5-1-4 Geophysical exploration (IP method)

(1) Survey method

1) IP method

IP survey was carried out in the phase I in order to map the mineralization zone using anomalous IP response that may be related to sulfide zone.

Figure 5-5 shows the layout of the IP lines in the survey area. Tape and compass survey was carried out to set the survey station and line. A triangulation was selected as base point point (B.P. in Figure 5-5). The Survey was commenced from Line 58N and forwarded southward to cover the anomalies expected of west side and east side of the area.

The IP survey employed the time domain method with a dipole-dipole array (a=100 meter, N=1～5; Figure 5-6). A two second on-off alternating square wave was used for transmitted current. Apparent resistivity was calculated from the primary voltage on current transmitting. Apparent chargeability (mV/V) is obtained by normalizing the secondary voltage after shut down using the primary voltage on current transmitting. In this survey, average second voltage taken from 650 to 1150 msec. after shut down was adopted. Figure 5-6 shows the model of waveforms measured by IP method and Table 5-2 is the specification of survey instrument.

2-dimentional inversion analysis was applied to each section to obtain a subsurface model of resistivity and chargeability. This inversion is a combination of 2 dimensional finite elemental method and non-linear least square method.

2) Rock measurement in Laboratory

In order to check the electrical characteristics of rocks in the survey area, measurements of resistivity and chargeability were carried out in the laboratory on 25 representative rock samples collected during the survey. With the exception of core samples, the samples were cut into the rectangle of 30mm x 30mm x 50mm size. After immersing them in water for 48 hours, measurement was carried out by the dipole-dipole method in the same way as in the field.

(2) Results

All resistivity and chargeability sections after 2-dimensional analysis are in Figure 5-8 and 5-8 respectively. Panel diagram of resistivity and chargeability by 2-dimantional analysis are shown in Figure 5-10 and 5-11. The feature of the inversion sections and plans will be described follows.

1) Western Zalturbulak

There is a north-south trending high chargeability zone at shallow levels in the Western Zalturbulak area. At depth it becomes bigger covering most of the western half of the area and at the same time, chargeability becomes higher. Anomalous high chargeability zone of more than 30mV/V covers an area of 1km(west-east direction) x 2km(north-south direction) at 250m depth. Surrounding this anomalous high chargeability zone is the area showing more than 10mV/V . The width of this zone is about 2km wide and the zone possible extends northwestward beyond the limits of the survey area. Within this zone resistivity also is low in general.

Drillcores, which were obtained in the previous Soviet age, are dumped near the center of this IP anomaly zone. The cores consist of granodiorite and fine grained granite with fractures stained by chlorite. A few % of pyrite is disseminated in these rocks. The granodiorite shows very high chargeability (21.9mV/V) and the granite also has high chargeability (10.5 mV/V) in the laboratory test.

2) Aktau West

There is a NNW-SSE trending high chargeability zone in Aktau West. Chargeability of this zone becomes higher in depth and seems to extend northward. Resistivity is generally low both at shallow and deep levels.

3) Central Zalturbulak zone

A zone consisting of weak anomalous high chargeability parts seem to have NW-SE trend. Central Zalturbulak zone is located in the weak anomalous high chargeability zone. Deeper part of this zone shows low resistivity (<300 Ω). This may show alteration zone developing in deep part.

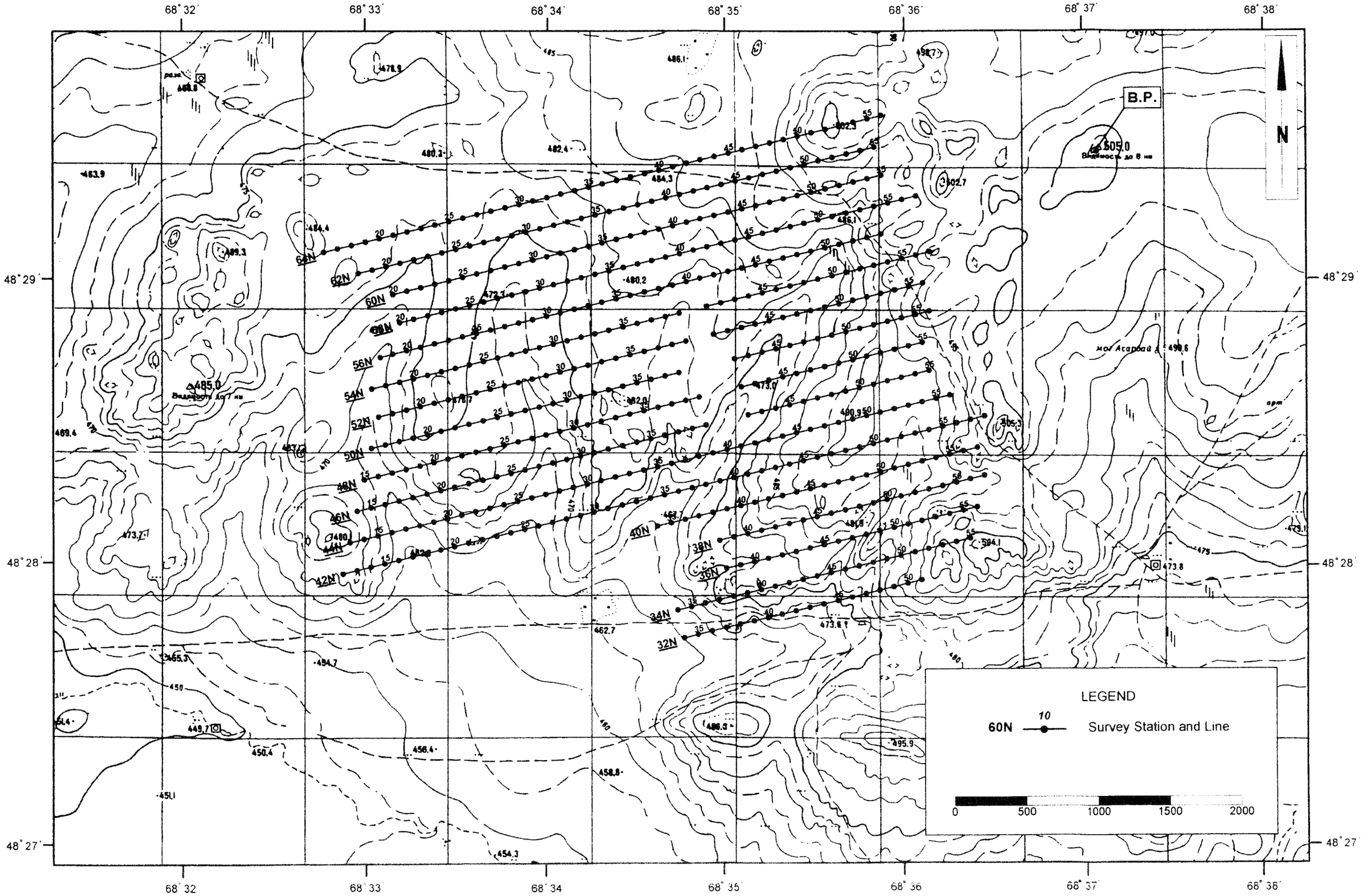

Figure 5-5 Map of Survey Lines (scale 1:25,000)

Table 5-1 Production summary

LINE	FROM	TO	LENGTH
64N	1600E	5600E	4.0 Km
62N	1800E	5500E	3.7 Km
60N	2000E	5500E	3.5 Km
58N	2000E	5700E	3.7 Km
56N	1800E	5400E	3.6 Km
54N	1700E	5700E	3.8 Km
52N	1700E	5600E	3.7 Km
50N	1600E	5600E	3.6 Km
48N	1500E	5500E	3.7 Km
46N	1400E	5500E	3.8 Km
44N	1300E	5600E	4.2 Km
42N	1200E	5800E	4.6 Km
40N	3400E	5700E	2.3 Km
38N	3800E	5700E	1.9 Km
36N	3800E	5600E	1.8 Km
34N	3400E	5500E	2.1 Km
32N	3400E	5100E	1.7 Km

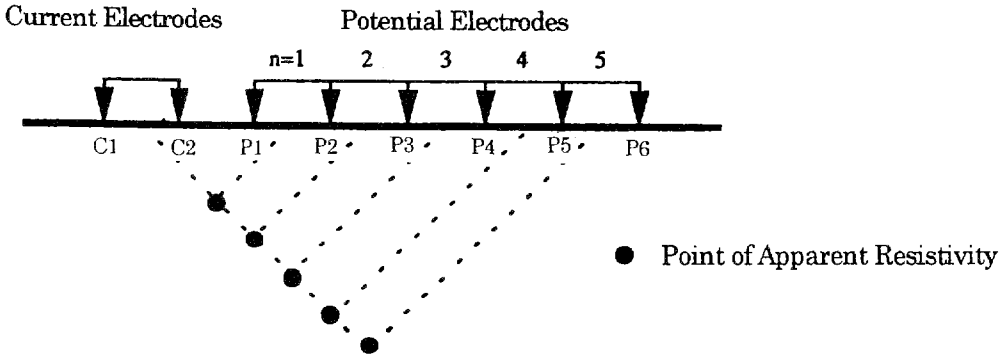

Figure 5-6 Potential Electrode Arrays

Table 5-2 Specifications of Survey Instruments

item	Name	Manu-Facturer	type	Specification
Receiver	Time Domain IP receiver	Scintrex (Canada)	IPR-12	Input channel : 8 Input impedance : 16 MΩ Input range : 50μV～14V resolution : primary voltage : 10μV , 1% common mode rejection : over100dB filter : RF, anti alias, low pass
Transmitter	High Voltage Tansmitter	IRIS (France)	VIP3000	Maximum power 3000 V A Maximum output voltage 3000 A Maximum output current 5A Voltage range : 10steps of 60 to 880V Power : AC175～275V, 45～450Hz, Single phase or 3 phases

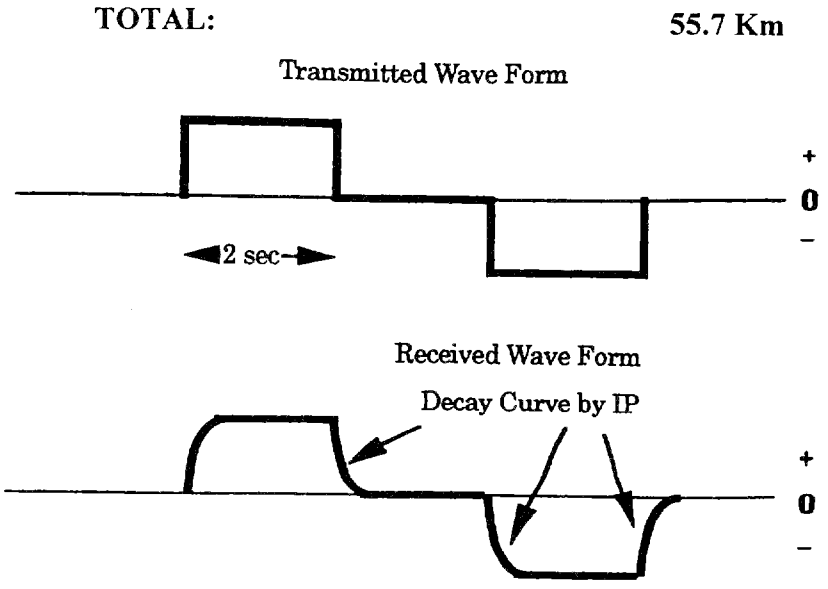

Figure 5-7 Model of Wave Forms Measured by IP Method

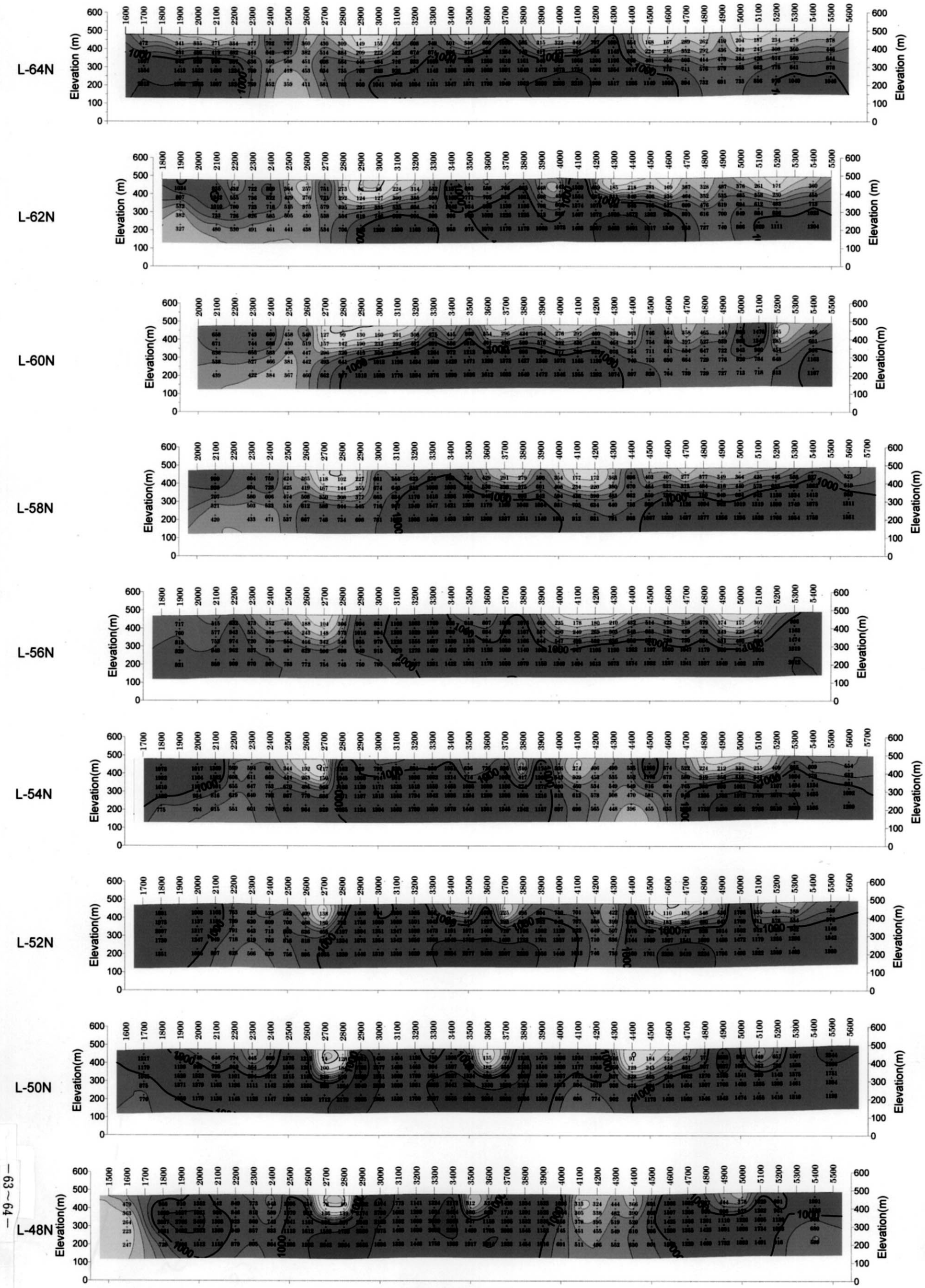

Figure 5-8 All Resistivity Sections by 2-D Inversion (1/2)

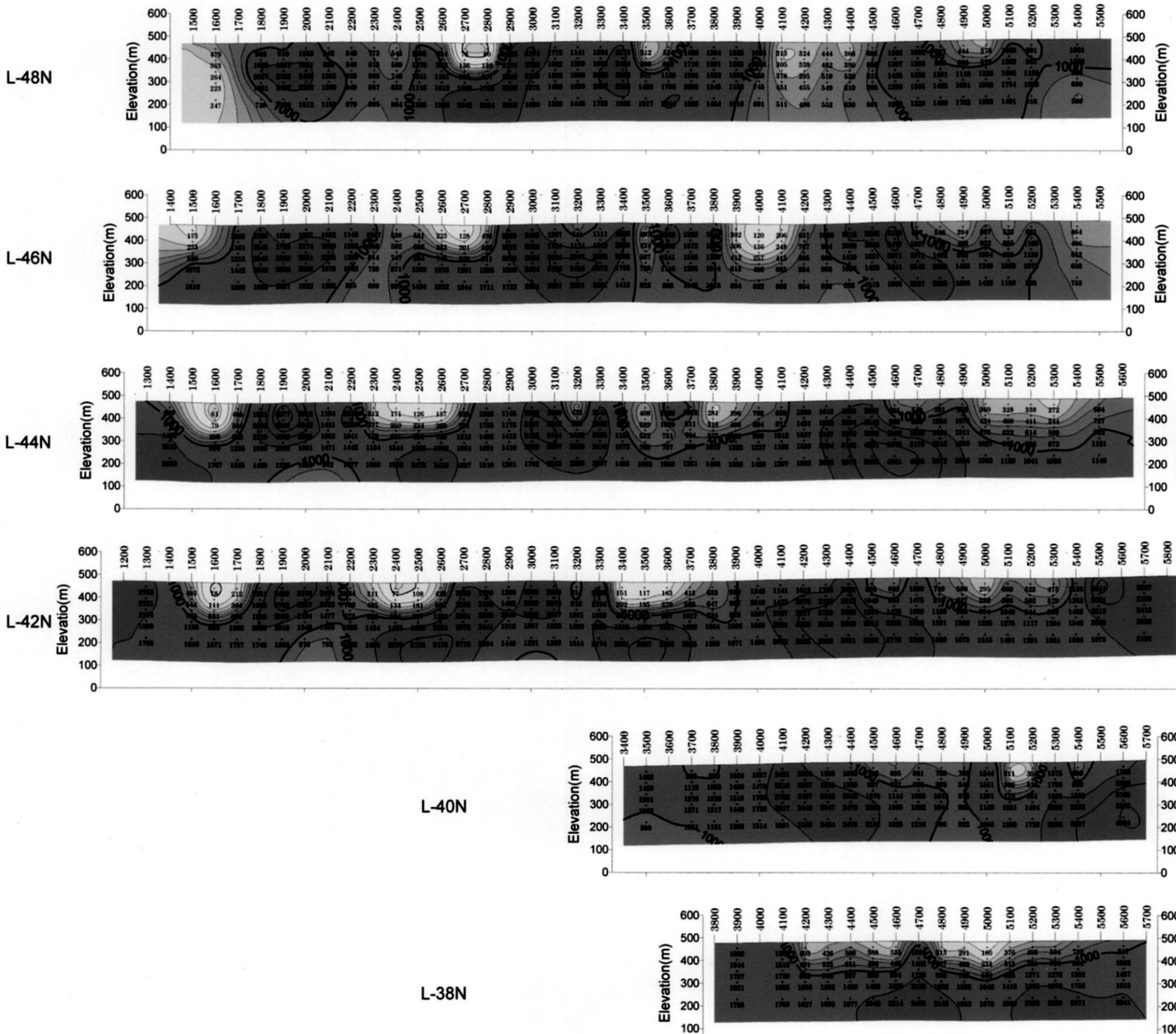

Figure 5-8 All Resistivity Sections by 2-D Inversion (2/2)

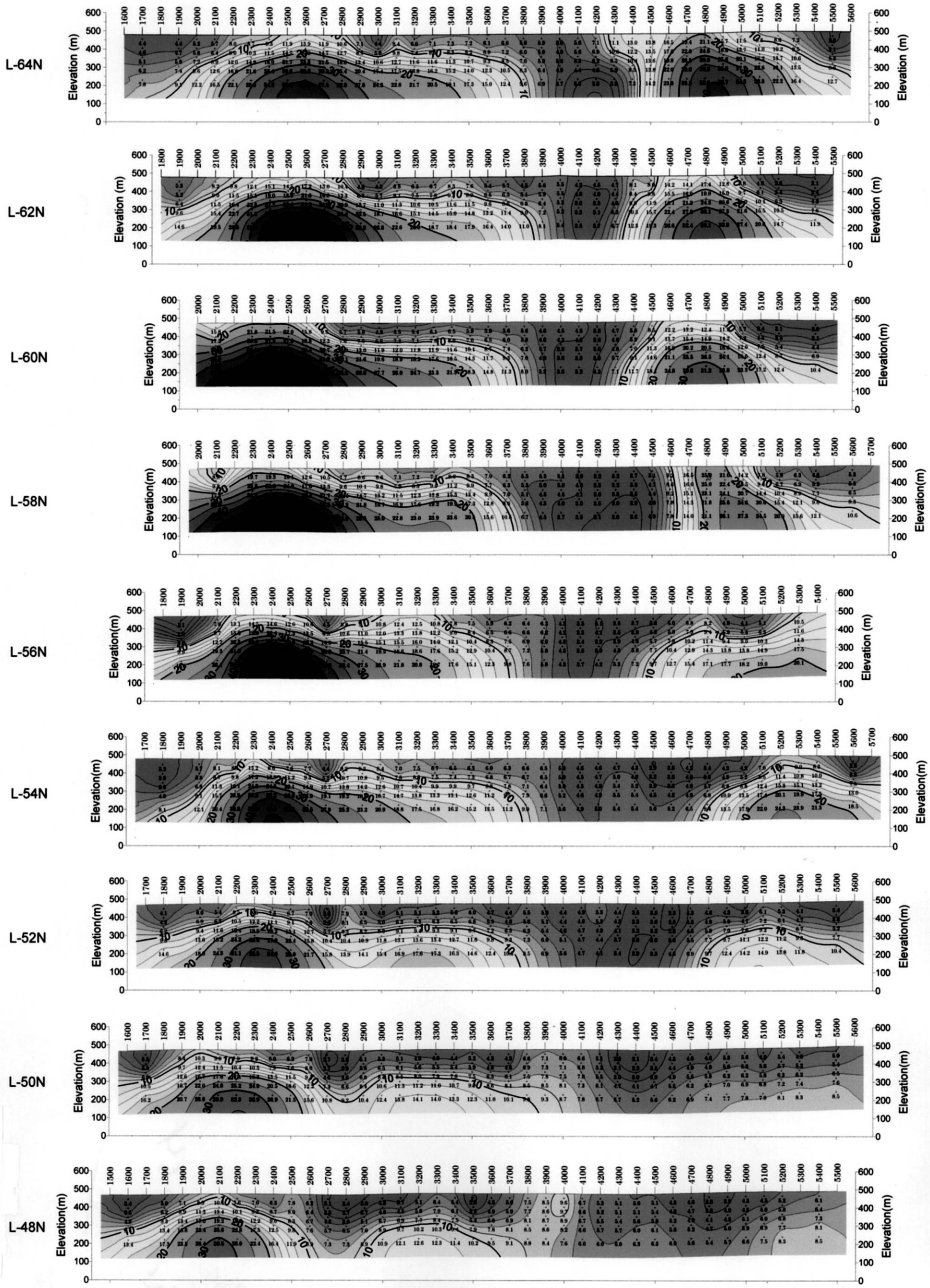

Figure 5-9 All Chargeability Sections by 2-D Inversion (1/2)

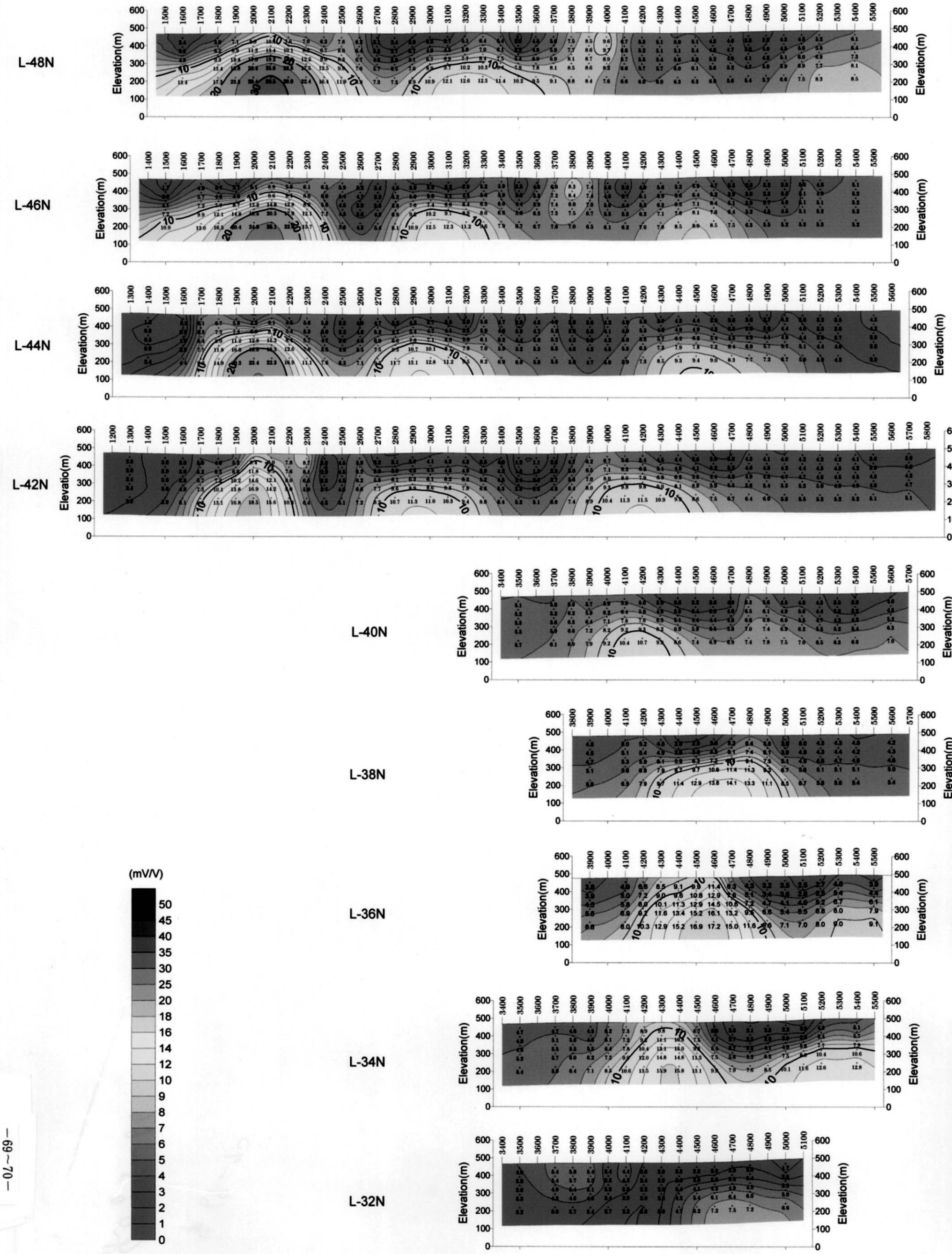

Figure 5-9 All Chargeability Sections by 2-D Inversion (2/2)

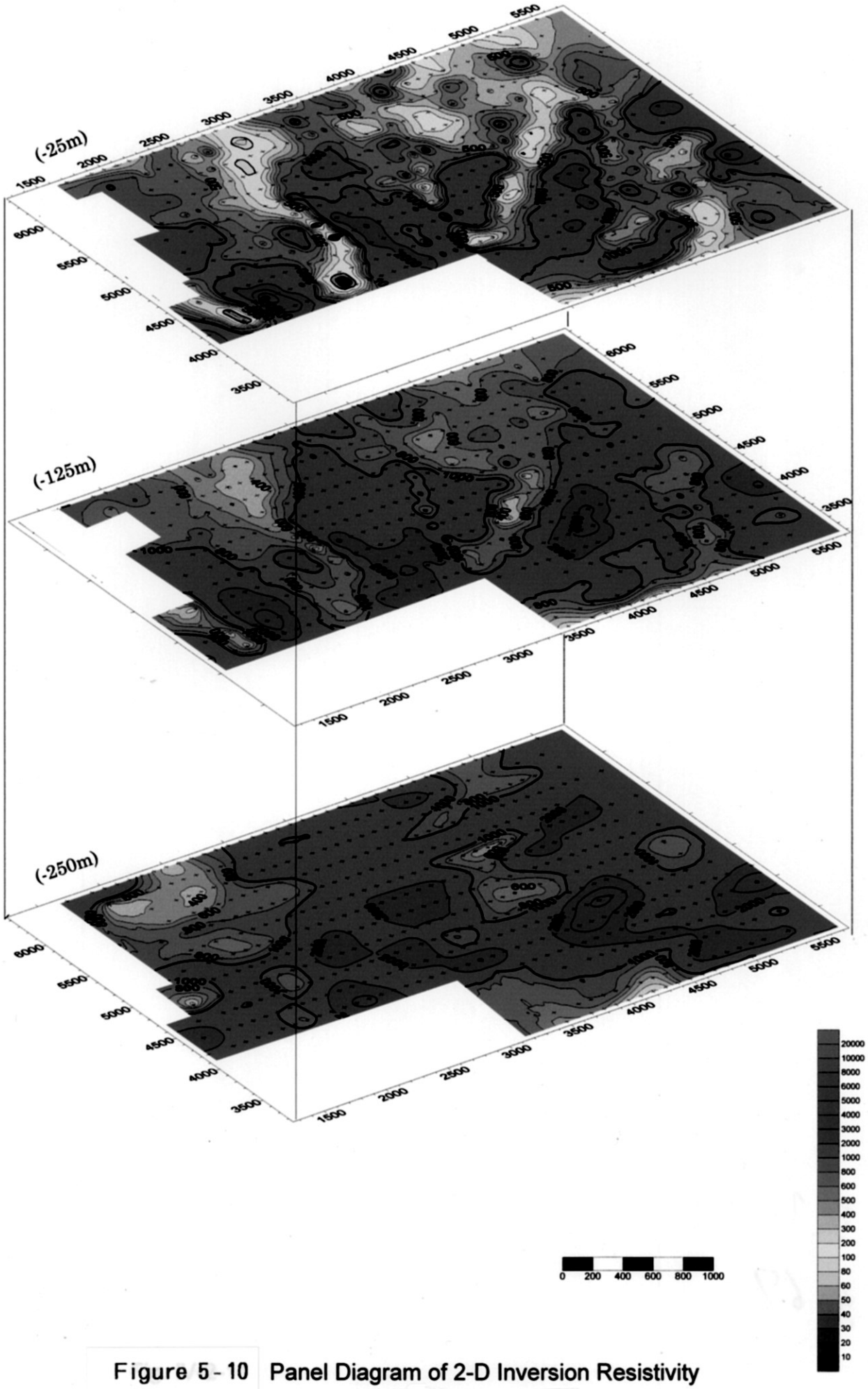

Figure 5-10 Panel Diagram of 2-D Inversion Resistivity

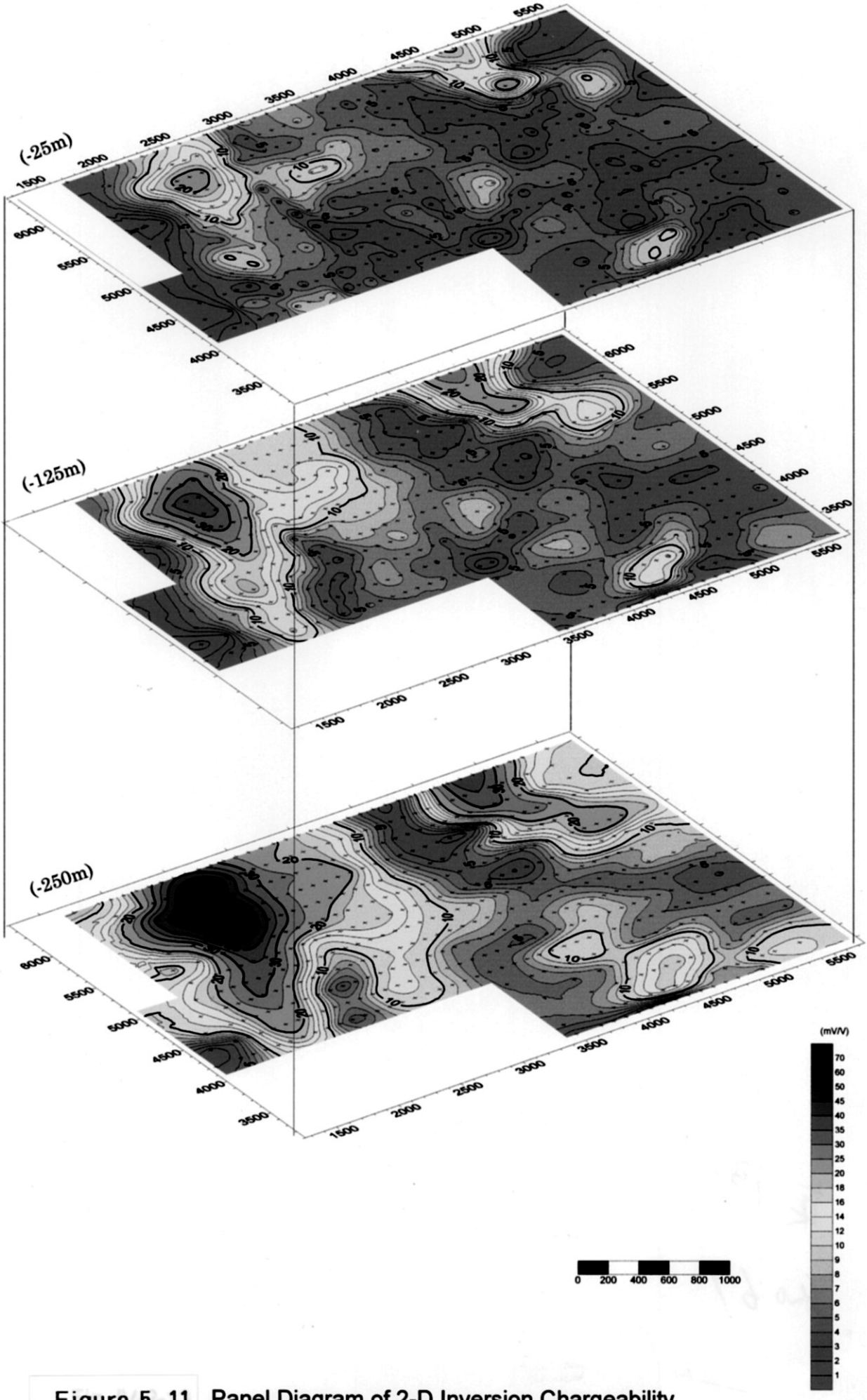

Figure 5-11 Panel Diagram of 2-D Inversion Chargeability