

# Magnetotelluric (MT) Study

The AGS in cooperation with the University of Alberta will release a comprehensive investigation of deep-seated geological features using a geophysical method called a magnetotelluric (MT) study. This study included a survey of the Earth's natural electromagnetic field in northcentral Alberta. MT is a method that measures properties of electrical currents to generate 3-D models of geological features. In conjunction with other geological and geophysical data, this data may indicate conditions favourable for the location of kimberlites, which are the typical carriers of diamonds. Kimberlites originate from great depths of more than 150 km in the Earth's mantle. The results of the study including raw and interpretive data and maps, will be freely available on the AGS' website.

Previous MT data was sparse, and the existing 3-D model generated by the data had relatively coarse resolution. To address this issue, state-of-the-art MT monitoring stations were temporarily installed in an area that encompasses the

kimberlite fields known in the Buffalo Head Hills and Birch Mountains of Alberta during the fall of 2022. Each station recorded data for 48 hours and gathered information from the Earth's surface to depths of more than 100 km in the Earth's mantle. The station locations were designed on a geometrical grid. In some instances, the remote locations could only be accessed with a helicopter.

As a result of this new work, the 3-D model resolution will be greatly improved with the data collected from the additional MT stations. The MT data analysis was conducted using proven analytical techniques to determine the chemical properties. Other analytical tools will be used to interpret the 3-D resistivity models which helps to compare and explore electrical currents. Early analysis of the data has revealed a striking correlation of MT anomalies with the seismic anomalies in the region.

## Highlights

The MT survey is an environmentally friendly way to explore electromagnetic properties of rocks as it does not disturb the

In 2022, each temporary monitoring station recorded:

**48** hours of continuous data



Data was collected from **100** km and deeper into the Earth's mantle



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In 2022, MT stations recorded data in the Buffalo Head Hills (BH) and Birch Mountain (BM) regions of northern Alberta. The white squares in the map demonstrate locations where new data was collected.

### Tectonic Units

- Archean Hearne Province - Loverna Block
- Archean Hearne Province - Matzhiwin High
- Archean Hearne Province - Medicine Hat Block
- Archean Hearne Province - Vulcan Low
- Archean Rae Province
- Archean Slave Province
- Belts of mylonitic rock along Snowbird Tectonic Zone - Wabamun Domain
- Buffalo Head Lower Proterozoic Terrane
- Chinchaga Lower Proterozoic Terrane
- Great Bear continental margin magmatic arc (1.88-1.84 Ga)
- Hottah Lower Proterozoic Terrane
- Kiskatinaw domain
- Ksituan continental margin magmatic arc (1.98-1.9 Ga)
- Lake
- Lower Proterozoic metavolcanic metasedimentary rocks - Lacombe Domain
- Rimbey continental margin magmatic arc (1.85-1.78 Ga)
- Taltson continental margin magmatic arc (1.98-1.9 Ga)
- Thorsby Lower Proterozoic Terrane
- Kimberlites

### MT Sites

- Previous data
- Data collected in Summer 2022

