Induced Polarisation Method

Disclaimer:

This presentation is a part of the assignment for MSc III Semester Mineral Exploration theory paper. This is an attempt to enable the students to collect and review the literature, prepare powerpoint presentation and present the work, independently. The data and literature used here has been taken from various sources, and duly acknowledged. This can help as a guideline, and should not be treated as final.

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**Presented by-**

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CONTENT

- Introduction.
- Equipments.
- Basic Theory.
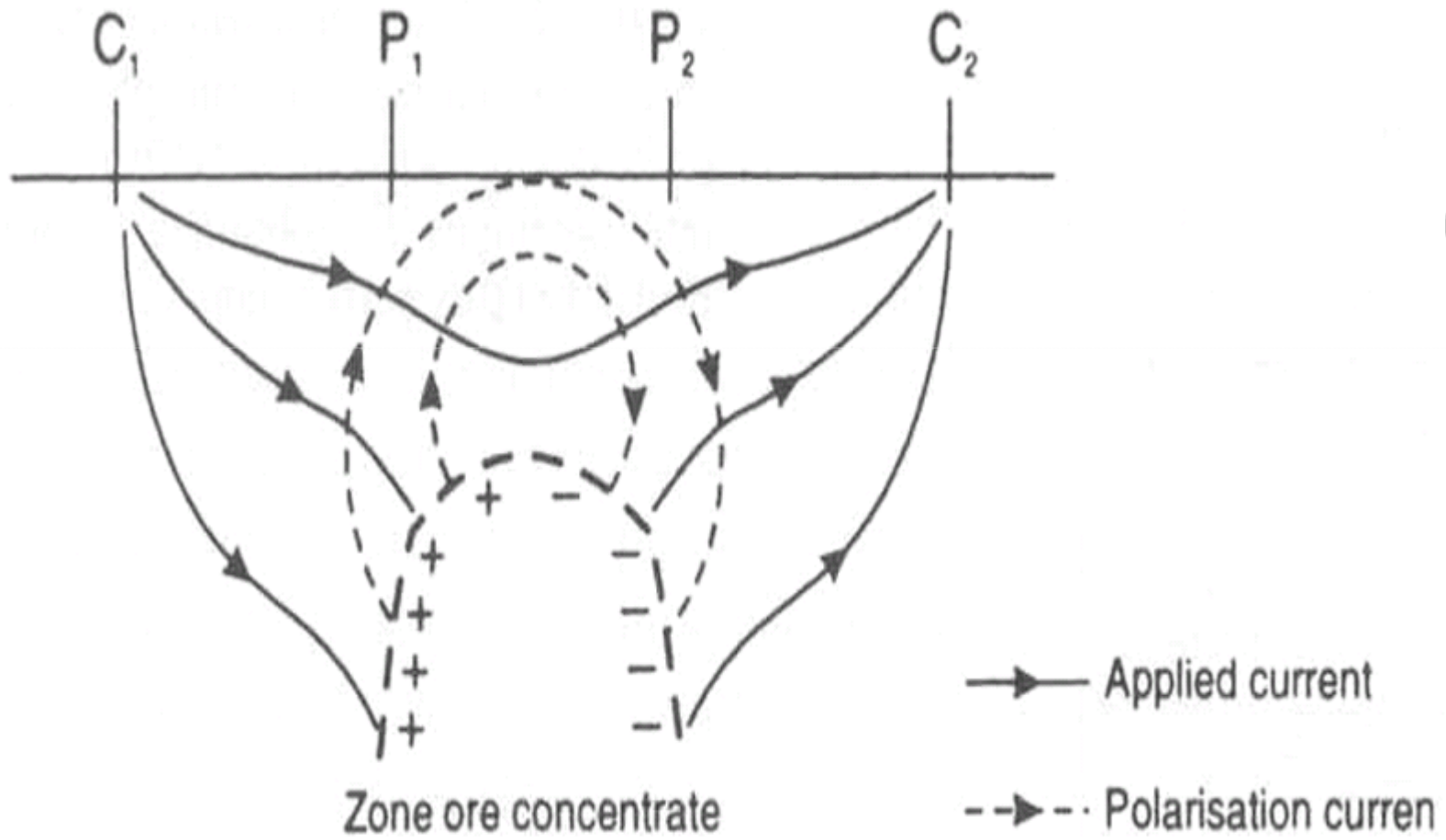- Method
- Field Process
- Application

INTRODUCTION

- Induced polarization is a geophysical imaging technique used in identify the electrical chargeability of subsurface materials such as ore bodies.

- This is used in method to surveying the ore bodies which come under electrical method.

EQUIPMENTS
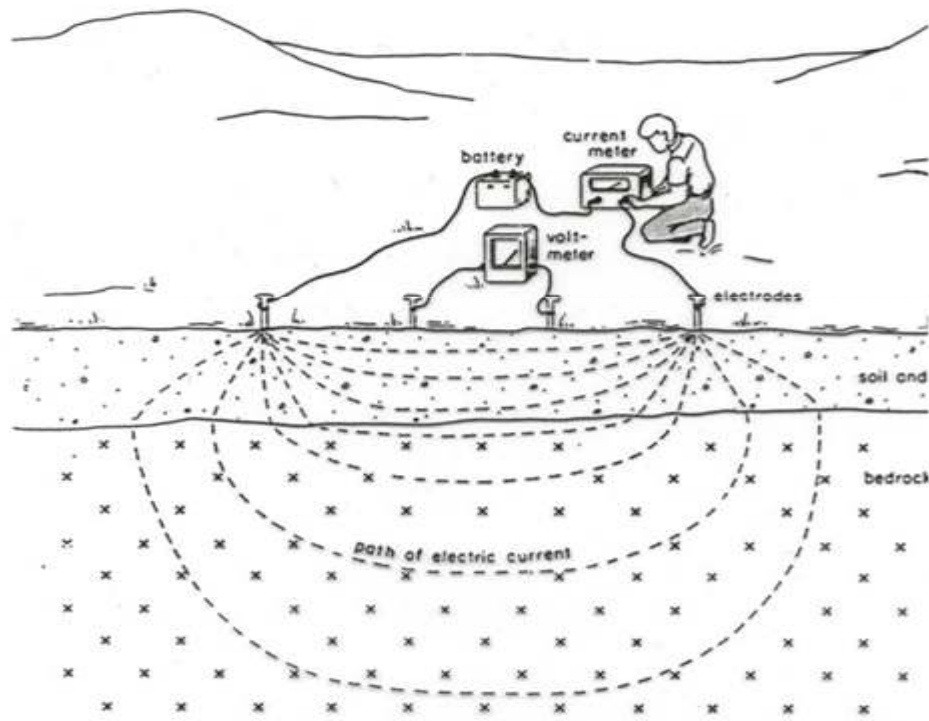
- Current meter(C)

- Voltmeter(P)

- Electrodes(4)

- battery

C₁   P₁   P₂   C₂

Zone ore concentrate

→ Applied current

--→-- Polarisation curren

BASIC THEORY

- The induced polarization method makes use of the capacitive action of the subsurface to locate zones where clay and conductive minerals are disseminated within their host rock.

- IP method is most suitable for detecting disseminated ore deposits which may otherwise be missed by inductive methods(resistivity method).

- Induced polarization method may also be used for locating water bearing aquifers.

Tx

Rx

ORE BODY

—— Primary magnetic field   .... Secondary magnetic field

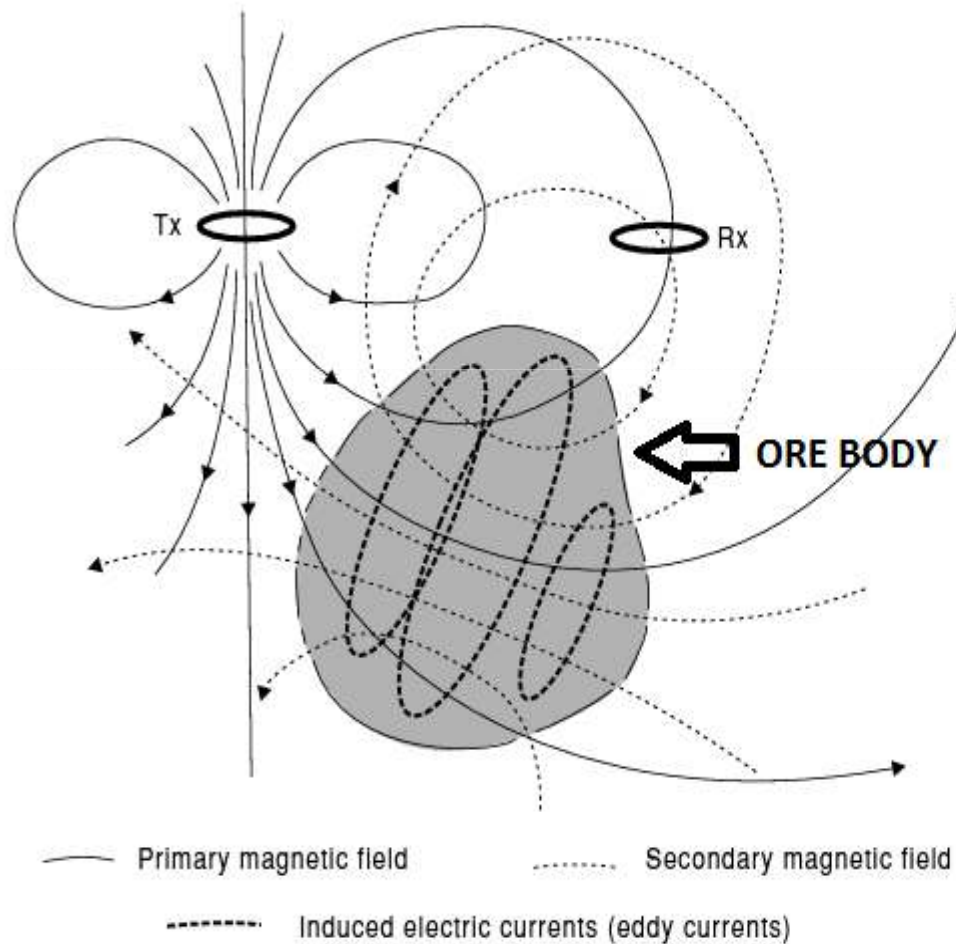- - - - - Induced electric currents (eddy currents)

FIG. 7.11   Schematic of an electromagnetic prospecting system. The transmitter (Tx) and receiver (Rx) coils are horizontal and co-planar. They may also be described as "vertical dipoles," referring to the magnetic field produced. The system is said to be "maximum-coupled" because the primary field is at right angles to the plane of the receiver coil where it passes through it. In ground surveys this system is sometimes denoted by the Swedish term *Slingram*. The currents induced in the conductor generate an alternating magnetic field that opposes the primary (transmitted) field, and hence produces a negative anomaly maximum (see Fig. 7.1c). (Drawing based on Grant & West 1965.)
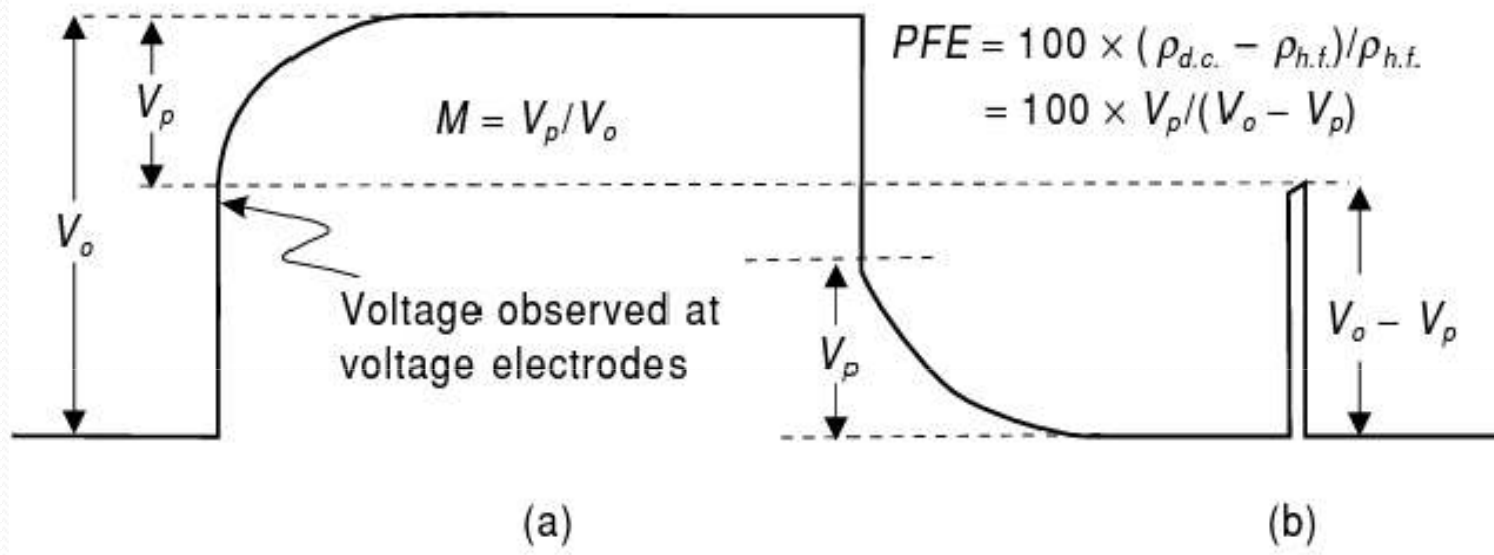
METHOD

This method is divided into two types are following-

1. TIME DOMAIN IP- Time domain IP method measure considers the resulting voltage following a change in the injected current. The time domain IP potential response can be evaluated by considering the mean value on the resulting voltage.

$$M_a = \frac{1}{V_0} \int_{t_1}^{t_2} V(t)\, dt$$

M_a is the apparent chargeability in milliseconds (ms)

$$PFE = 100 \times (\rho_{d.c.} - \rho_{h.t.})/\rho_{h.t.}$$
$$= 100 \times V_p/(V_o - V_p)$$

V_p

$M = V_p/V_o$

V_o

Voltage observed at voltage electrodes

V_p

$V_o - V_p$

(a)

(b)

Voltage applied at current electrodes (reduced vertical scale)

2. Frequency domain IP- Frequency domain IP method use alternating current(AC) to induce electric charges in the subsurface, and the apparent resistivity is measured at different AC frequencies.
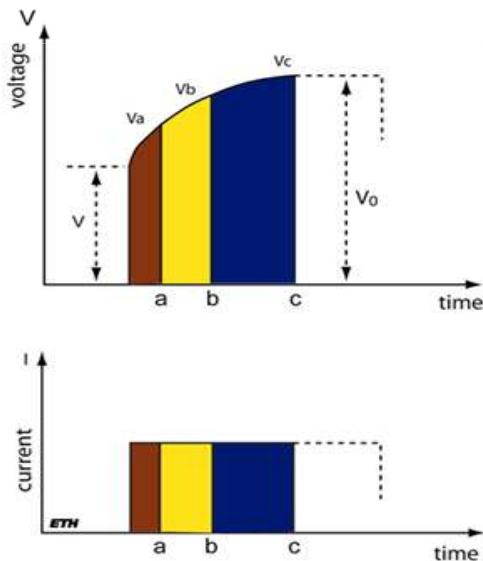
$$FE = 100 \frac{\rho_{aDC} - \rho_{aAC}}{\rho_{aAC}}$$

FE is the percent frequency effect (in %)

ρ_{aDC} is the apparent resistivity mesured at low frequency (0.05-0.5 Hz)

ρ_{aAC} is the apparent resistivity mesured at higher frequency (1-10 Hz)

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APPLICATION

- **Exploration of metalliferous mineral deposits.**

- **Clay location for hydrogeological survey.**

- **Mapping electrochemical reaction for pollutants in the ground.**