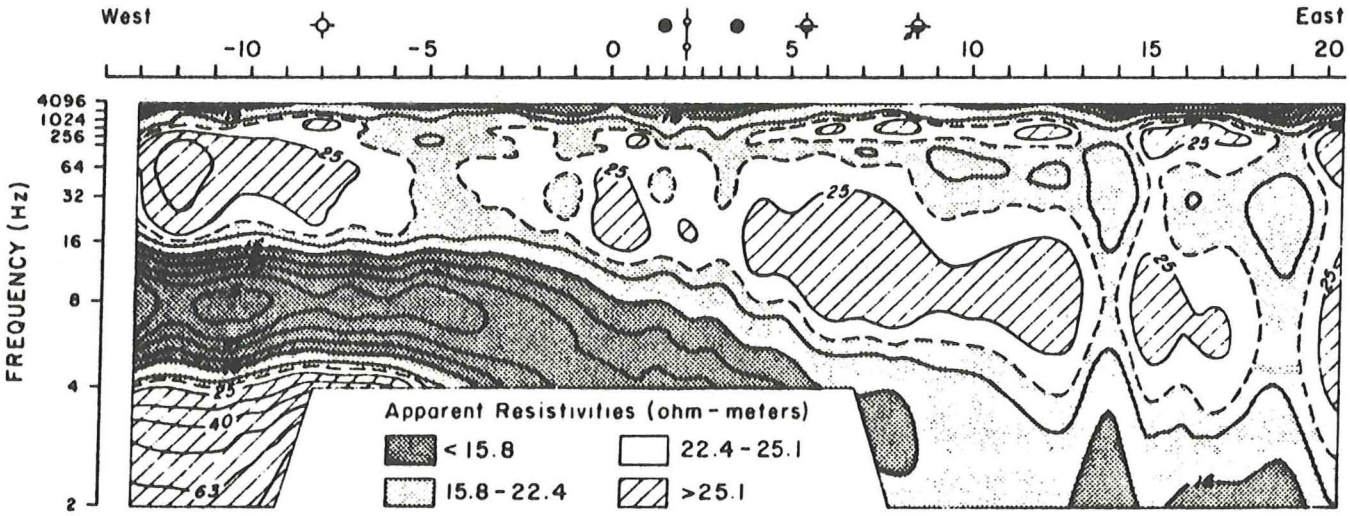
Petroleum Exploration With Electrical Geophysics

GL03306 4of8

Cost-Effective Supplement to Seismic and Geologic Exploration Programs



ZONGE ENGINEERING & RESEARCH ORGANIZATION, INC.

Zonge Engineering offers a number of electrical geophysical techniques which are effective in mapping structure and lithology on a reconnaissance or detailed basis. Electrical can serve as a valuable support for active seismic and geologic exploration programs. Some specific applications include:

* Inexpensive reconnaissance mapping of structure and lithology prior to seismic coverage
* Structure and lithology mapping in "difficult" areas such as those with thick volcanic overburden, severe surface weathering, complex overthrust areas, multiple carbonate or volcanic reflectors, etc.
* Joint interpretation with other data to help in statics corrections, migration, and lithologic interpretation
* Lower-cost alternatives to MT
* Detection of potential seismic problems, such as clinkers and volcanic lenses
* Mapping electrochemical alteration in near-surface sediments due to upward petroleum migration from some reservoirs
* Research into the possible polarization response of petroleum, effects of pyrite and clays on logging, etc.

In addition to exploration applications, electrical techniques are well suited to petroleum engineering purposes:

* Monitoring the progress of steam-flooding and other secondary recovery operations
* Mapping and monitoring groundwater contamination due to spills and leaks from injection wells, refineries, tanks, pipelines, storage facilities, transportation accidents, etc.

Field surveys may be conducted on the surface or in combination with in-hole probes. Applications vary from quick area reconnaissance to fairly detailed mapping, with an emphasis on techniques which best complement seismic techniques.

Zonge Engineering employs a number of versatile electrical techniques:

* Controlled source audio-frequency magnetotellurics (CSAMT) --- detailed electrical sounding at one tenth the per-station cost of MT and one-third to one-fifth the line-mile cost of seismics; useful in nearly any application for exploration, secondary recovery, or environmental purposes
* Induced polarization (IP) --- Schlumberger, Wenner, or dipole-dipole arrays; time or frequency domain; useful for structure and alteration mapping
* Complex resistivity (CR) --- multi-frequency IP for detailed mapping and research; relatively expensive but effective; discrimination of certain types of minerals; surface, downhole logging, laboratory core measurements
* Transient electromagnetics (TEM) --- medium-cost; used for mapping geology and structure, and for joint interpretation with MT and CSAMT data for making statics corrections

Zonge Engineering has extensive experience in the application of electrical techniques to petroleum exploration and development. Since its founding in 1972, the company has been employed by a number of energy companies for oil and gas exploration and for other energy-related and geotechnical projects. Our state-of-the-art instrumentation and interpretation techniques are oriented toward practical, multi-disciplinary exploration.

We would be happy to assist you in evaluating the application of electrical geophysics to your project. Please write or call for details on available spec data, copies of published papers, case histories, or other information.

SPECIALISTS IN ELECTRICAL GEOPHYSICS

Field Surveys
Electrical Spec Data
Geophysical Consulting
Instrumentation Sale and Lease

Zonge Engineering & Research Organization, Inc.
3322 East Fort Lowell Road, Tucson, Az. 85716 USA
Phone: (602)327-5501 * Telex: 165532 CEERHO TUC

Zonge Engineering Australia Pty., Ltd.
Adelaide Business Centre, 242 Glen Osmond Road
Fullarton, S.A. 5063 Australia
P.O.Box 180, Eastwood, S.A. 5063 Australia
Phone: (08)338-1559 * Telex: AA88713 ABCENT