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DEFORMATION CONDITIONS AT OCEANIC DETACHMENTS (MAR, 15°45′N)

J. Escartin (1), C. Mével (1), C. J. MacLeod (2), A. M. McCaig (3)

(1) Geosciences Marines, IPGP, 4 P. Jussieu, 75252 Paris Cedex 05, France (2) Cardiff U., Wales, (3) U. of Leeds, England (escartin@ipgp.jussieu.fr / Fax: +33 1 4427 3911 / Tel: +33 1 4427 4601)

Fault rocks sampled along a detachment off the Mid-Atlantic Ridge ($15°45'$N) provide constrains on the conditions of deformation and strain localization. Some of these rocks have been sampled in situ, associated with basement outcrops showing striations parallel to the spreading direction and larger-scale bathymetric corrugations and acoustic backscatter lineations. Deformation is inferred to be restricted to shallow levels of the oceanic lithosphere, as there is no evidence for widespread high-temperature deformation structures either along the fault zone or within the footwall rocks in proximity to the detachment. Most of the deformation that we can associate with the detachment occurred in the green schist facies, and the occurrences of high-temperature deformation ($\sim 720 - 750°$C) are very restricted and cannot be directly linked to the detachment. Detachment faulting was coeval with dyke intrusions cross-cutting it, as demonstrated by the presence of both undeformed and highly deformed diabase found in talc and amphibolite shear zones. Basalts are very scarce and restricted to clasts in sedimentary breccias, with no evidence of pillows or other extrusive structures. Gabbros outcrop primarily along fault and mass-wasting scarps, structurally below the detachment fault surface. Footwall rocks show little or no deformation, demonstrating that strain is highly localized in a narrow shear zone ($<$250 m). These observations support an oceanic detachment model that roots in the shallow lithosphere; we speculate that the alteration front in a compositionally heterogeneous lithosphere may correspond to a rheological boundary that can localize deformation during long periods of time. Geological observations here and elsewhere suggest that the model of a shallow detachment presented here is applicable to other striated, corrugated surfaces identified along slow- and intermediate-spreading oceanic crust. The observations presented

here do not support a model of an oceanic detachment rooting in melt-rich zones and recording high-temperature deformation as documented at Atlantis Bank (Southwest Indian Ridge). We infer that detachment faulting in the oceanic lithosphere localizes strain at shallow levels, is active during active magmatism, and roots at shallow rheological boundaries, such as a melt-rich zone or magma chamber ("hot" detachments) or an alteration front ("cold" detachments).