SIO 245, 2018 – Sediment Proxies for Chemical Paleo-Oceanography

The main goal of the course is to understand what are the key processes on Earth that control seawater geochemistry, how marine sediments chemical and isotopic compositions record the history of seawater geochemistry, and how do sediment diagenetic processes impact the important paleoceanographic proxies. A brief introduction on each of the following topics will be presented, followed by in-depth discussions based on the reading of pre-assigned papers. It will be assumed that all students took a course that covered the basic principles of isotope geochemistry.

The requirements are, to:

- read key papers on each of the topics discussed,
- answer questions (in writing) about some of the papers,
- answer the questions of a few problem sets,
- write a term paper, and
- give an oral presentation (~20 minutes) of the term paper.
  The term paper should have the format of a research proposal, with an emphasis on the proposed new research.

Regarding the term paper, the students will have to choose their own research topic that is related to the overall class topic. There will be no final exam.

This 4-unit class will meet twice a week for ~1.5 hours: T & Th 11:00 AM - 12:20 PM.

Topics and several of the proxies outlined below will be discussed:

1. A brief introduction on the various types of Deep Sea Sediments, their sources and distribution, and their potential as paleo-proxies;

2. Types of paleo-proxies, criteria for establishing paleo-proxies;

2. Sediment pore fluid chemical profiles - indicators of biogeochemical and inorganic fluid-rock diagenetic reactions, diffusion-advection;

3. The main processes responsible for sediment diagenesis and the potential impacts of diagenesis on the reliability of the impacted sediments as paleo-proxies;

4. Oxygen isotope ratios as a proxy for paleo-temperatures; why are additional paleo-temperature proxies needed, (e.g. Mg/Ca, Sr/Ca, clumped isotopes);

5. The history of seawater oxygen isotopic composition – evidence and controversies, (e.g. Mo isotopes);

6. Proxies for weathering and sediment sources; (e.g. seawater Sr, Li, Os concentrations and isotope ratios);

7. Boron isotope ratios as a proxy for Seawater pH and B concentration as indicator for fluid flow;

8. Potential redox proxies, (e.g.the REE and Mo and its isotopes);

9. Seawater Mg isotopes and the oceanic Mg cycle; on the origin of dolomites;

10. Gas hydrates-Clathrates- and environmental implications; methane C isotopes;