ORIGINS LAB

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF THE GEOPHYSICAL SCIENCES
ENRICO FERMI INSTITUTE
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PhD in Geochemistry/Cosmochemistry starting in Autumn 2015 at the University of Chicago

PhD opportunities in geochemistry and cosmochemistry are available for fall 2016 at the Origins Lab, University of Chicago (http://originslab.org). Examples of research projects are listed below:

1. Isotopic similarities and differences between Earth and Moon. The Moon is thought to have formed by a giant impact between the protoEarth and a Mars-size impactor named Theia. Modeling predicts that most of the material that formed the Moon came from the impactor, so the Moon may be chemically and isotopically different from the Earth. High-precision isotopic measurements of refractory and volatile elements will be conducted in lunar samples from the Apollo missions in order to test scenarios of the formation of the Moon.
2. The redox state of Earth's mantle influences the speciation of gases emanating from volcanoes but first order questions relevant to Earth's redox evolution are poorly constrained. Did the redox state of Earth's mantle remain constant through time? How does subduction affect the redox budget of Earth's mantle? To answer these questions, one has to develop new redox proxies. Iron isotopes are fractionated between ferric and ferrous iron, so by measuring the iron isotopic composition of mantle-derived rocks, one should be able to shed new light on the redox conditions during mantle melting. This work will involve high precision iron isotope measurements by mass spectrometry and calibration of iron isotope fractionation in magmatic systems by synchrotron nuclear resonant inelastic x-ray scattering spectroscopy.
3. Meteorites and planets show widespread isotopic anomalies of nucleosynthetic origin for many elements. In particular, elements in the iron mass region (e.g., Ca, Ti, and Cr) show excesses in the most neutron-rich isotopes that can be unambiguously tied to supernova nucleosynthesis. The source of some of these anomalies has been identified (e.g., nanospinel grains rich in chromium-54) but many uncertainties remain as to the exact stellar source and nature of these grains. Do they come from core-collapse or type Ia supernovae? Is there a unique carrier for calcium and titanium anomalies? Why are they heterogeneously distributed at a bulk planetary scale? This research will involve isolation of the carriers of isotopic anomalies from meteorites, in situ detection of anomalous grains by mass spectrometry, and mineralogical characterization.

Numerous opportunities are available, besides the three listed above, to study the formation of the solar system, environments of the early Earth, and modern geochemical processes. Students are encouraged to come with their own ideas to define a PhD project that teases their curiosity and matches their aspirations. A solid background in basic sciences is required.

Chicago is a vibrant city spread along scenic Lake Michigan with numerous recreational, cultural and sporting activities. The University of Chicago is a premier research and teaching institution (ranked #9 in the 2013 Shanghai academic ranking of world universities) that has a long tradition of training outstanding scientists (89 Nobel Laureates have been affiliated with the University of Chicago).

The application deadline for Autumn 2016 entry to the graduate program is January 12, 2016. To apply online please visit https://apply-psd.uchicago.edu/apply/. Opportunities also exist for undergraduate students who are interested in doing a summer internship at the University of Chicago.

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