CONCORSO PUBBLICO, PER ESAMI, A N. 1 POSTO DI CATEGORIA D POSIZIONE ECONOMICA D1, AREA TECNICA, TECNICO-SCIENTIFICA ED ELABORAZIONE DATI, PER LE ESIGENZE DEL DIPARTIMENTO DI SCIENZE DELLA TERRA, DELL'AMBIENTE E DELLE RISORSE (DISTAR) DELL'UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II (COD. RIF. 2002) INDETTO CON DECRETO DEL DIRETTORE GENERALE N. 441 DEL 30.06.2020 E PUBBLICATO SULLA G.U. IV SERIE SPECIALE – CONCORSI ED ESAMI – N. 53 DEL 10.07.2020

GRUPPO DOMANDE NON ESTRATTE PROVA ORALE DEL 22/09/2020

- ✓ Il candidato illustri le principali tecniche di indagine geofisica, sia in sito che di laboratorio, per lo studio della stabilità dei versanti in ambito piroclastico.
- ✓ Il candidato illustri la procedura per la preparazione, esecuzione e gestione di una prova edometrica ed i parametri determinabili.
- ✓ Il candidato illustri le modalità di esecuzione delle principali tecniche di indagine geofisica per l'individuazione di cavità sotterranee.
- ✓ Il candidato illustri come è possibile gestire, rappresentare e analizzare dati di una prova di taglio diretto in ambiente Excel.
- ✓ Il candidato illustri le caratteristiche degli elettromagnetometri ad induzione elettromagnetica multifrequenza e i loro vantaggi rispetto ad apparati a singola frequenza.
- ✓ Il candidato illustri la procedura per l'esecuzione di una prova di compressione triassiale consolidata e non drenata (CU) ed indichi i parametri geotecnici determinabili.
- ✓ Il candidato fornisca una breve descrizione delle tecniche geofisiche di laboratorio che ritiene idonee per la valutazione del contenuto d'acqua di campioni di rocce piroclastiche.
- ✓ Il candidato illustri come è possibile gestire, rappresentare e analizzare in ambiente Excel dati ottenuti con un sondaggio elettrico verticale con dispositivo Wenner.

PER ORDINE DEL PRESIDENTE
IL SEGRETARIO DELLA COMMISSIONE
f.to dott. Pasquale PIROLLI

(ALL.4)

4

Electrical resistivity method

In this chapter the electrical resistivity method, a mainstay of near-surface applied geophysics for many decades (Keller and Frischknecht, 1966; Bhattacharya and Patra, 1968) is described. The technique has enjoyed a resurgence in popularity since the mid 1990s (Loke, 1999; Dahlin, 2001; Zonge *et al.*, 2005) due to rapid and impressive advancements in data acquisition, forward modeling, and inversion capabilities.

The fundamental steps involved in the resistivity method may be outlined as follows. An electric current I [amperes, A] is directly injected into the ground through a pair of electrodes and the resulting voltage V [volts, V] is measured between a second pair of electrodes. The impedance $Z = V/I$ [V/A] of the Earth is formed; it is the ratio of the voltage output V measured at the potential electrodes to the current input I at the current electrodes. The impedance is then transformed into an apparent resistivity ρ_a [ohm-meters, Ωm] which is an intuitively understood indicator of the actual underlying electrical resistivity structure $\rho(\mathbf{r})$ of the Earth, where $\mathbf{r}$ is the position vector. Different arrangements of the electrodes permit the apparent resistivity to be determined at different depths and lateral positions. A map of the apparent resistivity plotted at these locations is termed a *pseudosection* (Loke, 1999). The pseudosection is then inverted to obtain a two- or three-dimensional (2-D or 3-D) resistivity section $\rho(\mathbf{r})$ of the ground. Finally, a geological interpretation of the resistivity section is performed that incorporates, as far as possible, prior knowledge based on outcrops, supporting geophysical or borehole data, and any information gained from laboratory studies of the electrical resistivity of geological materials (see Table 4.1).

Table 4.1 Resistivity of common geological materials

Geomaterial	Resistivity [Ωm]
Clay	1–20
Sand, wet to moist	20–200
Shale	1–500
Porous limestone	100–10^3
Dense limestone	10^3–10^6
Metamorphic rocks	50–10^6
Igneous rocks	10^2–10^6

(ALL.5)

70% worse in the case $x \sim 2h$ compared to the ideal zero-offset case. In other words, the lateral resolution of the seismic-reflection method degrades with increasing distance between the shotpoint and the receiver. It makes intuitive sense that the seismic footprint should grow larger as the incident angle becomes shallower.

6.10 Common midpoint profiling

The accuracy of a reflector image can be improved if the seismic shotpoints and receivers are arranged such that each location along the reflecting horizon is illuminated from a number of different perspectives. This is readily accomplished using the common midpoint (CMP) profiling method. CMP data acquisition involves moving the shotpoint and receiver array forward in regular increments and shooting at each successive move. A subset of the resulting shot records can then be selected to simulate an acquisition that consists of a symmetric configuration of n seismic TX–RX pairs about a common midpoint P, as shown in Figure 6.18. In other words, individual traces that share a common midpoint are collected from the various shot records. This is termed a *CMP gather*. The benefit of this procedure is that a single reflection point on a subsurface interface is sampled n times. A CMP profile constructed in this manner is said to have n-fold data coverage.

After NMO corrections of the form (6.25) are applied, according to the TX–RX offset, each seismic trace in the CMP gather becomes effectively a zero-offset trace. The n NMO-corrected traces are then ready to be averaged, or *stacked*, to enhance the signal-to-noise (S/N) ratio. Generally, the improvement in S/N ratio due to stacking a number of traces acquired with the same TX–RX acquisition geometry can be understood as follows. Suppose the amplitude of a seismic-reflection signal is S, while the average noise amplitude is N. Assuming the noise to be random, the S/N ratio of the stacked trace is related to the S/N ratio of an individual trace by the fundamental formula

$$\frac{S}{N}(n) = \sqrt{n}\,\frac{S}{N}(1). \qquad (6.31)$$

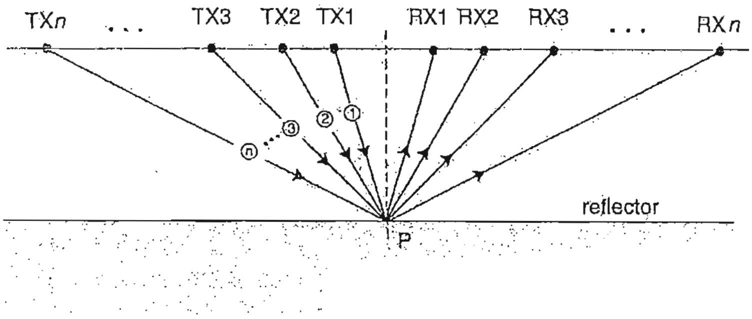

Figure 6.18 Common midpoint profiling, CMP.