Poster Session 4

MGH 258, Easel 181

4:00 PM to 6:00 PM

Estimates of Glacial-Interglacial Temperature Change in the Central Rocky Mountains, USA, from Clumped Isotope Paleothermometry of Soil Carbonates

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Global temperatures have been on the rise since preindustrial times due to an increased concentration of carbon dioxide in our atmosphere. Learning about how past climates have responded to changes in carbon dioxide concentrations is important to understand how our current climate will respond to atmospheric changes. Previous studies have tried to constrain the warming that occurred after the Last Glacial Maximum (LGM, ˜20,000 years ago), for example in the Central Rocky Mountains, USA, where glacial modeling-based estimates suggest temperature change from the LGM to the modern (interglacial) climate was 5-10 C. However, these glacier-based temperature estimates were influenced by other factors such as precipitation and seasonality, giving them large uncertainties. This study will use carbonate samples from soils from the LGM and modern interglacial ($<$3,000 years before present) to develop a more precise estimate of the amount of warming since the LGM. We will measure the clumped oxygen and carbon isotopes of samples collected from the Central Rocky Mountains and arid Western United States. The clumped isotopes measure soil temperature directly, providing a robust proxy for temperature change. This study will also investigate the time of year soil carbonates form, which is important for interpreting the soil temperature recorded by clumped isotopes. Through the use of clumped isotopes we will improve temperature change estimates, which will help improve climate models for the future.

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Understanding Fluid Migration History in Sedimentary Rocks of the Jurassic Carmel Formation, Utah, Using Petrography and Clumped Isotopes

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Understanding the permeability structure of sedimentary rocks is important for predicting migration of fluids like water, hydrocarbons, contaminants or CO_2 in the subsurface. Movement of pressurized pore fluid can cause coarse sediments to be injected into fine-grained, low-permeability sedimentary layers, forming "clastic pipes." Clastic pipes are important because they create pathways that enable fluid to migrate through the cross-cut impermeable layers. We studied the clastic pipes in the Jurassic Carmel Formation, Utah, to understand their formation conditions and timing, and their relationship with hydrocarbon migration in the region. Specifically, we used petrography including cathodoluminescence observations of calcite cements that grew from the migrating fluids to understand whether fluid migration through the pipes occurred in multiple generations or in one single event. Preliminary results of the cathodoluminescence observations show multiple generations of cementation and fluid migration. Some samples exhibit non-luminescent cements, which are typical of near-surface fluids and may represent syn-depositional fluid flow during initial pipe injection and formation. Other samples showed multiple generations of luminescent cements, which are typical of basin fluids. This included (1) large dull orange calcite crystals, with (2) bright yellow luminescent cement deposited along cleavage planes that are cross-cut by brittle fractures. Some of the large grains in these samples were partially coated with (3) dull orange-yellow luminescent cement with blotchy texture that cross cuts calcite generations 1 and 2. Further work in this study will be to use clumped, C and O isotopes to constrain the temperature and source of the different generations of fluids from which the cements grew. The obtained fluid temperatures will then be related to the burial history (temperature-time) curve for the region to understand the timing of fluid flow through the pipes and its relationship with hydrocarbon migration in the region.