



## 2023-24 CSEG Distinguished Lecture Tour

This national tour is sponsored by the Canadian Society of Exploration Geophysicists (CSEG) Foundation and presented by a distinguished member of the society. The goal of the tour is to promote the science and application of geophysics and to highlight a topic of current interest.

### Martyn Unsworth

#### 2023-2024 CSEG Distinguished Lecturer



Professor Martyn Unsworth is a faculty member in the Department of Physics / Earth and Atmospheric Sciences at the University of Alberta. His research focuses on the development of electromagnetic methods in geophysics. Applications in applied geophysics includes studies in mineral exploration, geothermal energy development and imaging permafrost. He has also used magnetotellurics extensively in investigations of plate tectonics, earthquake hazards and volcanoes. He received a BA in Natural Sciences (1986) and a PhD in Marine Geophysics (1991), both from the University of Cambridge. His postdoctoral research at UBC was focussed on the development of inversion methods for controlled source electromagnetic data. After working as a Research Professor at the University of Washington in Seattle, he joined the geophysics group at the University of Alberta in 2000.

### Magnetotellurics : Using natural radio waves to look inside the Earth

Geophysical exploration provides important information for resource exploration, studies of geohazards, and investigations into how the Earth works. Seismic exploration is the most widely used geophysical technique and is an invaluable tool for oil and gas exploration. However, no single geophysical technique can answer all questions about Earth structure. An alternative method uses low-frequency electromagnetic (EM) signals to image the electrical resistivity of the Earth. This rock property is sensitive to the presence of fluids and a number of economically important minerals. For more than a century, EM techniques have been applied in areas including hydrogeology, mineral exploration, and geothermal energy development. EM methods focused on near-surface exploration utilize signals generated with a transmitter. For deeper exploration it is most efficient to use magnetotellurics (MT) – an EM method that uses natural EM signals to image subsurface structure.

In this lecture, I will describe the physics of the MT method and outline its range of applications. This lecture will emphasize (1) how MT is now capable of working in 3-D to develop realistic models of subsurface resistivity (2) how MT is most effective when used in combination with other geophysical methods, and (3) introduce applications of societal relevance including include mineral exploration, volcanology, geothermal exploration, and tectonic studies.