High-temperature hydration of melt impregnated lithospheric mantle in the 15°20'N F. Z. area, MAR

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Gabbroic intrusions into the lithospheric mantle are common in oceanic core complexes worldwide, and it has been proposed that detachment faulting may focus along the contacts of meachnically strong gabbroic intrusions in weak serpentinized mantle [1]. Other studies have suggested that such melt-impregnated domains will hydrate, and hence weaken, at higher temperatures than unimpregnated mantle [2, 3].

We studied melt impregnated peridotites from ODP Leg 209 Site 1271 south of the 15°20‘ N Fracture Zone at the Mid-Atlantic Ridge (MAR). Whole-rock geochemical data indicate that the melt impregnations are mafic to felsic in composition and that metasomatic mass transfers were minor. The rocks have been altered by reactions with seawater-derived fluids to Ca-amphiboles + chlorite ± talc. Crystal-plastic deformation is uncommon in the variably serpentinized peridotites, but areas of hydrothermally altered melt-impregnated peridotites are strongly deformed via reaction-assisted strain, resulting in the formation of schistous rock in many cases. Geothermometric approaches yield temperature estimates of ~540–720 °C for the formation of the alteration minerals. These data are consistent with results of thermodynamic computations, which predict similar mineral assemblages for this temperature range. Our results support the findings of studies from nearby Site 1270, which indicate increased temperatures for the onset of hydration in peridotite impregnated by felsic melts [2, 3]. We show that impregnations by mafic melt have a similar effect.

The resultant mineral assemblages are thought to mechanically weaken the rock, leading to strain localization in these areas. Active faulting would promote further fluid flow, leading to further hydration of the rock and subsequent weakening. The results of our study support this idea of a positive feedback loop, and suggest that melt impregnations may play a general role in the initiation and evolution of detachment faults at slow spreading ocean ridges.

[1] Ildefonse *et al*. (2007) *Geology* **35**, 623-626. [2] Jöns *et al*. (2009) *Contrib Mineral Petrol* **157**, 625-639. [3] Jöns *et al*. (2010) *Chem Geol* **274**, 196-211.