Wednesday, January 27, 2010

Petroleum Club • 800 Bell (downtown)
Social 11:15 AM, Luncheon 11:30 AM

**Cost: $30 pre-registered members; $35 for non-members & walk-ups;
Emeritus/Life/Honorary: $15; Students: FREE**

**To guarantee a seat, you must pre-register on the HGS website (www.hgs.org) and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.**

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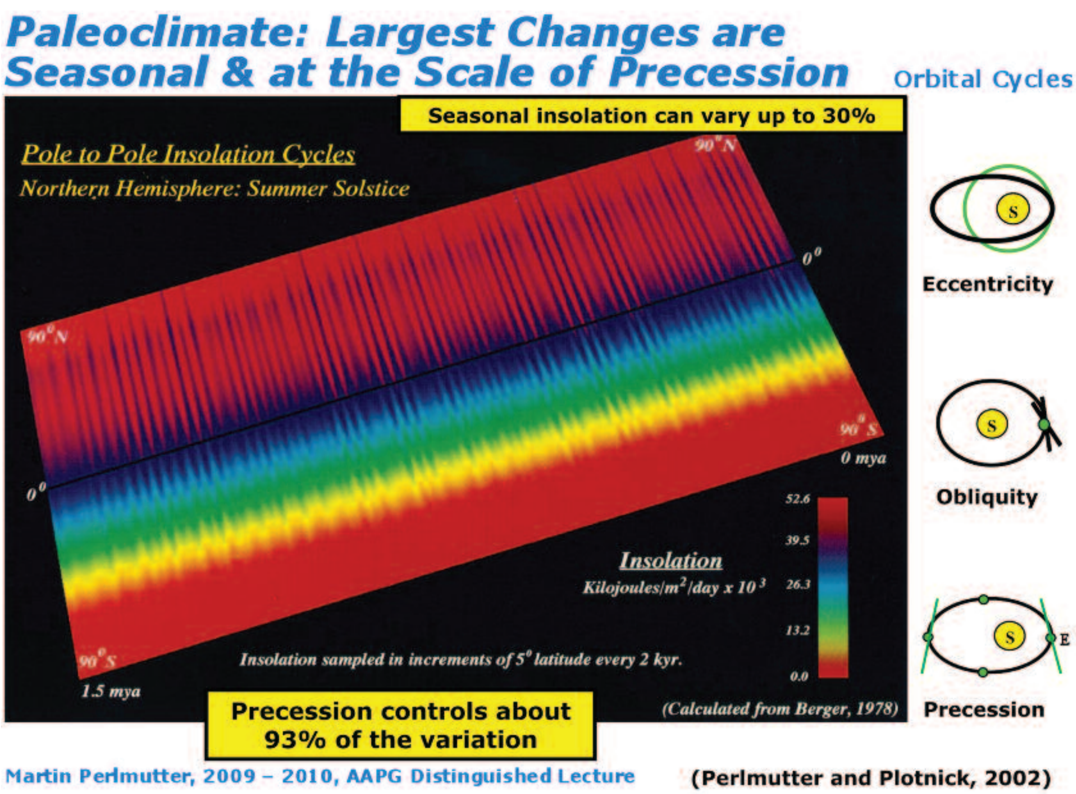
The Influence of High-Frequency Climate Variability on Paleoclimate Interpretation

Understanding past long-term climate states and their higher frequency variability can play an important role in helping to forecast future climate changes. The insolation cycles which drive high-frequency climate variability and their interference patterns have been mathematically resolved for the last 50 Ma. Inferences can be drawn on these patterns back through at least the Paleozoic. However, different regions of the Earth have different climatic responses to the same insolation cycles and record the changes differently. In some locations, the stratigraphic record of climate cycles is easily recognized and measured. In other areas, it's more difficult because the climate does not change much or perhaps stratigraphers who interpret climate ignore changes to sedimentary delivery systems and environments of deposition caused by the specific climate response. They don't recognize preservation bias caused by climate cycles so they fail to include the phase relationship of sediment supply and sea- or lake-level cycles. These issues can cause paleoclimatologists to misinterpret the actual temporal scales of climate change because they are looking for similar stratigraphic responses to the same climate cycle in areas that just don't preserve them the same way.

…regional and temporal variations in the phase relationships between sedimentary and glacioeustatic cycles may not be consistent with basic assumptions about stratigraphy…



Pole-to-pole insolation plotted at the Northern Hemisphere summer solstice for a 1.5 My interval. Precession-scale insolation cycles can change seasonal heating within a hemisphere by up to 30%. Insolation calculated from equations in Berger (1978). Figure from Perlmutter and Plotnick, 2002.

Presently, most paleoclimate analyses and interpretations are resolved only for mean annual conditions for time intervals ranging from 0.1 to 1 my. However, the greatest insolation changes occur seasonally at the scale of precession (~20 kyrs) during periods of high eccentricity. Similar to the conditions that cause summer in one hemisphere and winter in the other at

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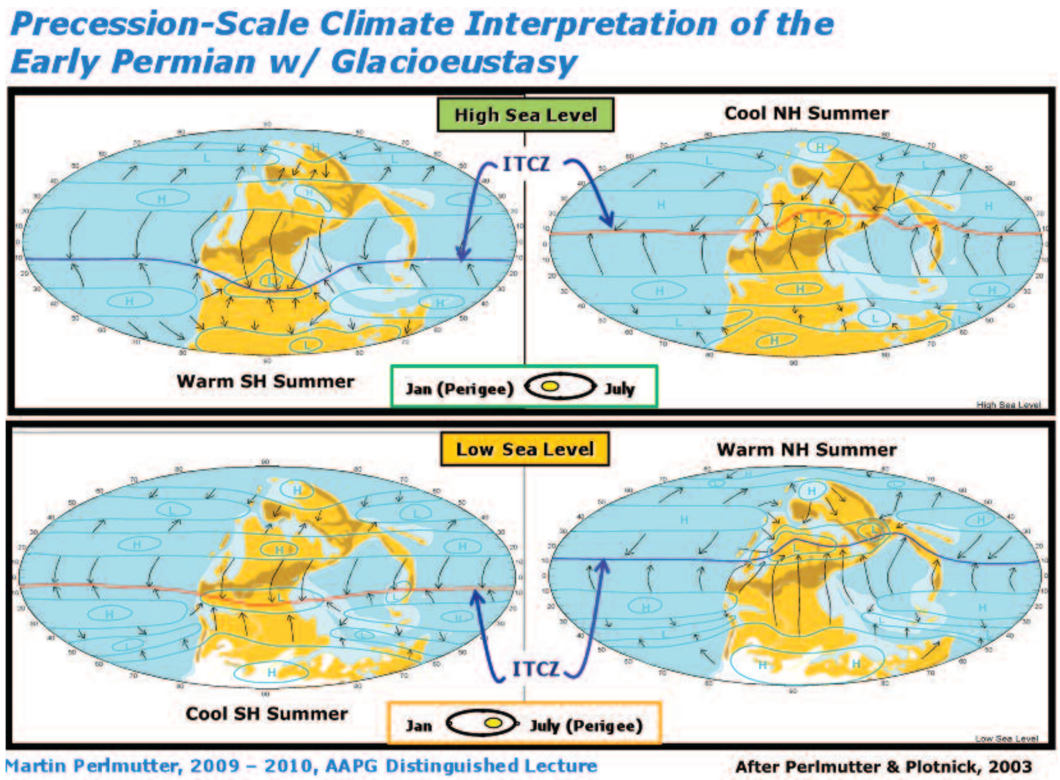

Relationship between precession-scale paleoclimate states and glacioeustasy for the E. Permian. High sea level is associated with intervals with warm southern hemisphere summers. Low sea level is associated with cool southern hemisphere summers. The time between these end member states can be a short as 10 kyrs. Note that cool northern hemispheres summers occur during times of warm southern hemisphere summers and cool southern hemisphere summers occur during the times of warm northern hemisphere summers. Figure from Perlmutter and Plotnick, 2003.

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the same time in the earth's orbit, precession cycles cause northern and southern hemisphere insolation to be about 10,000 years out of phase. Hot summers and cold winters in one hemisphere correspond to mild summers and mild winters in the other. The pattern reverses itself over a precession cycle so that similar climatic successions in opposite hemisphere, and their associated sediment yield cycles, will be 10,000 years out of phase, as well. These changes occur regardless of whether the earth is in a greenhouse or an icehouse state.

Until the Plio-Pleistocene glaciations, when they occurred, were unipolar. Under this condition, precession-scale eustasy tended to track the insolation cycle of the glaciated hemisphere. Consequently, similar climatic successions in opposite hemispheres would have had sediment yield cycles with distinctly different phase relationships to glacioeustasy. Such differences would not exist in an ice-free world. The regional and temporal variations in the phase relationships between sedimentary and glacioeustatic cycles may not be consistent with basic assumptions about stratigraphy and may impact how we interpret the causes and frequencies of the stratigraphic cycles themselves. This talk is a discussion of how these issues affect our understanding and interpretation of paleoclimate.

Biographical Sketch

Martin Perlmutter has 28 years of industry experience, including 25 years with Chevron and Texaco, as a research scientist, explorationist, and team leader, and 3 years at Argonne National Lab as research leader for oil and gas technology. He received his B.S. and M.S in Earth Science from Stony Brook University and a Ph.D. in Marine Geology from the Rosenstiel School of Marine & Atmospheric Science at the University of Miami. His career has led him to develop expertise in reservoir prediction, basin analysis, cyclostratigraphy, and paleoclimate. Dr. Perlmutter has evaluated more than 30 basins on 5 continents and performed mega-regional studies in North America, South America, Africa, and Asia. He has 25 scientific publications. Recent professional activities include co-chairing sessions at AAPG and SEPM on paleoclimate variability and its impact on exploration, being the industry representative to the National Research Council's Panel on Paleoclimate, and acting as adjunct professor at the University of Illinois in Chicago. Presently, he is an AAPG Distinguished Lecturer.