The recent deoxygenation of the North Atlantic thermocline: A harbinger of the future?

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Repeat measurements of the interior North Atlantic have revealed surprisingly large decreases in its oxygen content over the last few decades, primarily located at mid-depth and associated with intermediate and mode waters. This deoxygenation of the North Atlantic thermocline is driven by some combination of variations in ocean circulation/mixing and variations in the ocean's biological pump. Presently available analyses suggest that most of these changes are physically driven, owing to a climatically forced slowdown of the ventilation and circulation of these mode and intermediate waters. In the presence of a continuing biological pump, this led to a rapid consumption of the available oxygen. We will present updated analyses on the basis of a newly available data base of North Atlantic oxygen as well as new model-based results. In particular, we will investigate how the simultaneous measurements of oxygen and other constituents can help us to extract the mechanisms responsible for these changes. A better understanding of these components and processes are crucial for improving our ability to assess the vulnerability of the ocean in this century, especially since the observed oxygen changes are remarkably congruent with the changes that model projections suggest for a warming world. The ocean interior, and particularly its oxygen content, may therefore act as an early indicator of the impact that future climate change might have on ocean biogeochemistry.

Controls on hydrothermal system styles in submarine arc volcanoes

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Intra-oceanic volcanic arcs represent the boundaries between converging lithospheric plates where subduction-generated melts provide a steady supply of heat and magmatic fluids. Brothers volcano [1], situated along the active arc front of the Kermadec arc, northeast of New Zealand, provides insight into the style and composition of hydrothermal discharge at submarine arc volcanoes and acts as a natural reference system for our numerical study of subseafloor hydro- and thermodynamics.

Based on correlations describing phase stability relations in the binary salt-water system [2], and a realistic numerical transport simulation scheme, we present results of multi-phase fluid flow simulations in the subsurface of a submarine magmatic-hydrothermal system. Our results show that water depth and seafloor topography, crustal permeability, and the relative contributions of seawater and magmatic fluids are the first-order physical parameters controlling the development and style of hydrothermal venting.

[1] de Ronde *et al.* (2005) *Econ. Geol.* **100**, 1097-1133.
[2] Driesner & Heinrich (2007) *Geochim. Cosmochim. Ac.* **71**, 4880-4901.