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Role of oceanic detachment faults in controlling the chemistry of hydrothermal fluids

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Hydrothermal (black smoker) systems hosted in ultramafic rocks have distinctive chemical characteristics such as elevated contents of H_2 and CH_4, and have cation contents consistent with equilibrium with talc-tremolite bearing assemblages. Some basalt-hosted systems have chemical characteristics transitional towards these, implying some involvement of ulramafic rock along the flow path.

Oceanic core complexes in the Atlantic typically appear to be composed of serpentinised ultramafic rocks with a gabbroic core. Fault rocks consist of talc-tremolite-chlorite schists of mainly ultramafic protolith, but also contain inclusions and cross-cutting intrusions of partially altered mafic rock. Recent isotopic data from an oceanic core complex at 15^o 45'N suggests that these faults can act as conduits for hydrothermal fluid flow. This is consistent with the fact that some basalt-hosted systems such as TAG occur several km away from the neovolcanic zone and are underlain by dipping zones of seismicity. It appears that fluid discharge may be channeled along the fault zone before emerging through hangingwall basalts at high levels. Other hydrothermal fields such as Rainbow and Logatchev appear to be located on the ultramafic footwall of detachment faults, suggesting extensive penetration of fluid into the footwall.

This presentation aims to characterize various geometries and stages of evolution of oceanic core complexes in terms of the likely effects on both the location and chemistry of hydrothermal systems. This allows the characteristics of hydrothermal systems to be used as a tool for inferring the tectonic structure of the ocean floor.