Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05753, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05753
EGU General Assembly 2008


# Oceanic detachment faulting in modern oceanic lithosphere and in ophiolites: implications for the mode of extensional tectonics in seafloor spreading environments

**E. Miranda** (1), and Y. Dilek (2)

(1) California State University Northridge, Northridge, CA, 91330-8266, USA, (2) Miami University, Oxford, OH, 45056, USA (elena.miranda@csun.edu / Fax: 818-677-2820 / Phone: 818-677-4671)

Detachment faults observed in modern oceanic lithosphere are interpreted to be a manifestation of the tectonic partitioning of seafloor spreading during periods of episodic magmatism at intermediate- to ultra-slow-spreading mid-ocean ridges. Similar detachment fault structures are observed in ophiolites derived from lithosphere generated along intermediate- to slow-spreading ridges. Although the majority of ophiolites appear to have formed in suprasubduction zone extensional settings as suggested by the geochemical affinities of their crustal and mantle sequences, the similarities in the occurrence of detachment faults and the associated structures both in *in situ* oceanic lithosphere and ophiolites suggest that the mode and nature of extensional tectonics leading to detachment faulting may be controlled by plate separation and magma budget rates, and the rheology of oceanic lithosphere. We present a comparative study of regional structures and microstructural fabric development associated with detachment faulting at 1) the Atlantis Bank oceanic core complex (Southwest Indian Ridge), 2) the Mirdita ophiolite complex, Albania, and 3) the Kizildag ophiolite complex, Turkey.

Microstructural observations and thermometry calculations from *in situ* submersible samples and ODP Hole 735B samples collected from the Atlantis Bank core complex indicate that detachment faulting initiated at submagmatic conditions in the

ductile regime, and continued to sub-greenschist temperatures through the semi-brittle and brittle regimes as strain became localized along the exposed subhorizontal fault surface. Sample fabrics suggest that strain localization was achieved by dynamic recrystallization of plagioclase at temperatures 950-650$^\circ$ C, by amphibole-accommodated dissolution-precipitation creep at temperatures $\sim$600-450$^\circ$ C, by chlorite-accommodated reaction softening at temperatures $\sim$300-450$^\circ$ C, and by brittle fracturing and cataclasis at temperatures $< 300^\circ$ C. The development of submagmatic, crystal plastic and brittle fabrics within gabbroic rocks suggests that down-temperature changes in gabbro rheology control detachment faulting and attendant strain localization, and that amagmatic seafloor spreading is not required for oceanic detachment fault development.

We document similar detachment faults and core complex structures in the Jurassic Mirdita (Albania) and the Cretaceous Kizildag (Turkey) in the eastern Mediterranean region. Denudation of deformed gabbros and serpentinized peridotites in these ophiolites are constrained to have occurred in intraoceanic environments based on the existence of overlying pillow lavas and late-stage dikes crosscutting them. In the Western Mirdita ophiolites, serpentinized peridotite massifs form dome-shaped detachment surfaces; the detachment separates mylonitic to ultramylonitic serpentinized lherzolites in the footwall from significantly attenuated, deformed gabbros in the hanging wall. In contrast, detachment faulting in the Kizildag ophiolite appears to be localized near the dike-gabbro transition. Discrete mylonitic shear zones in gabbroic footwall rocks beneath the detachment faults in Kizildag contain fabrics and mineral assemblages suggestive of intermediate to high temperature conditions during extension. Based on the fabric development and associated detachment faulting documented in both crust and mantle rocks for these two ophiolite complexes, we suggest that both magma supply and the rheology of footwall rocks influences the development of detachment fault structures.