

MONDAY

DAVID COLE | 9:19-9:38am U11A-052 Room E2
Shale systems, such as the Utica, Marcellus, and Eagle Ford, host vast reservoirs of hydrocarbons. These natural systems comprise nanoscale labyrinths, with hydrocarbon fluids trapped in low porosity rocks. Cole and Alberto Striolo use a variety of cutting-edge electron microscopy, spectroscopic and molecular dynamic simulation techniques to quantify the physical and chemical properties of natural shales, focusing on understanding how fluids move through constricting channels and interact with surrounding minerals.

MARY REAGAN | 1:55-2:10pm V13E-02 Room 208-209
Earth's core is primarily a metal alloy composed of iron and nickel that is surrounded by a rocky mantle. Reagan and colleagues used laboratory techniques to mimic core conditions finding that nickel can affect how iron isotopes separate into the mantle and core. The addition of nickel causes heavy iron isotopes, which are iron atoms with extra neutrons, to enter the planet's mantle, while lighter iron atoms stay in the metal core. This discovery may offer an explanation for the varying iron isotope signatures found on Earth, the Moon, Mars, and the asteroid Vesta. Knowledge of the composition of Earth's core and the cores of other planetary bodies offer clues to how the solar system formed and to Earth's early history.

YUKI MORONO | 4:00-4:15pm B14D-01 Room 386-387
In the fall of 2016, a team of researchers headed out on International Ocean Discovery Program expedition 370 to look for microbes living at the extremes, at the temperature limit for life on Earth. The success of the expedition depended on regular helicopter shuttling of samples to the ultra-clean facilities of the Kochi Core Center in Kochi, Japan, and the unprecedented cell counting abilities of Morono and colleagues. This presentation will highlight initial results from the cruise.

LOUISE KELLOGG | 5:15-5:30pm D114A-06 Room 203-205
Comparing Earth and its planetary neighbor Venus is a useful tool for understanding a variety of geologic processes. A major difference between the two planets is the existence of plate tectonics on Earth, which Venus lacks. In this presentation, Kellogg will describe a model for the transport of Earth's carbon over deep time, assuming our planet was born with a carbon-rich atmosphere similar to Venus, which suggests that most of Earth's carbon was pulled from the atmosphere as long as three billion years ago.

TUESDAY

BOWEN LECTURES

BERNARD MARTY | 10:20-11:20am V22A-01 La Nouvelle C
While Earth is rich in life-bearing volatiles (water, carbon, and nitrogen) the question of where these volatiles came from remains unanswered. Some theories suggest that they originated from within the planet, as Earth's mantle "degassed" such volatiles over time. Others suggest volatiles arrived when Earth was bombarded with comets and/or asteroids. Marty's lecture will explore the origins of terrestrial volatiles using data from the Rosetta mission to Comet 67P/Churyumov-Gerasimenko and high-precision analysis of mantle gases to unwrap these theories and, perhaps, lead to an answer.

CRAIG MANNING | 11:20am-12:20pm V22A-02 La Nouvelle C
Elements and molecules move around in fluids within Earth's crust and mantle. These fluids vary in composition with increasing temperature and pressure the deeper they go, thus changing their behavior. Manning will summarize what we know about fluid transport in the lower crust and upper mantle, and discuss how water and carbon may influence deep volatile cycles.

MARIE EDMONDS | 1:40-1:55pm V23-F-01 Room 208-209
Volcanoes emit many different gases, during major eruptions and passively between eruptions. In addition to gases, these volcanoes are also releasing metals into the atmosphere. Edmonds and Emma Liu studied samples produced during the 2014–2015 Holuhraun basaltic fissure eruption in Iceland to study the role of water and sulfur. They found that the interplay between these volatiles encouraged the fractionation of metals into a vapor phase, and thus their release into the atmosphere.

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MAARTEN DE MOOR | 2:25-2:40pm V23F-04 Room 208-209

In April 2017, the Costa Rican volcano Póas erupted violently, dropping lava bombs on nearby tourist observation decks and completely obliterating the lake residing in its crater. The eruption also wiped out a MultiGAS monitoring station, a piece of equipment used to continuously monitor volcanic gas emissions. To keep studying the eruption, de Moor and colleagues turned to drone technology, strapping a miniaturized version of the MultiGAS ("miniGAS") to an unmanned aerial vehicle and flying it around Poas' plume, generating a unique dataset that provides valuable new insights into degassing processes occurring during explosive eruptions.

DANIEL HUMMER | 4:30-4:45pm V24C-03 Room 208-209

One of the most important events in the history of our living planet was the Great Oxidation Event (GOE), when the atmosphere was infused with oxygen for the first time. To understand what effect this had on Earth's crust, Hummer and colleagues turned to manganese minerals. Using a database that includes information about the geologic age of these minerals, they show that Earth's crust felt the influence of the GOE, and then continued changing as oxygen began to dominate our atmosphere. The most recent changes to Earth's minerals occurred 66 million years after oxygen was added. This long-term effect demonstrates the constant interplay between the geosphere and biosphere, and the timescales on which life affects the Earth and vice versa.

CATHERINE McCAMMON | 5:00-5:15pm V24C-05 Room 208-209

Earth's interior is not static, but rather physical and chemical processes are constantly taking place throughout its mantle and core. Many of these processes involve iron-carbon redox reactions. One example is diamond formation, which can be controlled by iron-carbon-bearing minerals. McCammon and colleagues will discuss their experiments to systematically characterize these iron-carbon redox reactions and illustrate their results by tracing the journey of iron, carbon, and oxygen atoms from the crust to the core and the different processes that they encounter along the way.

WEDNESDAY

ANIRUDH PRABHU | 8:00-8:10am IN33B-0125 Room 231-232

Big data and data science techniques are making it possible, and in some cases easy, to answer complex questions in the Earth and life sciences. Recent successes in the application of complex network theory to minerals, fossils, and proteins over billions of years of Earth's history, exemplifies the potential of using such data-driven approaches in the Earth Sciences. Prabhu will share some of the techniques for data-rich network analyses in the geosciences, he and his colleagues are using for discovery, and offer future paths for consideration.



The Deep Carbon Observatory (DCO) is a global community of multi-disciplinary scientists unlocking the inner secrets of Earth through investigations into life, energy, and the fundamentally unique chemistry of carbon.

THURSDAY

TOBIAS KELLER | 5:45-6:00pm V44A-08 Room 208-209

Earth is massive and many of its interior processes occur over very long time intervals. There is simply no way to recreate these planetary scales in a laboratory. To study geological processes at large scales and over long times, many scientists turn to computational models to simulate these natural conditions. Such simulations require careful calibration through natural observations, and enormous computing power. But, as Keller and his colleagues will show, simulations can offer important insights into what's going on inside Earth's deep interior. Keller will review the role of volatiles including water and carbon dioxide in magma transport beneath mid-ocean ridge systems, and will discuss implications for global volatile and trace element cycling as revealed by computer simulations.

FRIDAY

JULIE HUBER | 8:00-8:12am P51F-01 Room R04-R05

Earth's hydrothermal vents could once have nurtured life into existence. Recent data from the Cassini mission to Saturn suggests there is hydrothermal activity on one of its moons, Enceladus, and that this icy, watery moon could host extraterrestrial life forms. Huber has long studied hydrothermal vent systems on Earth. In this presentation she will talk about what we have learned about their geochemistry, types of life they support, and how these studies are helping to inform future space missions.

MATTHEW SCHRENK | 11:30-11:50am OS52A-05 Room 278-279

Microorganisms colonize Earth's crust beneath the oceans and continents, forming the deep biosphere. Unlike their surface counterparts, microbes in the subsurface rely on geochemical reactions for energy and food, and serpentinizing systems are an important ecological niche rich in carbon and energy. Schrenk and his colleagues studied microbes living in serpentinization-influenced systems in both marine and terrestrial settings and describe very similar metabolic processes that link the two environments.

JAMES BADRO | 5:45-6:00pm MR54A-08 Room 203-205

Using seismology, scientists have mapped several different layers inside Earth. This mapping resulted in the discovery of a layer at the core/mantle interface called E'. The material in the E' layer is less dense than the outer core, while subject to the same temperature and pressure conditions as the outer core. At the same time, seismic waves travel slower through this enigmatic layer, which is unusual because seismic waves travel faster in lighter materials. To figure out the chemistry that makes this possible, Badro and John Peter Brodholt used a thermodynamic modeling approach based on *ab initio* molecular dynamics calculations. They found that the only plausible explanation for the E' layer is a chemical interaction between mantle and core, which increases the concentration of oxygen or sulfur while depleting the layer in silicon or carbon.