

UR1973-44

Introduction to geophysical literature.

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For those new to geophysics there is always the problem of where to look for a simplified treatment of methods and their interpretation. For those more advanced the problem becomes one of needing good references dealing with method problems, technique and physical basis. The material below provides for all levels. The listing is not exhaustive but should serve as an introduction to more particular references. The most useful references are preceded by †.

GENERAL TEXTS

There are a number of excellent books available which provide an outline of methods, use and interpretation.

- DOBRIN, M.B. 1960. *Introduction to geophysical prospecting*. McGraw-Hill : New York. 446pp.
- †GRANT, F.S.; WEST, G.F. 1965. *Interpretation theory in applied geophysics*. McGraw-Hill ; New York. 583pp.
- †HEILAND, C.A. 1940. *Geophysical exploration*. Prentice-Hall : New York. 1013pp. [Reprinted 1963, Hafner : New York].
- HOWELL, B.F. 1959. *Introduction to geophysics*. McGraw-Hill : New York. 399pp.
- †NETTLETON, L.L. 1940. *Geophysical prospecting for oil*. McGraw-Hill : New York. 444pp.
- †PARASNIS, D.S. 1962. *Principles of applied geophysics*. Methuen : London. 176pp.
- PARASNIS, D.S. 1966. *Mining geophysics*. Elsevier : Amsterdam. (Methods in Geochemistry and Geophysics 3). 356pp.

MAGNETIC METHODS

General approaches to magnetic surveys are given in the basic texts. The important problem of remanent magnetism is discussed by Grant and West, 1965, *op.cit.*

- GREEN, R. 1960. Remanent magnetization and the interpretation of magnetic anomalies. *Geophys.Prosp.* 8:98-110.
- ZIETZ, I.; ANDREASEN, G.E. 1967. Remanent magnetization and aeromagnetic interpretation, in: *Mining geophysics*, 2:569-590. Society of Exploration Geophysicists : Tulsa.

Some simple approaches to interpretation are given by:

- PETERS, L.J. 1949. The direct approach to magnetic interpretation and its practical application. *Geophysics* 14:290-320.
- SMITH, R.A. 1959. Some depth formulae for local gravity and magnetic anomalies. *Geophys.Prosp.* 7:55-63.
- SMITH, R.A. 1961. Some theorems concerning local magnetic anomalies. *Geophys.Prosp.* 9:399-410.

Relation of susceptibility and percentage of iron

- BALSLEY, J.R.; BUDDINGTON, A.F. 1958. Iron-titanium oxide minerals, rocks, and aeromagnetic anomalies of the Adirondack area, New York. *Econ.Geol.* 53:777-805.

Computer matching

- McGRATH, P.H.; HOOD, P.J. 1970. The dipping dike case: a computer curve-matching method of magnetic interpretation. *Geophysics* 35:831-848.

GRAVITY METHODS

The basic texts and the following give good summaries of reductions and general technique (see Parasnis, 1962, *op.cit.*):

- GARLAND, G.D. 1965. *The Earth's shape and gravity*. Pergamon Press : Oxford. 183pp.
 HEISKANEN, W.A.; VENING MEINESZ, F.A. 1958. *The Earth and its gravity field*. McGraw-Hill : New York. 470pp.

Use of gravity methods in ore assessments

- HINZE, W.J. 1966. The gravity method in iron ore exploration, in: *Mining geophysics*, 1:448-464. Society of Exploration Geophysicists : Tulsa.
 PARASNIS, D.S. 1966. (*op.cit.*).
 SUMNER, J.S.; SCHNEPFER, R.N. 1966. Underground gravity surveying at Bisbee, Arizona in: *Mining geophysics*, 1:243-251. Society of Exploration Geophysicists : Tulsa.

Some calculations on local ores have been given by:

- LEAMAN, D.E. 1971. Application of gravity methods to mineral exploration. *Tech.Rep.Dep.Mines Tasm.* 16:110-112.

The problems of elevation control and terrain correction are discussed in detail (and tables are provided) by:

- DARBY, F. 1970. Barometric heighting - an assessment of the accuracy achieved during reconnaissance gravity surveys in Australia. *Rec.Bur.miner. Resour.Geol.Geophys.Aust.* 1970/89.
 DOUGLAS, J.K.; PRAHL, S.R. 1972. Extended terrain correction tables for gravity reductions. *Geophysics* 37:377-379.
 †HAMMER, S. 1939. Terrain corrections for gravimeter stations. *Geophysics* 4:184-194.

Basic interpretation methods are described by Nettleton, 1940, *op.cit.*; Parasnis, 1962, *op.cit.*; Dobrin, 1960, *op.cit.*, and

- BOTT, M.H.P.; SMITH, R.A. 1958. The estimation of the limiting depth of gravitating bodies. *Geophys.Prosp.* 6:1-10.
 †LONGMAN, M.J.; LEAMAN, D.E. 1971. Rapid numerical evaluation of two-dimensional gravity profiles. *Geophys.Prosp.* 19:265-273.
 NETTLETON, L.L. 1942. Gravity and magnetic calculations. *Geophysics* 7:293-310.
 SKEELS, D.C. 1963. An approximate solution to the problem of maximum depth in gravity interpretation. *Geophysics* 28:724-735.

SEISMIC METHODS

Good summaries of field usage and interpretation techniques have been given by †HEILAND, 1940, *op.cit.*, and †Nettleton, 1940, *op.cit.*, (the latter gives details of time delay analysis) and

- GEYER, R.A. (ed.). 1959. *Lessons in seismic computing*. Society of Exploration Geophysicists : Houston. 268pp.
 †HAWKINS, L.V. 1961. The reciprocal method of routing shallow seismic refraction investigations. *Geophysics* 26:806-819.
 MUSGRAVE, A.W. (ed.). 1967. *Seismic refraction prospecting*. Society of Exploration Geophysicists : Tulsa. 604pp.

RESISTIVITY

Basic texts include Howell, 1959, *op.cit.*, and

- †BHATTACHARYA, P.K.; PATRA, H.P. 1968. *Direct current geoelectric sounding*.

- C/O
- Elsevier : Amsterdam. (Methods in Geochemistry and Geophysics 9). 135pp.
†KELLER, G.V.; FRISCHKNECHT, F.C. 1966. *Electrical methods in geophysical prospecting*. Pergamon Press : Oxford. (International Series of Monographs on Electromagnetic Waves 10). 517pp.
KUNETZ, G. 1966. *Principles of direct current resistivity prospecting*. Borntraeger : Berlin. (Geoexploration Monograph (1) 1). 103pp.

Details of various arrays may be found in the above and in U.S. Geological Survey Bulletins 1313B, C and
HABBERJAM, G.M. 1972. The effects of anisotropy in square array resistivity measurements. *Geophys.Prosp.* 20:249-266.
†HABBERJAM, G.M.; WATKINS, G.E. 1967. The use of a square configuration in resistivity prospecting. *Geophys.Prosp.* 15:445-467.
KELLER, G.V. 1966. Dipole method for deep resistivity studies. *Geophysics* 31:1088-1104.

Interpretation methods

- LEAMAN, D.E. 1973. Computation of four layer resistivity curves using a small computer. *Tech.Rep.Dep.Mines Tasm.* 16:113-124.
MOONEY, H.M.; ORELLANA, E.; PICKETT, H.; TORNHEIM, L. 1966. A resistivity computation method for layered earth models. *Geophysics* 31:192-203.
ORELLANA, E. 1963. Properties and drawings of the so-called Dar Zarrouk curves. *Geophysics* 28:99-110.
ZOHDY, A.A.R. 1965. The auxiliary point method of electrical sounding interpretation, and its relationship to the Dar Zarrouk parameters. *Geophysics* 30:644-660.

Schlumberger Type Curves (EUROPEAN ASSOCIATION OF EXPLORATION GEOPHYSICISTS, 1955).

Curves may be affected by ground problems, layer variations.

- LEAMAN, D.E. 1974. Use of deep resistivity probes in basalt-covered Tertiary basins. *Tech.Rep.Dep.Mines Tasm.* 17.
TOPFER, K.D. 1972. Schlumberger measurements over undulating structures (model structures). *Geoexploration* 10:41-51.

INDUCED POLARISATION

An outline of the theory of IP methods is given in the basic texts (e.g. Parasnis, 1966, *op.cit.*) and some other papers. It is by no means established - see for example:

- NILSSON, B. 1971. A new combined resistivity- and induced polarization-instrument and a new theory of the induced polarization-phenomenon. *Geoexploration* 9:35-54.

An appraisal of the various types of configuration and techniques are given by the following authors:

- BERTIN, J. 1968. Some aspects of induced polarization (time domain). *Geophys.Prosp.* 16:401-426.
DATTA, S.; DEY, S.S. 1970. An equipment for induced polarisation measurements and some field results. *Geoexploration* 8:87-96.
HALLOF, P.G. 1961. *Variable frequency induced polarization data compared with drilling results at four properties*. McPhar Geophysics : Don Mills. [Reprinted from the *Northern Miner*].
HALLOF, P.G. 1965. *The proper choice of frequencies for induced polarization measurements*. McPhar Geophysics : Don Mills. [Reprinted from SEG Annual Meeting, Dallas, 1965].

- HALLOF, P.G. 1966. A comparison of variable frequency IP results with Turam electromagnetic conductors, *in: Mining geophysics*, 2:172-178. Society of Exploration Geophysicists : Tulsa.
- HALLOF, P.G. 1967. *An appraisal of the variable frequency IP method after twelve years of application*. McPhar Geophysics : Don Mills. [Reprinted from Symposium on Induced Polarization, Berkeley, California, 1967].
- KOMAROV, V.A. 1967. The importance of induced polarization method for the exploration of ore deposits. *Econ.Geol.Rep.geol.Surv.Can.* 26:138-147.
- LEE, T.; GREEN, R. 1972. The depth location by a induced polarization of a target equivalent to a simple induced dipole in a semi-infinite homogeneous medium. *Geoexploration* 10:109-114.
- MADDEN, T.R.; CANTWELL, T. 1967. Induced polarization, a review, *in: Mining geophysics*, 2:373-400. Society of Exploration Geophysicists : Tulsa.
- NEWTON, A.W.; SMITH, M.J.; McSHARRY, P.J.; EMERSON, D.W. 1972. Laboratory measurements of electrical resistivity polarization and phase angle spectra of sulphide bearing rocks from Captain's Flat, N.S.W. *Bull.Aust.Soc.explor.Geophys.* 2(4):49-69.
- OMNES, G. 1970. *Induced polarization role in mining geophysics. Application to exploration on low resistivity overburdens*. Compagnie Générale de Géophysique.⁴
- SEIGEL, H.O. 1967. The induced polarization method. *Econ.Geol.Rep.geol.Surv.Can.* 26:123-137.
- SHALLEY, M.J. 1972. A cost probability approach to induced polarization in Australia. *Bull.Aust.Soc.explor.Geophys.* 2(4):25-33.
- WAGG, D.M.; SEIGEL, H.O. 1963. Induced polarization in drill holes. *Can.min.J.* 84:54-49.

SELF POTENTIAL

A good treatment is given by Parasnis, 1966, *op.cit.*, and Nilsson, 1971, *op.cit.*

APPLIED POTENTIAL

See Parasnis, 1966, *op.cit.*, and
 KETOLA, M. 1972. Some points of view concerning mise-à-la-masse measurements. *Geoexploration* 10:1-21.

ELECTROMAGNETIC SURVEYS

The best available summary is given by:
 WARD, S.H. 1967. The electromagnetic method, *in: Mining geophysics*, 2:224-372. Society of Exploration Geophysicists : Tulsa.

GEOHERMAL SURVEYS

An introduction to practical techniques and value of geothermal surveys if provided by Howell, 1959, *op.cit.*, and
 LEAMAN, D.E. 1973. Use of geothermal methods in Tasmania. *Bull.Aust.Soc.explor.Geophys.* 4(2).

Other information and examples are given in the following references. The technique of shallow exploration is new and not well understood.
 CARTWRIGHT, K. 1971. Redistribution of geothermal heat by a shallow aquifer. *Bull.geol.Soc.Am.* 82:3197-3200.
 GEERTSMA, J. 1971. Finite element analysis of shallow temperature anomalies. *Geophys.Prosp.* 19:662-681.
 KRUMAR, B.; MASIN, J. 1970. Prospecting by the geothermic method. *Geophys.Prosp.* 18:255-260.

POLEY, J.P.; STEVENINCK, J. van 1970. Delineation of shallow salt domes and surface faults by temperature measurements at a depth of approximately 2 metres. *Geophys.Prospect.* 18:666-699.

SPECTROMETRY

New techniques of multi-spectral airborne analysis are described by: MOXHAM, R.M.; FOOTE, R.S.; BUNKER, C.M. 1965. Gamma-ray spectrometer studies of hydrothermally altered rocks. *Econ.Geol.* 60:653-671.
TEXAS INSTRUMENTS n.d. *Digital airborne gamma ray spectrometry. Outline of method, equipment and calibration.*

Logging

A good summary of logging and an introduction to all interpretive literature is given by:

EMERSON, D.W.; HAINES, B.M. 1972. *The interpretation of geophysical well logs in water bores in unconsolidated sediments.* Handbook of well log analysis, Vol. 2. Australian Water Resources Council (Project 68/7 Report, Draft).

WYLLIE, M.R.J. 1963. *The fundamentals of well log interpretation.* Academic Press : New York. 238pp.

PIEZOELECTRIC METHODS

LEAMAN, D.E. 1974. Tests of piezoelectric methods, Lefroy goldfield. *Tech. Rep.Dep.Mines Tasm.* 17.

PARKHOMENKO, E.I. 1971. *Electrification phenomena in rocks.* Plenum Press : New York. (Monographs in Geoscience). 285pp.

TELLURIC METHODS

See Keller and Frischknecht, 1966, *op.cit.*

[18 June 1973]