (Holes 1268A, 1275B, and 1275D). Sites 1268, 1270, 1271, and 1272 yielded substantial proportions of gabbroic rocks intrusive into mantle peridotite (25% of gabbroic rocks and 75% of residual mantle peridotite). Cores recovered from Site 1274 were mainly residual peridotite, with a few meter scale gabbroic intrusions. Cores from Site 1275 included mainly gabbroic rocks, containing 14% poikilitic dunite, troctolite, plagioclase harzburgite, and plagioclase lherzolite interpreted as residual peridotite impregnated by plagioclase and pyroxene crystallized from melt migrating along olivine grain boundaries. Impregnated peridotites have been observed to be common at Site 1271 and present at Sites 1268 and 1270. RAB-C hole (Hole 1275C) was found not successful in coring with recovery rate of 0.8%, though it was located only 5m from Hole 1275D where gabbroic rocks were cored with the second highest recovery of 50.1%. Penetrative mantle deformation fabrics were found to be weak at every site where mantle peridotite was sampled from 14. 43 to 15. 39 N: at all of these sites, deformation was localized along high-temperature shear zones and later brittle faults. Intact peridotite blocks with high-temperature, protogranular fabrics were preserved between these zones of localized deformation. Very different hydrothermal alteration styles were observed among sites. Talc observed in Hole 1268A was particularly abundant in metaperidotites, accompanied by a dramatic metasomatic decrease in the (Mg+Fe)/Si ratio. At other sites, brucite was observed to be a prominent part of the alteration assemblage in peridotites with high (Mg+Fe)/Si. Gabbroic intrusions probably gave an important local control on serpentinization reactions in peridotite. Carbonate alteration of peridotites in some locales appear to be correlated with a metasomatic influx of calcium.