What can subsurface chlorophyll maximum layers (SCML) tell us about productivity in ferruginous oceans?

ELIZABETH D. SWANNER[1]

[1]Iowa State University, Department of Geological & Atmospheric Sciences, Ames, IA 50010 USA, eswanner@iastate.edu

Subsurface chlorophyll maximum layers (SCML) are well-documented phenomena from stratified lakes and ocean regions, but the mechanisms driving their formation are diverse and specific to each aquatic system. SCML can represent either high phytoplankton biomass, or simply chlorophyll-rich cells. SCML can also be zones of enahnced new production in comparison to the surface, as remineralized nutrients are intercepted at the base of the photic zone. Given the ubiquity of SCML in aquatic systems, we need to understand their role in the evolution of the global carbon cycle. As ferruginous conditions characterized the deep ocean for much of Earth's history, but have now receded, useful analogues for SCML biogeochemistry are ferruginous lakes.

The Grosses Heiliges Meer (GHM) is a dimictic ferruginous lake in northern Germany with a persistent SCML that varies in magnitude seasonally. Ferrugionous conditions are present within the SCML during the late summer. Over several seasons of fieldwork, depth-resolved physicochemical, isotopic, and biological datasets provide a rich dataset to begin to understand the relationship of iron to the SCML. Results in brief are that the magnitude of the SCML as well as its phytoplankton composition changes as ferruginous conditions encroach. Hypotheses for how nutrient and redox conditions relate to these trends are being statistically tested, and will be related to productivity indicators from carbon isotopic and fluorescence data.

The GHM is but one example of a ferruginous lake with an SCML. Several other meromictic examples are known from North America. The seeming ubiquity of SCML indicates that this phenomena might have been widespread in ferruginous oceans. And, the particular geochemical and ecological conditions of each lake offer opportunities to study the interplay of ferruginous SCML with other nutrient and redox cycles, and potential biomarkers of these processes, which can be useful in piecing together past productivity.