Chapter 3 Airborne geophysical survey

3-1. Aeromagnetic survey

3-1-1. Objective and Method

The objective of the aeromagnetic and radiometric survey is to define lithologies by means of their magnetic and radioactive characteristics. The interpretation of the inferred subsurface geology will then be used to locate favorable areas for follow-up exploration. Calcrete covers more than three quarters of the survey area, mainly in the northeast.

During this high resolution aeromagnetic survey a Cesium magnetometer was used. For higher accuracy of data acquisition, low flight altitude and a small line spacing were maintained. Magnetic storms were measured and daily magnetic deviation was calibrated by a Proton magnetometer situated on the ground at the magnetic observatory station

3-1-2. Specifications of the survey

(1) The magnetic and radiometric data acquired within the flown area are shown in Fig. II-3-1 and Table II-3-2.

(2) The direction of the flight line was planned basically north to south.

(3) The line spacing was determined as 200 metres.

(4) The tie line was planned at 2.5 kilometres intervals.

(5) A Cessna-type small aircraft was used.

(6) Constant altitude of the equipment was maintained at 80 metres, provided the aircraft and the equipment towed were safe.

(7) GPS-Video Tracking parallel method was used for navigation.

(8) The effects of artificial noise, climate and magnetic storm were minimized when flown.

Total line kilometre flown was 27,518 kilometres including the tie lines. The horizontal sampling interval was no less than 9 metres.

3-1-3. Equipment

The equipment used is shown in Table II-3-1.

3-1-4. Data Processing and Interpretation Procedure

Flow chart of data processing and interpretation is illustrated in Fig. II-3-2.
This is followed by an explanation of the fundamentals and some technical terminology of the flow chart which concerns aeromagnetic interpretation.

Table II −3−1 Specifications of Equipment for Aeromagnetic

System	Maker	Type	Specification	Num.
Airborne magnetic survey system	Scintrex	H8 Cessium vapour magnetometer	Dynamic range: 20,000nT (69,972Hz) ~ 100,000nT (349,860Hz) Gradient :up to 50,000nT/m Sensitivity:0.005nT(10/sec)	1
Airborne radiometric survey system	Exploranium	GPX 2048,256 γ -ray detector	NaI-crystal:2048in3-Down 256in3-Up Absolute sensitivity : 8%	each 1
	Exploranium	GR-820-3 γ -ray spectrometer	Channel:256;(K40,Bi214,Th208 were selected)	1
Ground fixed magnetic system	Geometrics	G856-X Proton Magnetometer	Sampling rate : 1 time/30sec	1
Altitude measuring system	Intellisensor	AIR-DB-2B DigitalBameter/altimeter	Op.Range : -700m ~ 4206m RMS-Sense: ± 0.01mbar(0.1m) at sea level	1
	Sperry	Sperry 200-A Radar altimeter	Relative Accu. Altitude ± 3'(± 1m) ; 0 ~ 30m ± 3% ;30 ~ 152m	1
Navigation system	National Panasonic	AC-7450 S-VHS Video system	Tracking : Flight path Magnetic data	1
	Garmin	Differential GPS SRVY II system	Sence : ± 100m (flighting) : 3-10m (post flight)	1
Aircraft	Cessna	Cessna Titan 404	Twin engine Fuel capacity : 2400 l (9hours) Maximum gross weight:8400las Production speed : 260 ~ 300Km/hr	1

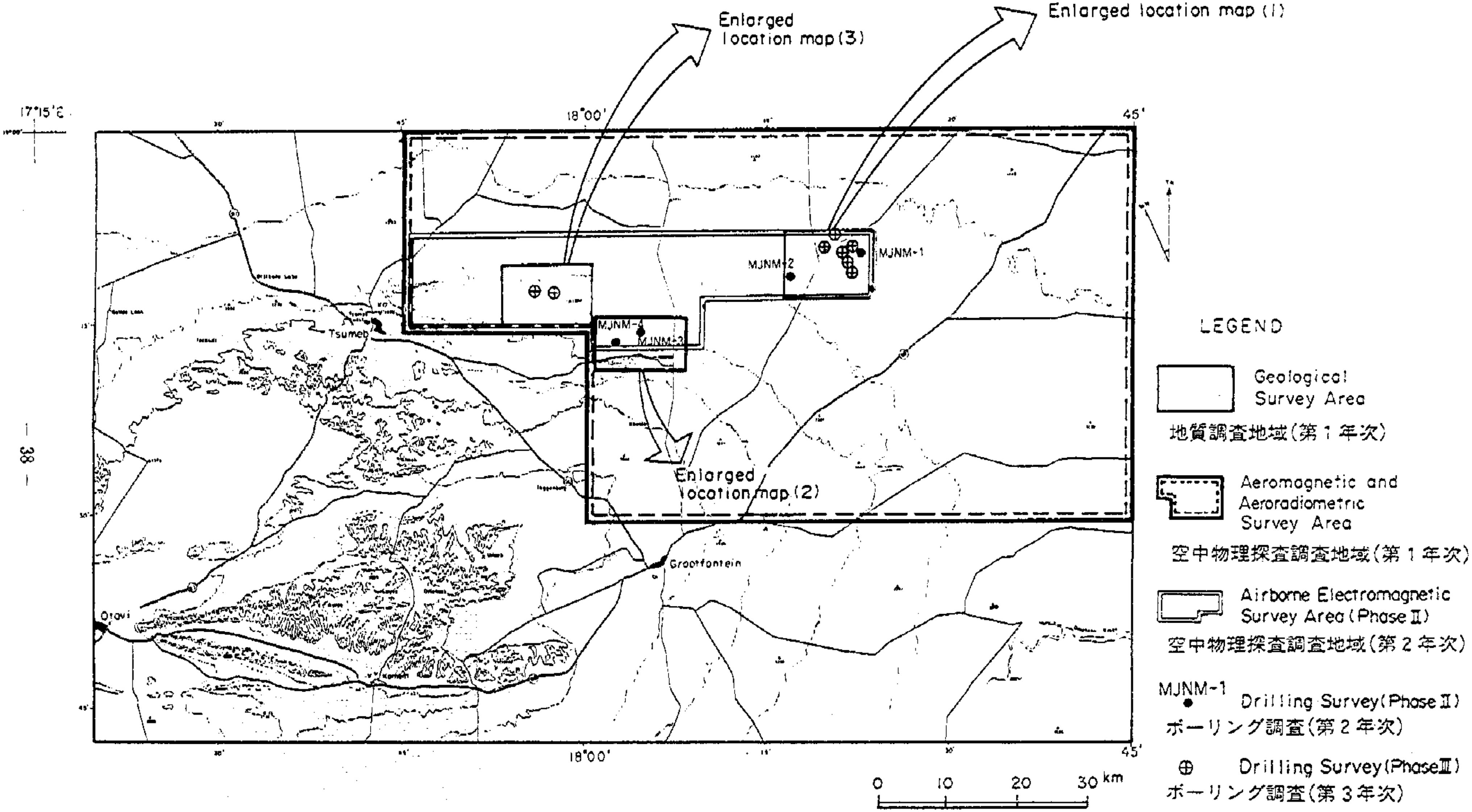

Fig. II—3—1　Location map of airborne geophysical survey

Table II－3－2 Boundary Points of the Survey Area

	XTM	YTM	Latitude			Longitude		
			Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	131410W	303956N	19	15	0.000S	17	45	0.000E
2	131608W	331632N	19	00	0.000S	17	45	0.000E
3	105284W	331800N	19	00	0.000S	18	00	0.000E
4	78962W	331931N	19	00	0.000S	18	15	0.000E
5	52640W	332025N	19	00	0.000S	18	30	0.000E
6	26320W	332081N	19	00	0.000S	18	45	0.000E
7	26280W	304410N	19	15	0.000S	18	45	0.000E
8	26240W	276738N	19	30	0.000S	18	45	0.000E
9	52481W	276681N	19	30	0.000S	18	30	0.000E
10	78723W	276585N	19	30	0.000S	18	15	0.000E
11	104965W	276451N	19	30	0.000S	18	00	0.000E
12	105126W	304126N	19	15	0.000S	18	00	0.000E

3-1-5. Result and Interpretation

Total field magnetic intensity contour map, Contour map of total field magnetic intensity data reduced to the pole and Magnetic Image Processing Products were produced to interpret the result.

The survey area could be subdivided into three terrains based upon the magnetic characteristics as follows.

(1) Terrain exposed or underlain by the basement complex at a shallow depth

(2) Terrain occupied by thick Damara sediments

(3) Terrain underlain by Karoo basalt

A swarm of magnetic lineaments traverse the three terrains with varying length and width. Some of them are associated with faults. The southeast of the area is characterized by short-wave magnetic pattern indicating shallow emplacement of the basement complex. It seems that thin Damara sediment overlies the basement. The magnetic anomaly patterns suggests the basement stepping down towards northwest by east-north east trending faults as well as dome structure interpreted by long-wave pattern. Thick Damara sequence may overly the deep seated basement complex here.

Potential stratigraphic boundary could be traced because of faint contrast of magnetic susceptibility, in spite of totally low susceptibility of Damara sediments.

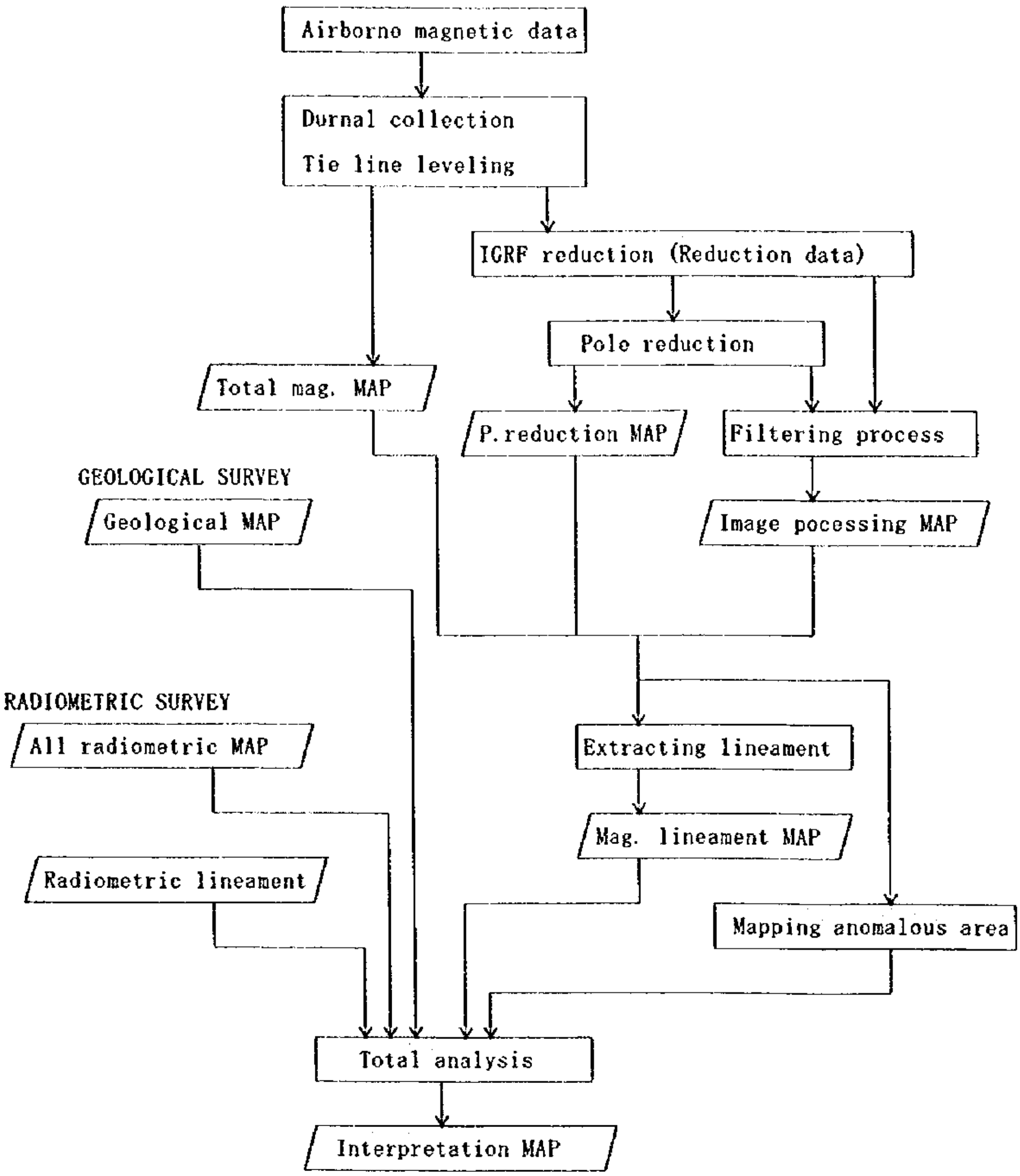

Fig. II −3−2　Flow chart of aeromagnetic survey

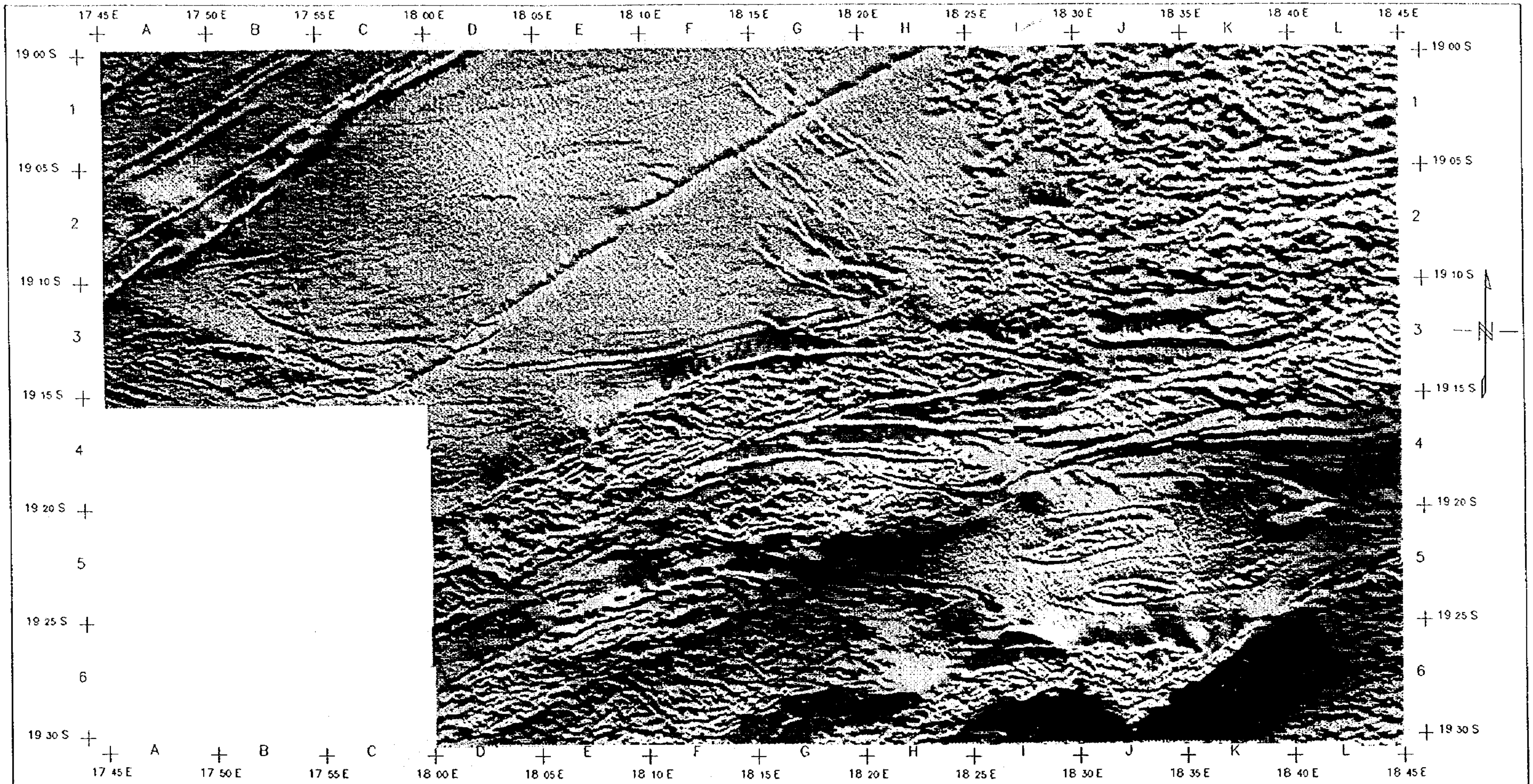

Fig.II −3−3　Magnetic image processing product

Scale 1:250000

5000 0 5000 10000 15000

(metres)

MAGNETIC IMAGE PROCESSING PRODUCT
OTAVI MOUNTAINLAND PROJECT (MARCH 1996)
M. M. A. J.

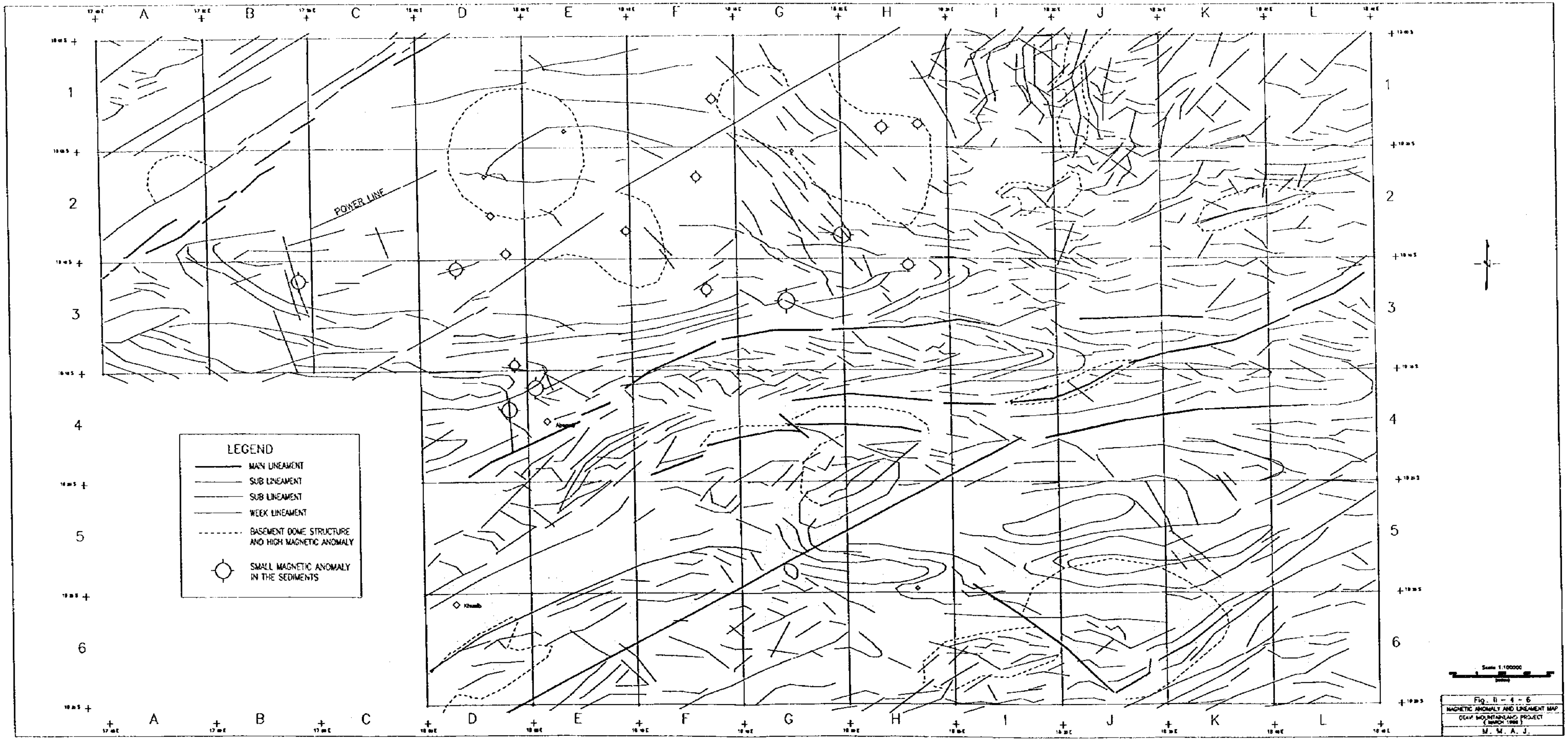

Fig. II −3−4 Magnetic anomaly and lineament map

3-2. Radiometric Survey

3-2-1. Objective and Method

The main objective of a radiometric survey is to delineate subsurface radioactive rock units and interpret these for favorable ore hosting structures. The total gamma, K, Th and U intensity observed by gamma ray spectrometer are processed appropriately to extract fracture zones and to assume lithomaps.

3-2-2. Specifications

This the survey was carried out in conjunction with the aeromagnetic survey and the specifications are thus the same as those described in 3-1-2.

3-2-3. Equipment

The equipment used are listed in Table II-3-1. The calibration of gamma ray spectrometer was done prior to the survey at the Eros airport calibration padsand again in Henties Bay.

3-2-4. Data Processing and Interpretation Procedure

Flow chart of the data processing and interpretation is illustrated in Fig. II -3-5.

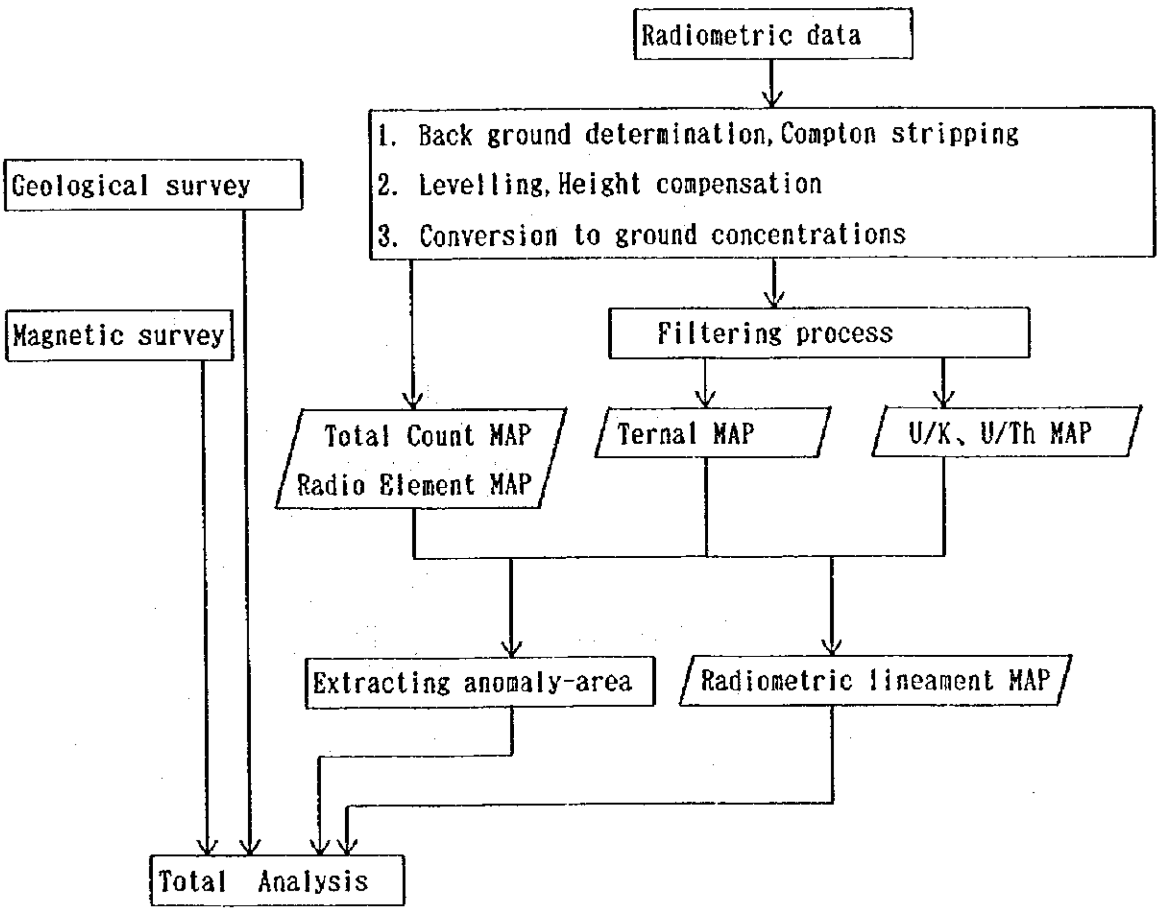

Fig. II −3−5 Flow chart of airborne radiometric survey

3-2-5. Result of Measurement and Interpretation

Commonly radiometric surveys include exploration of uranium ore deposit, discrimination of lithofacies and extraction of fracture lineaments. The analysis and interpretation were emphasized on the last two objectives. The features derived form total count of gamma-ray and radioelement concentration maps are summarized as follows.

(1) Total gamma-ray anomaly

The northeast-trending lineaments observed particularly in the northern half of the survey area are interpreted as fluvial paleochannels. Surfy pattern of anomaly identified east of the area seems to be paleodunes of the Kalahari desert resulting from the varying degree of concentration of each radioelement as well as paleotopography .

(2) Equivalent Uranium anomaly

The uranium concentration is generally low and shows no specific anomalies. Weak concentration with northwestern trend is recognized in the central part where the thorium content is low. The northwest of the area is also anomalous.

(3) Thorium anomaly

The thorium concentration is high over the exposed terrain as well as potassium and is comparatively high also in the central west and central part of the area. The concentration seems extend along with uranium concentration.

(4) Potassium anomaly

The potassium content is higher over the exposed area than over calcrete terrain.

Potassium concentration coincides conformably with the lithological boundary and Within the Damara sequence, the Abenab Subgroup in particular is more potassic. Within the Kalahari sand terrain, potassium is slightly high in the extreme northeast and low in the south. The anomaly map revealed that potassium was the important tool to discriminate the exposed lithofacies but in the terrain of calcrete.

Linear anomalies of uranium may provide useful information necessary for fracture mapping. It is generally accepted that mineralisation may occur through the fractured zones. Mineralisation of this area which is believed of the Mississippi Valley Type therefore could be related to the linear structures that had enabled to form karsting at the loci of ore deposits. But it is quite difficult to clarify the relationship between the currently observed lineaments and ore deposits as stated above.

The only anomaly originated from uranium could be extracted by means of U/K and U/Th ratios because these ratios of common rocks are less variable. U/K and U/Th ratio maps are shown in Fig. II -3-6 and Fig. II -3-7. In addition to the above-mentioned characteristics, the ratios are very important for the survey because of elimination of such radiometric disturbances as topography, artificial structure and meteorological change which may effect equally on a count of each radioelement.

The following aspects were indicated from the lineaments thus extracted and are illustrated in Fig. II -

3-8.

(1) A northeasterly trending radiometric lineament traverses close to the Abenab and Khusib ore deposits showing lithological extension.

(2) In the terrain of calcrete, a couple of weak but long lineaments were followed some of which are locally curved suggesting deformed older fracture zone. Those include chiefly west- northwesterly trending long lineaments running from the west to central of the surveyed area with some lineaments parallel to those.

(3) Weak but continuous lineaments strike northwesterly to the south of Abenab mine.

(4) Uncertain lineament

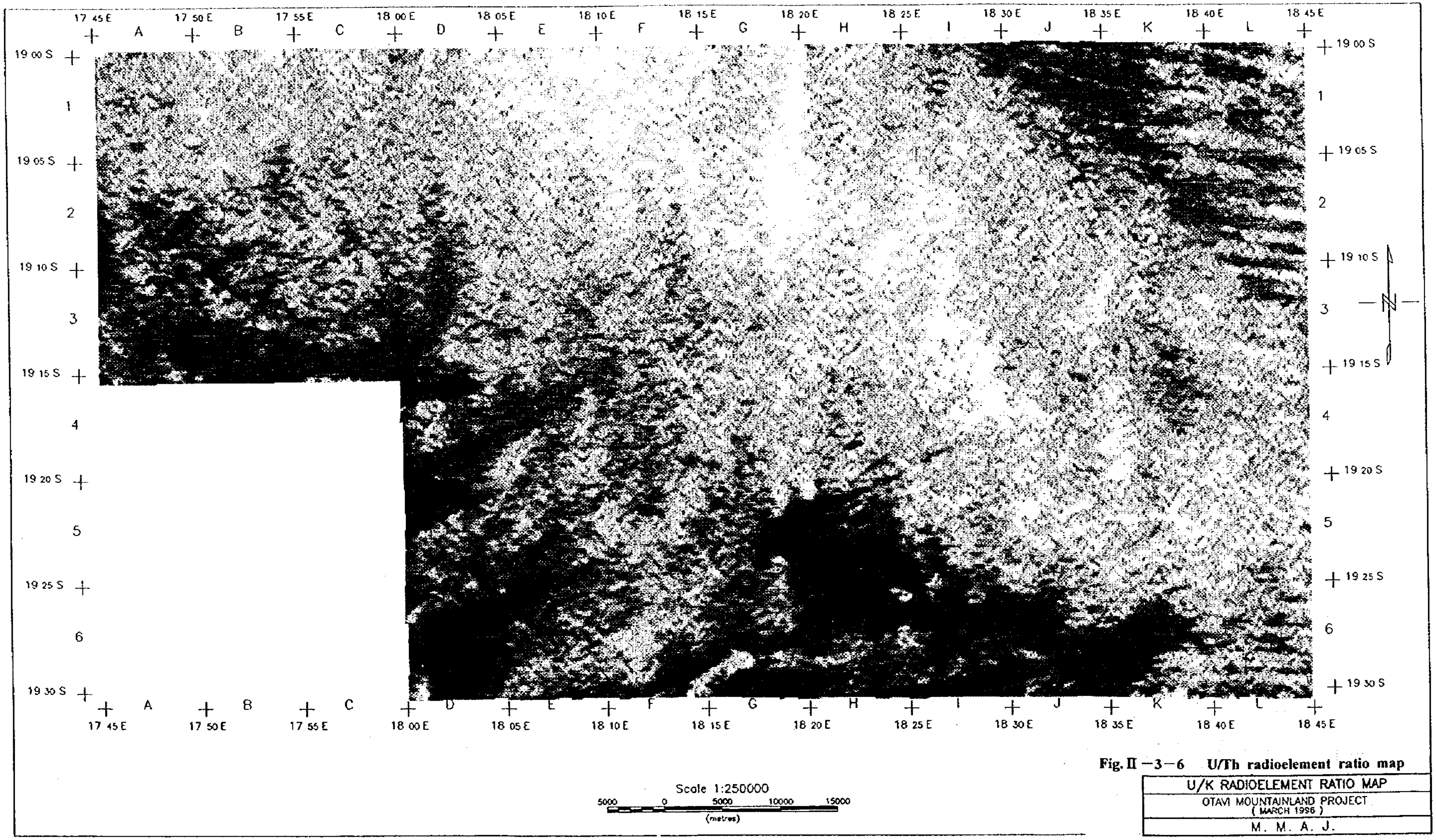

Fig. II－3－6 U/Th radioelement ratio map

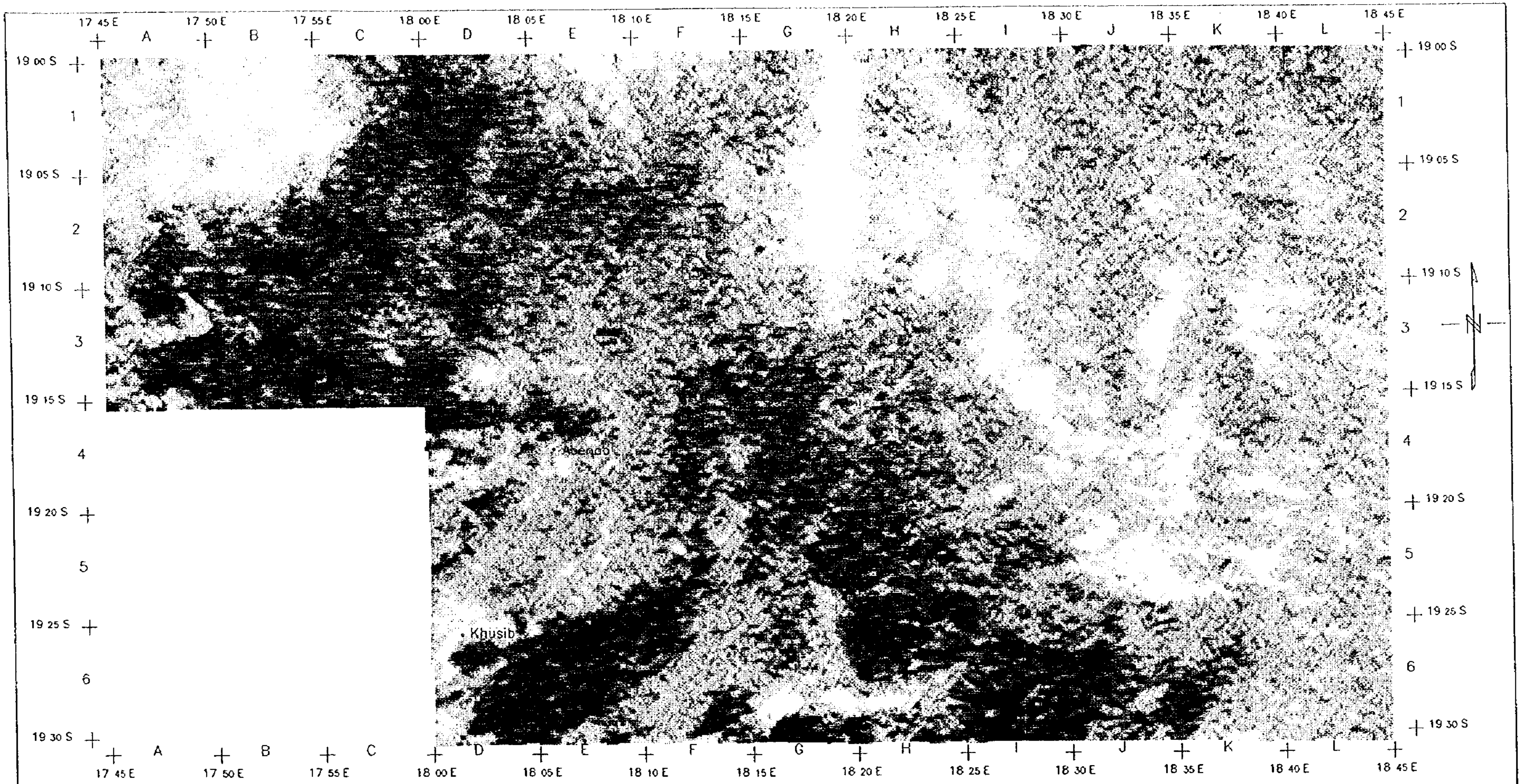

Fig. II −3−7 U/K radioelement ratio map

Scale 1:250000

5000 0 5000 10000 15000

(metres)

U/Th RADIOELEMENT RATIO MAP

OTAVI MOUNTAINLAND PROJECT
(MARCH 1996)

M. M. A. J.

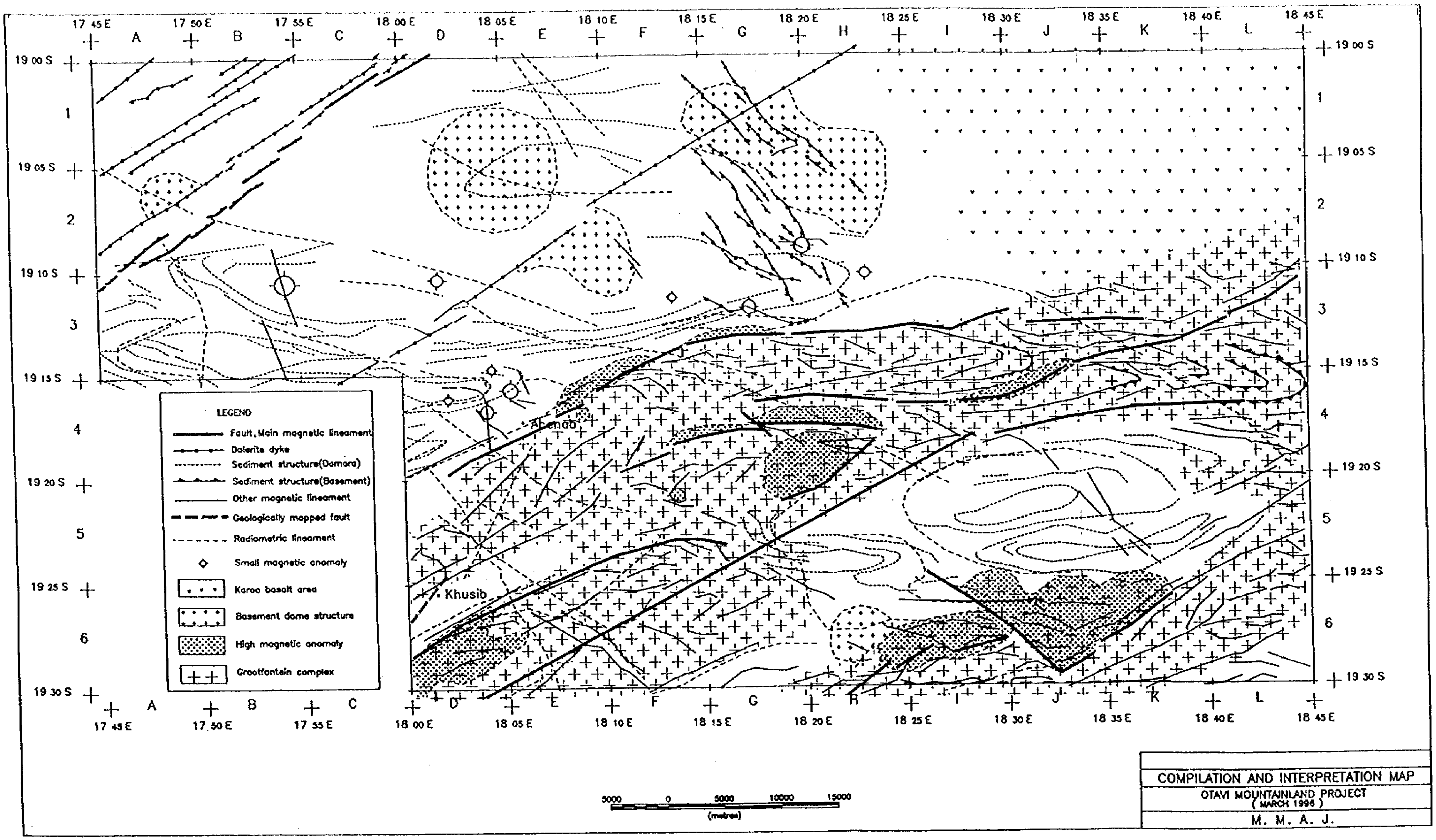

Fig. II－3－8 Compilation and interpretation map of aeromagnetic and radiometric survey

3-3. Airborne Electromagnetic Survey

3-3-1. Objective and Method

The objective of the survey is to obtain the subsurface resistivity maps and to extract low resistivity anomalies which may derived from sulphide deposits over the survey area where no proterozic formations expose being covered by calcrete sediment.

The electromagnetic (EM) method is a survey method which uses electromagnetic induction to measure the distribution of resistivity in the Earth as well as to locate buried electrically conductive bodies such as ore deposits. There are various measuring systems for the electromagnetic method. The Dighem V airborne EM system employs the in-phase / quadrature measuring method.

This method uses a combination of transmitter (Tx) coil and receiver (Rx) coil with fixed coil spacing and measures the phase components (in-phase and quadrature components) of the mutual inductance between the coils which vary due to the effect of the Earth's induction. An EM instrument is moved over a survey line to observe the variation of the phase components and the subsurface resistivity distribution below the survey line can be obtained by analyzing the measured data according to the EM theory described later.

Fig.II-3-9 illustrates the concept of electromagnetic-induction in the EM method. The transmitter (Tx) coil generates an alternating primary magnetic field, shown as a solid line. When this passes through a buried conductor, an eddy current flows inside the conductor. The eddy current generates the secondary magnetic field shown by dashed lines in the figure, which is measured by a receiver (Rx) coil.

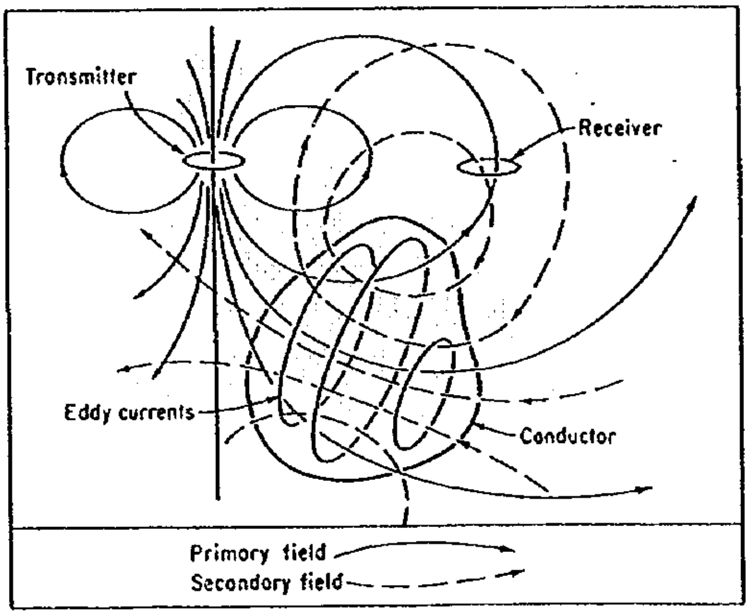

Fig. II −3−9 Concept of electromagnetic induction

Table II −3−3 **Boundary Points of Airborne Electromagnetic Survey**

	XTM	YTM	Latitude			Longitude		
			°	′	″	°	′	″
1	131410E	303956S	19	15	00.000S	17	45	00.000E
2	131503E	316871S	19	08	00.000S	17	45	00.000E
3	63118E	317233S	19	08	00.000S	18	24	00.000E
4	63083E	307087S	19	13	30.000S	18	24	00.000E
5	87617E	306986S	19	13	30.000S	18	10	00.000E
6	87579E	299053S	19	17	48.000S	18	10	00.000E
7	105096E	298960S	19	17	48.000S	18	00	00.000E
8	105126E	304126S	19	15	00.000S	18	00	00.000E

3-3-2. Survey Specifications

The main specifications are mentioned below.

(1) Location and Coverage

Fig. II -3-1 and Table II -3-3 delineate the survey area with a coverage of 904 km2 where the data acquisition of resistivity was conducted.

(2) Direction of the flight line is true north to south and the interval is 200 metres with tie lines of 5 km interval. The shortest flight line is 2500m long and the total line kilo is 4895 km.

(3) Air craft

Bell-Long Ranger III ZS-RFA helicopter was used.

(4) Altitude was maintained at 35 m for electromagnetic and 50m for aeromagnetic.

(5) Lateral sampling interval is less than 6 metre.

(6) Navigation was of GPS-Video tracking system

Boundary points of the survey area are shown in Table II -3-3.

3-3-3. Equipment

The equipment used in this airborne EM survey is the DIGHEM V system produced by the Canadian firm DIGHEM. Dighem V system consists of a EM unit (EM response measuring unit), a high-sensitivity magnetometer, a radio altimeter, a GPS navigation system, a tracking video camera, and analog- and digital recorders. The specifications of the Dighem V system are shown in Table II -3-4. Fig. II -3-4 is a diagram of the in-flight measurement. The EM console was loaded on the helicopter.

Table II --3--4 Specifications of Equipment for Airborne Electromagnetic Survey

Item	Manufacturer · Type · Specifications etc.	No
Aircraft (Helicopter)	Bell Long Ranger L3-ZS-RFA	1
Magnetometer	Scintrex H8 cesium vapor optically pumped magnetometer with the sensor installed in a tail stinger pod.	1
Acquisition system	RMS DAS 8 -including: RMS 4183A micro computer module RMS 4185A analogue input module RMS 4239A tape interface module RMS 4272A smart serial interface module RMS 4137 digital interface module RMS TDC 3620 tape cartridge recorder, interfaced to the digital acquisition system via the RMS 4239A module RMS GR33A chart recorder	1
Compensator	RMS AADC II,27 terms.	1
Flight path tracking	National Panasonic AG-7450 S-VHS video system recorded to VHS cassette, in the European PAL format.	1
Navigation & flight path recovery	Two NovAtel 3151R GPS receivers for flight location and base station location information operating in real time differential mode.	1
Altimeter	Sperry 200-A radar linear tracking altimeter	1
Barometer	Intellisensor AIR-DB-2B digital barometer /altimeter	1
Base Magnetometer	Scintrex H8 Cs vapor magnetometer	1
Processing platform	IBM-PC 486 computer with SCSI tape drive	1
Base receiver	NovAtel 3151 GPS receiver employing a PC driven NovAtel GPS card TM Performance 3151R	1

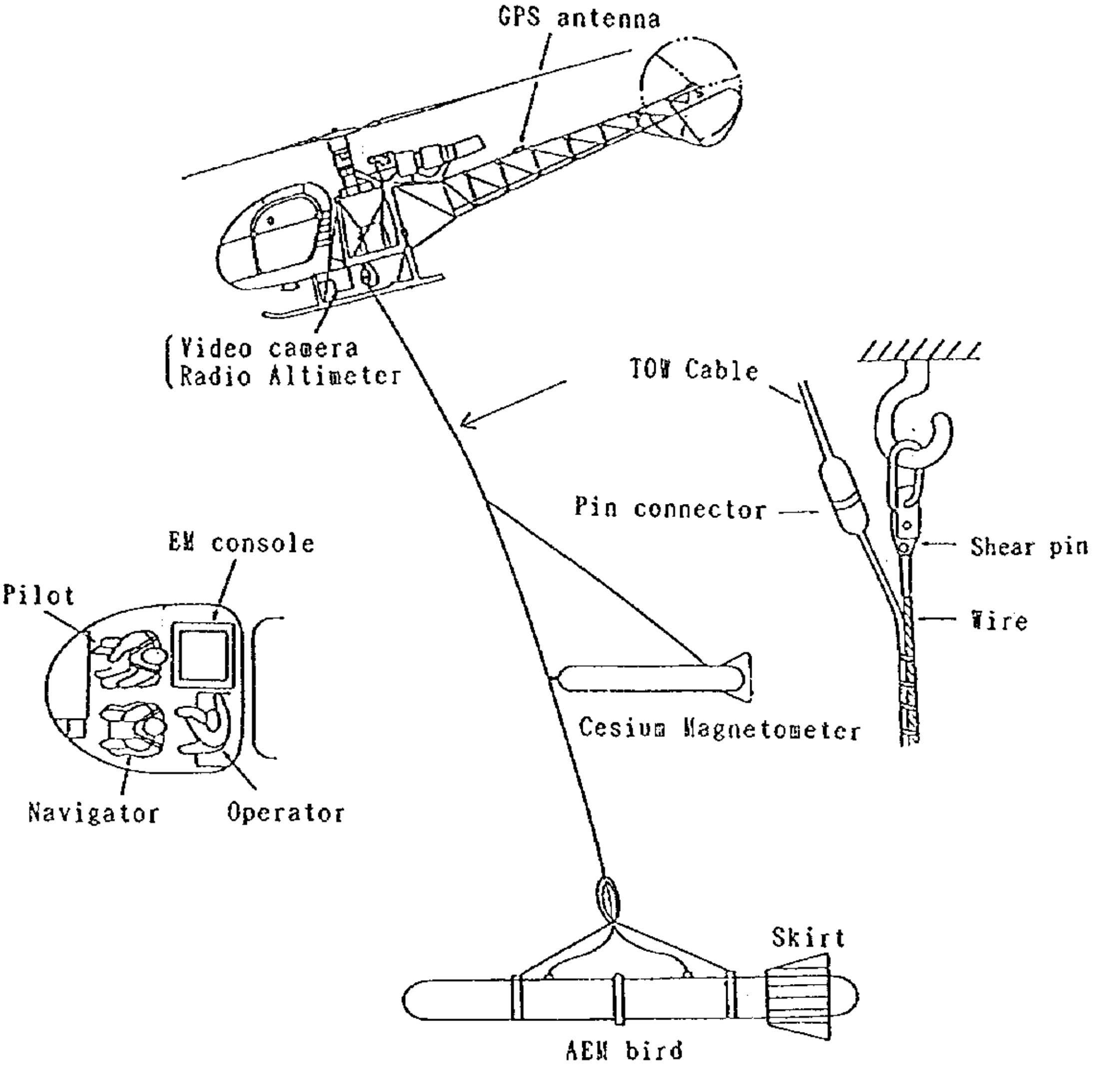

Fig. II — 3 — 10 AEM instrumentation

An EM sensor (or EM bird) and a magnetic sensor(or Mag-bird) are towed by a 30m long towing cable. The cable contains multi-conductors and is bundled together with a steel wire. A shear pin has been designed to break so that in case of a sudden shock the bird will fall free of the helicopter.

The EM unit consists of the EM sensor and EM measuring circuits contained in the EM console. The EM bird is a cylinder 10m long and 50cm in diameter made of fiber reinforced plastic containing four pairs of transmitter/receiver coils, and is electrically connected to the EM console through the cable.

Dighem V measures eight channels of EM responses, that is, in-phase and quadrature for each of four frequencies. Both Hi/Hp and Hq/Hp are measured in ppm units, and recorded digitally. Three pairs of horizontal-coplanar coils are suitable for resistivity mapping, and a vertical-coaxial coil-pair is good for detecting steeply dipping conductors. The magnitude of the secondary field(Hs) is much smaller than the primary field(Hp), therefore the EM unit is designed to measure Hs accurately by means of canceling Hp in the circuits.

3-3-4. Result and Interpretation

Apparent resistivity plan maps were prepared using three frequencies in a coplanar coil disposition as well as apparent resistivity cross sections using differential resistivity versus depth calculation method(Huang et Fraser 1996). The plan maps are presented in Fig.II-3-12 to Fig.II-3-14, and the cross sections in Fig.II-3-15.

For reference, the same index as used in the compilation and interpretation map of Phase I was applied to each maps.

Interpretation for resistivity map of 56000Hz(Fig. II-3-12)

(1) Among three frequencies, resistivity plan map of 56000Hz signifies the shallowest structure. Although the detecting depth may vary with the ground resistivity, the 56000Hz frequency could search the signals from about 100 metre deep in high resistivity zone equivalent to 10000 ohm meter and some 10 metre deep in the low resistivity zone of 100 ohm metre as shown in the cross section.

(2) The three resistivity maps are uniformly conformable to the existing geologic maps and aeromagnetic anomaly maps.

In the section A through D, four subparallel folding axes of east-west trend forming syncline and anticline are traced. In A and B sections the axes plunge easterly while in the D4 section westerly. The low resistivity band meandering along the fringe of the synclinorium is correlated to pelitic or psammitic layer of the upper Tsumeb subgroup. The inner bands of high resistivity and broad low resistivity to the inner direction may coincide with the uppermost dolomite of the Tsumeb subgroup and Mulden group respectively. The Tsumeb subgroup/Mulden group contact is well coincident with that delineated by aeromagnetic lineaments.

(3) In the section B, the resistivity for subsurface Mulden group is lower in the south than in the north, suggesting the calcrete of high resistivity is thin or lacking.

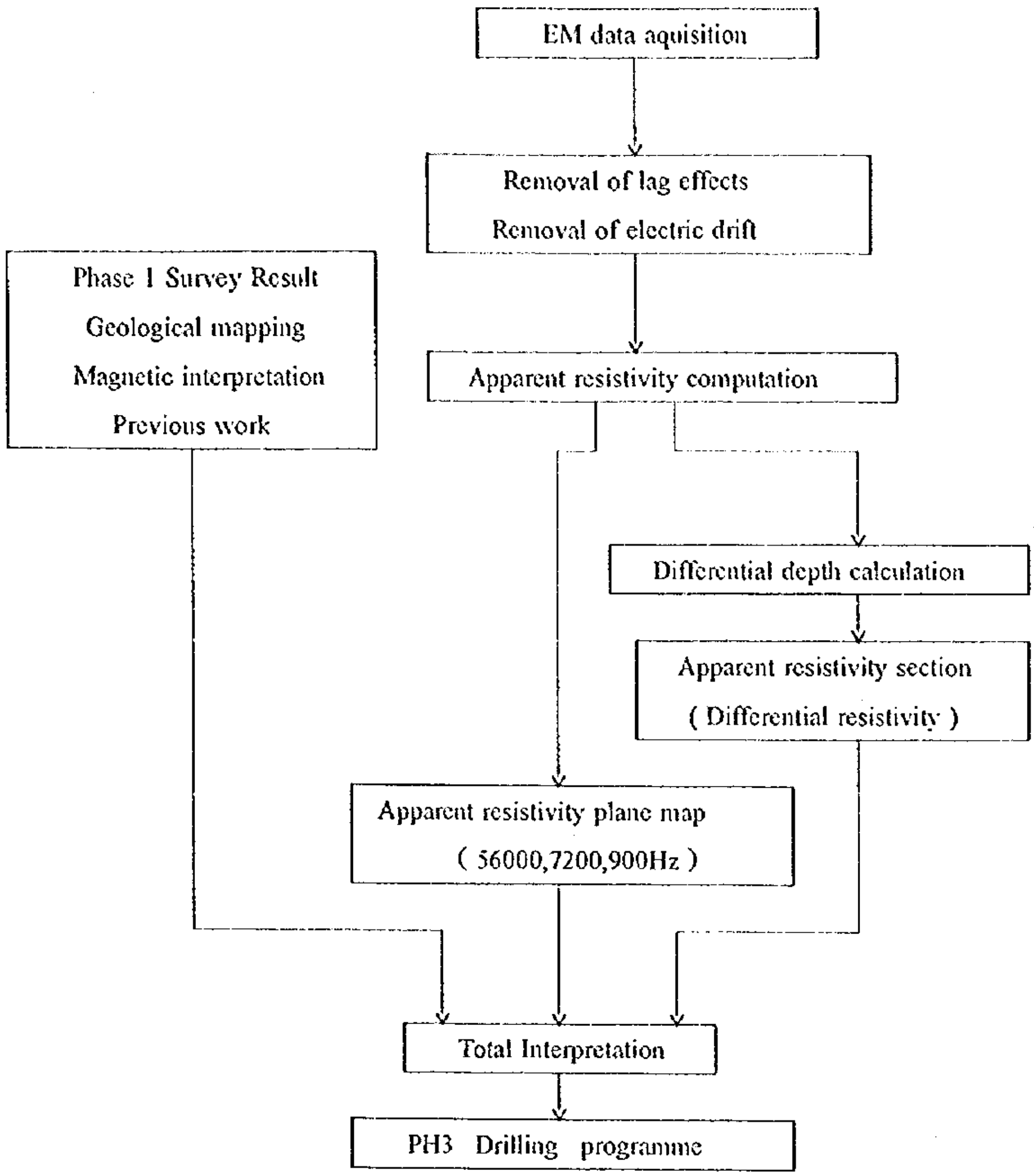

Fig. II −3−11 Flow chart of airborne electromagnetic survey

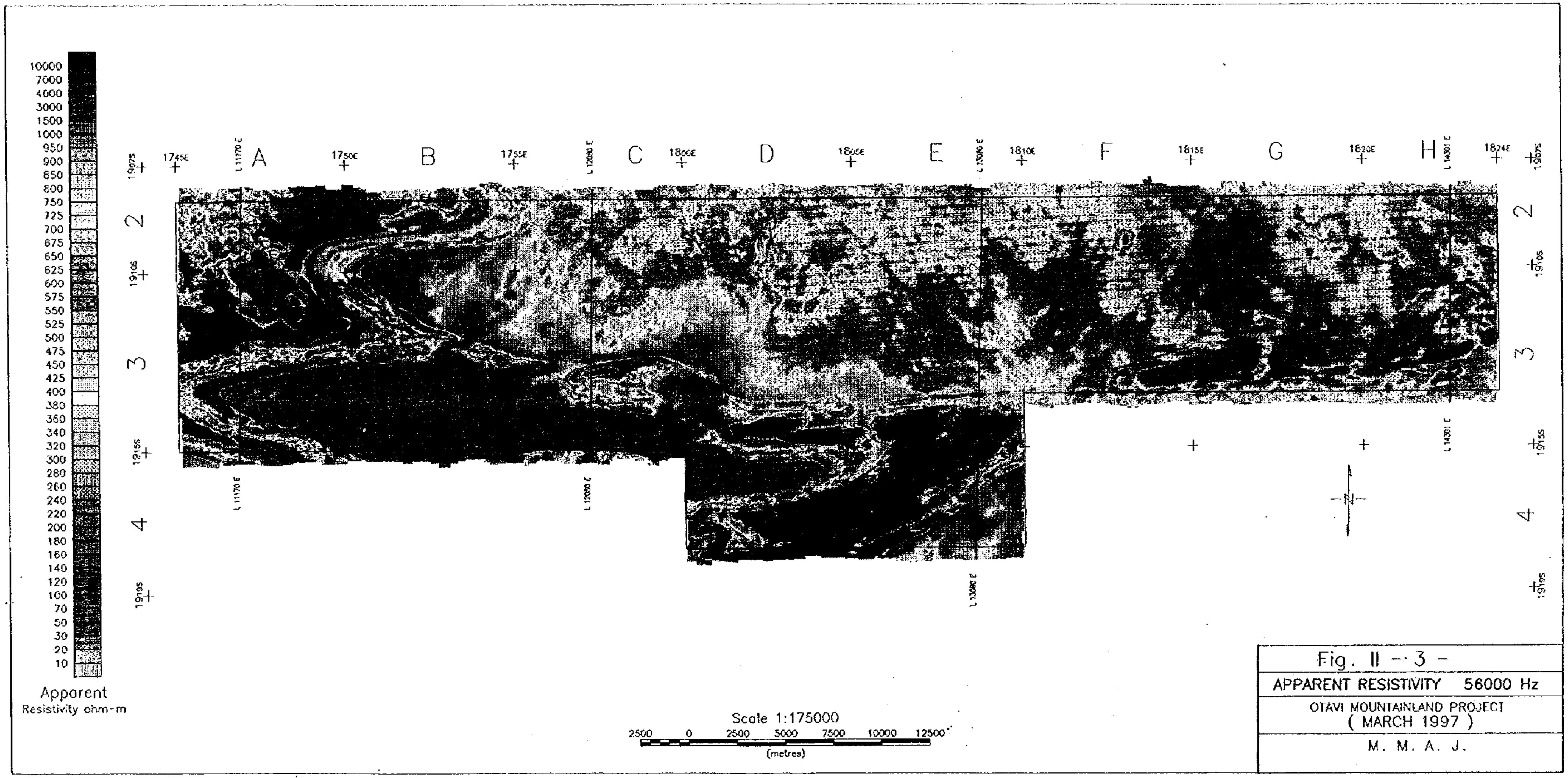

Fig. II −3−12 Resistivity map for 56000 Hz

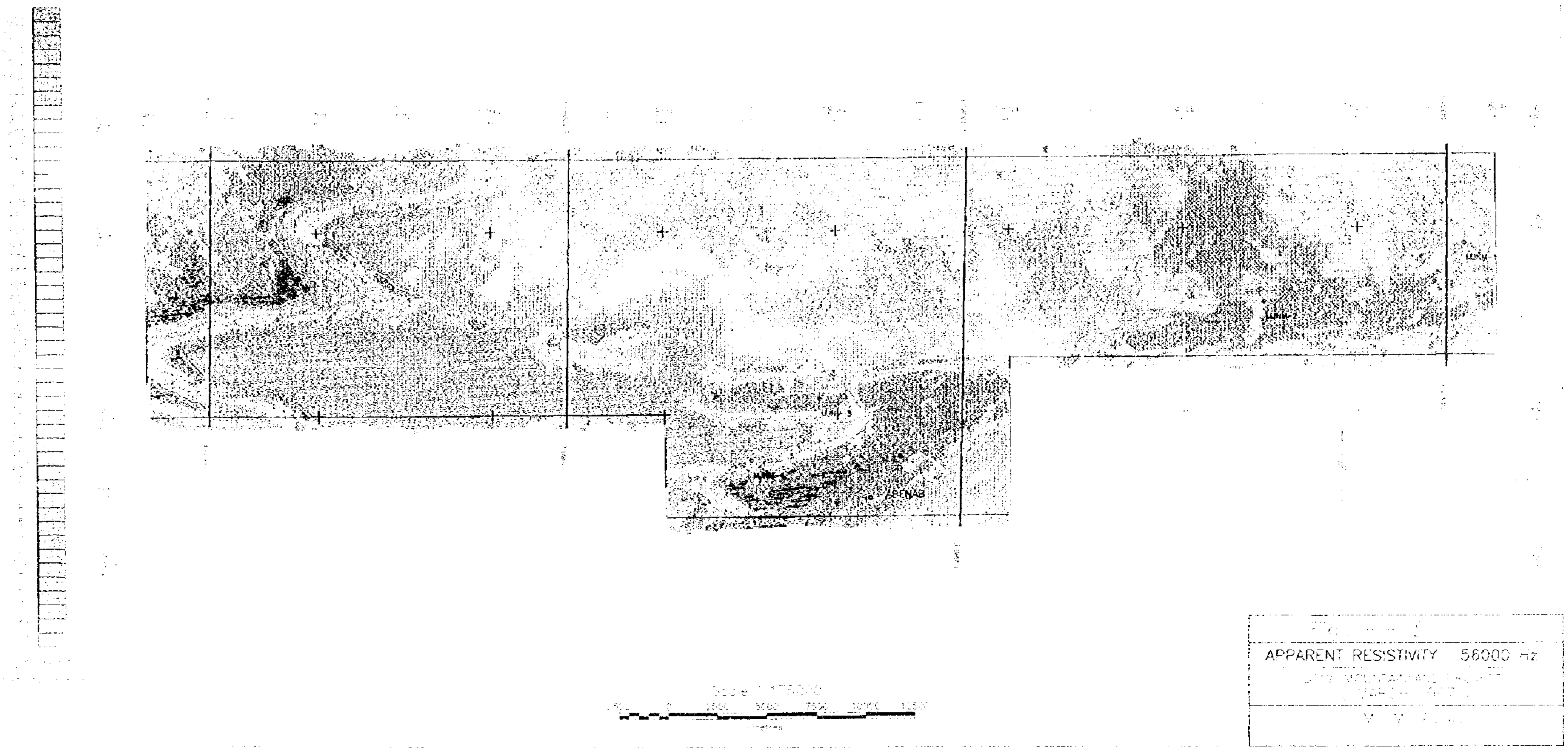

Fig. II-3-12 Resistivity map for 56000 Hz

(4) In the east of the survey area the resistivity is generally high except E4 section includes some low resistivity area. The contact between low and high area coincides with the aeromagnetic fault traversing the Tsumeb subgroup and the basement complex.

(5) An isolated low resistivity zone is delineated over an area 2 km by 500 m within the high resistivity terrain. The zone is stretched subparallel to the folding axis and correlated to the upper Tsumeb subgroup, and is therefore likely to be originated from a formation of locally low resistivity. But the zone has uniform resistivity values for three frequencies in the order of 50 to 100 ohm metre, indicating that the zone may extend to 150 m depth or more.

(6) With 56000Hz, the low zone lying over A2/A3 boundary is most remarkable. With other two frequencies the zone contracts and shows higher resistivity. It is therefore correlated to a shallow-seated weathered formation or aquifer. The resistivity values vary from 50 ohm m near surface through 150 ohm m at 50 m deep to some hundreds ohm m at the greater depth.

Interpretation for resistivity map of 7200Hz(Fig. II -3-13)

(1) The general trend of the resistivity for this frequency is similar to that of 56000Hz with generally lower resistivity than the latter. The searching depth is 300 m in the high resistivity terrain of 8000 ohm m and 50 m in the low resistivity terrain of 100 ohm m.

(2) While the low resistivity band of the upper Tsumeb subgroup mentioned in II-3-5-2(2) changes into further lower band, another low zone related to the Mulden group gives slightly higher resistivity than those of 56000Hz. This is because the upper Tsumeb group extends to the deeper place and the Mulden group is significantly thin or the surficial layer was turned to be low resistivity caused by weathering.

(3) The Mulden group shows lower resistivity than the 56000Hz in B2 to B3 section.

(4) The low resistivity band of the upper Tsumeb can be traced from E3 towards H3 section. In G3 and H3 a low resistivity zone is recognized which may suggest the synclinal Mulden group plunging to the west.

(5) The terrain of basement complex which was indicated in the southeast of the survey area by aeromagnetic survey, gives pervasive low resistivity resulting from argillaceous mineral(saplorite) formed through weathering of ultrabasic rock.
The cross section indicate the low resistivity layer may be some 50 metre thick and is underlain by unaltered basement of high resistivity.

(6) In H2 and H3, a lineament of low resistivity runs northwesterly. No lineament is recognized in 56000Hz map and a significantly remarkable lineament is traced also in 900 Hz map suggesting that the

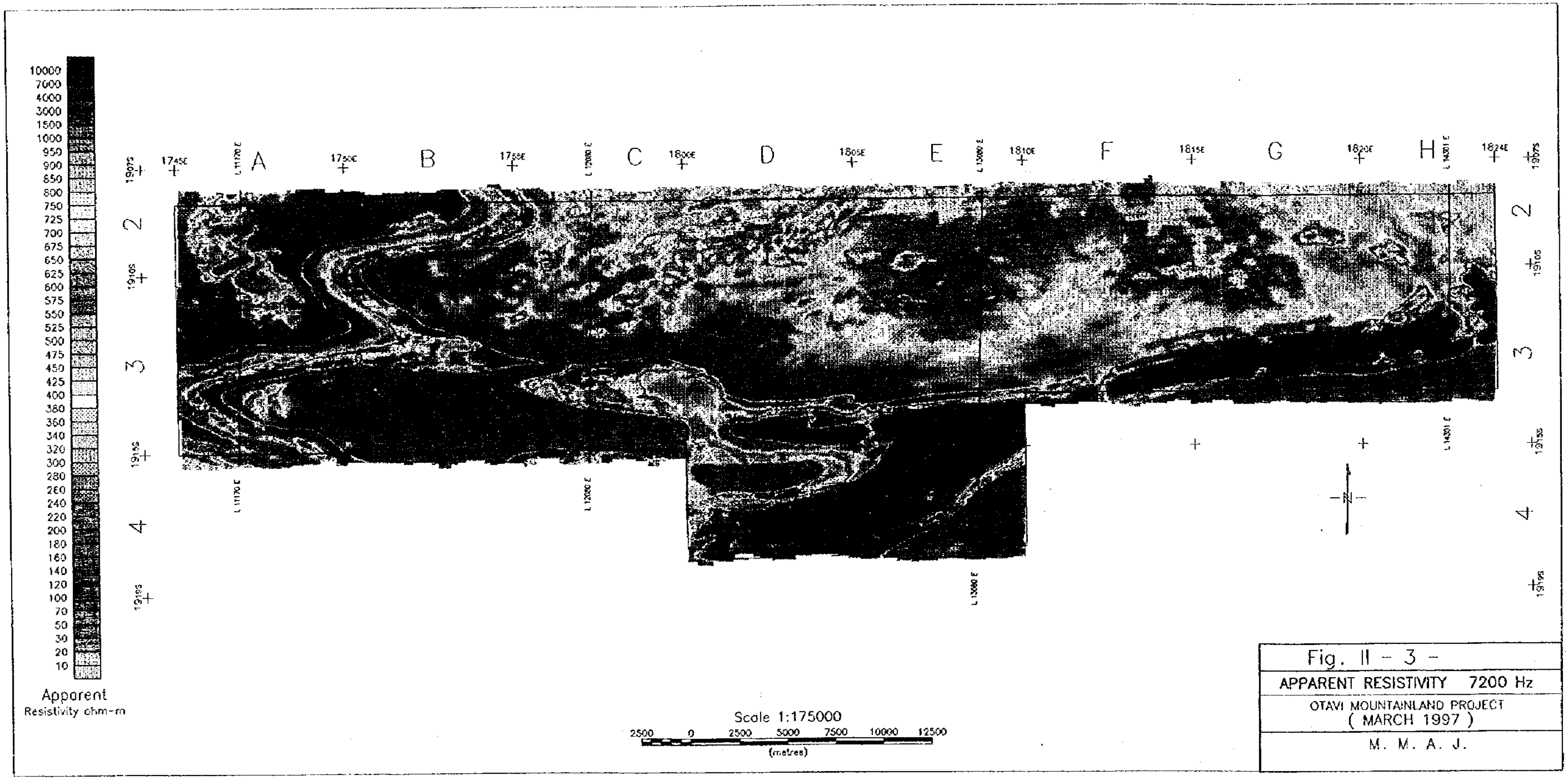

Fig. II-3-13 Resistivity map for 7200 Hz

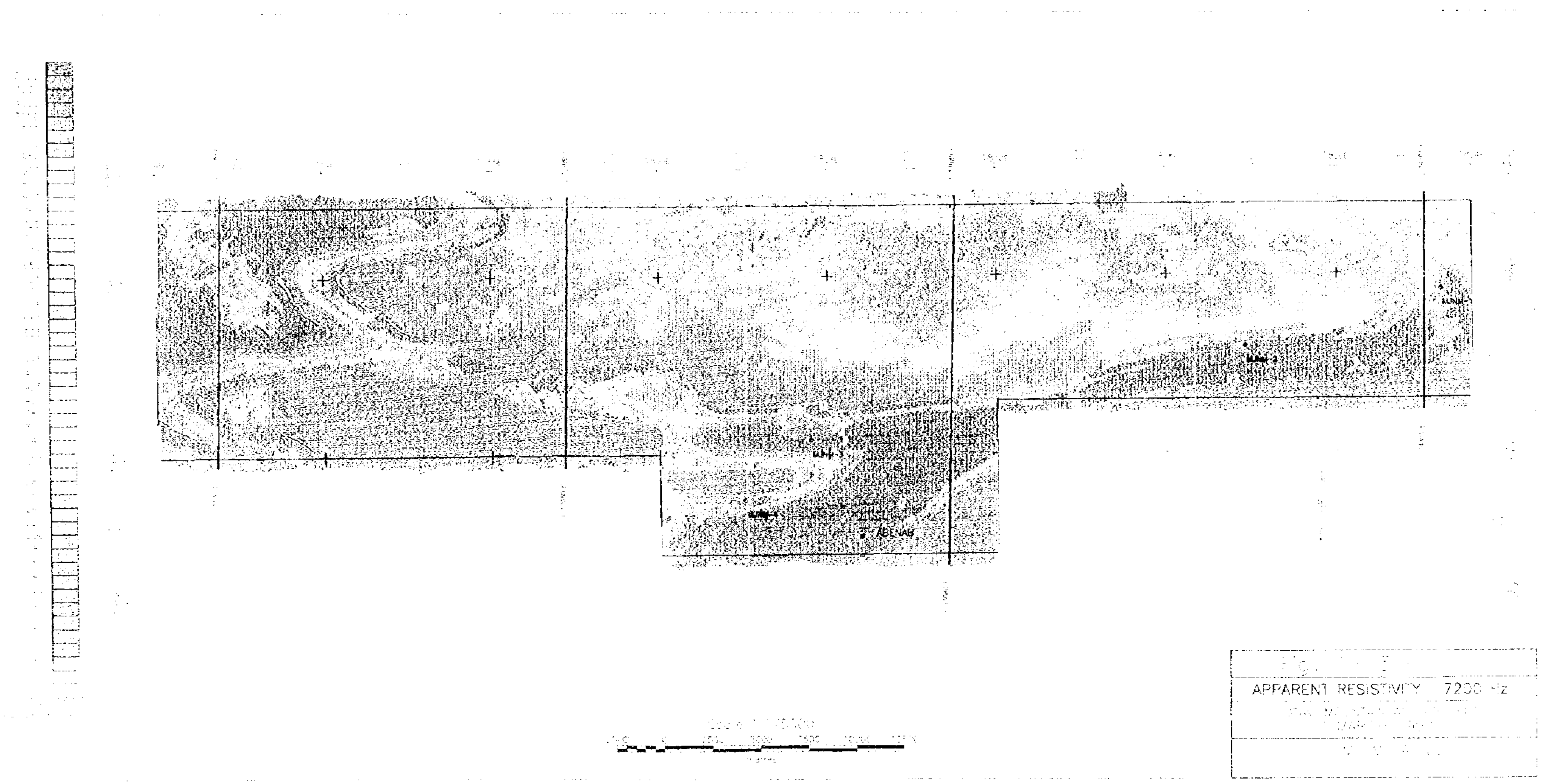

Fig.II - 3 - 13 Resistivity map for 7200 Hz

lineament may extend to the depth. It is noted that the lineament traverses nearby sedimentary structures giving much lower resistivity when it overlaps the folding axis. It was realised that MJNM-1 hole was located at the tip of low resistivity'branch stemmed from the lineament.
In addition, parallel to the lineament a resistivity limit is recognized in G2 and G3. A low resistivity zone extends to the east of the limit and may indicate alteration and an independent structural domain. The limit is parallel to the aeromagnetic lineaments correlated to a swarm of dolerite dykes and forms the west limit of the swarms.

(7) The low resistivity zone mentioned above(6) contracts in this map and some sots of low resistivity extend along the northeast trending aeromagnetic lineament of dolerite.

Interpretation for resistivity map of 900Hz(Fig. II-3-14)

(1) Total trend of resistivity is the same as 56000 and 7200 Hz. It implies the deepest information of the survey area. The searching depth is greater than 300 m in the high resistivity terrain of some thousands of ohm m, being about 150 m when the low resistivity zone of 100 ohm m underlies from the surface and is 200 to 300 m where the high resistivity zone lies 100 m thick from the surface with low resistivity zone underlain.

(2) The extension of the low resistivity which is correspondent to the Mulden group mentioned in the item(3) of 7200 Hz is obviously recognized in the east to middle of the survey area.

(3) Some northwest striking faults are localized in E2 and D3 sections. Some of them are coincident to the aeromagnetic lineaments which are possibly derived of dolerite dykes associated with faults. Some other lineaments in no association with aeromagnetic anomalies occur. The electromagnetic image processing map enhances this characteristic. Neither of the maps for 56000Hz and 7200Hz give such lineaments implying that the lineament is deep-seated fractures without surface showing. The fractures dislocate the Mulden group to the south in the east.

(4) From C2 to F2, east-west orienting low resistivity lineaments are observed. Those could be regarded as the lower Mulden just above the unconformity or the low resistivity band of the upper Tsumeb subgroup.

3-3-5. Discussion

Resistivity and electromagnetic features of lithofacies

(1) Calcrete

The surficial calcrete is compact and the cores give high resistivity of 1500 ohm m, while the lower facies sometimes include pebbles giving low resistivity. The electromagnetic data would give no

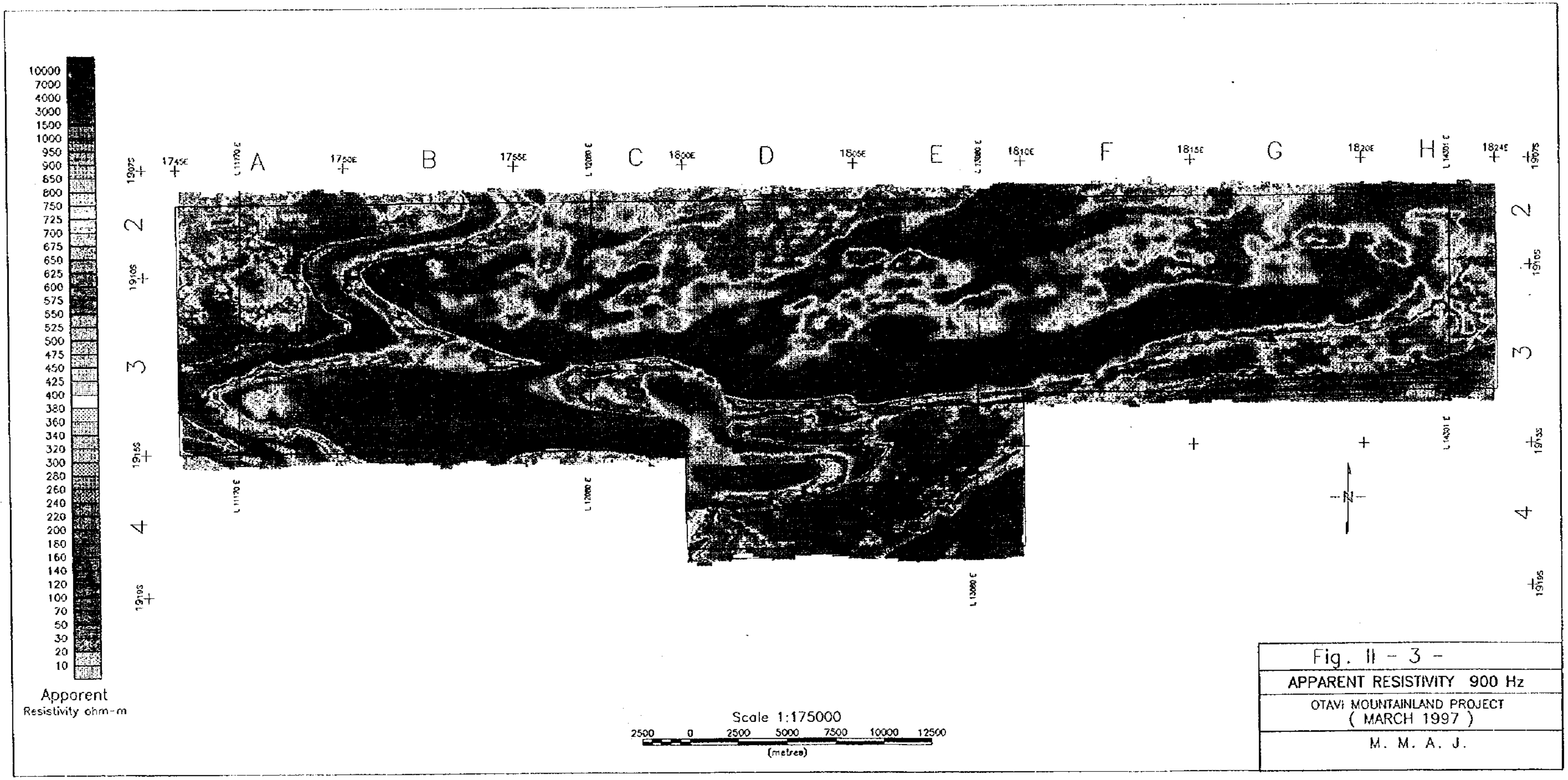

Fig. II－3－14 Resistivity map for 900 Hz

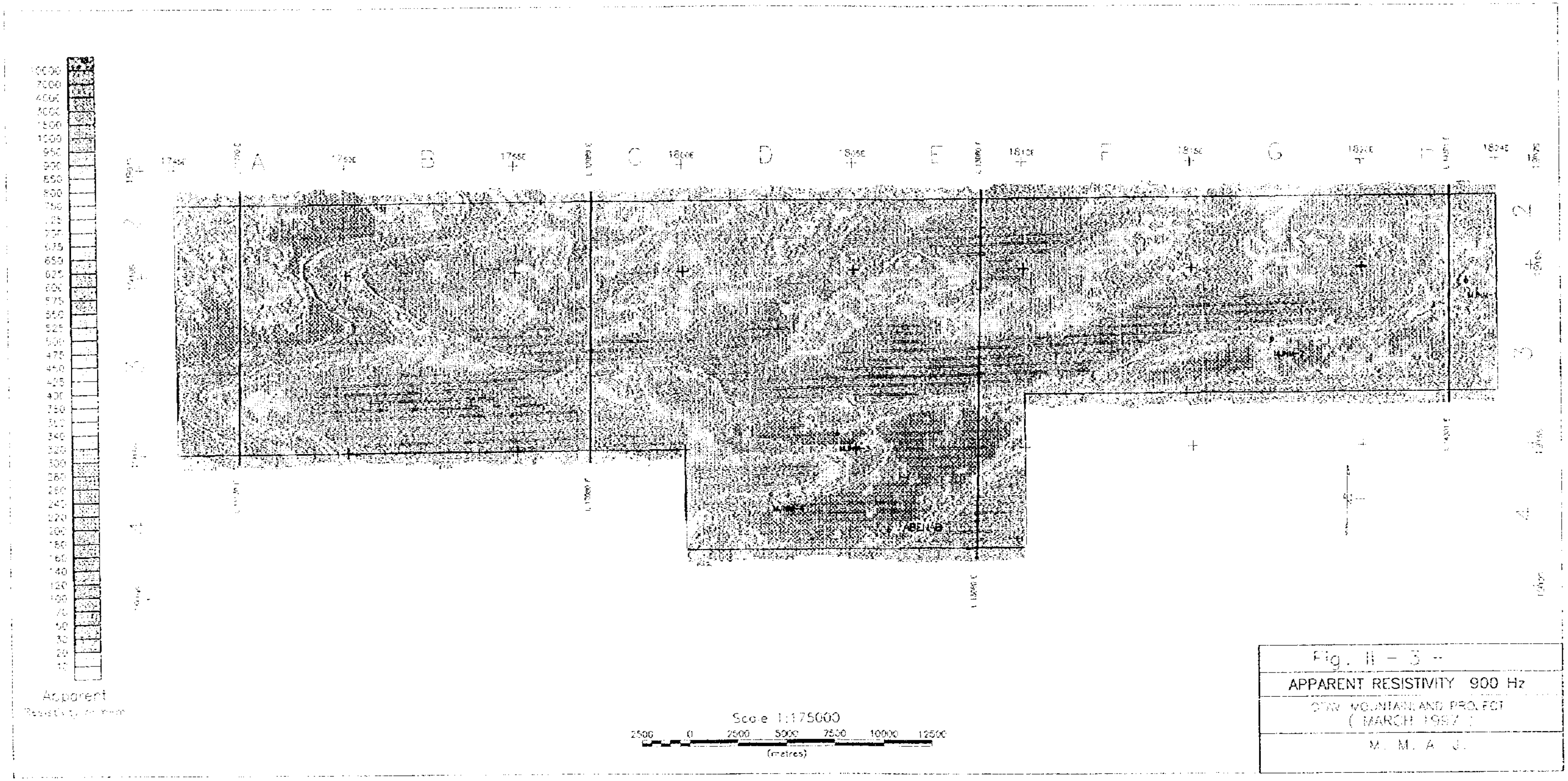

Fig. II－3－14 Resistivity map for 900 Hz

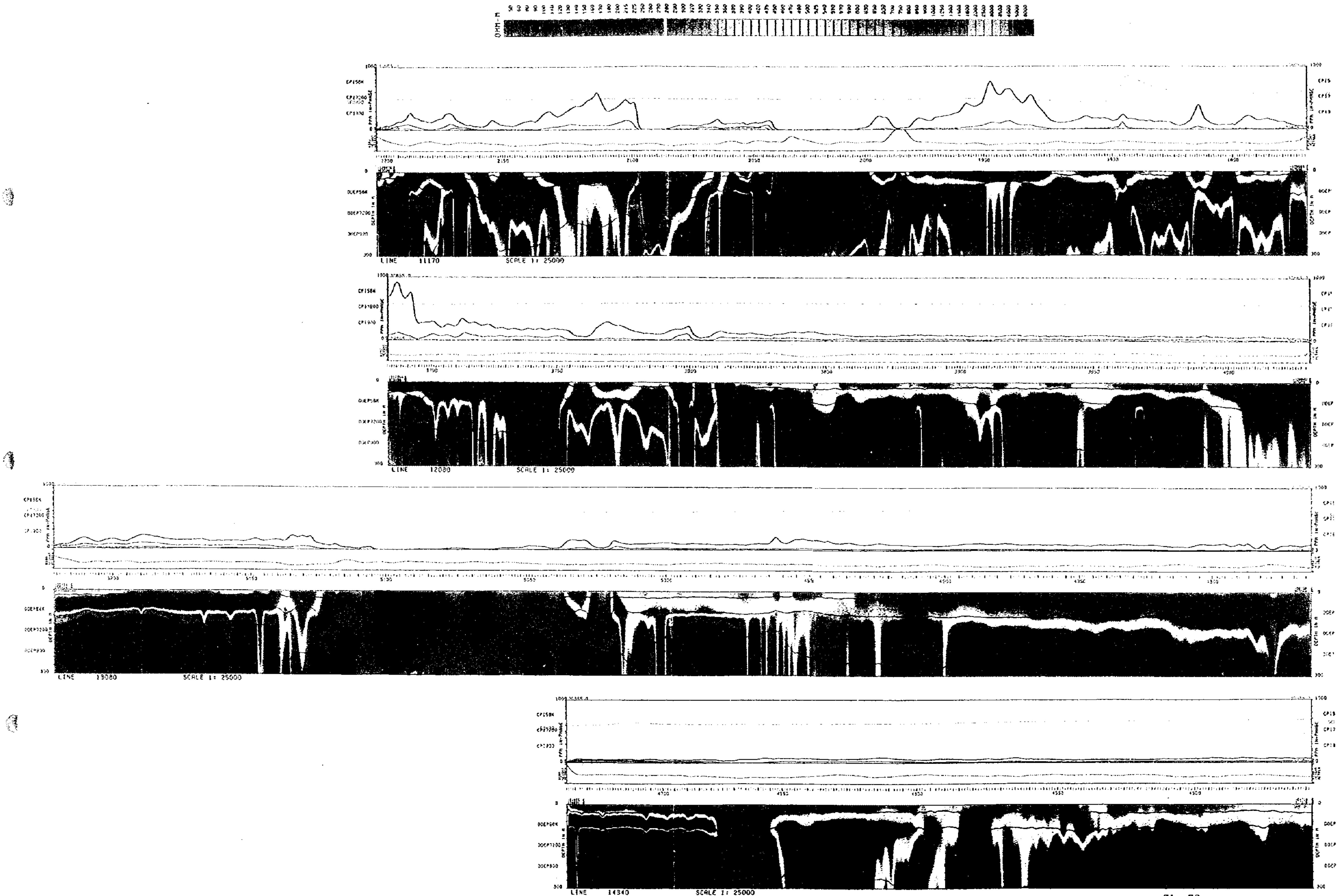

Fig. II－3－15 Cross section of Resistivity

discrimination of the stratigraphic position but give medium to high resistivity of 500 to 1000 ohm m. Irregular formed anomalies plotted in 56000Hz map may indicate lithological Inhomogeneity or ground water rather than fracture zone traversing the calcrete.

(2) Mulden group

The Mulden group shows considerably low resistivity varying from 50 to 150 ohm m lying in the core part of the east-west trending syncline.

(3) The pelite bearing lithofacies assigned to the upper Tsumeb group show low resistivity of 100 ohm m with local 10 ohm m from the surface to the depths. The host rock of the Tsumeb and Kombat ore pipes is dolomite formation underlain by pelitic beds and therefore is used as a key bed for interpretation.

(4) Dolomite of the Tsumeb subgroup

The dolomite formation presents the highest resistivity ranging from 1000 to 10000 ohm m. It is suggested that the shallow layer shows higher resistivity than the depth.

(5) Shallow-seated basement complex

The shallow seated basement complex lying to the south of the survey area is identified as the remarkably low resistivity layer under thin calcrete with high resistivity of 1000 ohm m. The apparent resistivity at 900 Hz ranges from 15 to 40 ohm m. The contact between the Damara system and the basement complex is coincident to that delineated by aeromagnetic survey and may suggest the faults. The cross section reveals that the low resistivity layer is 50 m thick and thereafter is underlain by unaltered high resistivity basement complex.

Ground water and aquifer

The resistivity of ground water which were measured in situ is constant over the survey area giving about 10 ohm m; conductivity 1 mS/cm. As the values are low for the ground water, it is expected to be rich in salts. It is anticipated that such a ground water as those filling the cavities of dolomite and calcrete gives low resistivity as sulphide ore does. The small-sized low resistivity zone of 200 to 300 ohm m delineated in the thick calcrete terrain only in 56000 Hz map may be resulted from the ground water reservoir.

Potential anomalies for mineralisation

A potential massive sulphide ore deposit could be hosted within the formation of high resistivity, which results in the model for an isolated low resistivity spot within the upper dolomite of the Tsumeb subgroup of high resistivity. Thus an outstanding electromagnetic response would be available in this model. But the discrimination of the response by a potential ore deposit from the low anomaly of resistivity caused by ground water is difficult because there occurs aquifers of low resistivity in various geometry.

In addition, the dolomite overlain by the Mulden group is believed to be favourable to a Tsumeb-Kombat sulphide ore pipe. However, because the Mulden group is uniformly of low resistivity, low anomalies in the underlying formation are not easily detectable. Therefore another three criteria were used to locate the targets for further exploration based upon the ore-type model.

(1) Lineament of low resistivity

This is a low resistivity zone delineated in 7200Hz map in context of the item(6) of 7200 Hz and is about 8 km by 0.5 to 1 km. The zone traverses the upper Tsumeb subgroup which is favourable host rock for ore deposits and diminishes the resistivity at the intersection of the folding axis indicating 200 to 300 ohm m at the depth of 100 to 200 metres.

(2) Low resistivity zone close to the TM contact and associated with magnetic anomaly

This is located at the north wing of the syncline in the B2 and B3 section showing low resistivity anomaly associated with the slightly intense aeromagnetic anomalies in the range of 20nT.

(3) Isolated low resistivity spots of Abenab West-type

In the vicinity of MJNM-1, small branches of low resistivity and spots stemmed from the resistivity lineament are located. These may be indicative of Abenab West-type ore potential.

The above mentioned anomalous areas are sometimes overlapped increasing the favourability of ores.

The result of the airborne geophysical survey was compiled into Fig. II-3-16. The exploration model shown in Fig. II-3-17 was constructed on the basis of a series of exploration work starting from the compilation of previous work up to the airborne geophysical survey. The determination of location of the drill hole was done according the flow chart illustrated in Fig. II-3-18.

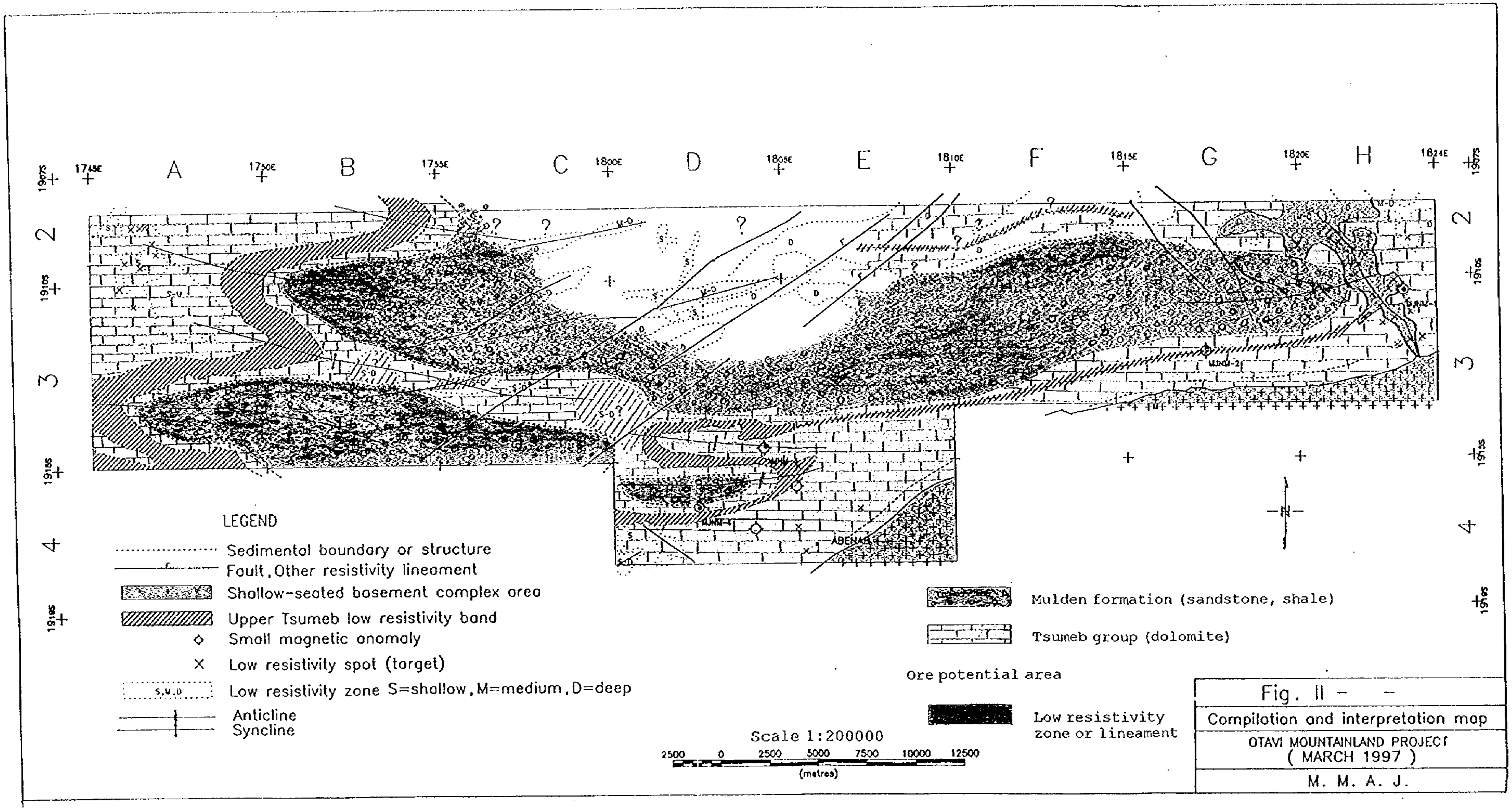

Fig. II −3−16 Compilation and interpretation map of airborne electromagnetic survey

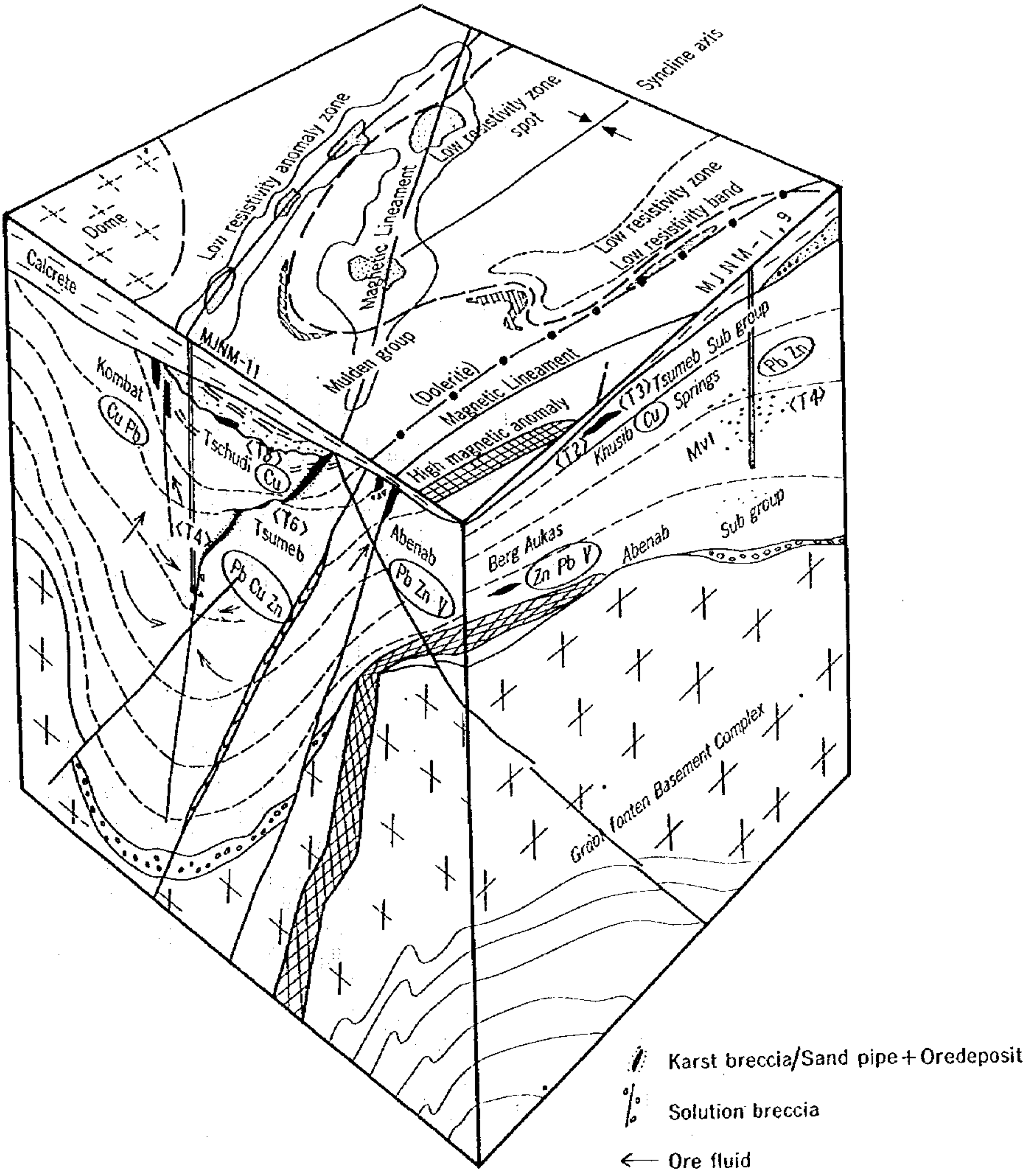

Fig. II −3−17 Exploration model for drilling

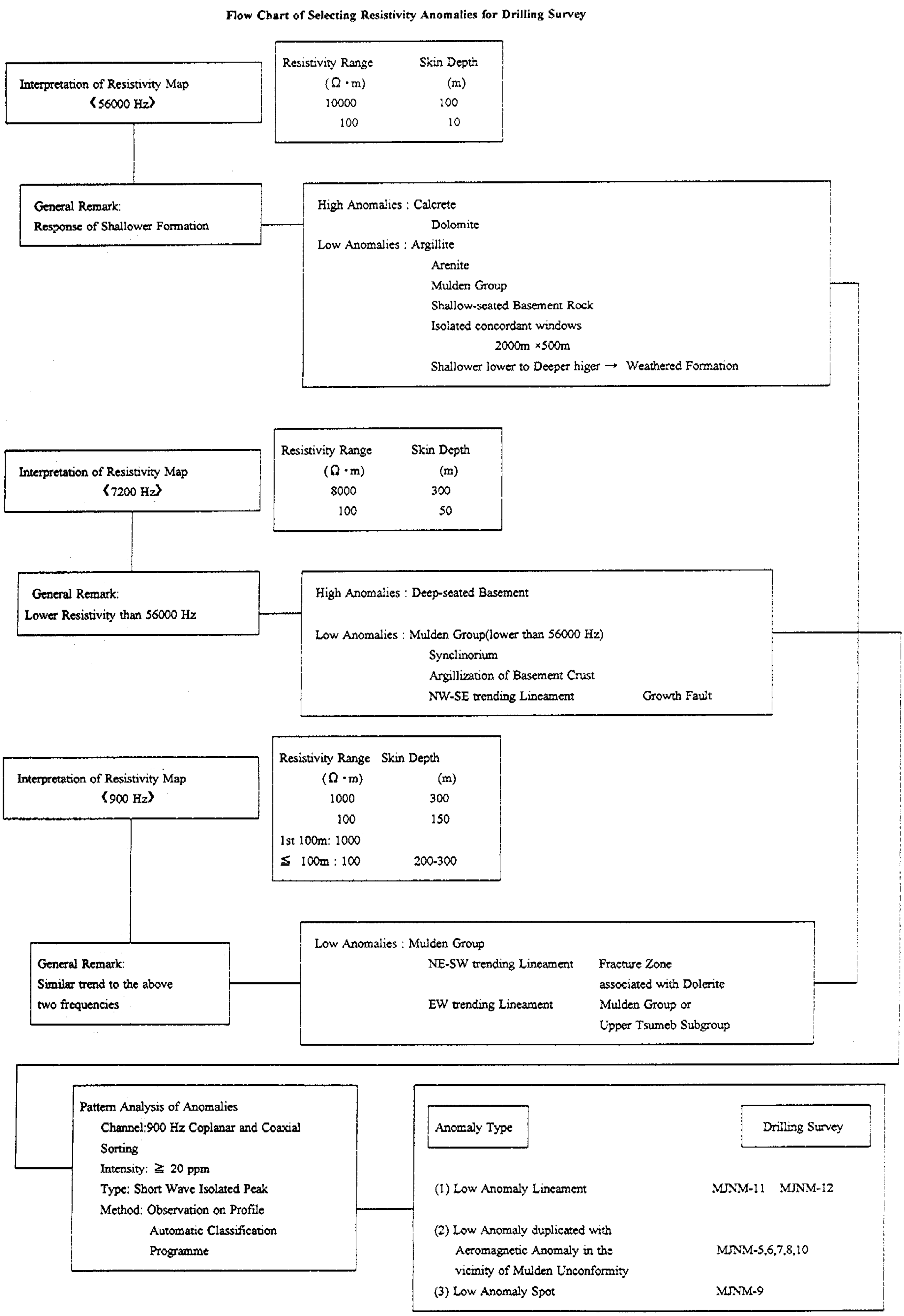

Fig. II-3-18 Flow chart of resistivity anomaly selection