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Geophysical Surveys for Mapping Shallow Permafrost on King George Island, Antarctica

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The application of geophysical methods to the study of permafrost depends on changes in the physical properties of earth material which occur with freezing of incorporated water and formation of varying amounts of ground ice. Electrical and seismic techniques are commonly used to study permafrost (Scott *et al.*, 1990).

During 94/95 austral summer season, electrical and reflection seismic surveys were carried out on the Barton Peninsula, King George Island for mapping shallow permafrost. Two reflection seismic profiles were obtained and the electrical surveys were conducted along the seismic lines.

Assessment of 2-D resistivity structures using 1-D successive sounding was applied for interpretation of sub-

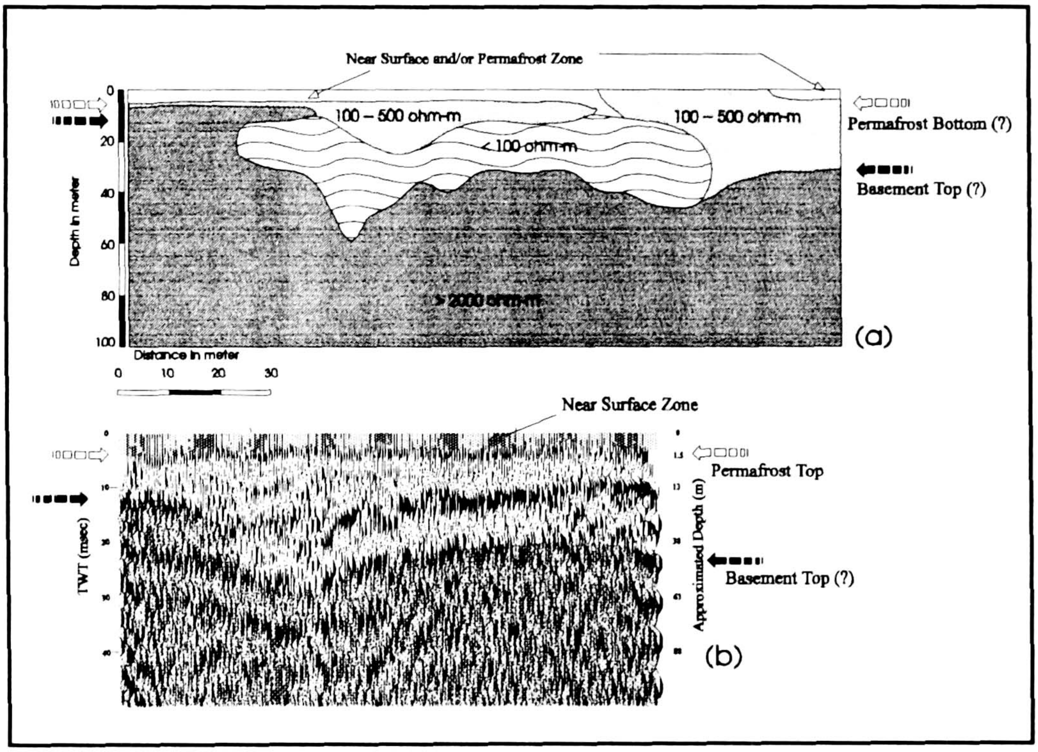

Fig. 1. The resistivity model and CMP stack secion of line B on Barton Peninsula, King George Island, Antarctica.
(a) Interpreted 2-D resistivity model using successive 1-D sounding results.
(b) Seismic CMP stack section the part of resistivity line.

surface permafrost structure. Even though the 2-D model, which is interpolated from series of 1-D resistivity layer structure, does not always reflect real suburface structure, it is a useful tool for interpretation of resistivity structure (Beard and Morgan, 1991). Fig. 1-(a) shows a preliminary result of resistivity model along line B in the survey area. The upper boundary of permafrost layer does not reveal resistivity section due to limit of our electrode array configuration but the lower boundary varies in depth from 5 to 10 m. The layers below the permafrost may be saturated of moistened with groundwater and the resistivety values of these layers are lower than 500 ohm-m. The resistivity values of the basement are higher than 2000 ohm-m in this area and the basement seems to be impermeable rocks, supported by this high resistivity.

Reflection seismic data have been processed to common mid-point (CMP) stack using standard procedures (Yilmaz, 1987). Fig. 1-(b) shows the CMP stack section of line B. The seismic profile shows the upper boundary of permafrost but the profile does not show the lower boundary of permafrost. In summer season, the thin top surface layer above permafrost has velocity and high resistivity since this area is mainly composed of gravel, boulder and soil which are not compact. This top layer, however, is not believed to exist in the same state throughout the year. The velocity contrast between the top surface layer and the underlying permafrost is distinct during the summer. The velocity of top layer is about 700 m/sec and that of the permafrost about 5,000 m/sec. On the other hand, it seems that the velocity of lower boundary of the permafrost changes gradually rather than abruptly. Seismic profile indicates geological boundaries which are consistent with resistivity model. We suggest that resistivity and reflection seismic methods can be useful tools for mapping permafrost in Antarctica if they are applied carefully.

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