Comparison of geophysical techniques to determine depth to bedrock in complex weathered environments of the Mount Crawford region, South Australia

Thesis submitted in accordance with the requirements of the University of Adelaide for an Honours Degree in Geophysics

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November 2013

THE UNIVERSITY of ADELAIDE

COMPARISON OF GEOPHYSICAL TECHNIQUES TO DETERMINE DEPTH TO BEDROCK IN COMPLEX WEATHERED ENVIRONMENTS OF THE MOUNT CRAWFORD REGION, SOUTH AUSTRALIA

GEOPHYSICAL COMPARISON OF BEDROCK DEPTH

ABSTRACT

Geophysical techniques have the ability to characterise the subsurface and define the depth to bedrock. The non-destructive nature and relatively cheap costs of geophysical surveying compared to drilling make it an attractive tool for subsurface analysis. Many studies have utilized geophysics to interpret soil features such as clay content, water content, salinity, textural properties and bulk density. Further work has been done to map the regolith-bedrock boundary. Previous work has been conducted in the Mount Crawford region using remote sensing based techniques to determine depth to bedrock. Comparisons between the effectiveness of different geophysical techniques at determining depth to bedrock have not previously been undertaken in similar environments. Fieldwork was undertaken along three transects chosen to represent different geological environments. Three geophysical apparatus were compared: Electrical Resistivity (ER), Frequency Domain EM (FDEM) and Ground Penetrating Radar (GPR). A simultaneous soil sampling program was conducted to provide ground truthing. The work in this study reveals the strengths and weakness of the three geophysical techniques at determining depth to bedrock in complex weathered environments of the Mount Crawford region, South Australia. The study reveals differences in the responses of the three geophysical techniques at each of the transects. The GPR was found to be largely unsuitable due to rapid attenuation of the signal. Resistivity and FDEM appeared to show similar variations in the models generated, with differences in the resolution and depth of investigation relating to intrinsic differences between the two systems. Qualitative analysis of the data suggests resistivity provides the strongest correlations with drill refusal depths. The FDEM appeared to display similar trends to the resistivity data and the system offers faster data acquisition, however the inverted model displays lower resolution. The data suggests that bedrock along the surveyed transects is highly weathered and relatively conductive compared to overlying regolith.

KEYWORDS

Bedrock, resistivity, DualEM, GPR, comparison, Mount Crawford, geophysics

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