ALASKA GEOLOGY

February 19th Lecture Abstracts

Early Cenozoic Climate and Carbon Cycling: The Sedimentary Record of Global Warming and Massive Carbon Input

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Funded by the AAPG Foundation

Note: AGS meetings will be at the BP Energy Center for 2008-2009.
Please check the website (www.alaskageology.org) and issues of the AGS newsletter for updates.
This newsletter promotes the February luncheon talk of the Alaska Geological Society, to be held Thursday, Feb. 19th at the BP Energy Center.

The "Greenhouse Earth" of the late Paleocene and early Eocene was generally characterized by warm temperatures and elevated pCO2. Climate and carbon cycling were, however, far from equable during this interval, as once believed. Surface temperatures slowly warmed by about 5 °C from 59 Ma to the Early Eocene Climatic Optimum centered about 50 Ma. This long-term warming generally coincided with greater inputs of carbon, presumably caused by volcanism. Superimposed on this background change were a series of "hyperthermals", the most pronounced corresponding to the Paleocene/Eocene Boundary ca. 55 Ma. These were geologically brief (<200 kyr) events that began with rapid warming across the globe and massive input of 13C-depleted carbon. They were also times of extreme variations in ecosystems and the hydrological cycle.

Our current understanding of the late Paleocene and early Eocene allows us to link disparate and unusual observations in strata from across the globe with a holistic perspective. In particular, the start of the PETM (Paleocene Eocene Thermal Maximum?) is clearly identified in scores of sedimentary records by a prominent negative carbon isotope excursion in carbonate, organic carbon, or both. This excursion precisely coincides with profound mammal and plant migrations in the northern hemisphere, a mass extinction of benthic foraminifera, elevated terrigenous discharge to many continental margins, laminated sediment facies on continental slopes, and a carbonate dissolution horizon in the deep-ocean. Similar changes, though of lesser magnitude, appear to mark the other hyperthermals. Although cause and effect relationships during hyperthermals, as well as links between them, remain uncertain, the hyperthermals and their sedimentary expressions are, without doubt, somehow related to extreme global warming and tremendous additions of carbon to the ocean and atmosphere. Speculative links will be discussed.

Alaska Geological Society Luncheon

Date & Time: **Thursday, Feb. 19th, 11:30 am – 1:00 pm**

Program: **Early Cenozoic Climate and Carbon Cycling**

Speaker: Gerald Dickens - AAPG Distinguished Lecturer, Rice University, Houston, Texas

Place: **BP Energy Center**

Reservations: **Please make your reservation before noon Tuesday, Feb. 17th, 2009.**

Cost:	**Seminar only, no meal:**	**Free**
	Reserve a box lunch:	**$13**
	Nonmember:	**$15**
	Reserve a hot lunch:	**$20**
	Nonmember:	**$22**

No reservation: add $5 to the above (on an "as-available" basis only)

E-mail reservations: **vp@alaskageology.org**
Or phone (907) 230-1672
(Tom Morahan, AGS VP)

For more information: visit the AGS website:

www.alaskageology.org

Second talk by Gerald Dickens, AAPG Distinguished Lecturer:

The Global Carbon Cycle with Seafloor Methane

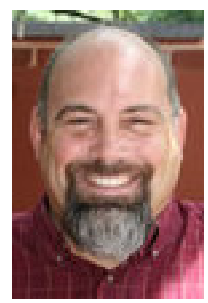
February 19th, 2009 at 3:30 PM
ConocoPhillips Building, 700 G Street
Room ATO-1 (first floor lecture room through the elevator lobby)
Note: for ease of entry, please pre-register
with Tom Morahan (vp@alaskageology.org or 230-1672, specify afternoon lecture)

Large quantities of methane occur as dissolved gas, gas hydrate and free gas in the pore space of sediment along continental margins. This methane is habitually omitted from discussions of carbon cycling, despite obvious fluxes to and from the ocean. At the most basic level, carbon enters the seafloor methane cycle through the breakdown of solid organic compounds, and leaves as dissolved bicarbonate, solid carbonate or methane.

Organic carbon landing on the seafloor passes through a gauntlet of microbially mediated reactions during burial. In regions with a sufficiently high flux of organic carbon, large quantities reach a methanogenic zone where approximately equal portions of dissolved bicarbonate and methane are produced. The bicarbonate is enriched in 13C while the methane is extremely depleted in 13C. With continual production of methane, gas concentrations can surpass solubility conditions to precipitate gas hydrate or free gas, depending on local pressure, temperature and salinity conditions. Gas hydrate overlies free gas in many deep ocean settings because of the geotherm. Carbon cycles between dissolved gas, gas hydrate and free gas through several pathways, including burial of all three phases, upward advection of dissolved gas and free gas, diffusion of dissolved gas, dissociation of gas hydrate, and dissolution of gas hydrate. Carbon leaves the seafloor methane cycle as bicarbonate or methane, the latter of which can involve reaction with sulfate in the sediment or venting into the water column. Excess production of bicarbonate, from either methane production or consumption, can lead to formation of authigenic carbonate, which provides another means to remove carbon.

All of the fluxes depend on external conditions such as temperature or seawater chemistry. Given that oceanographic conditions have changed significantly over time, it is speculated that the amount and fluxes of various components of the seafloor methane cycle have also varied through time substantially.

ABOUT THE AUTHOR



Education:

1989 Bachelors, The University of California at Davis
1993 Masters, The University of Michigan at Ann Arbor
1996 Ph.D., The University of Michigan at Ann Arbor

Experience:

2008-Present: Professor, Department of Earth Sciences, Rice University
2001-08 Associate Professor, Department of Earth Sciences, Rice University
1997-2001 Lecturer and Senior Lecturer, Department of Earth Sciences, James Cook University (Australia)

Publications and Awards:

Authored or co-authored over 90 scientific papers

Sluijs, A., Brinkhuis, H., Schouten, S., Bohaty, S.M., John, C.M. Zachos, J.C., Reichert, G.-J., Sinninghe-Damste, J.S., Crouch, E.M. and DICKENS, G.R. (2007). Environmental precursors to rapid light carbon injection at the Palaeocene/Eocene boundary. Nature, v. 450, p. 1218-1221

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Snyder, G.T., Hiruta, A., Matsumoto, R., DICKENS, G.R., Tomaru, H., Takeuchi, R., Komatsubara, J., Ishida, Y. and Yu, H. (2007). Pore water profiles and authigenic mineralization in shallow marine sediments above the methane-charged system on Umitaka Spur, Japan Sea. Deep-Sea Research (II), v. 54, p. 1216-1239

Hancock, H.J.L., DICKENS, G.R., Thomas E., and K.L. Blake, K.L., (2007). Reappraisal of early Paleogene CCD curves: foraminiferal assemblages and stable carbon isotopes across the carbonate facies of Perth Abyssal Plain. International Journal of Earth Sciences, DOI 10.1007/s00531-006-0144-0.

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2006-present Chief editor Paleoceanography
2002-03 JOI/USSAC Distinguished Lecturer

Professional Interests:

Cretaceous and Cenozoic Paleoceanography
The submarine methane cycle
Sedimentary responses to climate and sea-level change