A New Generation of 3-D and 4-D Electromagnetic Instrumentation

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The "System 2000" introduced in 1997 is a distributed 24-bit electromagnetic measurement system with an effectively unlimited number of channels. The first installations incorporated the well-known tensor MT (Magnetotelluric) technique. Tensor MT is an information-rich, wide band, deep-looking EM technique (using natural source fields) which can provide an image of the Earth's conductivity structure from near surface to as deep as the bottom of the lithosphere. Variants are called AMT (Audiofrequency, 1 Hz to 10,000 Hz); MT (approx. 1/2000 Hz to 400 Hz); and Long Period MT (approx. 1/30,000 Hz to 1 Hz). The longer the period, in general, the greater the depth of investigation.

All variants previously were affected by spatial under sampling due to high cost. The System 2000 architecture solves this problem by reducing cost, permitting optimal spatial sampling density on a routine basis. Such spatially dense grids of measuring points are denoted “3-D”. The System 2000 has been used for 3-D MT (and controlled source) exploration surveys for oil and gas, deep metal deposits, and geothermal resources in Canada, Japan, Hungary, China, Philippines, Italy, etc.

Repetitive 3-D measurements at the same measuring points are denoted “4-D MT” and are used to image the slowly changing conductivity structure of a geothermal reservoir under production.

Another variant of 4-D MT uses fixed permanent locations (observatories) or temporary stations near active faults (Japan, Turkey) to research deep resistivity changes often observed before earthquakes