Oceanography 635

Isotopic Marine Geochemistry

Lecturer: Yuan-Hui (Telu) Li
Credits: 3
Pre-requisite: College Chemistry, Physics, and Calculus

Course description:

The objective of the course is to apply unstable and stable isotope tracers to study biogeochemical processes and their rates in the oceans. For examples, the class will cover the following subjects: water mass movement and mixing rates; material transfer rates across air-sea and water-sediment interfaces; biogeochemical cycling rates of metals; sediment accumulation and mixing rates; adsorption-desorption kinetics; dispersion rate of pollutants in environment; changes of isotopic compositions in the ocean with age etc.

1. Principal of nuclear chemistry: atomic nuclei, radioactive decay and growth, radiation detection and measurement, stable isotopic fractionation and measurements. (Four weeks)

2. Natural U-Th decay series disequilibrium in the sea: systematic survey in air, soils, river, ocean water column, suspended particles, sediment traps, bottom sediments (including ferromanganese nodules and phosphate nodules), and pore water. (Three weeks)

3. Cosmogenic and anthropogenic radionuclides in the ocean: production and pathways of ^{14}C, ^{137}Cs, ^{90}Sr, $^{238,239,240}Pu$, ^{241}Am, ^{3}H, ^{39}Ar, ^{26}Al, ^{32}Si, $^{7,10}Be$, $^{127,129}I$ and $^{32,33}P$ in the atmosphere, on lands and in the ocean. (Four weeks)

4. Stable isotope tracers: applications of $^{18}O/^{16}O$, $^{13}C/^{12}C$, $^{34}S/^{32}S$, $^{2}H/H$, $^{15}N/^{14}N$, $^{3}He/^{4}He$, Pb isotopes, $^{87}Sr/^{86}Sr$, $^{187}Os/^{186}Os$, $^{6}Li/^{7}Li$, $^{56}Fe/^{54}Fe$, $^{11}B/^{10}B$ etc. in oceanographic problems. (Four weeks)

Upon successful completion of OCN 635, students are expected to be able to:

1. apply the principal of the nuclear chemistry in the field of geochemistry
2. calculate the changing rates of various oceanic processes using natural and anthropogenic radioactive tracers.
3. understand the scientific issues concerning the nuclear bomb proliferation and nuclear energy.
4. understand the usage of stable isotopes to discern sources and isotope fractionation, and their application to paleo-oceanography.