Earth Sciences Colloquium Series

Presents

Dr. Bruce Hart

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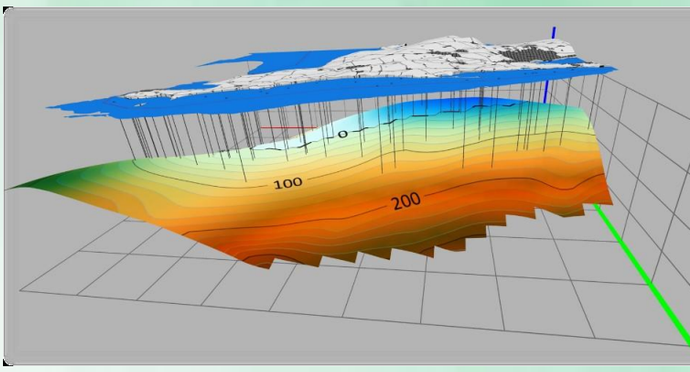
Date: Tuesday, January 16, 2024

Time: 1:30 PM

Location: BGS 1053



The Why, What, Who, When, and Where of Carbon Capture and Storage in Southern Ontario

The geological sequestration of CO_2 emitted from industrial point sources, carbon capture and storage (CCS), has been recognized by the IPCC as a potentially significant way of reducing atmospheric carbon dioxide levels and so mitigating the effects of humankind's activities on climate. The geologic repositories selected for CCS projects, of which there are many already in operation globally, need to have a certain combination of characteristics: a) they need to have adequate porosity and permeability to enable sufficient volumes of CO_2 to be sequestered at sufficient rates, b) they need to be at least 800 m below the ground surface to keep the CO_2 in a high-density/low-volume (supercritical) state, c) they need to have structural and stratigraphic characteristics that prevent the injected CO_2 from returning to the surface, and d) they need to be geomechanically stable (injecting the CO_2 will not induce seismicity). Portions of sedimentary basins having these characteristics can be defined as carbon-sequestration geosystems.

Southern Ontario has an urgent need to establish CSS hubs. Many of the heavy industries here produce materials (e.g., steel, concrete, plastics) that are needed to make the transition to low- or zero-carbon emission energy sources. They also are significant contributors to the local, provincial, and national economies and cannot easily be shut down without drastic social and political consequences. However, the federal government's plan to increase carbon prices by 2030 may force these industries to move elsewhere if CCS options are not available in Ontario by then.

Cambrian sandstones are buried to >800 m depth in this area and have porosity and permeability characteristics that could make them suitable repositories. Furthermore, CO_2 injected into these rocks will remain trapped for periods of at least several 1000 years. Faults, that could potentially be reactivated by injection-related stress-field perturbations, are present in some areas but are not common. While these factors are positive, heterogeneity/anisotropy is present at multiple scales in the Cambrian section and is mostly related to interbedding of sandstones and dolomites, a consequence of their shallow-marine depositional system. The extent to which this heterogeneity will affect CO_2 injection remains unclear and needs to be predicted via integration of geoscience and engineering data and concepts. Three areas along the north shore of Lake Erie represent the likely sites of CCS hubs, and pilot projects are likely to be established within the next 2 years.

Bruce Hart obtained his PhD in Geology from UWO in 1990 then worked for the GSC, Penn State, New Mexico Tech, McGill University, ConocoPhillips, and Equinor before returning to UWO in 2020. He was selected twice as the joint Distinguished Lecturer of the Society of Exploration Geophysicists and the American Association of Petroleum Geologists. Current research at UWO focuses on geoscience aspects of CCS in Southern Ontario and relationships between paleoenvironments and carbon burial in epicontinental seaways.

Western Science