

Gabbroic rocks drilled at Site U1309, IODP Expedition 304/305, Atlantis Massif, Mid-Atlantic Ridge

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Atlantis Massif, 15 km west of the axis of the Mid-Atlantic Ridge, is a 0.5-2 myr old oceanic core complex (Blackman et al., 2004). Two deep holes at Atlantis Massif, Holes 1309B and 1309D, penetrate an oceanic crustal section during IODP Expeditions 304 and 305. Hole U1309B cored to 101.8 meters below seafloor (mbsf) during Expedition 304, and Hole U1309D, ~ 30 m ENE of Hole U1309B cored to 401.3 mbsf during Expedition 304. Gabbroic rocks make up about 50% and 90% of the recovered sections of Holes 1309B and 1309D, respectively. Hole 1309D was further deepened during Expedition 305 to ~ 1300 mbsf.

Gabbroic rocks sampled at Site U1309 were classified into troctolite, troctolitic gabbro, olivine gabbro, olivine-bearing gabbro, gabbro, gabbro-norite, and oxide gabbro based on abundance of primary minerals. In addition to these lithologies, ultramafic to mafic plutonic rocks with typical cumulate textures were recovered at Hole U1309D and classified into dunite, plagioclase-bearing dunite, olivine-rich troctolite, and wehrlite. Lithological change is abrupt and gradation in general and troctolite grades over a few centimeters to dunite, for example. These ultramafic to mafic rocks are clearly cumulate from mafic magmas. Gabbroic intervals recovered during Expedition 304 at Hole 1309D, including the ultramafic to mafic cumulate units, were grouped into ten zones, Zone 1 to Zone 10 in descending order. Gabbroic units of Hole U1309B correspond to Zones 1 and 2. The thickness of each zone is from ten to several tens of meters. This stratigraphy reflects changes in principal lithologies and conceptually different from that for layered intrusions. It is noted that the almost subhorizontal magmatic layering defined by variations in modal composition and/or grain size is observed in more primitive gabbroic intervals.

Gabbroic rocks sampled at Site U1309 have a wide compositional range in Mg# ($100 \cdot \text{Mg}/(\text{Mg} + \text{Fe})$) of up to 90. These magnesian gabbros are among the most primitive sampled along Mid-Atlantic Ridge (Agar et al., 1997; Kelemen, Kikawa, Miller, et al., 2004) and also from Southwest Indian Ridge (Dick, Natland, Miller, et al., 1999). Petrogenetic linkage between the primitive gabbros and mantle peridotites will be one of the most interesting subjects for onshore research.

References

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