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TECHNICAL NOTE #98/10
Actual Case of the
Measurement of Conductivity using the GCM-2

1. Introduction

As a general principle, to aid in the interpretation of geophysical survey data, measurements of the physical properties of rocks from the particular study area should be made, where possible.

In particular, measurements of electrical conductivity should be made for the full interpretation of electromagnetic and resistivity surveys. The Geo Instruments hand-held conductivity meter, model GCM-2, is especially designed for this purpose. It measures conductivity inductively and resistivity galvanically (by probe contact) of rock and mineral specimens, both in hand samples and drill core and of fresh rocks and ores at the mine face.

(See the GMS-2 data sheet for further details and specifications).

2. Case-Study of the Measurement of Drillcore

As part of a study carried out by Geo Instruments of the Burraga Mine site in NSW following a helicopter electromagnetic survey (HEM)† , Mike Smith of Geo Instruments located relevant core at the NSW Dept. of Mineral Resources Core Library (see photo # 1 attached) and measured it using the GCM-2 and the appropriate sensor for the size of core. Photo #2 illustrates the set-up.

The required readings were stored in memory and the store position was noted against the type of mineralisation and the depth from which the core was taken. In this case the piece of core to be measured was lifted up away from the core tray which was a metal one and therefore itself conductive. Had this not been done the readings would not be of the core only but include some effect of the metal tray as well and therefore be erroneous. Note: plastic core trays, which are becoming more common because of other advantages (lighter and non corrosive), will not cause this disturbance but until a half circle sensor is available the core still has to be lifted out to be able to place the full circle sensor around it.

For a good reading, the core should not be held as it is in Photo No. 2, as fingers and arms are conductive and will falsely increase the value by a few S/m.

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†Paper entitled: Recent Results from the Latest Developments in Towed Boom HEM Systems by Smith, M., Henderson, R. and Rangott, M., 1998, presented at the 13th ASEG Conference and Exhibition, Hobart, Tasmania, November 1998.

To avoid false readings due to the sensor detecting the ends of the core, the minimum length of core should be 3-5 times the width of the coil sensor. The greater length applies if the conductivity is low, as in this case the sensor is able to detect further.
If the core is not a full cylinder, that is part is broken off just at the place that needs to be measured, then an estimate should be made of the percentage volume that is present (some value less than 100%) and the reading divided by this number to get an approximate value.

If the core has been split in half then the flat plate sensor could be used on the cut surface. However, this will also not give an exact value if the core is of such small diameter that the plate sensor can detect the other (round) side of the core. Again this depends on the conductivity with low conductivity cores being more likely to give erroneous values. Thus unless the split core is of diameter 63.5mm or greater, or it is very conductive if less, then the value will be incorrect.

In all these cases of possibly inexact measurements, at least the readings can be relative if all other conditions are equal, and are therefore still useful in identifying anomalous zones and ones say more likely to be related to anomalous borehole measurements or the source of surface EM anomalies. As an example of this, Mr Smith measured values of over 1000 times the value of the host rock in a narrow zone at the very depth in a drill hole where a borehole EM surface gave a strong sharp response. This zone was, on inspection of the core, a narrow vein of pyrrhotite, a very conductive mineral. Thus the cause of the borehole result was determined from the relative change in level and regardless of whether the values were exact.

In general, Mr Smith wished to determine the values of conductivity for the mineralisation and the country rock at Burraga so that the contrast in values could be applied to the interpretation of the HEM survey and also if possible to identify which mineralisation was causing the HEM anomalies. By measuring many samples of each type of rock he obtained the following general averages.

Rock type	**Conductivity in Siemens/m**
Sediments	0 -10
Basic dyke	3
Massive pyrite	8 - 1540
Pyrrhotite veins	2,000 - 7,000

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Photo No. 1   Burraga Core at NSW Government Core Library

Photo No. 2   Measurement set-up with GCM-2 and appropriate sensor

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