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Deep electrical structure of the Canadian Cordillera: A long period MT survey across the entire orogen

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The Canadian Cordillera in southwest Canada has been thoroughly investigated with electromagnetic induction techniques over the last forty years. However, none of these studies collected the long period magnetotelluric (MT) data needed to constrain upper mantle structures.

In 2003 and 2004, the University of Alberta used long period MT instruments to collect data at 63 stations on an 800 km profile that extended from Vancouver Island to east of the Rocky Mountains in Alberta. The instruments used fluxgate magnetometers at a typical spacing of 15 km. Six stations were collected on a second profile in Washington State to allow for investigations of 3-D effects due to the conductive sea water in the Strait of Georgia and Puget Sound.

The data set collected in 2003 above the Cascadia subduction zone has been analyzed more thoroughly and two dimensional inversion imaged the following features:

1. An east dipping conductor beneath Vancouver Island, similar to that detected with MT data in the 1980's. This conductor is coincident with a zone of high seismic reflectivity and low velocity. It is still not clear if these geophysical anomalies are located in the top of the subducted oceanic plate, within the over lying continental crust, or within the oceanic crust itself.

2. In the forearc, below the Strait of Georgia and Lower Mainland, increased conductivities are observed (30 Ohm.m). This feature is either located in the mantle wedge or represents an area of sub-crustal stacking, and is also characterized by the absence of a Moho discontinuity. The coincident low velocities and high conductivities may be due to water released from the underlying plate.

To the east, the MT inversion model shows the following:

1. The volcanic arc has a subdued conductivity signature, but from the Coast Range to the Rocky Mountains, enhanced conductivities are observed at mid and lower crustal depths, with some variations observed across the terrane boundaries.
2. The upper mantle east of the volcanic arc, appears to have an elevated conductivity, likely indicating a shallow asthenosphere.

In this presentation, data analysis and results from 2-D modeling investigations of the complete data set will be presented. The focus will be on the depth extent of the continental crustal conductor and its later variation across terrane boundaries.