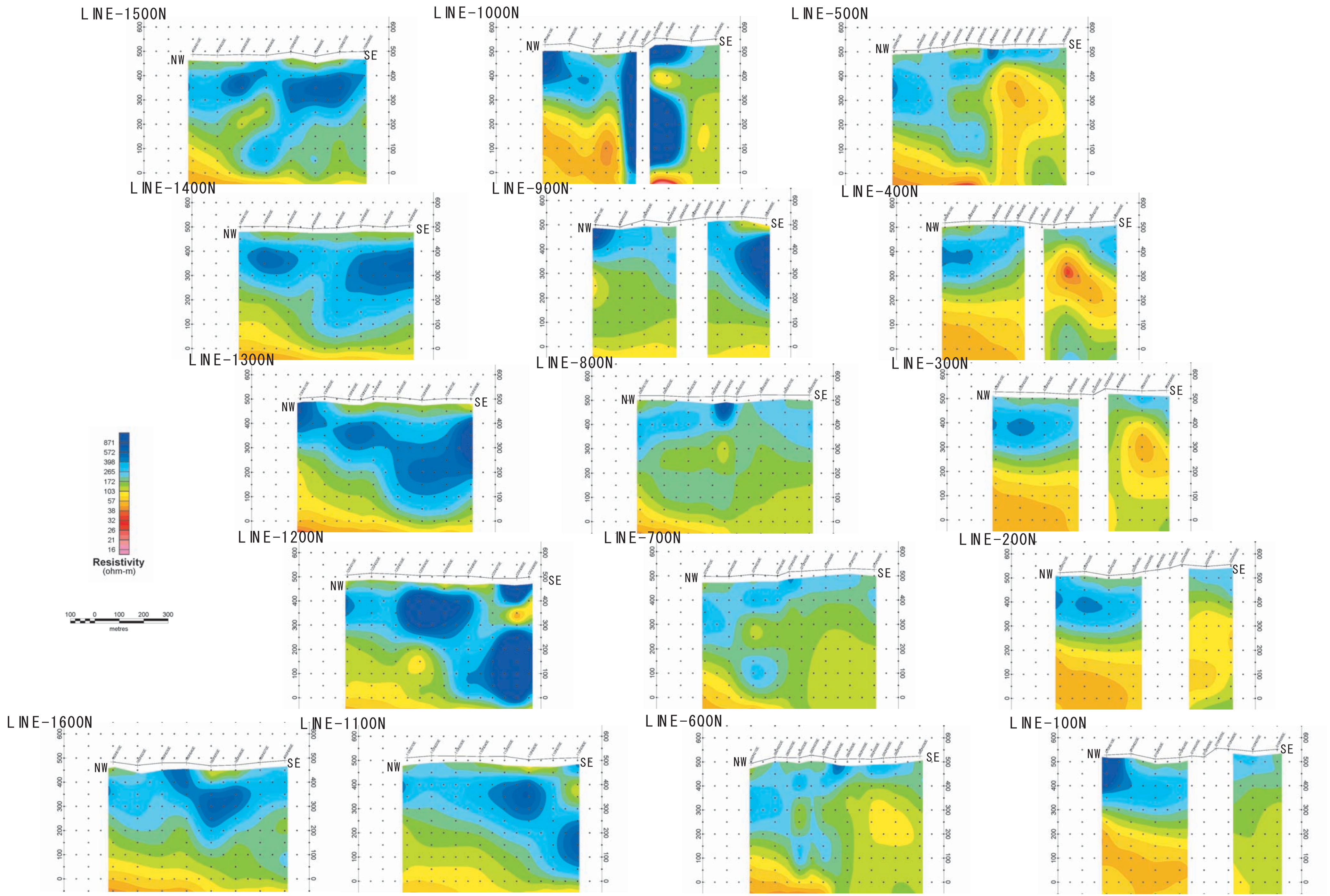

Fig. II-4-2-11 Resistivity structure sections by Occams inversion in Azzouz

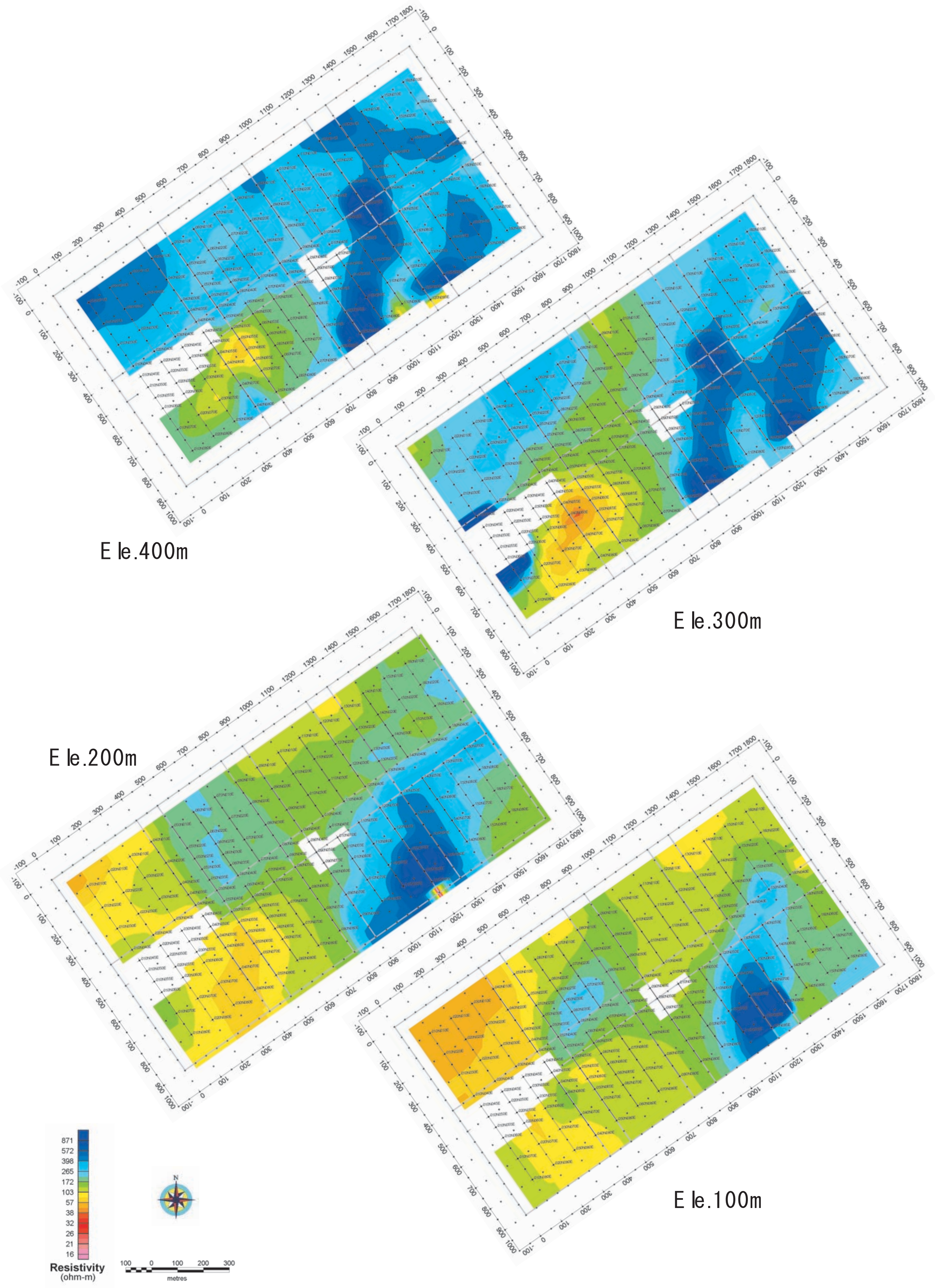

Fig. II-4-2-12 Resistivity distribution maps by Occams inversion in Azzouz

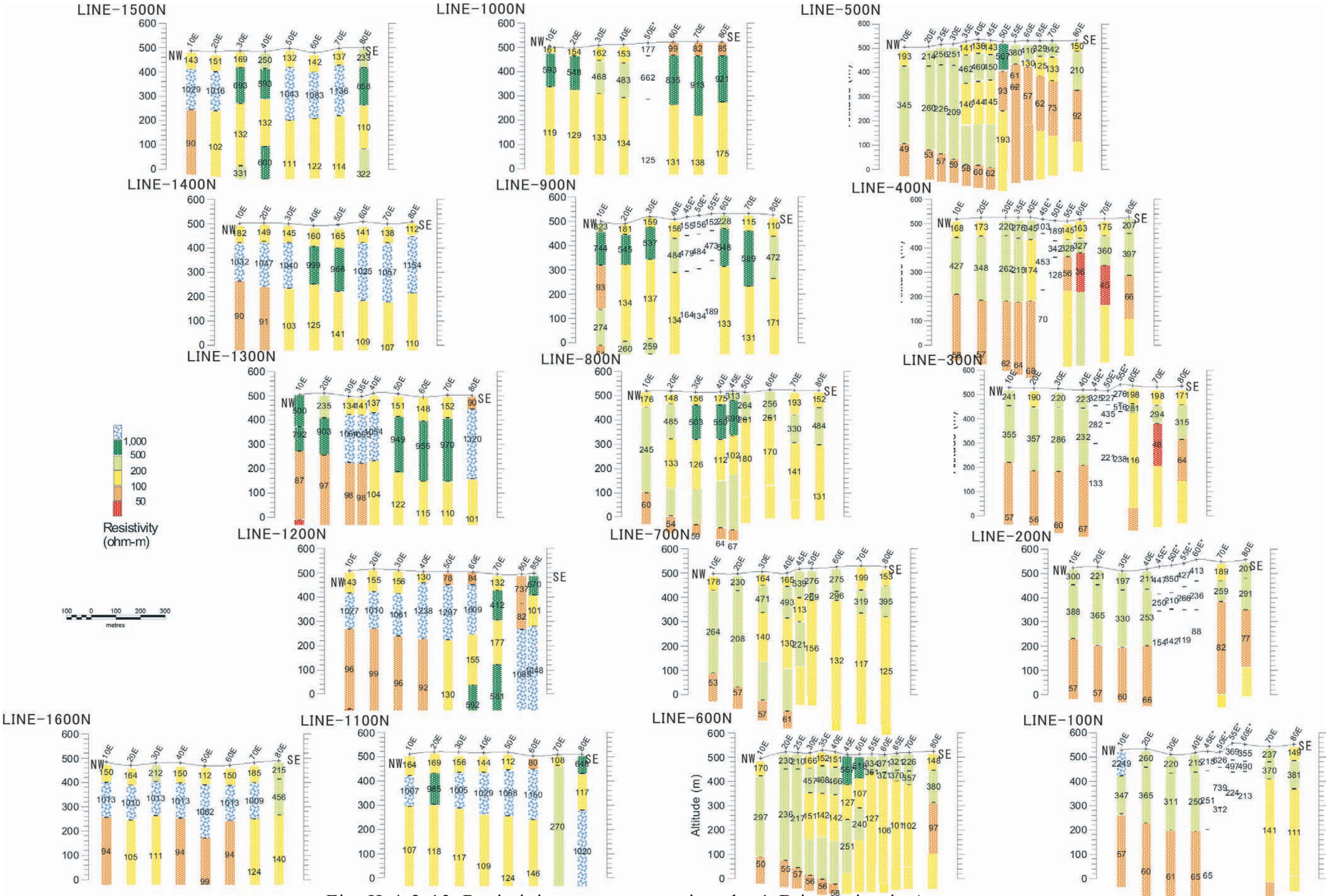

Fig. II-4-2-13 Resistivity structure sections by 1-D inversion in Azzouz

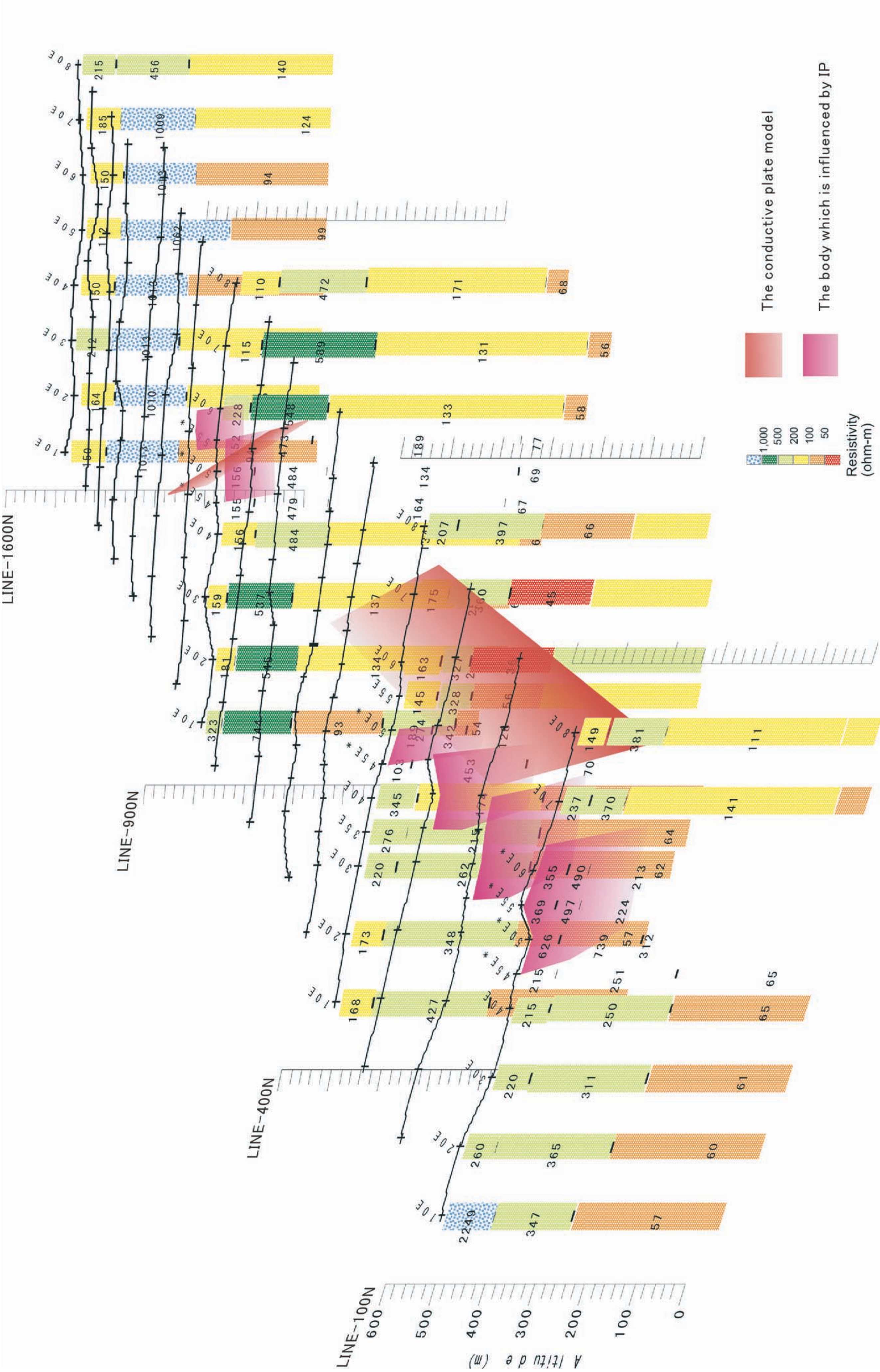

Fig. II-4-2-14 The resistivity structure model by TEM in Azzouz

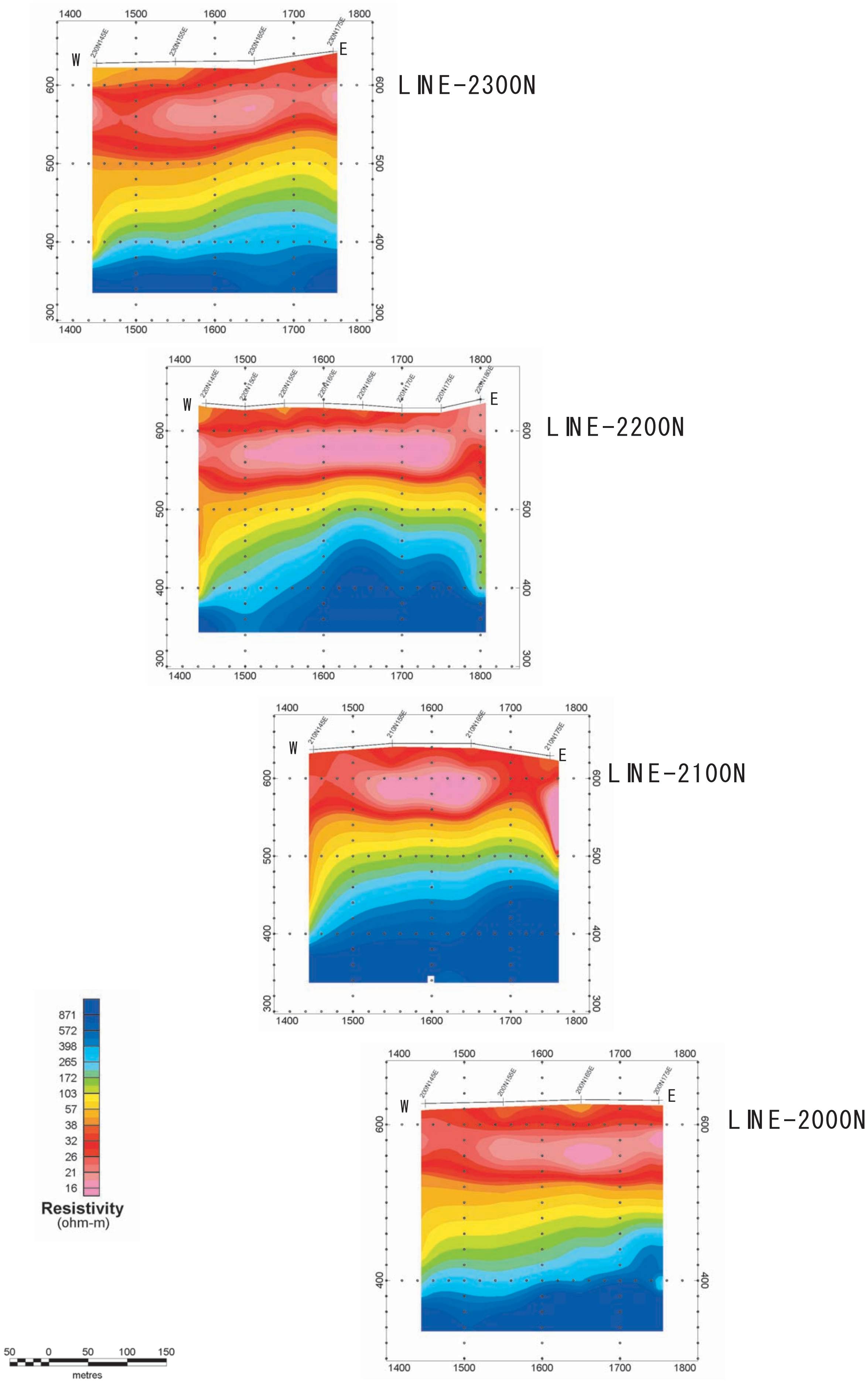

Fig. II-4-2-15 Resistivity structure sections by TEM in Khefawna

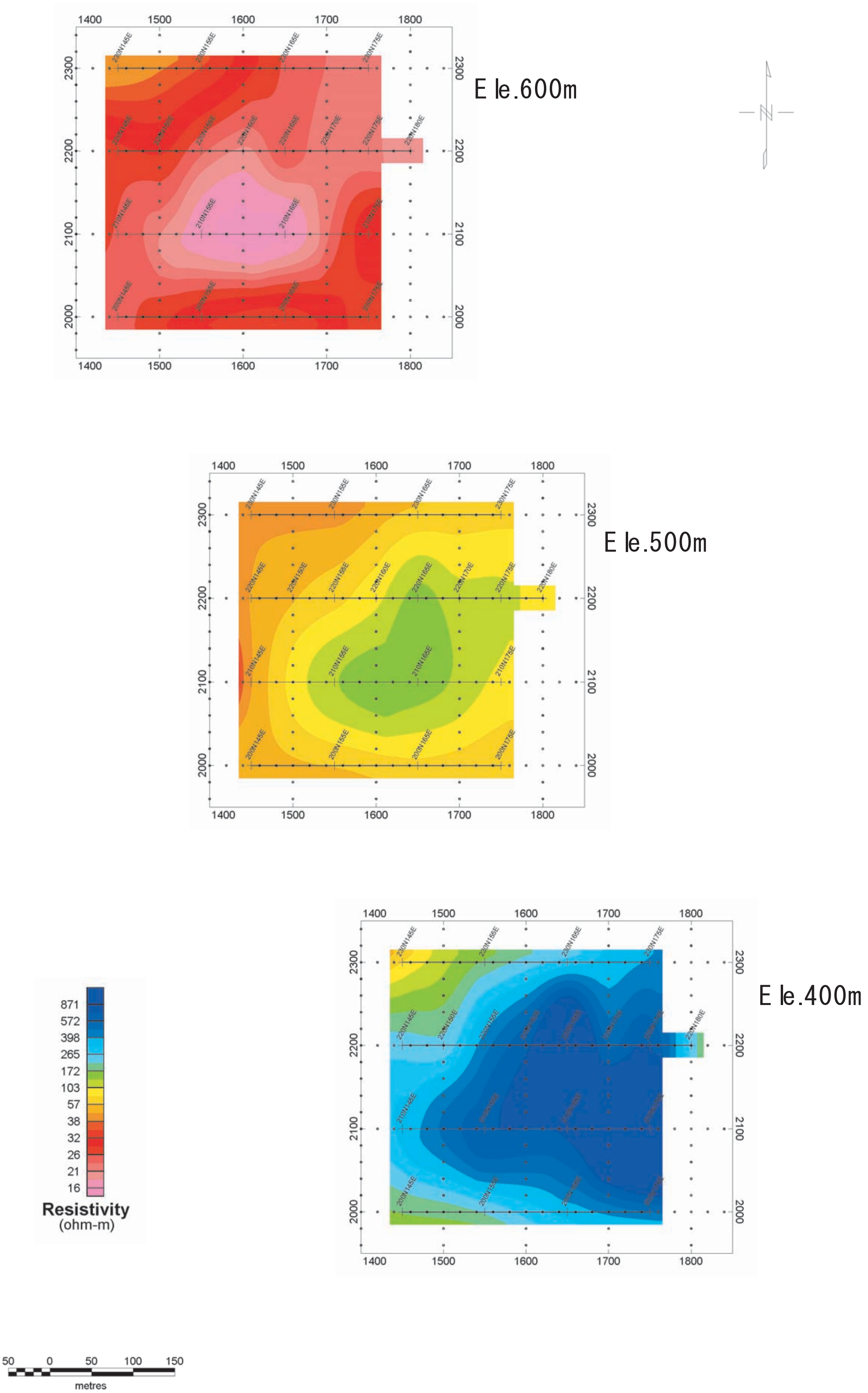

Fig. II-4-2-16 Resistivity distribution maps by TEM in Khefawna

Chapter 5　Drilling survey

5-1 Drilling survey (Phase II)

The drilling survey (2 holes) was carried out at the locations in the following map, in order to know the property of the mineralization zone based on the geophysical survey (Phase III).

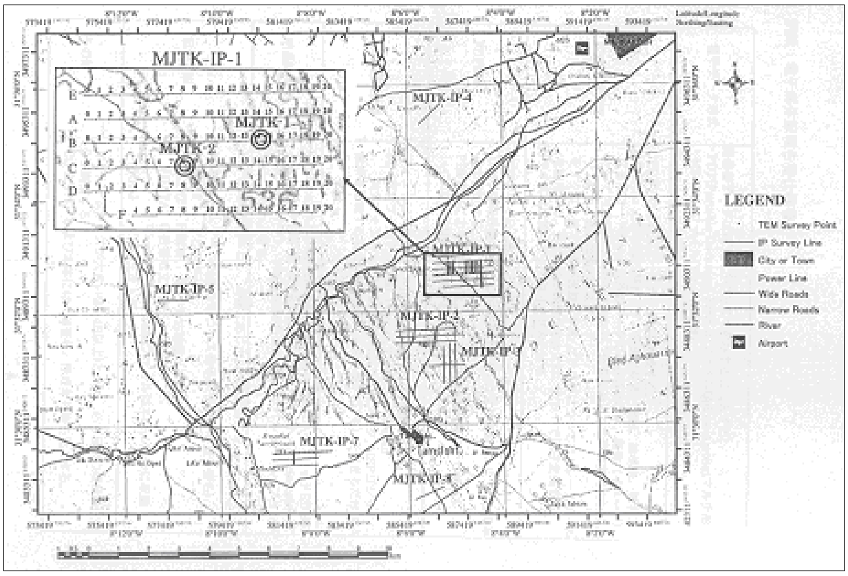

Fig.II-5-1-1 Location of　MJTK-1 and MJTK-2

As the result, it was shown that the situation of the basement resembles 1) in 4-1, and that it was recognized that the magnetic anomaly of the central part of this area was caused by an intrusive gabbro, a kind of igneous rock. And a lot of small veins including sphalerite were found in the pelitic and psamitic schist in MJTK-1 that is at the East of the gabbro of MJTK-2. These situations are shown in Fig.II-5-1-1.

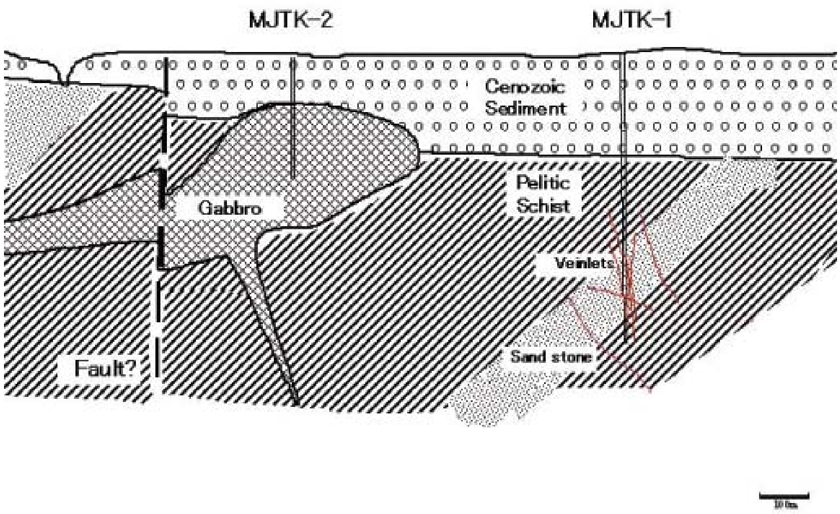

Fig.II-5-1-2 Conceptual Section around MJTK-1

Some outcrops of fine sandstone at a river around MJTK-1 have a dip toward west. However, some seismic data show that Paleozoic including Carboniferous has a gentle dip toward east in the eastern region from MJTK-1. It seems that an unsymmetrical anticline axis runs in the eastern region in perspective.

There may be a recumbent fold structure around MJTK-1, because sandy rock bed is between pelitic rock beds in the hole. However, any obvious and structural evidence of a recumbent fold cannot be shown. And the lower pelitic rock is different from the upper pelitic rock in the following situations.

1. The schistsity is not so obvious.
2. It sometimes includes pyrrhotite.

It is unlikely that the veinlets in MJTK-1 are directly related with any massive sulfide deposit. However Zn should have leached, have moved from somewhere, and have been precipitated in the area. The veinlets include white quartz and carbonate, with brown or dark gray sphalerite, and sometimes with pinkish pale gray barite. The direction of the veinlets is sometimes along lamination or schistsity, sometimes crossing them. And the dip is generally steep. Most hydrothermal water seems to have moved through fractures formed by some structural or igneous activity rather than schistsity. Some fracture with mineralization is reverse fault like and small in width. Therefore they are probably formed stress rather than tension. And It the veinlets cross some chlorite veins.

Therefore it is supposed that the veinlets were formed after alkali alteration of the rocks. The hydrothermal sphalerite veinlets in MJTK-1 and gabbro in MJTK-2 indicate some past igneous activity, and suggest “bimodal” volcanism. However the rock cores that were already gotten consist of only the upper formation from the ore horizon. And there is no evidence to indicate any past rhyolitic volcanic activity at present.

5-2 Drilling survey (Phase III)

4 holes (MJTK-3, 4,5 and 6) were drilled based on above geophysical data (Phase III). These locations are shown in the following figure.

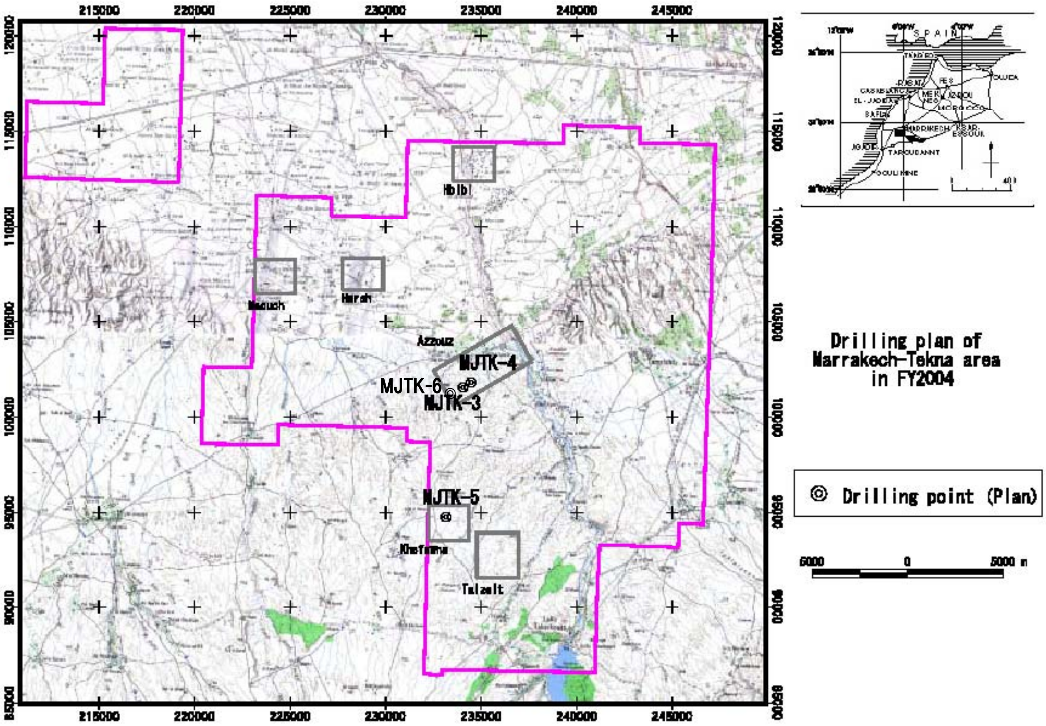

Fig.II-5-1-1 Location of MJTK-3,4,5 and 6

Metamorphic sedimentary rocks are distributed over the surface and in the drilling cores. The sedimentary rocks are mainly pelitic - silty, partly sandy and also calcareous. They are alternated with several mm unit layers and repeated.

The schistosity (foliation) sometimes has a different direction from bedding. the schistosity was formed by structural movement metamorphism, and schistosity usually has similar direction to axis of a fold. Therefore bedding is often different to schistosity near anticline or syncline.

As a result of drilling survey, sulfide concentration that mainly consist of pyrrhotite, calcite, sphalerite, chalcopyrite and galena was found in sedimentary rocks (pelitic – silty schist). The main elements' contents of the samples of The MJTK,3,5 and 6 is shown in Table II-5-2-1. ore minerals may be secondary sediments or vein-like. The process of mineralization is not known well even now, although they are similar to surrounding ore deposits.

Table II-5-2-1 The Result of Chemical Analysis of MJTK,3,5 and 6

SAMPLE	Au	Ag	As	Ca	Cu	Fe	Mn	S	Pb	Zn
DESCRIPTION	ppm	ppm	ppm	%	ppm	%	ppm	%	%	%
MJTK-3 62.7-62.75	0.035	2.4	<2	3.45	202	5.1	1350	4.3	0.02	8.45
MJTK-3 76.3-76.4	0.73	6	>10000	24.1	91	4.45	24100	3.6	0.26	0.58
MJTK-3 80.5-80.6	0.022	6.8	1605	6.58	787	>50	4620	8.83	0.32	0.41
MJTK-3 99.5-99.6	0.038	6.1	287	2.46	6460	19.8	1425	7.26	0.05	8.07
MJTK-3 99.6-99.7	0.146	6	1795	1.32	2470	>50	635	7.75	0.06	2.15
MJTK-3 148.2-148.3	0.114	7.4	1095	8.07	483	20.3	6520	>10.0	0.08	6.96
MJTK-3 319.2-319.4	0.033	18.7	1380	7.59	1210	38.3	4830	9.32	1.51	2.58
MJTK-3 340.3-340.4	NSS	8.8	5510	1.66	792	>50	952	7.12	0.15	0.23
MJTK-3 473.4-473.6	0.101	10.3	1075	0.71	1530	31.8	409	>10.0	1.07	3.22
MJTK-6 90.7-90.8	0.042	18.2	47	14.6	4900	23.9	3690	>10.0	2.41	1.65
MJTK-6 101.2-101.3	0.096	3	695	0.37	429	18.3	1960	>10.0	0.24	0.33
MJTK-6 125.2-125.3	0.112	3.5	338	1.02	2900	42.1	8230	>10.0	0.05	0.10
MJTK-6 134.6-134.7	0.087	19.7	1055	14.2	3210	25.7	13050	>10.0	0.84	0.35
MJTK-5 256.7-256.8	0.15	1	40	0.41	5770	38	2050	8.76	0.03	0.02
MJTK-5 358.9-359.0	0.322	1	19	0.63	2160	29.6	1600	7.25	0.02	0.02
MJTK-5 466.6-466.7	0.03	0.5	7	0.64	2020	25.5	637	7.57	0.01	0.01

Wedge-shaped and irregularity-shaped heterogeneous fragments (pelitic rock, tuffaceous rock) are in concentrated sulfide.

Sulfide concentrations are linearly distributed or like trailing. And there are many parts where sulfides are observed in thin-layer in turbidite-like mudstone. This situation indicates the re-sedimentation of the host rock and mineralization may several secondary sediments.

Sulfide concentrations are apt to be in firm rocks with plane fractures. And some sulfide is along foliation. Some pyrite was metamorphosed to pyrrhotite, as some mineralization preceded metamorphism.

Pyrrhotite is dominant with sphalerite, galena, chalcopyrite and pyrite. Pyrrhotite seems to be vein-like or network-like, however it can be thin-layered texture.

Sulfur isotope ratio in the survey area resembles to Hajar deposit. MJTK-6 is probably closer to a hydrothermal deposit originated from volcanic rocks than MJTK-3 in Azzouz district.

And the resistivity of rock cores inversely correlates with the chargeability in general. And the chargeability correlates with the magnetic susceptibility. Therefore the chargeability is due to the quantity of pyrrhotite. Pyrrhotite concentration around 360m of MHTK-5 is regarded as the cause of the regional magnetic anomaly. Other mineralization zones probably occur IP anomalies. Low resistivity zone in deeper part of MJTK-3 is due to the sequence of sheared zones.

Therefore the characters of mineralization in MJTK-3,4,5 and 6 can be summarized as follows.

1. Mineralization zones dominant in pelitic – silty schist consist of second sedimentary or vein-like sequence of concentrated sulfide of pyrrhotite, calcite, sphalerite, chalcopyrite and galena

2. Alterations of the host rocks indicate that the rocks are hanging wall and surrounding parts.

3. Sulfur isotope ratio indicates the possibility hydrothermal activity originated from Volcanism. And blind volcanic massive sulfide deposits may be near this survey area.

4. Magnetic, resistivity and chargeability anomalies mean the concentration of sulfide and mineralization zones.

Part III

Conclusion and Recommendation

Part III Conclusion and Recommendation

Chapter 1 Conclusion

Mineralization of calcite and sulfide was mainly found at MJTK-1,3,4,5 and 6. Sulfide is usually along schistosity (foliation).

Pelitic and silty schist is friable with graphite even though the schist is with calcareous and sandy schist.

However, the lithofacies do not change so much, and sometimes alternate with several mm unit. Therefore it is difficult to simply divide the lithofacies by the repetition of same lithofacies.

The schistosity (foliation) sometimes has a different direction from bedding. the schistosity was formed by structural movement metamorphism, and schistosity usually has similar direction to axis of a fold. Therefore bedding is often different to schistosity near anticline or syncline.

Pyrrhotite was metamorphosed from pyrite, however it is often along foliation. Metamorphism was not at a time.

Pyrite was formed more than twice, and the latter mineralization was much weaker.

In other words, most pyrite were brought by early mineralization. The earlier mineralization is with sphalerite, and a considerable part of pyrite changed to pyrrhotite through metamorphism.

The resistivity inversely correlates with the chargeability in general. And the chargeability slightly correlates with the magnetic susceptibility. Therefore the chargeability is due to pyrrhotite more than graphite.

Pyrrhotite concentrate at 360m depth in MJTK-5 and this mineralization zone probably form the magnetic anomaly. The chargeability may be due to pyrrhotite even around other drilling holes. It is likely that there are a wide pyrrhotite zone around MJTK-3,4 and 6. Pyrrhotite is dominant with sphalerite, galena, chalcopyrite and pyrite in microscope. It can be regarded not only as vein-like and network-like but also as thin layered type. The ratio of sulfur isotope is similar to Hajar mine. Probably, MJTK-6 is near a volcanic hydrothermal ore deposit, and MJTK-3 is affected by biological isotope circulation.

Chapter 2 Recommendation for future

It is difficult to distinguish the main ore deposit and surrounding sulfide concentration only by magnetic anomalies. The existence of the volcanic rocks as the footwall may indicate main ore body, therefore it is necessary to know the underground structure by gravity survey. And the method of sulfide isotope is effective to consider the drilling survey method of the part under the

Cenozoic sediments.

Isotope ratio indicates some past hydrothermal activity by volcanism in Azzouz area. Some magnetic anomalies distribute even in west area from the Azzouz area, therefore the gravity survey in the expanded area may indicate volcanic rocks as the footwall of volcanic massive sulfide deposit.

The magnetic anomaly in Khefawna area is not large and the pyrrhotite concentration in MJTK-5 can be regarded as the cause of the anomaly. Therefore Khefawna area can hardly have any more promising part.

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