Life in the ice cover and underlying cold brines of Lake Vida, Antarctica

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The 20m-thick permanent ice cover of Lake Vida in the Victoria Valley, Antarctica and underlying cold brines provide opportunities to study both life in ice, and life isolated from surface processes for over 2800 years. We characterized the microbial communities in the ice cover, and sampled the brine (but not the lake itself) from a dept of 16.5 m. The microbial communities in the ice were stratified, with a photoautotrophic assemblage in the surface (4.8 m) and a chemoheterotrophic assemblage at depth (15.9 m). The -13C-cold brine has a water activity of 0.866 and is perhaps one of the most stable, liquid, cryo-environments on Earth. It is chemically complex, rich in dissolved organic carbon and metals and has incredibly high concentrations of both reduced and oxidized forms of inorganic nitrogen. Microbial cells were abundant (5.9×10^7 cells per mL), and dominated by small cells (< 0.2 um). Microbial activity assays indicated low levels of amino acid production evidenced by ^{3}H-leucine incorporation under both aerobic and anoxic atmospheres. The Lake Vida brine SSU rRNA gene sequences revealed a community that is unique in comparison to other polar and deep oceanic brines while SSU rRNA provided clues to those microorganisms suspected to be most active. Understanding microbial survival and growth in isolated low temperature habitats provides valuable insight into the possibility of life's persistence in extremes that may be experienced in other subglacial environments and on other icy worlds.

Biogeochemical impacts of a western iron source in the Pacific equatorial undercurrent

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Profiles of total acid soluble iron in the western equatorial Pacific (~155°E) have a maximum associated with the equatorial undercurrent (EUC) (Mackey et al., 2002; Slemons et al., submitted). This maximum is mostly in the form of particulate iron that appears to originate from rivers and sediments along the northeastern continental margin of Papua New Guinea. There does not appear to be a corresponding maximum for filterable Fe.

We conducted a model simulation (OPA/PISCES) in which this western iron source imposed in the EUC was transported to the east and we evaluated its impact on biogeochemical distributions. We treated all of the total acid soluble iron as if it was 100% bioavailable. A control simulation without the enhanced iron source was run for reference. In the source runs the concentrations of iron decrease from west to east, primarily due to scavenging. The western iron source can explain the maxima in total iron (dissolved plus particulate) observed at 140°W (Gordon et al. 1997). But the control runs did a better job of reproducing the climatological fields of NO_3 and chlorophyll. With the source runs NO_3 was much lower and chlorophyll is much higher than expected. Diatom production was also excessively enhanced. There were a few examples where the source runs reproduced the data better such as zonal gradients of surface nitrate along the equator and the meridional gradients of primary productivity and carbon export production.

Overall, the implications are that most of the total acid soluble iron in the EUC is not bioavailable to phytoplankton in the eastern equatorial Pacific. Even though there is a maximum in acid soluble iron associated with the EUC not all of this iron is available for biological uptake.

[1] Mackey *et al* (2002) *Deep-Sea Res. I* **49**, 877-893.
[2] Slemons *et al* (submitted) *Global Biogeochemical Cycles*.
[3] Gordon *et al* (1997) *Limnol. Oceanogr*. **42**, 419-431