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The use of geophysics in hydrological investigations by Tasmania Department of Mines

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Methods and equipment

Resistivity

Yokogawa Electrical Works, Model L-10 for shallow work to 200 feet, Model 3244 for deep work to 800 feet. Both very satisfactory instruments.

Seismic

Geospace GT-2A refraction seismic equipment. Adequate to 1000 feet.

Magnetic

Elsec Proton Precession magnetometer. Adequate.

Gravity

A Woden gravity meter is available if needed.

Borehole logging

Widco Porta-logger 1000 feet. Single point resistivity, SP and gamma ray. Limited facilities.

Geophysics in groundwater surveys

Mostly in Tertiary sediments in north and northeast Tasmania. Two areas of 200 and 140 square miles.

The aim of geophysics in any groundwater survey is to enlarge the knowledge of the geology of an area and enable boreholes to be sited where they will:

(i) gain most information, and

(ii) find most water.

As the purpose of the survey is to investigate the hydrogeology rather than to sink production bores the second is subordinate to the first.

Specifically, geophysical methods have been used to identify known water-bearing formations (Leaman, 1967); and to locate pre-Tertiary bedrock under Tertiary basin sediments (gravity, seismic and resistivity – Longford Basin; and seismic and resistivity, Scottsdale–Bridport area).

Problems encountered

In bedrock studies difficulties are often encountered because the bedrock is deeply weathered and is not easily distinguishable geophysically, in drill cuttings, or even in core from overlying sediments (e.g. Tertiary granodiorite-derived sediments from rotted Devonian granodiorite). This bedrock, as identified seismically, is often 100 feet or more deeper than the true bedrock surface.

Correlation and controls

By rotary drilled boreholes and cutting samples. Not wholly satisfactory, but aided by geophysical borehole logging. A cored hole is regarded as essential in Tertiary sediments.

Surveys are conventional and comprise three overlapping stages of geological mapping, geophysics, drilling and pump testing, carried through under the supervision of the same personnel and not divided between different sections.

Geophysics in dam site surveys

Equipment as above.

Seismic techniques are almost invariably used, even in preliminary stages. Magnetometer techniques are commonly used in basalt and dolerite areas, which are widespread in the State. Resistivity surveys are used for the location of faults.

Aims

To correlate with geological findings, locate dolerite rock-fill reserves and solid rock for abutments.

Problems

Usually connected with dolerite which weathers very irregularly. This makes the interpretation of seismic and magnetic results difficult. Geophysical techniques are useful for boundary definition in both dolerite and basalt.

Correlation and controls

By subsequent diamond drilling.

Reports are usually for internal circulation and few have been published, while others only exist as manuscripts.

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