NON-LINEAR CONDUCTION IN SULPHIDES

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A search for an exploration technique that was unique to sulphides, i.e. did not respond to graphite, clays and other polarisable materials, lead to the investigation of non-linear conduction in sulphides.

Early work in the 1960s indicated that non-linear effects were only detectable at high current densities, such as those found in borehole surveys.

When currents of two different frequencies are passed through a non-linear network, the resultant output contains the original two frequencies, harmonics of the two frequencies, and inter-modulation products of the two frequencies.

If the non-linearity arises at the semiconductor interface or junction then adding a direct current bias should increase the non-linearity to the extent it could be used in the field under normal field current densities of around 1.0μA/cm2. Work by previous investigators found the DC bias increased the effect 3 to four-fold.

Test work on core in the laboratory indicates that the effect is detectable at field current densities, although the measured inter-modulation products are 3 orders of magnitude less than the primary signal.

At CSIRO, recent laboratory based reinvestigation into non-linear properties of sulphides has been undertaken with a view towards field application. This study used modern electronics and signal processing to ascertain if this system could be viable in the field.

This presentation highlights some of the history, theory and problems associated with using non-linear conduction in sulphide mineralisation as an exploration tool.