1. Introduction to Rhenium (Re) and Osmium (Os)

- Both Rhenium and Osmium are Platinum Group Elements with interesting geochemical behavior.
- Re and Os accumulate in certain minerals and substances (sulfides, metals, organics).
- Re and Os are often found in the minerals/rocks that make up the majority of the crust.

2. Applications of the Re-Os system

- Isotopic Dating
  - The 
  - The older the rock or mineral, the more Re converts into Os. Through measuring the relative abundances of these elements we can determine how old a rock or mineral is.
  - Due to the unique geochemical behavior of Re (e.g. chalcophile siderophile/organophile) compared to other radioactive elements (e.g. uranium, rubidium), this isotope system can date rocks that would typically be impossible, such as sulfide minerals (ECONOMIC GEOLOGY) and organic-rich sediments/rocks (PETROLEUM GEOLOGY, CHRONOSTRATIGRAPHY).

- Geochronology of Lisheen was important in determining what large-scale magmatic activity associated with the OAE in the Cretaceous. It is suggested that Os input from magmatic sources increased by 30-50x. Suggesting a massive magmatic episode.

- Pyrite Re-Os Geochronology
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- Osmium Isotope Tracing
  - Turgeman & Cosner (2000) proposed a way to test if ocean anoxia occurred by measuring the ratio of Os in seawater and sediment. The authors suggested that Os input from magmatic sources increased by 30-50x. Suggesting a massive magmatic episode.

- Environmental/Anthropogenic Tracing
  - Contamination in Oil
    - Mix formation waters: A-B
    - Sample 1 and 2 are typical values for oil (radiogenic Os signature)
    - Sample 3 has a mantle signature (unlikely in the NCBSB). Simplest explanation is that the Os is sourced from metal associated with the coal.

3. Real World Research Examples

- Pyrite Re-Os Geochronology
  - The precise nature of this date (347 +/− 3 Ma) is consistent with a very diagenetic mineralization event for Lisheen.

- Osmium Isotope Tracing
  - Ocean anoxia events (OAE) can be found throughout geologic history, however their cause is often poorly understood. During these events, a large amount of organic material is often preserved and is often marked by an excursion in carbon isotope space.

- Environmental/Anthropogenic Tracing
  - Water/oil samples were collected from water source wells and oil wells.
  - During collection there were suspected signs of sample contamination.

4. Re-Os at UCD

- Goals/Philosophy for the UCD Re-Os Laboratory
  - UCD’s Re-Os group is relatively new (<5 years) and is interested in developing the lab into a well-recognized research facility.
  - Provide opportunities for students, researchers, and industry to acquire high-resolution and accurate Re-Os ages and isotope ratios.
  - Working towards these goals requires collaboration with established research labs and experts in the appropriate fields.

- Research Capabilities
  - Short-term Capabilities
    - Isotopic analysis of non-radiogenic sulfides (e.g. pyrite).
    - Isotopic analysis of organic-rich sediments (e.g. black shales).
    - Isotopic analysis of petroleum (e.g. crude oil).
  - Potential Future Development
    - Abundance analysis of water.
    - Isotopic analysis of water.
    - Isotopic analysis of highly radiogenic sulfides (e.g. molasses).