

Osmium isotope and PGE variations in Oceanic Core Complexes: Atlantis Massif, a typical crustal section formed at the MAR

Rosner, Martin¹ Peucker-Ehrenbrink, Bernhard² Bach, Wolfgang³

¹Federal Institute for Materials Research and Testing ²Woods Hole Oceanographic Institution, Marine Chemistry Geochemistry ³Universität Bremen, Petrologie der Ozeankruste

During IODP Expeditions 304/305 a 1400m thick section of ultramafic to gabbroic oceanic crust was recovered from the Atlantis Massif. The massif is an Oceanic Core Complex that formed in the past 1.5-2.0 Ma at the intersection of the Mid-Atlantic Ridge and the Atlantis fracture zone. Hole U1309D was drilled in the central part of the Core Complex, and gabbros and troctolites are the dominant rock type (92%), followed by ultramafic (~5%) and basaltic (~3%) rocks. Hole U1309D is the third deepest drill hole in oceanic crust and the recovered section is believed to be a common endmember of ocean crust from at slow spreading mid ocean ridge settings. We initiate a platinum group element and osmium isotope project to characterize the PGE inventory of ocean crust of this reference section and study chemical fluxes during late-stage alteration processes related to the uplift of the crust. To characterize the drilled section we selected MORBs (from the top of the massif) and diabases (intrusive in gabbros) as well as gabbros (gabbros to olivine gabbros) and ultramafics (troctolitic lherzolite).

First, PGE data show a three orders of magnitude range of concentration between the gabbros and the ultramafics. Without exceptions, the gabbros are extremely depleted in PGEs relative to PUM (10^{-4} to 10^{-2}), whereas the ultramafics are similar to troctolites recovered from ODP Hole 735B and show only minor depletion relative to PUM. The investigated basalts and diabases show a wide range of PGE concentrations reflecting mainly different degrees of alteration or seafloor weathering. The impact of alteration is illustrated by the $^{187}\text{Os}/^{188}\text{Os}$ isotope ratios that correlate positively with $1/\text{Os}$. The troctolite with the highest osmium concentration shows the lowest $^{187}\text{Os}/^{188}\text{Os}$ ratio of 0.1438, whereas the osmium-poor gabbros and a highly weathered basalt sample have $^{187}\text{Os}/^{188}\text{Os}$ ratios between 0.1624 and 0.2288.

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Abs. No. **477**
Meeting: **DMG 2008**
submitted by: **Rosner, Martin**
email: **martin.rosner@bam.de**
date: **0000-00-00**
Req. presentation: **Poster**
Req. session: **S05**