MARUM / GLOMAR Expert Course:

Carbon cycle chemistry for beginners: concepts and consequences

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Although carbon makes up less than 0.1 % of the lithosphere of Earth, its particular properties mean it has a disproportionately significant role in Earth's biological and climate cycles. For instance, the ability of carbon to form long chains is fundamental to the composition of all living things, while the structure of carbon's gas phases (e.g. methane and carbon dioxide) means that these act as 'greenhouse gases'. Such gases amplify solar warming, controlling global temperature and thus ice volume and sea-level. Dissolved inorganic carbon (DIC) in sea-water controls the pH of the oceans with consequences for marine life.

An appreciation of carbon and its chemical behaviour is therefore important for an understanding of earth science, on both geological timescales and, when considering consequences of human perturbations to the carbon system, on timescales of human lives. This short course aims to give an overview of the important concepts of carbon chemistry with particular reference to its effect on Earth's climate.

Aimed at: Graduate students (and anyone else interested). Although this is classed as an 'expert' course in the GLOMAR scheme, due to its focus on one topic; it is meant to provide an introduction and overview of the important aspects of carbon cycle chemistry. It is a chance to discuss and learn more about these important themes and is suitable for anyone interested, with or without a chemistry background.

The course is taught with reference to, and discussion of, key papers dealing with aspects of the carbon cycle and some of its extreme settings through time.

The topics to be dealt with include:

- Important concepts of carbon chemistry –
  (Carbonate system equilibrium, alkalinity, greenhouse gases)
- Carbon cycles on various timescales -
  (Soil cycle, atmospheric-ocean cycle, rock-weathering cycle, deep biosphere carbon cycle)
- Extreme carbon system settings -
  (The Pre-Cambrian Snowball earth and the Eocene thermal maximum)
- Glacial to Interglacial controls on carbon cycle -
  (Coral reef hypothesis, the importance of Southern Ocean sea ice cover)
- Anthropogenic forcing –
  (Global warming, ocean acidification)

Papers to be discussed

Sigman & Boyle (2000),
Glacial/interglacial variations in atmospheric carbon dioxide
Nature 407,
http://www.nature.com/nature/journal/v407/n6806/abs/407859a0.html

Zachos, Roehl, Schellenberg, Sluijs, Hodell, Kelly, Thomas, Nicolo, Raffi, Lucas, Lourens, McCarren & Kroon (2005),
Rapid Acidification of the Ocean during the Paleocene Eocene Thermal Maximum,
Science 308, 1611 doi: 10.1126/science.1109004
www.sciencemag.org/content/308/5728/1611.full.pdf

Hoffman, Kaufman, Halverson & Schrag (1998),
A Neoproterozoic Snowball Earth,
Science 281, 1342, 10.1126/science.281.5381.1342
http://www.sciencemag.org/content/281/5381/1342.abstract

Location
MARUM, University of Bremen, 28359 Bremen, Germany, Room 2060

Time
09.00 – 12.30

To subscribe
Please send a mail to Christina Klose (glomar-courses@marum.de). Please give your name, status (PhD student, Postdoc or Master Student), institute / university and research area / working group as well as your **field of study**.