REPORT
ON
THE MINERAL EXPLORATION
IN
THE OTAVI MOUNTAINLAND AREA
THE REPUBLIC OF NAMIBIA

PHASE II

FEBRUARY 1997

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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PREFACE

In response to the request of the Government of Namibia, the Japanese Government decided to conduct a Mineral Exploration in the Otavi Mountainland Area Project and entrusted the survey to the Japan International Cooperation Agency (JICA) and the Metal Mining Agency of Japan (MMAJ).

The JICA and MMAJ sent a survey team to Namibia headed by Mr. Tetsuo Hatasaki from 26 August to 28 November, 1996.

The team exchanged views with the officials concerned of the Government of Namibia and conducted a field survey in the Otavi Mountainland area. When the team returned to Japan, further studies were made and the present report has been prepared.

We hope that this report will serve for the development of mineral deposits and contribute to the promotion of friendly relations between the two countries.

We wish to express our deep appreciation to the officials concerned of the Government of Namibia for their close cooperation extended to the team.

February 1997

Kimio FUJITA
President
Japan International Cooperation Agency

Shozaburo KIYOTAKI
President
Metal Mining Agency of Japan

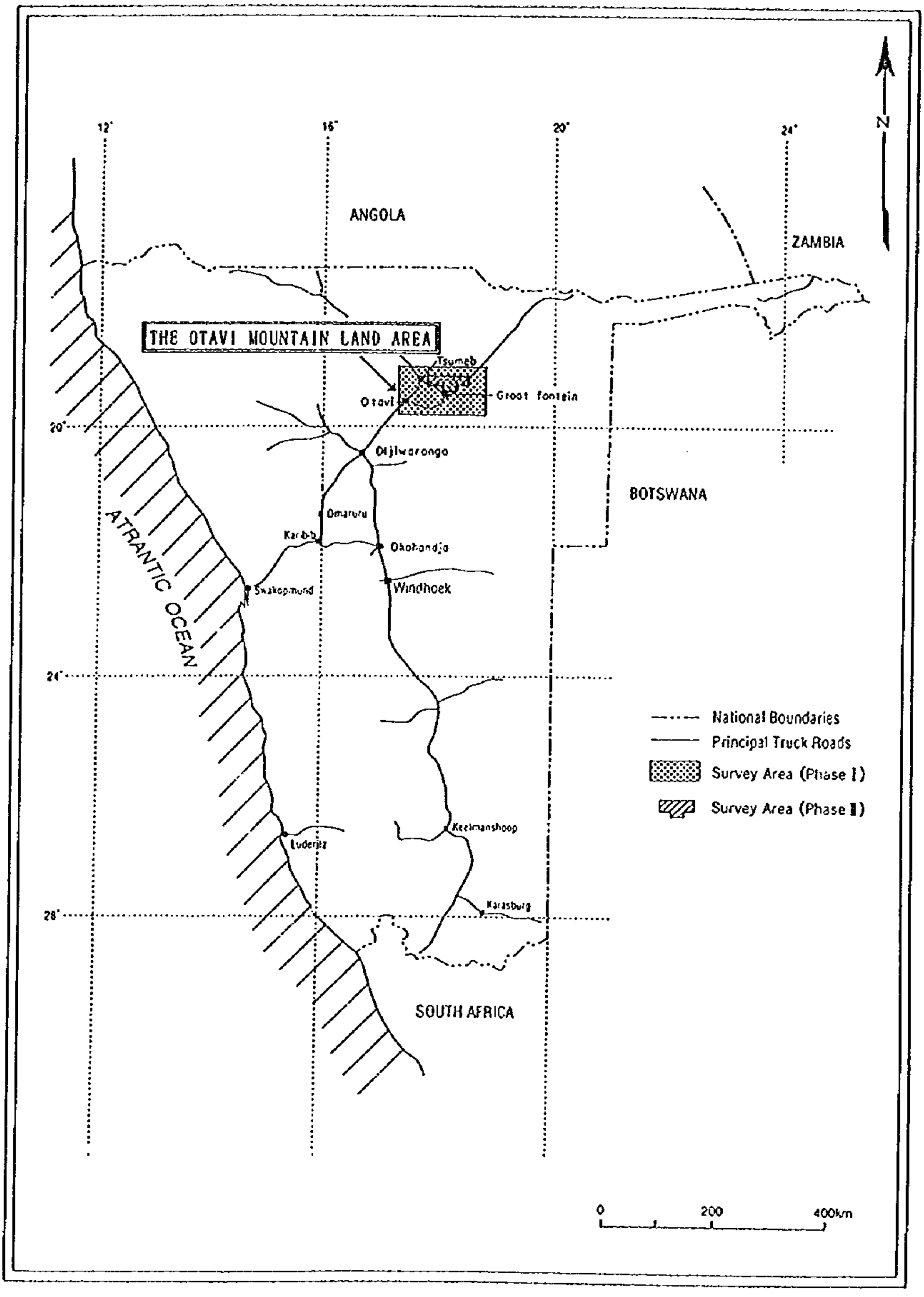

Fig. I - 1 - 1 Index map of the Otavi Mountain Land Area

Summary

The phase II exploration programme consisted of an airborne electromagnetic frequency domain survey which was flown over a portion of the Phase I aeromagnetic survey area and the investigation of four isolated aeromagnetic anomalies, which were delineated by the Phase I aeromagnetic survey, by drilling. The geophysical properties of the drill core were determined in order to compare these measurements with the airborne geophysical data.

The drill hole MJNM-1 intersected a lead and zinc mineralisation. The most significant mineralisation showed 4.52% lead and 1.58% zinc over 0.32 m. The average grade of lead and zinc over 9.16 m are 0.23% and 0.38 % respectively. It is of low grade but should be noteworthy as it is situated some 30 km from the known mineral occurrences of the Otavi Mountain Land.

Detail logging of cores and microscopic observation suggest that the mineral occurrence has been derived of deep-seated brines in the thick carbonate sediments similar to classic Mississippi Valley-type deposit.

Previous exploration located a great number of low to medium grade lead and zinc mineral occurrences which are hosted within T5 or T6 in the Tsumeb and Kombat areas. The mineralisation intersected by MJNM-1 seems to be the equivalent of this T5 or T6 type mineralisation.

An electromagnetic survey was conducted and the results are represented as three resistivity maps representing the different frequencies. The maps indicate that resistivity trend is roughly conformable to geological structures and lithology. It is noted that some of the low resistivity anomalies within high resistivity zone lie in a lineament oblique to the geological trend. The interpretation of the low anomalies along with aeromagnetic anomalies indicate that the linear low resistivity zones or spots are possibly related to massive sulphides that are mainly composed of copper sulphides, and high grade lead zinc and/or and fracture zones associated with the deposits. The favourable low resistivity anomalies located are thus recommended as targets for the Phase III programme.

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Part I General Remarks

Part I General Remarks

Chapter 1 Introduction

I-1-1. Background and Objective of the Survey

This survey is part of a three year-mineral exploration project which started in 1995. The survey is conducted in the Otavi Mountainland Area of Namibia, which is one of the most promising base metal provinces of the country. Three operating mines; Tsumeb, Kombat and the new Khusib Springs and several dormant mines as well as many mineral deposits are situated in this area. The area has been explored by several companies in the past. Exploration mainly focused on the areas of outcrop where most of the deposits were located. However, exploration in areas overlain by calcrete and Kalahari sediments was minimal due to the difficulties in assessing the underlying geology. The depletion of ore reserves in the operating mines and the favourable geological setting of this area has necessitated the urgent appraisal of mineral potential and exploration in the eastern extension of the Otavi Mountain Land. The Government of Namibia, through the Ministry of Mines and Energy has thus requested the Japanese Government to conduct a proper exploration survey in this area by means of bilateral technical aid.

Initially the Japanese government embarked on the survey by conducting a high resolution geophysical survey as well as research and compilation of the previous exploration information. This phase will be followed up by more detailed surveys and if warranted, drilling.

I-1-2. Conclusion of Phase I and Recommendation for Phase II

I-1-2-1. Conclusion of Phase I

The survey of Phase I included research and compilation of the existing data, geological survey and airborne geophysical survey. The conclusion of the survey is summarized below.

1. Some features of the known ore deposits and mineralisation of the survey area are similar to those of so called Mississippi Valley-type ore deposits.

2. The ore deposits are hosted in the Karst related sediments which filled caves formed in the carbonate rocks of Otavi Group of upper Proterozoic Damara sequence.

3. The karst related sediments are principally permeable areneous sediment unconformably lying in the carbonate rock and these karsts result in conduits for deeper mineralized fluids.

4. The Damara sequence of the survey area was subject to several types of deformation to form multiple synclinoria and anticlinora with an east trending fold axis. Deformation of the primary fold axis has occurred under an east-west compressional stress during later deformation.

5. The fold structures and geometry of the basement complex are believed to be controlled by NE-SW or ENE-WSW trending basement faults. These deep-seated faults and fracture system are important

conduits for mineralized fluids from the depth.

6. Magnetic lineaments and which may represent possible seated faults and folding structure were interpreted from an area east of Grootfontein which is mainly calcrete covered.

7. The portions in the east and north of the survey area are underlain by the basement complex and thick carbonates of the Damara sequence. Fold structures of the Mulden and Otavi Group were delineated by a faint difference in magnetic intensity between the two Groups.

8. Radiometric lineaments that coincide with magnetic lineament were also identified. These are interpreted as lineaments originating from the depth.

9. It seems that the known ore deposits are primarily controlled by NE-SW trending lineament and fracture systems that occur west of Tsumeb and Kombat and extend through Harasib, Border, Khusib Springs to Abenab. The intersection of the primary with various secondary trends of fracture system related to folding also appears to be of importance. Of particular interest is that Tsumeb and Kombat are localized at the distorted primary

synclinorium where NE-SW trending faults or fractures are duplicated.

10. Based upon the aeromagnetic and aeroradiometric anomaly maps from the survey, favourable areas of mineral potential were selected.

A model for geological setting and ore deposits as of Phase I was prepared (Fig.I-1-2).

I-1-2-2. Recommendation for the Phase II

Based upon the result from the survey, followed by total interpretation and discussion, the following exploration programme for Phase II was recommended.

(1) Survey area (Fig.I-1-3)

The location of the area is represented by the alphabetical letter combined with the number which are given to each section five by five minutes in the flown area.

(1) G3 central area : Aregoas 282 Farm

(2) E3/E4 border area : Cleveland 706 Farm

(3) B3 northeast area : Aarhus 659 and Accra 660

(4) H3 north area : Guinab 277

(5) D4 north area : Cadix 678 and Christiana 705

(6) G2 south area : Vogelsang 284

(7) D3 central area : Demerara 699

(2) Method

A massive copper-lead-zinc sulphide ore deposit is targeted. It may be of a steeply emplaced pipe like-geometry at a depth of 50 to 100 metres. Resistivity methods, using the resistivity contrast between ore and host rock is most effective for the search of such ore deposit. Taking the surface condition into consideration, Time Domain Electromagnetic Method was considered to be the most

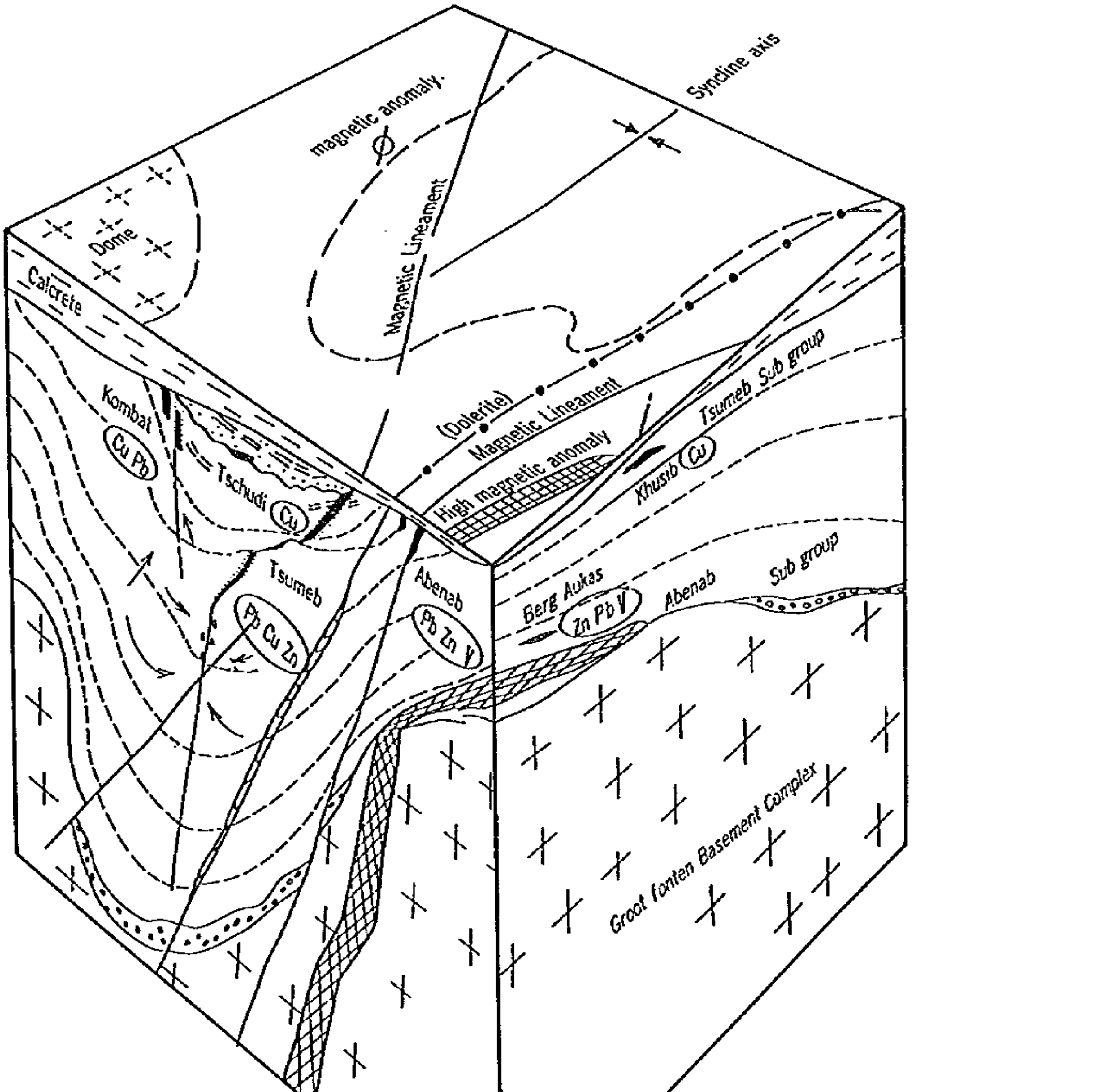


Fig. I - 1 - 2 Model for ore deposits and aeromagnetic anomalies

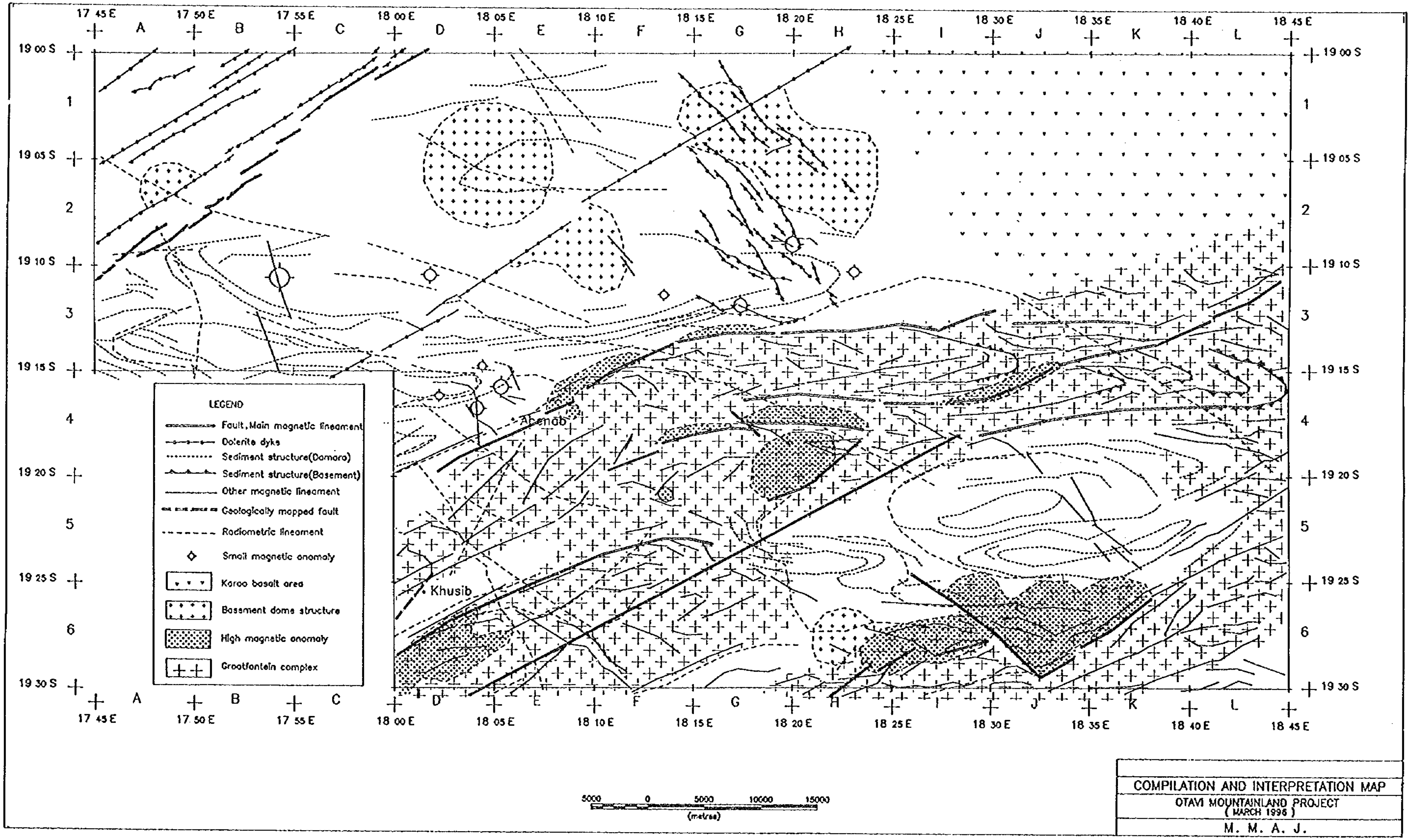


Fig. I - 1 - 3 Compilation and interpretation map of the Phase I survey favourable.

Coil disposition is of in loop capable of both vertical and horizontal surveys with loop size of 100 metres to 200 meters square for grid sampling.

Subsequent drilling exploration is also recommended when the result of the ground geophysical survey reveals favourable.

I-1-3. Summary of the Phase II

I-1-3-1. Survey area

The survey area is illustrated in Fig.I-1-1.

I-1-3-2. Objective of the survey

The objectives of the survey of Phase II is to evaluate the ore potential by means of drilling at sites which were deemed to be favourable for ore formation based on the Phase I survey.

At the same time as the drilling programme an air-borne electromagnetic survey was conducted over the favourable areas selected from the early aeromagnetic survey of Phase I. The aim of the survey is to define some low resistivity zones which may imply the sulphide mineralisation.

I-1-3-3. Survey methods

Flow chart of the Phase II survey is shown in Fig.I-1-4.

(1) Airborne geophysical survey

As suggested in the Phase I report, initially ground TDEM (Time Domain Electromagnetic) survey was planned for the seven sections selected . The cost effectiveness and efficiency were taken into account and the programme was modified to an airborne electromagnetic survey. The data acquisition and processing were contracted by the local contractor; Geodass. The preliminary resistivity maps were used for ground checking. The airborne electromagnetic survey was conducted using a helicopter parallel to the aeromagnetic survey.

(2) Drilling survey

The Phase I report also recommended drilling subsequent to a ground geophysical survey. However, the drilling was programmed on the three sections out of the seven sections as mentioned above taking the inferred geological structure, previous exploration by private mining houses and current situation of mineral licenses into consideration. Four holes were recommended targeting the subsurface geological sequences and the sources of the aeromagnetic anomalies.

The drilling was contracted by South Africa based contractor who conducted diamond drilling.

The details of the surveys are illustrated in Table I-1-1(1). The Specifications of the Survey is shown in Table I-1-1(2).

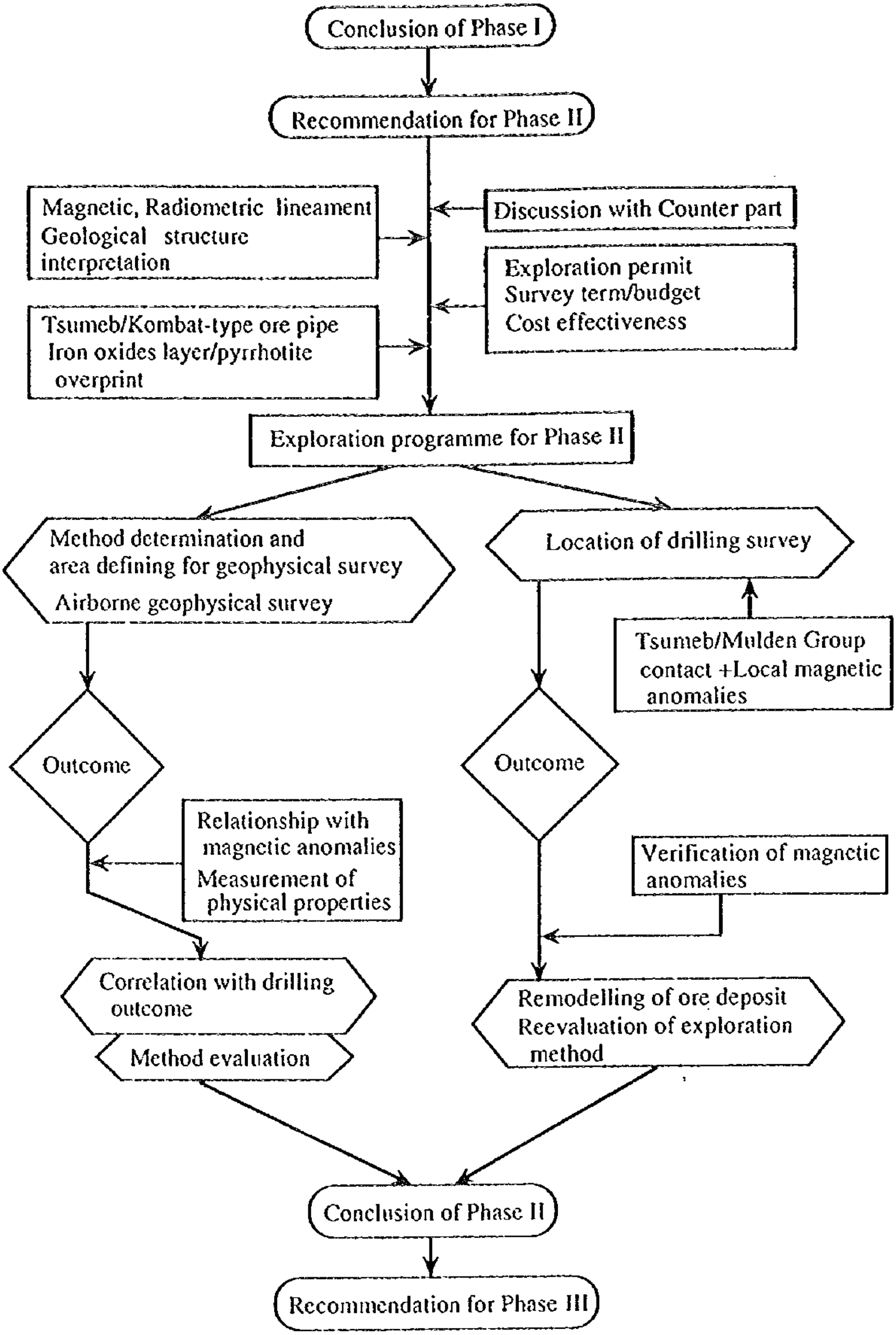


Fig. I - 1 - 4 Flow chart of the Phase II survey

Table I-1-1 Specifications of the Survey(1)

Items	Detailed Specifications and Amount			
Airborne Geophysical Survey	Frequency domain electromagnetic Coverage: 904 km^2 Total line kilo: 4,895 km			
Drilling Survey	**Hole No.**	**Depth**	**Inclination**	**Direction**
	MJNM-1	300 m	-90°	
	MJNM-2	300 m	-90°	
	MJNM-3	150 m	-90°	
	MJNM-4	150 m	-90°	
	Total depth 900 m			

Table I-1-1 Specifications of the Survey(2)

Items of Laboratory Test	Number
(1) Microscopic Identification of Thin Section	10 samples
(2) Microscopic Identification of Polished Section	5 samples
(3) X-ray Diffractometry	5 samples
(4) Chemical Assay of Ore (Au, Ag, Cu, Pb, Zn, Cd, Ga ,V)	30 samples
(5) Analysis of Lead Isotope	7 samples
(6) Measurement of Geophysical Property (Magnetic Susceptibility, Resistivity, and Chargeability)	40 samples

I-1-3-4. Members of the Survey

The following members were organized for the survey team, planning of the project and negotiations between the two countries.

Planing and Negotiation:

Japanese Representative	Namibian Representative
Mr.Kenji Nakamura (Metal Mining Agency of Japan) Mr.Haruhisa Morozumi (Metal Mining Agency of Japan) Mr.Katsuhisa Ohno (Metal Mining Agency of Japan)	Dr.Gabriele I.C. Schneider (Director: Geological Survey of Namibia) Mr. Herbert Roesener (Chief Geologist Geological Survey of Namibia) Mr. Volker Petzel (Chief Geologist Geological Survey of Namibia)

Survey:

Japanese Member	Namibian Member
Mr. Tetsuo Hatasaki Chief of the mission Organization of Airborne Geophysical Survey and Drilling Survey (Dowa Engineering Co., Ltd.) Mr. Yoshiaki Karino Airborne Geophysical Survey (Dowa Engineering Co., Ltd.)	Mr. Herbert Roesener (Chief Geologist Geological Survey of Namibia)

I-1-3-5. Terms of the Survey

The survey was conducted as the following programme.

Total Period Overseas: From 26 August to 28 November 1996

Drilling Survey: From 31 August to 24 November 1996

Airborne Geophysical Survey:

From 19 September to 16 October 1996

Preliminary Data Analysis and Measurement of Geophysical Properties:

From 28 October to 24 November 1996

Chapter 2 Physical Features

I-2-1. Location and Access

The survey area is located in the northeast of the republic of Namibia centered by Tsumeb and Grootfontein extending from 19° 08′ 00″ to 19° 17′ 00″ south latitude and from 17° 45′ 00″ to 18° 24′ 00″ east longitude.

The area is situated about 500 km north of Windhoek and is accessible by road (B1) from Windhoek via Otjiwarongo to Tsumeb. Air Namibia's is also flying from the Eros airport in Windhoek to Tsumeb and Grootfontein.

I-2-2. Topography and Drainage System

Namibia covers 820,000 square kilometers, more than twice the size of Japan. It is bordered by Angola, Zambia, South Africa, Botswana and the Atlantic Ocean.

The land is geographically divided into three zones; the forest zone in the northern part, the savanna zone of inland plateau, and the desert zone along the Atlantic Ocean. While the forest zone and the desert zone are of flat relief, the inland plateau is of high relief and mountainous.

The Otavi Mountainland is situated in the savanna zone. The geomorphology of the survey area is controlled by the underlying geology. The area underlain by basement complex shows gentle relief, whilst the terrain consisting of the overlying Damara carbonate rocks shows considerably rigid topography particularly at the axial cores of anticlinorium. The eastern part of the survey area is flat and covered by calcrete and recent sediments. The flat areas range in height between 1,200 metres and 1,600 metres. The highest peak in the mountainland is 2,155 metres above the sea level. The southwest corner of the survey area is the highest and flattens towards the north and east. No well developed fluvial systems are present in the survey area.

I-2-3. Climate and Vegetation

The climate of the Namibia is between semi-arid and subtropical. The highest mean temperature for Windhoek is 23 deg. centigrade in November and the lowest mean temperature is 17 deg. centigrade in July. The annual average rainfall is 600 milimetres in the northern forest zone, 20 milimetres in the desert zone, and 350 milimetres in the inland plateau. The wet season is in summer (October to April) with rare winter rains occurring in the extreme south of the country. The temperatures at Tsumeb are 2 to 3 deg. centigrade higher than in Windhoek while the annual average rainfall for Tsumeb is 572 milimetres. The vegetation in Namibia is also variable. The forest zone is covered with broad-leaved trees. The inland plateau is spotted with stunted acacias while the desert zone is covered by scattered shrub and lichen.

Chapter 3 General Geology

Regional stratigraphy is presented by Geological Survey of Namibia(1982) and the Geological Society of South Africa(1983). There were five main periods of lithogenic activity and these are as follows.

Tertiary to Recent (<65 Ma)
Carboniferous to lower Cretaceous (345 to 120 Ma)
Namibian (1,000 to 570 Ma)
upper Mokolian (1,800 to 1,000 Ma)
Vaalian to lower Mokolian (2,100 to 1,800 Ma)

The oldest rocks occur within metamorphic complexes of Vaalian (2620 to 2070 million years) to early Mokolian age (Mokolian: 2070 to 1080 million years). These form a basement to younger sedimentary and volcanic successions, the oldest of which are of mid-Mokolian age and of limited regional extent. The next major phase of activity involved the formation of the Rehoboth-Sinclair magmatic arc and the Namaqua Metamorphic Complex during the late Mokolian. The Damaran orogenic phase is the third main event; it started with intracontinental rifting and sedimentation about 900 million years ago and lasted approximately 450 million years. Extensive peneplanation preceded the fourth phase which was the deposition of the Karoo Sequence between the Carboniferous and early Cretaceous. Cretaceous to Recent deposits cover many of the older stratigraphic units. Lower cretaceous to tertiary sediments and minor volcanics which are probably underlain by Karoo Sequence rocks form a thick offshore succession.

The distribution of pre-Tertiary rocks divides the country roughly into three regions. the Damara Sequence covers most of the northern half of the country. The southern half is divided along an approximate north-south line into a western third, underlain by rocks older than about 600 million years, and an eastern two-thirds underlain largely by the Nama Group and Karoo Sequence: older rocks are exposed in the far south of the latter portion. Tertiary deposits of the Kalahari Sequence cover large areas in the eastern and northern parts of the country. Much of the coastal region is covered by sand seas, deflation lag deposits and fluviatile sediments of the Namib Desert.

Mineralisation in the survey area includes two broad types: the Tsumeb-type and the Berg-Aukas type. The Tsumeb type is characterised by complex sulphide ores containing Cu, Pb, Zn, Ag, As, Ge, Cd and Ga. The ore minerals occur in several loci: pipes, solution breccias, shear zones, dilation fractures etc.. These ore bodies are not stratabound and are generally confined to the upper Tsumeb Subgroup and appear to be related to the disconformity between the Tsumeb Subgroup and the Mulden Group.

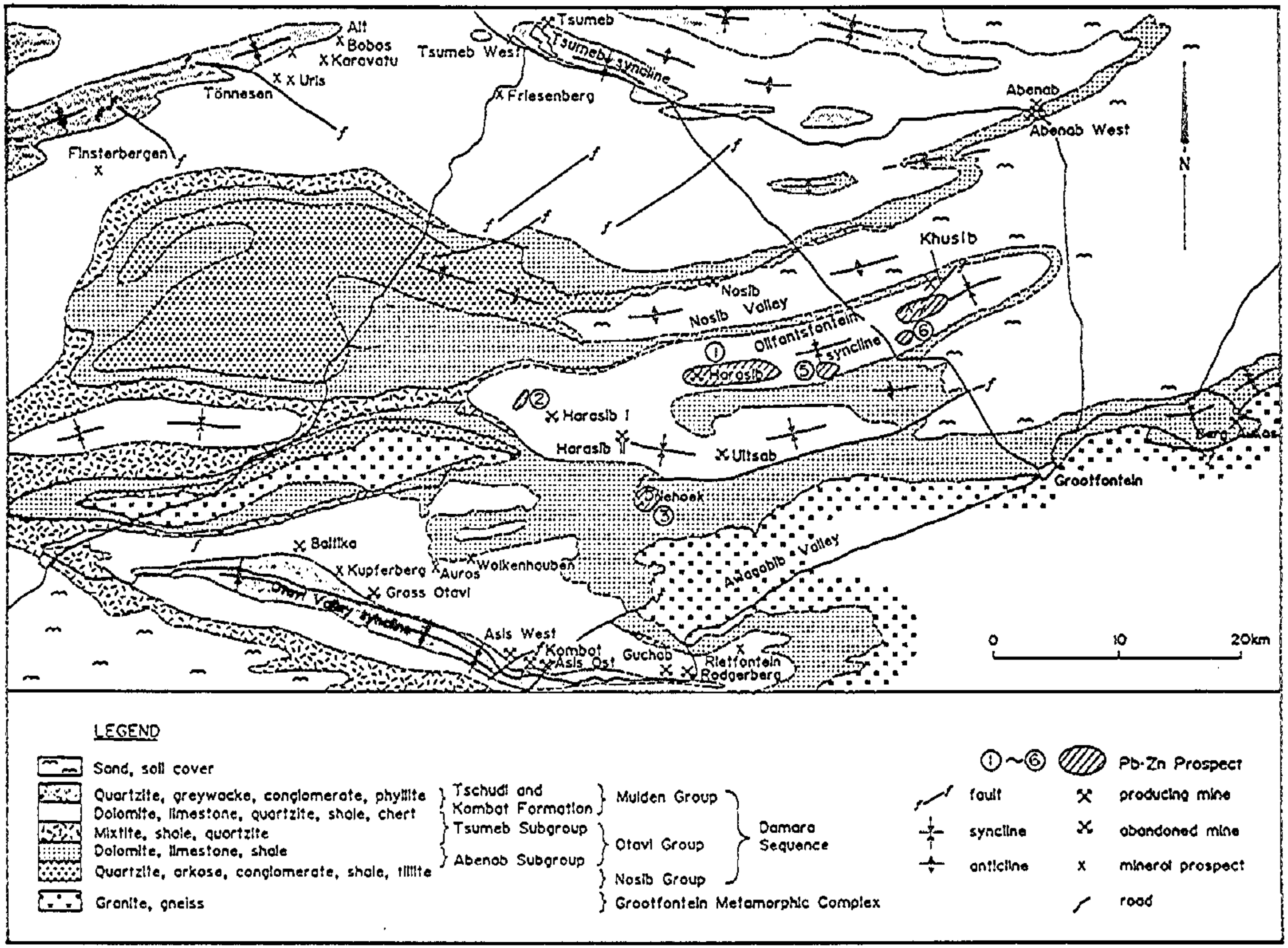


Fig. I - 3 - 1 Regional geologic map of the Otavi Mountain Land Area

The Berg Aukas type is similar to the Pb-rich Mississippi Valley type deposits. The sulphide ore contains Pb, Zn and V with little or no Cu. Enrichment of Ag, Ge, Ga and Cd is less than those in the Tsumeb type ore deposits. The Berg Aukas type deposits are generally confined to the Abenab Subgroup and the middle-lower part of the Tsumeb Subgroup. The mineralisation occurs in breccia bodies and may be stratabound or discordant. Brecciation and karst structures are important in the localisation of the ore bodies.

Table I - 3 - 1 Stratigraphic Succession in the Otavi Mountain Land Area

Sequence	Group	Subgroup	Formation	Informal Lithozone	Lithology	Average thickness (m)
Damara	Mulden		Kombat and Tschudi		Kombat Formation: slate; sub-arkose and pebbly sandstone near base Tschudi Formation: feldspathic sandstone, sub-greywacke; argillite and conglomerate interbeds in basal portion	> 700
			Disconformity			
	Otavi	Tsumeb	Hüttenberg	T8	Dolomite, bedded light to medium grey; oolitic chert and stromatolite layers near top	240
				T7	Dolomite, bedded dark grey; limestone, shale and chert interbeds	300
				T6	Dolomite, bedded light grey; abundant chert; stromatolite interbeds in lower part	300
			Elandshoek	T5	Dolomite, bedded and massive light grey	1 200
				T4	Dolomite, massive light grey	
			Maieberg	T3	Dolomite, thinly bedded light and dark grey	180
				T2	Limestone, bedded light and dark grey	700
			Chuos	T1	Tillite, quartzite, shale, minor dolomite and limestone	200
			Disconformity			
		Abenab	Auros		Dolomite, bedded and massive light to medium grey; limestone, marl, shale, oolite and stromatolite interbeds	350
			Gauss		Dolomite, massive light to dark grey; local oolite and stromatolite interbeds	750
			Berg Aukas		Dolomite, laminated and massive light and dark grey; black limestone, shale	550
			Disconformity			
	Nosib		Varianto		Quartzite, conglomerate, arkosic mixtite, dolomite, ferruginous shale	
			Askevold		Phyllitic agglomerate, tuff; epidosite	750
			Nabis		Feldspathic quartzite, arkose, conglomerate	
			Unconformity			
Grootfontein Basement Complex					Granite, gneiss, mafic schist	

Chapter 4 Compilation and Interpretation

I-4-1. Characteristics and Structural Control of Mineralisation

Comprehensive interpretation and discussion of the result of Phase I survey together with that of Phase II survey produced Fig.II-4-1.

The low to medium grade lead and zinc mineralisation intersected by the Phase II drilling programme showed no characteristic potential structures (such as karst breccia and dissolution breccia) as are associated with the Tsumeb-Kombat type ore deposits. The sulphide assemblage of the mineralisation also differs from the Tsumeb Kombat type. Microscopic identification revealed that the host rock is mostly grainstone and had been subjected to dolomitization, followed by silicification which is associated with the sulphide mineralisation. The mineralisation intersected is thus considered to be of classic Mississippi Valley-type deposits.

Previous literature reported that potential MVT mineralisation is hosted in the dolomite of the Gauss Formation, Abenab Subgroup;. Huttenberg Formation, of the Tsumeb Subgroup; and in particular in the grainite of the Elandshoek Formation(T5) and the Huttenberg Formation(T6). The host rock to the mineralisation intersected in MJNM-1 is correlated to the T6.

I-4-2. Relationship between Resistivity Anomalies of AEM Survey, Geological Structure and Mineralisation

The resistivity maps produced from the airborne electromagnetic survey are conformable to the existing geological maps. The Phase II survey area is principally underlain by calcrete, the Mulden group, dolomite of the Tsumeb subgroup or Abenab subgroup and the basement complex. Shales and aquifers within calcrete form a low resistivity zone and massive dolomite and the basement form the high resistivity zones. In areas covered by calcrete, resistivity images show that the shale interbedded with the dolomite is an important marker horizon that can be used to define geological structures.. The local low resistivity anomaly zones cross cutting the geological trend are significant for exploration as these zones may be faults and fracture zones associated with massive sulphide mineralisation.

Physical properties measured from the core, indicate that a low grade lead and zinc mineralisation as intersected in borehole MJNM-1 of Phase II is unlikely to be reflected as a low resistivity anomaly. If the mineralisation is of Tsumeb or Kombat type, which contains chalcocite and chalcopyrite, the mineralisation could well be reflected as a low resistivity anomaly. Tests on the drill core suggests that the origin of the isolated magnetic anomalies, on which Phase II target selection was based, stems from iron oxides in a red argillaceous zone of dolomite shortly below the unconformity. This suggest that isolated magnetic anomalies may not necessarily be effective for the exploration of Tsumeb-Kombat-type deposit.

I-4-3. Possible Ore Potential

The exploration targets for this survey were classic Mississippi Valley Type as well as the massive sulphide type deposits. The Phase II drilling survey confirmed this potential but these deposit types are not expected to respond to geophysical surveys due to the thick calcrete overburden. The helicopter borne electromagnetic survey delineated the subsurface Mulden group, which in turn indicates potential for Tsumeb/Kombat-type massive sulphide ore deposits. Further exploration is recommended placing emphasis upon the aeromagnetic and low resistivity anomaly zones which cross cut the geological trend of the Mulden group.

Chapter 5 Conclusion and Recommendation

I-5-1. Conclusion

The Phase II survey included an airborne geophysical survey(airborne electromagnetic survey) and a drilling programme with measurements of geophysical properties on the drill core. The conclusions of the programme are discussed in detail below:

1. The targets based on aeromagnetic anomalies delineated during Phase I were drilled. Four drill holes were sunk. One hole MJNM-1 intersected disseminated low grade lead and zinc mineralisation.

2. The mineralisation showed average grade of 0.23% lead and 0.38% zinc over 9.16m.

Within 9.16 metre, the mineralised portions showing more than 1 percent concentration, are as follows.

111.58m-111.69m(0.11m)	Pb=1.45%	
112.30m-112.62m(0.32m)	Pb=4.52%	Zn=1.58%
245.75m-246.25m(0.50m)		Zn=1.76%
246.25m-246.65m(0.40m)		Zn=2.28%

3. The occurrences under microscope and chemical assays indicate that the mineralisation formed in a similar way to Mississippi Valley-type ore deposits.

4. No specific relationship between the mineralisation and aeromagnetic anomalies is recognized.

5. Geophysical properties of core samples suggested that the mineral occurrence of this type would give very poor resistivity response for electromagnetic signals.

6. The electromagnetic survey by frequency method produced three resistivity plan maps of three depths corresponding to three frequencies. The maps would explain the lithological contrast and general trend of geology. Some local low resistivity anomaly zones within a high resistivity zone traversing the geological trend are important for mineral potential of massive sulphide ore pipe in particular, when overlapped with aeromagnetic lineaments.

7. The favourable area thus delineated for further exploration programme of Phase III was encompassed. The area is situated to the west of MJNM-1 and extends 8 kilometre east to west by 5 kilometre north to south including a part of Guinab 277, Aris 283 and Vogelsang 284.

I-5-2. Recommendation for the Phase III

Based upon the result of the survey and subsequent discussion and interpretation of all the data available, the following exploration programme for Phase III is proposed.

(1) Survey area

The area is illustrated in Fig.II-4-1. It is located in the east end of Phase II survey area and extends within Guinab 277, Aris 283 and Volgelsang 284 encompassing 8 kilometres east to west and 5 kilometres north to south.

(2) Exploration method

Drilling survey is proposed following to the Phase II survey aiming at the subsurface evaluation of airborne electromagnetic anomalies. Necessary depth of holes is estimated at 300 metres each and the calcrete underlying first 80 metres from the surface has no potential for ore deposit and therefore coring is not needed.

Part II Details of the Survey

Part II Details of the Survey

Chapter 1 Drilling Survey

II-1-1. Outline of the Survey

The location of the drilling survey is illustrated in Fig.II-1-1. The drilling was assigned to the local contractor based at the Republic of South Africa. The logging was recorded to the logging sheets at a scale of 1:200. The mineralised portions were taken at an appropriate interval for chemical assays. The thin sections and polished sections of typical rock facies and mineralisation were prepared for microscopic test. The altered or argillaceous parts were collected for X-ray diffractometry. Some of the mineralised portion with lead and zinc were analyzed for lead isotopes. All the cores were marked showing up side direction and packed in steel made core boxes and recorded on the colour photos. The core boxes were housed in the core depository of GSN.

The coordinates of the drill holes determined by GPS are shown in Table II-1-1.

Table II - 1 - 1 Coordinates of the Drill Holes

	Hole No.	Farm	Latitude			Longitude		
			°	′	″	°	′	″
1	MJNM-1	Guinab 277	19	10	26.530S	18	23	00.540E
2	MJNM-2	Aris 283	19	12	01.570S	18	17	19.800E
3	MJNM-3	Christiana 705	19	16	15.810S	18	02	30.420E
4	MJNM-4	Cadix 678	19	14	36.110S	18	04	27.520E

II-1-2. Method and Equipment

The equipment and the consumables necessary for drilling were provided by GEOMECHANICS CC. The normal method was applied to the holes drilled with SECO12 rig and the wire line method with L-38 rig. Cementing and installation of the casing pipes were needed where the rock condition was not favourable. The important equipment and the consumables are listed in Table II-1-2 and Table II-1-3.

II-1-3. Drilling Work

(1) Transportation and Access Road

The farm roads were used for transportation to the nearest point to drilling sites and thereafter, the bush was slashed for a new road to the site. In the case of MJNM-3, three days with 6 workers were

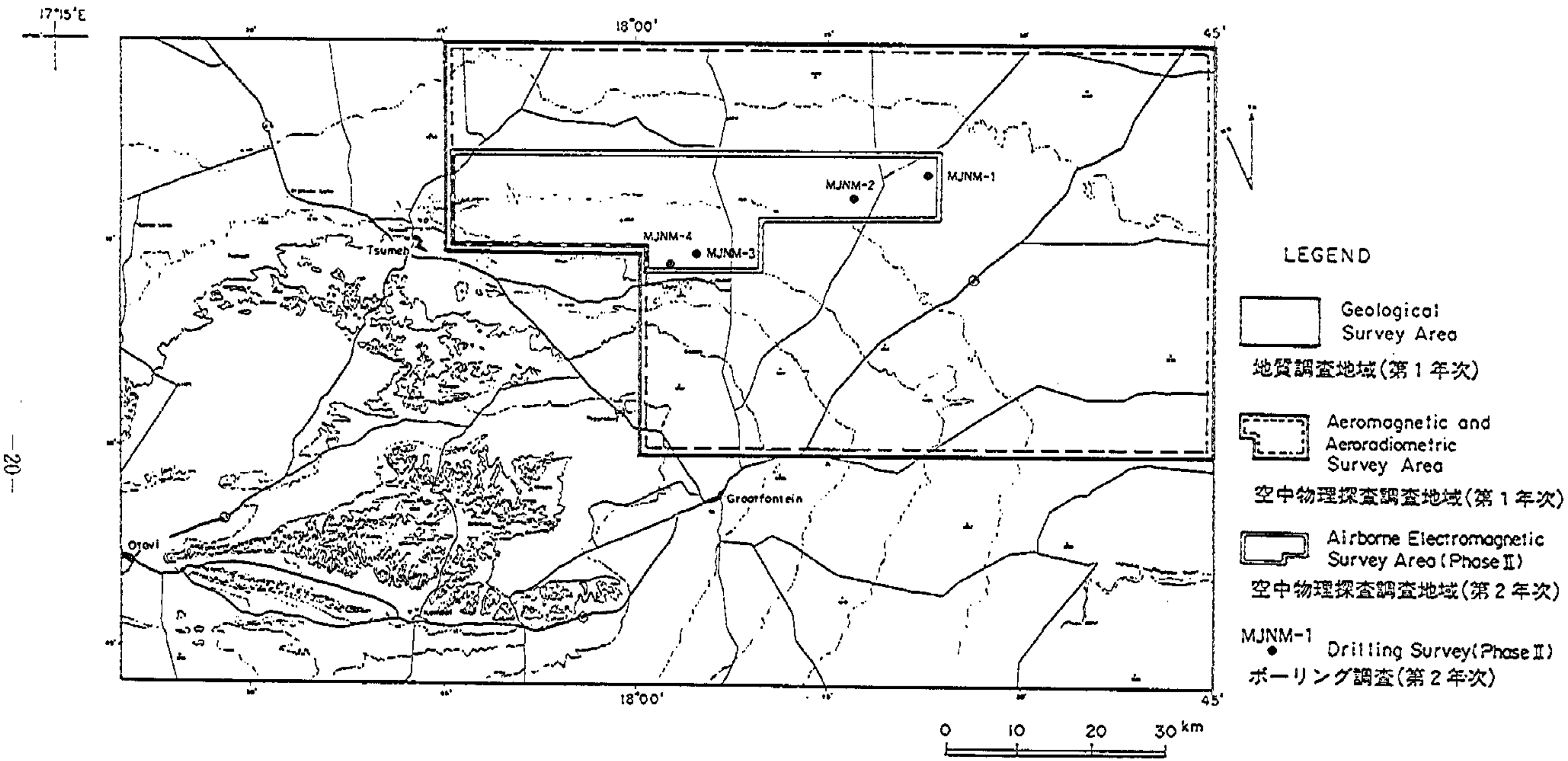


Fig. II - 1 - 1 Location of the drilling survey and the airborne geophysical survey

Table II - 1 - 2 Specifications of Equipment for Drilling

Item	Model	Specifications	Amount	Remarks
Drilling Rig	SECO12	Capacity : 350 m	1	
		Transmission : 8 Speed-Ford		
		Diesel Engine : Type-Deutz F5L912		
		Air Cooled		
		86 HP / 2300 R.P.M.		
	L-38	Capacity : 800 m	1	
	(Long Year)	Transmission : 8 Speed-Ford		
		Diesel Engine : Type-2Cyl Hatz F4L912		
		Air Cooled		
		68 HP / 2300 R.P.M.		
Pump		Type : Bean R35B	1	
		Max.Pressure : 50 kg/cm2		
		Max rate : 140 litres/min		
		Diesel Engine : 2Cy Hatz Z79Q		
		20 HP / 3000 R.P.M.		
		Type : Bean R20B	1	
		Max.Pressure : 46 kg/cm2		
		Max rate : 76 litres/min		
		Diesel Engine : Yanmar L100		
		10 HP / 1800 R.P.M.		
Rod	NQ	3.00m / 70.00mm ϕ x60.3mm ϕ	150	
	NQ	6.00m / 70.00mm ϕ x60.3mm ϕ	36	

Table II - 1 - 3 Amount of Used Diamond Bit and Reamer

Item	Type	Specifications	Amount (MJNM-1)	Amount (MJNM-2)	Amount (MJNM-3)	Amount (MJNM-4)	Total
Diamond Bit							
	TNW	75.31mm ϕ ×60.81mm ϕ	7	2		7	16
	NWD4	75.44mm ϕ ×54.74mm ϕ	2			1	3
	NQ	75.31mm ϕ ×47.63mm ϕ	1		4	3	8
Reamer							
	TNW	75.69mm ϕ	4	1		2	7
	NWD4	75.69mm ϕ	1			1	2
	NQ	75.69mm ϕ	1		3	3	7
Casing Shoe Bit	(Composite)						
	IMP	92mm ϕ ×77mm ϕ	1	1	1	1	4

outer diametre × inner diameter

Table II - 1 - 4　Amount of Consumables

Item	Specifications	Unit	Amount (MJNM-1)	Amount (MJNM-2)	Amount (MJNM-3)	Amount (MJNM-4)	Total
Outer Tube (TNW)	73.0mm×60.3mm×3.0m	No	1		1	1	3
Outer Tube (NQ)	73.0mm×60.3mm×3.0m	No			2	1	3
Inner Tube (TNW)	64.0mm×60.5mm×3.0m	No	1				
Inner Tube (NQ)	55.6mm×50.0mm×3.0m	No	1	1			
Inner Tube Head	TNW	Set			1	1	2
Inner Tube Head	NQ	Set	1	1			2
Overshot	TC(Vertical)	No	1	1			2
Overshot	NX(Vertical)	No			1		1
Wire for Wireline	6mm φ ×300m	Role	1	1			
Casing Pipe (NX)	89.1mm×80.8mm×3.0m	M	13.5	17	3	60	
Casing Pipe (NW)	89.1mm×76.4mm×3.0m	No	1	1	1	1	
Core Lifter	NQ	No	13	12		5	
Core Lifter	TNW	No	10		15	15	
Core Lifter Case	NQ	No	6	8		1	
Core Lifter Case	TNW	No	5		8	7	
Diesel Fuel		Litre	4,000	4,300	2,200	3,000	13,500
Petrol		Litre	460	400	80	380	1,320
Turbine Oil		Litre	80	80	20	20	200
Cement		Kg	800	200	200	800	2,000
Bentonite		Kg	160			240	400

needed for 1.6 kilometre clearing.

(2) Setting

One 10 ton truck and three 4 ton trucks were used for transportation of the drilling equipment from Johannesburg to the drilling site. The crew camped near the site.

(3) Working shift

The drilling was undertaken on the one or two shifts a day with ten hours per shift.

(4) Interhole Move and Demobilization

The trucks were used for interhole move and demobilization after completion of the whole work as the mobilisation. The ground damage was restored and the hole mouths were cemented.

(5) Drilling and Coring

The core size is 60.8 m/m(TNW) near the surface and is 47.6 m/m(NQ) or 54.7m/m(MD4) in the deeper than that. In MJNM-4, percussion drilling replaced the core drilling between 36.4 m and 60.0m because of the cavities, therefore the rock chip was used for geological logging. The whole schedule of drilling is shown in Table II-1-4 and The summary of drilling of each hole is shown in Table II-1-5 through Table II-1-8. The progress of the holes was as follows.

MJNM-1

For the formation from the surface down to a depth of 166.75 m the normal method was used and thereafter down to 300m deep the wire line method replaced In the calcrete formation from the surface to a depth of 85.40 m the drilling efficiency was elevated to 14 m/shift in average, 24 m/shift in maximum though, since the formation changed to dolomite it was fluctuated from 7 to 8 m/shift in average. The water was transported from the farmer's well over 2.5 kilometres by a 4 ton truck on which two bousers of 2.5 m3 each were mounted. Casing pipes were installed from the surface down to a depth of 13.5 m. The wire line method sustained an average efficiency of 12.7 m/shift.

MJNM-2

The hole was drilled only by the wire line method. Shortly after the formation changed to dolomite at a depth of 61 m, jamming caused by the wall collapse and trouble at the core barrel followed by a break for installation of a pump, resulted in the significant decrease of efficiency of drilling. It was revealed that as the formation dips steeply in the vertical hole, even a thin bed of chert caused an unfavourable efficiency of drilling which attained to less than 7.5 m/shift throughout the hole. The water was available from the well and the reservoir for cattle which are just beside the hole. But because the water was pumped by means of wind mill in the daytime, it ran short at night, therefore a new pump was installed to clear the problem.

Table II - 1 - 5 Time Schedule of Drilling

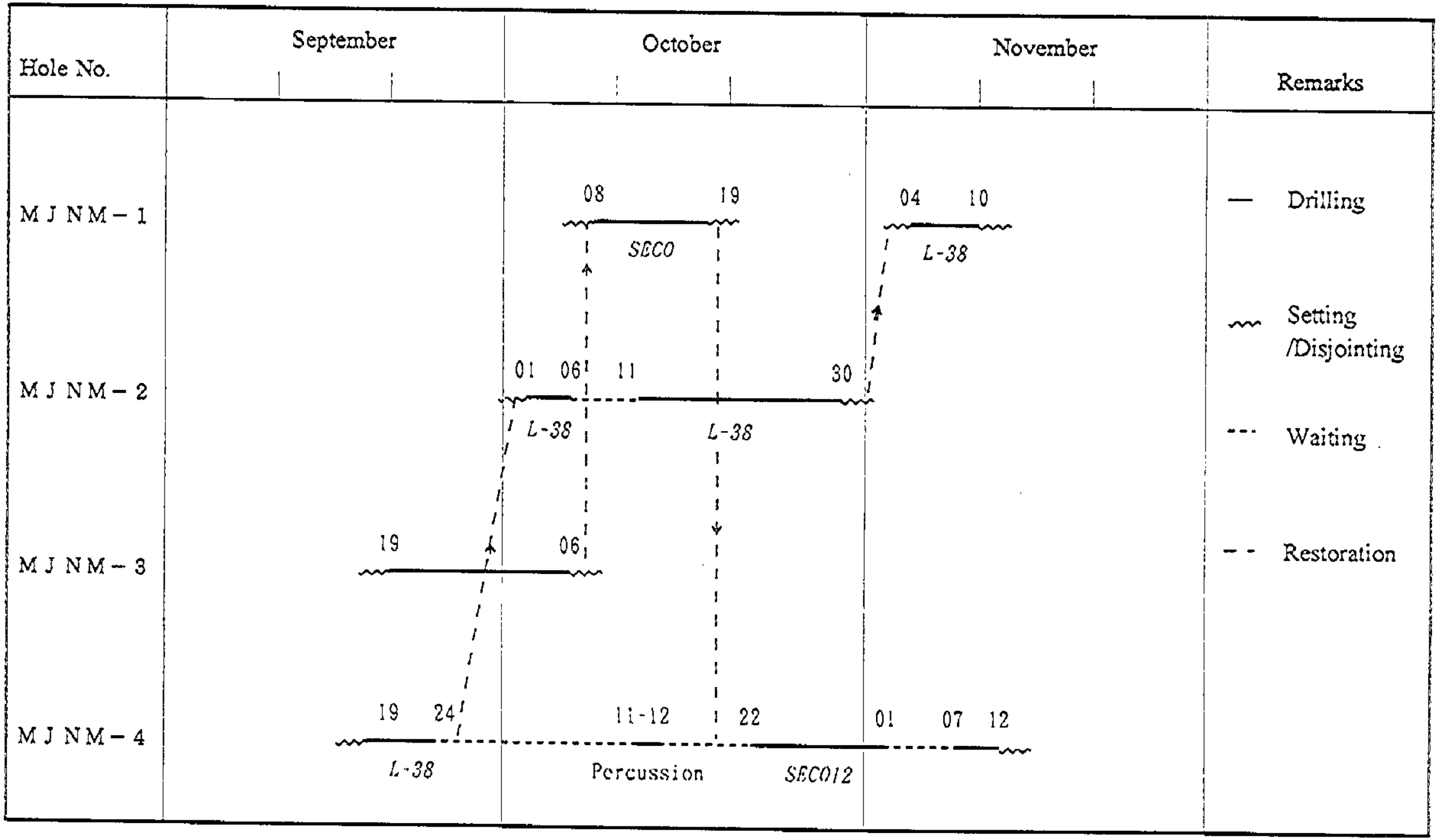


Table II - 1 - 6 (1) Summary of Drilling Work [MJNM-1]

Period of Drilling

Working Item	Period	Total Days	Working days	Off days	Numbers of Person·day
		Details of the Period			
Set up	1996/09/18～09/19, 10/20～10/21	2	2	0	12
Drilling	1996/09/20～09/24, 10/22～11/12	38	24	14	182
Tear Down	1996/09/30, 11/13～11/14	3	3	0.0	18
		43	29	14	212

Total Depth

Planned Depth	150.00 m	Soil	3.0 m
Additional depth	0.00 m	Core Length	111.80 m
Total Inspected Depth	150.60 m	Recovery Rate	74.2 %

Core Recovery Rate per 100 meters

Depth(m)	Core length	Recovery Rate	Cumulative Rate
0.00 ～ 101.40	64.10 m	63.21 %	63.21 %
101.40 ～ 150.60	47.70 m	96.95 %	74.24 %
	m	%	%

Break Down of the Working Time

Net Drilling	198.0 h	45.9 %	40.0 %
Rod Raising and Insert	90.0 h	20.9 %	18.2 %
Inner Tube Operation	16.0 h	3.7 %	3.2 %
Contingent	5.0	1.2	1.0
Recovering from Trouble	122.0 h	28.3 %	24.6 %
Others	0.0	0.0	0.0
Subtotal	431.0 h	100.0 %	87.1 %

Interhole Moving

Set Up	40.0 h		8.1 %
Tear Down	24.0 h		4.8 %
Grandtotal	495.0 h		100.0 %

Drilling Effeciency

Total Depth/Total Days	3.50	m/day
Total Depth/Working Days	5.19	m/day
Total Depth/ Drilling Days	3.96	m/day
Total Depth/ Net Drilling Days	6.28	m/day
Total Depth/Total Person·day	0.71	m/P·day
Net Drilling Person·day/ Total Depth	1.21	P·day/m

Casing

Casing Diamtre and Cased Length		B/Ax100 (%)	Recovered Casing (%)
86mm	60.0	39.8	0.0

Remarks
A:Total Depth
B:Cased Depth

Table II - 1 - 6 (2) Summary of Drilling Work [MJNM-2]

Period of Drilling

Working Item	Period	Details of the Period: Total Days	Working days	Off days	Numbers of Person·day
Set up	1996/10/06～10/07, 11/03	4	3	0	21
Drilling	1996/10/08～10/18, 11/04～11/10	22	19	0	107
Tear Down	1996/11/19, 11/11～11/15	6	6	0.0	42
		35	32	3	170

Total Depth

Planned Depth	300.00 m	Soil	1.0 m
Additional depth	0.00 m	Core Length	296.50 m
Total Inspected Depth	300.08 m	Recovery Rate	98.8 %

Core Recovery Rate per 100 meters

Depth(m)	Core length	Recovery Rate	Cumulative Rate
0.00 ～ 107.50	103.70 m	96.47 %	96.47 %
107.50 ～ 205.70	95.50 m	97.25 %	96.84 %
205.70 ～ 300.08	97.30 m	103.09 %	98.81 %

Break Down of the Working Time

Net Drilling	199.0 h	50.8 %	46.3 %
Rod Raising and Insert	109.0 h	27.8 %	25.3 %
Inner Tube Operation	53.0 h	13.5 %	12.3 %
Contingent			
Recovering from Trouble	31.0 h	7.9 %	7.2 %
Others			
Subtotal	392.0 h	100.0 %	91.2 %

Interhole Moving

Set Up	18.0 h		4.2 %
Tear Down	20.0 h		4.7 %
Grandtotal	430.0 h		100.0 %

Drilling Effeciency

Total Depth/Total Days	8.57	m/day
Total Depth/Working Days	9.38	m/day
Total Depth/ Drilling Days	13.64	m/day
Total Depth/ Net Drilling Days	15.79	m/day
Total Depth/Total Person·day	1.77	m/P·day
Net Drilling Person·day/ Total Depth	0.36	P·day/m

Casing

Casing Diamtre and Cased Length		B/Ax100 (%)	Recovered Casing (%)
77mm	13.5	4.5	100.0

Remarks
A:Total Depth
B:Cased Depth

Table II - 1 - 6 (3) Summary of Drilling Work [MJNM-3]

Period of Drilling

Working Item	Period	Total Days	Working days	Off days	Numbers of Person·day
Set up	1996/09/30~10/01	2	2	0	12
Drilling	1996/10/02~10/30	29	29	0	297
Tear Down	1996/10/31	1	1	0.0	10
		32	32	0	319

Total Depth

Planned Depth	300.00 m	Soil	1.4 m
Additional depth	0.00 m	Core Length	290.10 m
Total Inspected Depth	300.30 m	Recovery Rate	96.6 %

Core Recovery Rate per 100 meters

Depth(m)	Core length	Recovery Rate	Cumulative Rate
0.00 ~ 102.60	99.25 m	96.73 %	96.73 %
102.60 ~ 202.70	97.05 m	96.95 %	96.84 %
202.70 ~ 300.30	93.80 m	96.11 %	96.60 %

Break Down of the Working Time

Net Drilling	239.0 h	46.0 %	43.5 %
Rod Raising and Insert	6.0 h	1 2 %	1.1 %
Inner Tube Operation	60.0 h	11.5 %	10.9 %
Contingent	0.0	0.0	0.0
Recovering from Trouble	215.0 h	41.3 %	39.1 %
Others	0.0	0.0	0.0
Subtotal	520.0 h	100.0 %	94.5 %

Interhole Moving

Set Up	18.0 h		3.3 %
Tear Down	12.0 h		2.2 %
Grandtotal	550.0 h		100.0 %

Drilling Effeciency

Total Depth/Total Days	9.38	m/day
Total Depth/Working Days	9.38	m/day
Total Depth/ Drilling Days	10.36	m/day
Total Depth/ Net Drilling Days	10.36	m/day
Total Depth/Total Person·day	0.94	m/P·day
Net Drilling Person·day/ Total Depth	0.99	P·day/m

Casing

Casing Diamtre and Cased Length		B/Ax100 (%)	Recovered Casing (%)
77mm	17.0	5.7	100.0

Remarks
A:Total Depth
B:Cased Depth

Table II - 1 - 6 (4) Summary of Drilling Work [MJNM-4]

Period of Drilling

Working Item	Period	Total Days	Working days	Off days	Numbers of Person·day
Set up	1996/09/18～09/19	2	2	0	8
Drilling	1996/09/20～10/06	17	16	1	54
Tear Down	1996/10/06	1	1	0.0	4
		20	19	1	66

Total Depth

Planned Depth	150.00 m	Soil	2.3 m
Additional depth	0.00 m	Core Length	147.70 m
Total Inspected Depth	150.30 m	Recovery Rate	98.3 %

Core Recovery Rate per 100 meters

Depth(m)	Core length	Recovery Rate	Cumulative Rate
0.00 ～ 97.90	95.60 m	97.65 %	97.65 %
97.90 ～ 150.30	52.10 m	99.43 %	98.27 %

Break Down of the Working Time

Net Drilling	95.0 h	63.8 %	57.6 %
Rod Raising and Insert	44.0 h	29.5 %	26.7 %
Inner Tube Operation	0.0 h	0.0 %	0.0 %
Contingent	0.0	0.0	0.0
Recovering from Trouble	10.0 h	6.7 %	6.1 %
Others	0.0	0.0	0.0
Subtotal	149.0 h	100.0 %	90.3 %

Interhole Moving

Set Up	10.0 h		6.1 %
Tear Down	6.0 h		3.6 %
Grandtotal	165.0 h		100.0 %

Drilling Effeciency

Total Depth/Total Days	7.52	m/day
Total Depth/Working Days	7.91	m/day
Total Depth/ Drilling Days	8.84	m/day
Total Depth/ Net Drilling Days	9.39	m/day
Total Depth/Total Person·day	2.28	m/P·day
Net Drilling Person·day/ Total Depth	0.36	P·day/m

Casing

Casing Diamtre and Cased Length		B/Ax100 (%)	Recovered Casing (%)
86mm	3.0	2.0	100.0

Remarks
A:Total Depth
B:Cased Depth

MJNM-3

The hole was drilled exclusively by the normal method. The drilling efficiency reached 8.8 m/shift with substantially one shift per day because of comparatively short recovering time from mechanical break down. Monotonous condition of dolomite formation was also favourable cause for the moderate efficiency. The water was transported from the irrigation well 2 km far from the site by 4-ton truck.

MJNM-4

Shortly after the drilling was commenced by the wire line method, it was disturbed by total lost circulation caused by cavities and dissolution fractures development. These parts of geological disturbance were cemented in vain and the drilling was interrupted at a depth of 35.4 m. From 35.4 m to 60.0 m percussion drill was introduced to determine the necessary depth of casing depending on the ground condition. Thereafter, the hole was drilled by the normal method to the end. The wire line method took one shift per day and the normal method usually two shifts and the completion of the hole eventually required three months including the waiting time for engine repairs and grouting. Thus the true drilling efficiency was 5.8 m/shift which was the lowest of the four holes. The water was introduced by pumping from the irrigation well 150 m apart from the hole.

(6) Water

The groundwater of the farm lands was pumped for drilling. MJNM-1 and MJNM-3 were distant from the water holes and the water was transported with the bousers on a truck. On the other hand, MJNM-2 and MJNM-4 were provided with water directly to the hole by pumping up from the irrigation cistern. The water was used with environment friendly type polymer. Bentonite was also used when lost circulation or wall rock collapse occurred

II-1-4. Result of the Survey

The geological column sections are illustrated in Fig.II-1-2(1) through Fig.II-1-2(13), and the geological profiles in Fig.II-1-4. The result of microscopic identification of thin sections, polished sections and X-ray diffractometry are shown in Table II-1-7 through Table II-1-9. The geological summary for each hole is as follows.

MJNM-1

0.00m- 85.40m Calcrete

The calcrete is post Tertiary sediment overlying unconformably over the dolomite of Damara system in the upper Proterozoic age being pale brown and massive or stratified. The basal facies include gravels over 25 metres. From 50 metre to 30 metre deep the rough size-grading of gravels is recognized. Local development of the cavities elongated parallel to the bedding plane may form an

LEGEND

	SYMBOL	ROCK NAME	LITHOFACIES
Tertiary		CALCRETE	Less stratified calcrete
			Gravel bearing calcrete
Upper Proterozoic		DOLOMITE	Massive dolomite
			Well bedded dolomite
			Sandy dolomite
			Oolitic dolomite
			Stromatolitic dolomite
			Stylolite developed
	△ △ △		Brecciated,flextured
		CHERT	
		SHALE	
	~~	ARGIL	Argillaceous zone
			Fractured zone (young and open)
			Crackled zone (old and closed)
	∴ •	MINERALISATION	Pod,dot,speck
			Veinlets

ABBREVIATIONS

COLOR AND FORM
- wht : white
- blk : black
- ppl : purple
- brn : brown
- irreg : irregular

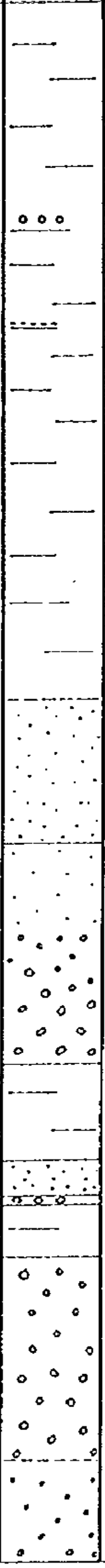
MINERAL
- sp : sphalerite
- hmt : hematite
- clay : clay mineral

ALTERRATION
- cal : calcitization
- dol : dolomitization
- arg : argillization
- ox : oxidation
- sil : silicification
- sel : selicitization

VEIN MINERAL
- Qtz : quartz
- Cal : calcite

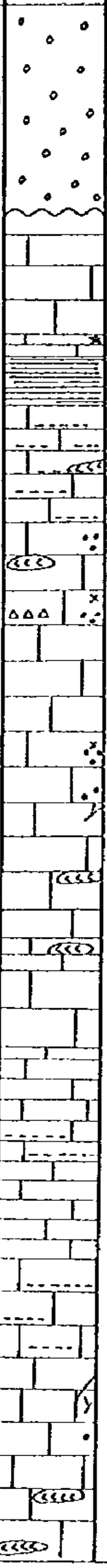
Fig. II - 1 - 2 (1) Geological logs for drill holes

MJNM-1 0m-75m



DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
	CALCRETE	cream to light brown showing breccia texture,bedding in part													
5															
10		10.70m -typical calcrete showing brn rimmed brc 3cm φ													
15		16 15m -massive to stratified calcrete druse calcite in part													
20															
25		23 30-28.70m pebbles cemented with powdery material													
30	CALCRETE														
35		34 50m gradually sandy grains/pebbles increase													
		sandy calcrete													
40		40.50m ~ 1cm φ round to angular pebble													
		pebble,wht-orange, grey calcrete round <5cm φ													
45															
50		51.58m massive calcrete with horizontal vugs													
55		55.83m sandy calcrete													
		57.30m pebble calcrete 57.85m massive calcrete with horizontal vugs													
60		60.30m													
65		67.60m coarse pebbles 10cm φ													
70		70.00m matrix reddish brown argillaceous pebble grey dolomite													
75															

Fig. II - 1 - 2 (2) Geological logs for drill holes



DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
80	CALCRETE														
85		85.40m grey to dark grey dolomite													
	DOLOMITE	88.60-89.50m argil	arg hmt	X-01	89										
90		sandy dol. ∠30°													
		91.35m well bedded grey dol. ∠20-30°													
		92.60m chalcocite-malachite specks		P-01	91.6										
		92.40-94.90m blk dol. distorted													
95		med. to crs sandy grainite with irregular lenses of chert 1-2cm													
100		100.45m cracks with reddish matrix													
	DOLOMITE	101.86-102.26m disseminated sphalerite mineralisation		A-01	101.55	102.26	0.40	< 1	2.45	13	1710	851	4	< 1	4
				I-01	101.55	101.90	0.04								
		-102.70m brnish grey dol. with reddish argil	arg	S-05	102.10										
105				A-02	104.01	104.41	0.40	< 1	0.50	6	151	107	< 1	< 1	45
		103.95m yellow veinlets of vanadium	sil	A-03	104.41	104.66	0.25	< 1	0.50	30	635	241	1	< 1	42
		104.10-104.70m breccia dolomite		A-04	106.70	107.00	0.30	< 1	0.50	4	95	35	< 1	< 1	12
		104.45-104.66m blk dots or stains of sphalerite or vanadium													
110		110.51-110.90m cinnabar red and black veinlets V or Zn		A-05	110.81	110.94	0.13	< 1	0.20	4	55	35	< 1	< 1	22
				A-06	111.09	111.29	0.20	< 1	1.49	7	374	139	2	< 1	42
		110.10m sphalerite along stylolite plane		A-07	111.58	111.69	0.11	< 1	7.06	12	14500	1400	5	< 1	7
		well bedded dol. ∠40-45°		I-02	111.55	111.69	0.11								
	DOLOMITE CHERT/ OOLITE	111.60m sphalerite		A-08	112.30	112.62	0.32	< 1	19.00	39	45200	15550	32	< 1	< 1
115		112.30-112.55m galena-sphalerite pods		P-02	112.30										
		113.20m sphalerite vein/specks		I-03	112.30	112.40	0.10								
		113.97m sphalerite dots		I-04	112.47	112.62	0.15								
		114.15m sphalerite veinlets		X-02	112.50										
				A-09	113.91	114.15	0.21	< 1	0.60	5	161	43	< 1	< 1	15
120		well bedded dol∠chert lense ∠30°													
		123.80m open fracture with reddish argillaceous sediment		A-10	123.85	124.08	0.20	< 1	0.30	8	136	226	< 1	< 1	28
125		124.00m black stripe mineral													
		massive dol.													
		125.3m grey to wht finely bedded dol. ∠20° partly sil. irreg. bands	sil												
		129.10m dark grey dol.													
130		129.45m green vanadium films													
		129.95m-131.00m dark grey sandy dol. showing distorted lamina													
		131.00m- bedded dol. chert or sil.beds	sil												
		134.30m calcite box work druse													
135		135.30m dark grey dol.													
		135.36m crs to med sandy grey dol.													
		136.10m vanadium film in crack													
		crs graphitic carbonaceous grainite													
		finely bedded∠20°													
140			hmt	S-01	141.06										
		141.50m -creamy brn to light grey dol. with vertical cracks Zn+V		A-11	141.55	141.93	0.38	15	0.79	23	267	909	15	< 1	27
		massive non bedded		P-03	141.65										
				A-12	143.70	144.06	0.30	< 1	0.83	9	150	3506	12	< 1	13
		144.47m sphalerite speck													
145		146.65m dol.>chert 2-5cm thick beds													
150															

Fig. II - 1 - 2 (3) Geological logs for drill holes

DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
	SHALE	152.40-.65m chert or sil sandstone ∠20°													
		153.25-.65m dark grey dolomitic shale													
		153.65-155.55m med sandy dol.													
155		155.55m- brn grey finely bedded dol.													
		157.30-158.50m fine Zn veinlets along steep cracks		A-13	157.25	157.55	0.63	< 1	0.07	8	128	49	< 1	< 1	12
				A-14	158.08	158.78	0.70	< 1	0.70	3	69	67	< 1	2	11
160	DOLOMITE	brnish grey to grey dolomite fine massive fractured locally													
165		167.80m- grey dolomite ∠30°													
170															
		light grey													
		174.35-178.45m crackled dolomite													
175		175.55-175.65m Vanadium mineral veinlets													
		grey dolomite ∠50-60°													
180	DOLOMITE	182.70m- crackled dolomite													
185				A-31	185.93	186.07	0.14	1	0.60	5	85	72	< 1	< 1	13
		186.00-186.05m Zn or V													
		189.90-189.95m V?													
190															
195		198.85m Vanadium along stylolite													
200		HCl Δ													
		204.55m transparent calcite open fracture w=1cm	Cal w=1cm												
205		206.65m dark grey fine dolomite													
		208.10m light grey to brnish grey dol.													
210		210.20-210.26m chert bed contact irregular ∠10°		A-15	211.57	211.77	0.20	< 1	2.10	8	102	302	2	1	13
		210.85m Vanadium film in cracks		A-16	211.91	212.08	0.17	< 1	1.50	11	147	995	5	< 1	27
		stylolite predominate		A-17	213.00	213.15	0.15	< 1	2.90	13	605	5710	21	< 1	57
		211.65m V or Zn in stylolite	cal	S-04	212.00										
215		211.95-212.00m sphalerite specks													
		212.95-213.10m black Zn ore specks													
		sandy dolomite		A-18	217.15	217.30	0.15	< 1	0.50	8	85	55	< 1	< 1	12
		216.15-216.35m chert ∠20°													
		217.25m Cu oxide dot in breccia													
220	DOLOMITE	massive dol. stylolite													
		222.75-222.83m Cu-Zn(?) oxide dots		A-19	222.60	222.85	0.25	< 1	2.00	32	136	2360	10	1	7
		223.12-223.67m Sphalerite(?) dots		A-20	223.07	223.67	0.60	< 1	0.80	22	165	3150	15	< 1	9
225		224.98m green Vanadium in cavity calcite													

Fig. II - 1 - 2 (4) Geological logs for drill holes

DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
		grey med dol. light bmish grey dol. massive 228.45-229.30m chert beds													
230															
235															
240		bmish grey bedded dol. fine calcitized	cal												
		242.90-243.00m Sphalerite pods and veinlets in druse		A-21	242.76	242.97	0.21	5	16.00	4250	179	3	< 1	31	
				I-05	242.76	242.97	0.21								
		245.60-245.91m Sphalerite Galena in horizontal cracks and pods	sil	S-02	242.90										
245				A-22	245.75	246.25	0.50	4	29.00	1990	17600	45	8	8	
				A-23	246.25	246.65	0.40	5	20.00	781	22800	74	< 1	13	
				P-04	246.25										
				A-24	246.92	247.17	0.25	2	13.00	172	6110	24	8	2	
		pale bmish grey dol. roughly bedded	sil	S-03	245.00										
250			dol	I-06	245.07	245.18	0.11								
255															
				X-03	257.40										
				A-25	258.95	259.50	0.55	3	19.00	353	7610	29	1	30	
260		258.95-259.50m Sphalerite dots and veinlets in druse													
		263.20-264.20m Sphalerite dots / Vanadium in the upper part		A-26	263.20	264.04	0.84	1	6.00	539	137	< 1	1	36	
265		265.32- .34m sphalerite in calcitized layer													
	DOLOMITE	265.43-265.52m chert													
				A-27	268.10	268.20	0.10	1	4.00	114	49	< 1	1	20	
270															
		271.50-271.53m Galena, Sphalerite thin patches		A-28	271.50	271.58	0.08	7	18.00	4960	183	1	< 1	13	
				A-29	273.64	273.69	0.05	5	7.00	4870	33	< 1	< 1	13	
		274.00m Sphalerite, galena specks W=1cm		I-07	273.64	273.69	0.05								
275		275.65-275.77m chert ∠30° 277.74-277.83m chert 277.93-278.03m breccias cemented with dolospar	dol												
280		280.25-280.35m chert 280.58-280.64m chert 282.30-282.60m vertical cracks with Zn film 284.00m Sp(Zn) specks													
285		284.45m local Sp(Zn) small pods or specks crack veinlets 285.00m upper most black shale 285.50m Cu oxide in flecture of reddish facies 287.50-287.75m shale ss.													
290		massive dolomite intercalated with chert													
295		bedded dolomite ∠10° 295.85-296.05m stromatolite oolite 15cm thick chert ∠20° red dots													
300		300.08 STOP													

Fig. II - 1 - 2 (5) Geological logs for drill holes

MJNM-2 | 0m-75m

DEPTH (m)	GEOLOGIC COLUMN	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
		CALCRETE	whi to pale brown breccia >>matrix													
5																
10																
15			15.10m lost circulation													
20			whi to brn 5cm ϕ angular dol. bre													
25																
30		CALCRETE	druse calcite crystals													
35			37.50m - abundant breccias, reddish brn to dk gry 1-2cm ϕ dominant													
40																
45																
50																
55																
60			60.96m gry with white spots dol. calcrete filling gash and cavities													
65		DOLOMITE	obscure bedding ∠30° 69.80-70.00m vertical chert/dol.													
70			ppl grey with wht dolospar spots 72.20m weathered zone clay	dol												
75			steeply dipping stylolite													

Fig. II - 1 - 2 (6) Geological logs for drill holes

MJNM-2 75m-150m

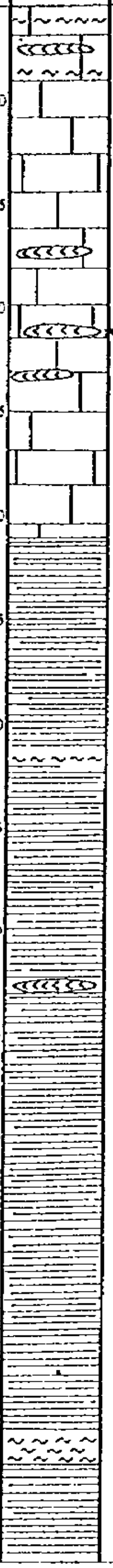
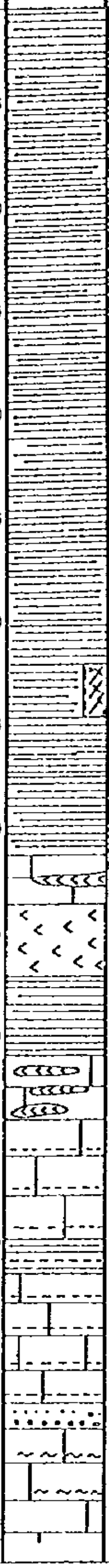
DEPTH (m)	GEOLOGIC COLUMN	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
			75.45-.65m argilaceous zone 77.12m chert∠dol. chert∠20° boundary vertical 78.00-.20m clay	arg arg												
80																
85		DOLOMITE	85.00m -ppl gry wht dots HCl × 87.00m - chert/dol. steep but irreg.	dol												
90			90.86m - dol∠chert oolitic ∠80° 90.96m green malachite speck in chert 93.10m													
95			drk grey dol./chert irreg. bands boudinage like													
100			100.60m -blk dolomitic shale with wht dots HCl △ or ○ 102.30m spar vein druse some part chert bands intercalated													
105																
110			blk dolomitic shale bedding obscure ∠30-40° 111.00-111.61m fractured with reddish cream argil calcareous blk shale													
115			116.12m wide space fracturing qtz-cal veinning stylolite vertical	Qtz ∠15°												
120			121.70m shale/chert with fossil like texture, ∠70-80°													
125		SHALE	124.85m blk calcareous shale 126.0m bedded shale													
130			bedding vertical blk to dark grey med. chert thin beds intercalated													
135																
140			142.40m - reddish oxidized shale ∠80° 143.60m 144.79-145.10m fractured zone argilaceous zone	Cal w=1cm arg												
145																
150																

Fig. II - 1 - 2 (7) Geological logs for drill holes



DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	CHEMICAL ASSAYS Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
		151.60m chert < blk shale chert beds almost vertical													
155															
160															
		white transparent vein minerals HCl ×													
		blk shale stratified													
165		166.52m veining ∠45°	Cal w= 0.5cm												
170		few beds of chert													
175															
180	SHALE	180.96m oxidized zone of shale	ox												
				S-12	182.39										
		qtz-clay white vein 184.0-185.30m fractured	Qtz-clay												
185															
		blk shale 187.97m ∠30° qtz+α vein	Qtz												
190															
	DOLOMITE	192.70m oolitic chert intercalated dolomite 194.30m -Chert													
195	CHERT		sil cal	S-07	196.00										
	SHALE	198.00m - black dolomitic sandstone // shale alt.													
200		199.00-202.80m veining	Qtz-Cal												
	DOL.// CHERT	201.80m - dark grnish grey dol. // chert black patched dolomite to sandy													
		204.95m - blk crs dolomite to sandstone													
205															
	DOL.// SS.														
		208.10m calcrete gash w=3cm cream brn HCl O	dol												
		209.76m orange film vanadium?													
210	SHALE // SS.	blk shale//med sandy dol alt.													
		210.30m- chert thin lense//dol.		S-08	210.50										
		213.36-.80m hexagonal crystal													
		214.00m dolomitic shale med to crs sandy													
215															
		fine grey dol.//ss.		S-09	218.40										
		218.50-219.12m crs ss to conglomerate	arg												
220		argil layer w=1cm	hmt												
	DOLOMITE	dolomite/argil intense white veining													
225															

Fig. II - 1 - 2 (8) Geological logs for drill holes

MJNM-2 225m-300m

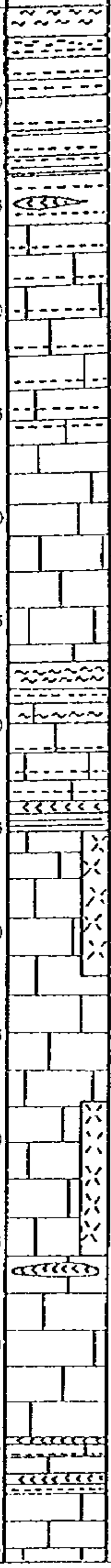
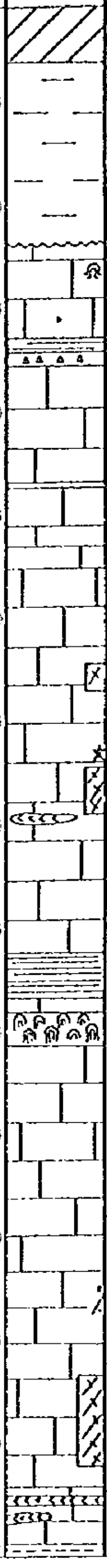
DEPTH (m)	GEOLOGIC COLUMN	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	SAMPLE From (m)	SAMPLE To (m)	SAMPLE Length (m)	CHEMICAL ASSAYS Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
			226.50-227.50m clay crs sand ∠90°	arg												
		SANDSTONE	229.20m													
230			sporadic chert lense													
			blk sandy shale to ss dol./chert beds													
235																
240																
			blk sandstone													
245			246.50m- dolomite intercolated with argil layers													
		DOLOMITE														
250																
			253.40-254.00m white veining ∠20°	dol												
255																
			257.00-257.60m argil	arg												
		DOLOMITE // SS.	257.60m dol sandy to sandstone with argil beds													
260																
		CHERT/DOL SHALE	263.60-264.95m chert/dol shale													
265																
		DOLOMITE	267.70-271.90m brecciated dol.>>chert crackled argil X-ray matrix reddish brown+spar.quartz?													
270																
			grey massive dol. with horizontal wht veining-white spots stylolite vertical													
275																
			277.85-285.25m crackled dolomite													
280			massive dolomite													
285		DOLOMITE	285.00-286.33m dol/chert vertical bedding													
			massive dolomite													
290																
295			294.07m chert/crs quartz sandstone grey dol alt. 296.50m grey msv dolomite													
300			299.50m greenish grey drk grey dolomite 300.30m stop													

Fig. II - 1 - 2 (9) Geological logs for drill holes

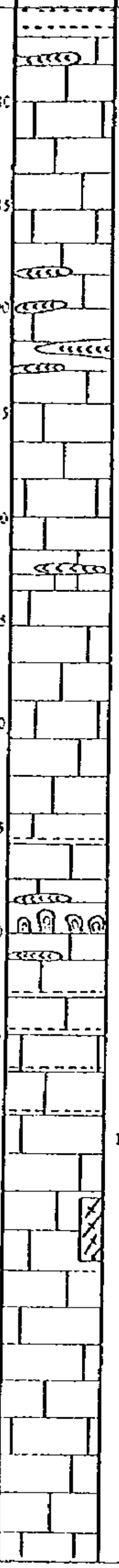
MJNM-3 0m-75m



DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
		0-2.30m Soil Non core													
		grey to purple brown, partly argillaceous,													
5		gravel to bedded texture													
		some vuggy													
	CALCRETE														
10															
		12.00m -gry roughly bedded showing													
		stromatolitic texture													
15		16.40m flat lying bedded dol.													
		reddish gry to purplish													
		17.30-17.50m angular blebs dol.													
20		massive dol. partly algale(fibrous) vuggy													
		23.30m partly thin bedded													
25		cracks filled with calcite and quartz													
		stylolite layers and thinly bedded dol.													
		∠5-10°													
		Grey sandy dol. ∠20-30° bedding endulated													
30	DOLOMITE														
		32.20-32.90m fractured steeply ∠70°													
35		36.64m calcite gash with malachite speck													
		36.60-40.85m													
		vertical fractures filled with calcite													
		39.35-.45m 10cm thick chert bed													
40		∠5°													
		40.60m hematite bed 1-2cm thick ∠15°													
		43.00-45.00m massive dol. dark gry													
45		dolospar	dol												
		46.45-.65m wht mineral veinning cavities													
		magnesite? HCl×													
		48.60-50.38m light gry dol.													
		stromatolitic texture													
50		50.38m argillaceous green brown mineral													
		massive to flat lying dol.													
		massive to roughly bedded in part													
55		57.10-.20m hematite fracture	hmt												
		58.00m ∠60° cavity													
60		light gry to reddish dol.													
		62.00-62.50m wht spots dolomite	dol												
		63.10m sphalerite grains with wht vein													
		63.55-.60m green vanadium film in cracks		P-05	63.55										
65		66.00-70.60m vertical to steep cracks													
		∠60°													
70		black stains(vanadium?) in crack													
		72.35-.60m chert bed ∠15°													
		73.25m vanadium mineral in crack													
		73.50-.60m chert bed													
75	SANDSTONE	74.60-76.45m calcareous sandstone													

Fig. II - 1 - 2 (10) Geological logs for drill holes

MJNM-3 75m-150m



DEPTH (m)	GEOLOGIC COLUMN	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	SAMPLE From (m)	SAMPLE To (m)	SAMPLE Length (m)	CHEMICAL ASSAYS Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
			med to fin ∠10°													
		CHERT	?7.20m chert													
			?7.70m crystalline dolomite partly thin beds of chert intercalated													
80																
		DOLOMITE	light fry fin dol.													
			?83.45m ∠30°													
85																
		CHERT	88 15-.25m chert 10cm thick													
			89 05m argilaceous matter-hmt 3cm thick													
90		CHERT	89.25-.45m chert													
			91.60m fractured over 60cm magnesite vug	dol												
			92 50m irreg wht to pink chert in dol.													
			93 38m													
95			94.20m light gry med sandy dol. bedding flat													
			95.60m drk grey dol. veinning crystalline calcite	Cal	,											
100			sandy dolomite bedded ∠5-10°													
		DOLOMITE	100 60-101.33m fine dol. sandy partly chert horizontal beds 10cm thick													
105			fine light grey dol.													
110																
			fractured with wht minerals(dolospar?) ∠60-70° <5mm	dol												
115			115 20m gry med dol. sandy ∠20°													
			118.00-118.15m irreg chert beds													
120			118 70-119.50m thinly bedded dol hem laminae stromatolitic													
			120.75m chert													
			120.85-121.40m pale brn grey crs sandy													
			123.70m green/red blk clay mineral?													
			massive med crystallized dol. ∠20°													
125			crs graded dol.													
			127.45-.50m hematite layer													
			127.80-128 50m mottled crs dolomite													
130		DOLOMITE														
			131.20m- fine grey dol.													
			132 85m- steeply or vertical fractured													
135			135 0m													
			gry fine to med dol.													
			138.30m- irreg. fracture with wht vein wht to greenish brn													
140																
			wht spots dol.	dol												
145			med to fine gry dol.													
150			150.30m stop													

Fig. II - 1 - 2 (11) Geological logs for drill holes

MJNM-4 **0m-75m**

DEPTH (m)	GEOLOGIC COLUMN	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	SAMPLE From (m)	SAMPLE To (m)	SAMPLE Length (m)	CHEMICAL ASSAYS Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
		CALCRETE	wht clay/dolomite frag, blocks													
5			5.58m gry bedded dol. sandy in part black grains													
		DOLOMITE														
10			dark grey/wht banded dol. ∠60° still vuggy porous 12.50m thinly bedded dark gry dol.													
			14.20-.40m black shale frag.													
15																
			black stripes of argillaceous dol. 19.00m open fracture/ calcite, quartz	Qtz - Cal												
20			20.36m cavity 21.46-22.00m													
		SHALE	black calcareous shale bedding ∠30° 22.00m orange Vanadium mineral?													
		SHALE	24.00-24.57m blk shale													
25																
			27.45-28.55m cave?													
30			intercalated with 5-20cm thick chert bands ∠30°													
			reddish to gry fine dol.													
35		CHERT	35.00m- wht chert ∠45°													
			35.40-60.00m Percussion drill chip logging (brownish grey dolomite+chert)													
40																
		DOLOMITE	(brownish grey dolomite)													
45																
			(grey dolomite)													
50																
			(dark grey argillaceous dolomite or shale)													
55																
			(black shale >dolomite)													
60		SHALE DOLOMITE	blk sandy shale 60.80m grey well bedded DOLOMITE thin chert beds ∠40-45°													
			64.50-65.80m fractured core brittle													
65			66.80m vein ∠45° stylolite and bedding	Qtz - Cal												
			calcitized? but HCl ×	dol												
70			71.30m chert clasts sediment dol/chert beds ∠45°													
			74.30m fractured over 20cm													
75																

Fig. II - 1 - 2 (12) Geological logs for drill holes

MJNM-4 75m-150m

DEPTH (m)	ROCK NAME	LITHOLOGICAL DESCRIPTION	VEIN ALT.	SAMPLE No.	From (m)	To (m)	Length (m)	CHEMICAL ASSAYS Au (ppb)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Cd (ppm)	Ga (ppm)	V (ppm)
		76 06-78.00m black shale													
		79.50-80.00m fractured													
80		80 00m cavity crystal HCl O													
		80.00-80.30m good fracture for minerali-sation	cal												
		82 06-83.50m cavity													
85		well bedded dol/ppl chert $\angle 45^\circ$													
		87.65-88.55m brittle fractured zone dol.													
		88 55-89.00m dol.with cavities													
90		grey dol.with thin chert beds													
		calcitization	cal												
		90.60-92.90m drk grey to wht sandy dol dol.slt													
		93.60m well bedded dol													
95		93 60-94.00m cream limestone HCl O													
		dark grey dol. with druse													
		well bedded shale stripes													
	SHALE	96 12-99.10m black shale													
100		dol.with black and white stripe													
	DOLOMITE														
		101.65m oolitic beds 10cm thick $\angle 30^\circ$													
		103.20-104.70m													
		grey sandy dol/dolomitic blk shale													
105		well bedded													
		dol sandy dol $\angle 20\text{-}30^\circ$													
		calcitized to small druse													
		109.25-109.65m black shale													
110															
		112 45m													
		calcareous shale with spot druses		S-10	113.20										
		fine stripes HCl O $\angle 20^\circ$													
	SHALE	massive dol. light grey to cream													
115															
		117.00m bedded dol. $\angle 45^\circ$													
		118.80m druse abundant dol ls $\angle 45^\circ$ filled with calcite													
120															
		121.00m well bedded dol. with chert lenses													
	DOLOMITE	partly distorted													
125															
		125.50-125.75m druse rich dol. black and													
		well bedded dol. $\angle 30^\circ$													
		$\angle 45^\circ$													
130		$\angle 60^\circ$													
		132.50-133.45m druse rich dol.													
		133.45-134.40m well bedded dol. pink/													
		grey slt. $\angle 45^\circ$ argillaceous		X-05	134.60										
135		134.40-136.70m druse dol.													
		138.00m-partly druse calcite													
		light cream brnish grey dolomite													
140		fractured filled with dolospar	dol												
	SHALE	143.35m bedded dol.													
145		143.65-143.80m black shale													
		144 00-144.25m fractured													
		dol. with small druses													
		145.20-145.55m black shale	ser												
		cavity													
150		bedded dol. $\angle 30^\circ$													
		148.15-150 60m chert intercalated dol.													
		with sericite layers													
		150.60m STOP													

Fig. II - 1 - 2 (13) Geological logs for drill holes

aquifer of groundwater.

85.40m-300.08m Dolomite

The dolomite is greyish white to grey and occasionally pale brown. The lithofacies are less variable except for thin beds of chert some centimetre to ten centimetre thick over the formation and beds of black to dark grey shale within the section from 92.40 m 94.90 m and around 153.50 m. The dolomite is massive or well bedded where the bedding planes cross the hole at 60 to 80 degree. It gives tiny bubbles against chloric acid. The stylolite develops over the massive facies from 210 m to 240 m deep. Along the undulating plane the thin argillaceous layer occurs including iron oxides. Grainite which is composed of medium to coarse grained dolomite underlies the shale.

Oolitic dolomite occurring locally within the formation seems to have undergone silicification during the diagenesis stage. The small mound textures which seem to stromatolite were observed at around a depth of 296.0 m with oolitic texture. The formation may be correlated to T6 of the Tsumeb subgroup according to the overall lithological sequence.

The mineralisation occurs intermittently over 12 metres from 102 m to 114 m deep and from 212 m to 285m deep including principally sphalerite and galena in the form of pods, irregular network and dots associated with silicification in dolomite. The mineralisation is also restricted to the fine fractures at the proximity of the stylolite and is conformable to the bedding plane giving possible model of strata-bound type lead and zinc mineralisation.

Copper mineralisation includes a coveline-galena dot at 92.60 m and a green copper mineral at 285.50 m deep. Vanadium mineralisation basically overlaps the above mentioned mineralisation filling the young fractures with the characteristically green to orange-coloured showing.

MJNM-2

0.00m- 60.96m Calcrete

The calcrete is white to pale brown and includes a large number of breccias less than 5 centimetre in diametre. The breccia is commonly dolomitic showing grey to reddish brown. The calcrete between 25 m and 37 m deep includes elongated cavities where crystalline calcite occurs. The water circulation was lost at 15.10 m deep.

60.96m-100.60m Dolomite

The formation is light grey and fine grained dolomite including white spots of dolospar. Local lenses of chert and silicified oolite are intercalated. The bedding planes are approximately parallel to the drill hole. A dot of green copper mineral is embedded in the thin bed of chert at 90.96 m deep.

100.60m-204.95m Shale

The formation is black shale rarely intercalated with red chert. The shale is identified with calcareous shale because of the reaction with chloric acid. The angle between the bedding plane and drill hole varies from 10 to 20 degrees. The formation is fractured at around 111 m and 145 m deep to form argillaceous matter.

204.95m-300.30m Dolomite

The formation is composed of dark coloured coarse to medium-grained sandy dolomite with argillaceous intercalation and conglomerate at around a depth of 219 m .

At depth it changes to fine grained dolomite. Old crackled zone develops between 267.70 m and 285.25 m. The bedding plane runs almost parallel to the drill hole. No mineralisation was recognized.

MJNM-3

0.00m- 12.00m Calcrete

The formation is grey to purplish brown and is sometimes stratified with vugs.

12.00m-150.30m Dolomite

The massive facies are dominant with thin beds of chert. The dolomite from 74.60 m to 76.45 m, from 94.20m to 100.60 m and from 120.85 m to 128.50 m shows medium grained sandy facies. Remarkable stromatolitic texture is recognized at around 50 m deep. The angle between the bedding plane and drill hole varies from 60 to 85 degrees. Mineralisation includes a dot of green cupriferous mineral which is associated with dolospar filling the fractures within dolomite at 36.64 m and a large grain of sphalerite at 63.10 m as well as descloizite film at 63.55 m.

MJNM-4

0.00m- 5.58m Calcrete

The calcrete is composed of white argil and dolomitic gravels.

5.58m- 50.00m Dolomite

The formation is grey bedded or massive dolomite intercalated with black shale some ten centimetre thick and chert. The bedding plane gives 45 to 60 degrees with the drill hole. Orange coloured mineralisation in the form of veinlets at round 22 m deep is possibly vanadium.

50.00m-117.00m Dolomite/Shale alternate

The formation is composed of bedded dolomite, sandy dolomite, black shale and chert. Within the dolomite with black carbonaceous stripes, a large number of vugs which vary from 0.5 to 1.0 centimetre in diametre characterize the formation.

117.00m-150.60m Dolomite

The formation includes well bedded pale brownish grey dolomite with thin beds of black carbonaceous dolomite. The carbonaceous facies show stripe texture and are rich in vugs formed by dissolution. The formation is also characterized by pink coloured sericitic layers deeper than 133 m.

The bedding plane gives 45 to 60 degrees with the drill hole. No mineralisation was encountered.

II-1-5. Chemical assays

The mineralised cores were quartered using diamond blade and cut into samples more than 10 centimetre long. Each sample was prepared for chemical assay of eight elements including Au, Ag, Cu, Pb, Zn, Cd, Ga and V. The result is shown in the geological column sections as well as Table II-1-10. The analytical methods were atomic absorption method for Au, Ag, Cu, Pb Zn and Cd using Hitachi Z-6000 and Z-8100 (flameless) and absorbance optical density method for Ga and V.

Detection limit for Au and Ag is 1 ppb whereas that for Cu, Pb, Zn, Cd, Ga and V is 1 ppm. The cumulative length of the mineralised cores reaches to 9.16 metres, while the cumulative value of the mineralised lengths by assay values amounts to 2.125 metre×percent (m×%) for Pb and 3.461 m ×% for Zn with 5.586 m×% for Pb+Zn. Of the assayed samples, the mineralised sections which gave

more than 1 % are as follows.

111.58m-111.69m(0.11m)	Pb=1.45%	
112.30m-112.62m(0.32m)	Pb=4.52%	Zn=1.58%
245.75m-246.25m(0.50m)		Zn=1.76%
246.25m-246.65m(0.40m)		Zn=2.28%

Almost all Au assays are less than detection limit and the values over 1 ppb of Au come from the samples in which Pb and Zn are concentrated. Silver assays show a remarkable positive correlation with Pb assays with 19 ppm for a sample which assays 4.52 % Pb. Copper assays are approximately correlative to Pb and Zn assays as well with maximum value of 59 ppm. The relation between Pb and Zn is obscure. The one group shows considerably obvious relations while another group show deviant relations. Cadmium assays are definitely proportional to Zn content. Comparison with Tsumeb ore which contains 3% Zn with 400 ppm Cd in average, may indicate that the core samples show lower Cd content for Zn assays than Tsumeb ore. Gallium is less than detection limit for most of the samples. Vanadium is in order of some tens ppm with maximum assay of 57 ppm however, the assays are higher for the concentration of Pb and Zn compared to Tsumeb ore.

II-1-6. Lead Isotope Analysis

Table II - 1 - 7 Microscopic Identification of Minerals in Thin Section

Sample No.	Hole No.	Depth (m)	Rock Name	Constituen Minerals			Accessory Minerals				Secondary Minerals				Remarks
				Qz	Cal	Dol	Hm	Mt	Ap	Zr	Ser	Qz	Dol	Cal	
S-01	MJNM-1	141.00	Shale	△		◎	*								
S-02	MJNM-1	242.80	Sandy dol	△		◎	△					○			
S-03	MJNM-1	246.00	Dolomite			◎	△					○	○		
S-04	MJNM-1	212.00	Calcitizaiton			◎								◎	
S-05	MJNM-1	102.10	Oolite	◎		◎	△					◎			
S-07	MJNM-2	196.00	Chert	◎				△				○		△	
S-08	MJNM-2	210.50	Dol/Shale	△		◎	△								
S-09	MJNM-2	218.40	Sandy dol	△		◎	△						○		
S-10	MJNM-4	113.20	Calc shale	△	○	○		△							
S-12	MJNM-2	182.39	Argil	◎				*	*	*	○				

◎:abundant ○:common △:rare *:trace

Abbreviations

Qz:quartz Cal:calcite Dol:dolomite Hm:hematite Mt:magnetite Ap:apatite Zr:zircon

Ser:sericite

Table II - 1 - 8 Microscopic Identification of Minerals in Polished Section

Sample No.	Hole No.	Depth(m)	Sulphide mineral				
			Primary				Secondary
			Gn	Sp	Ds	Py	Cv
P-01	MJNM-1	91.6	○				※
P-02	MJNM-1	112.3	◎	○			※
P-03	MJNM-1	141.63	※	◎			※
P-04	MJNM-1	246.25	◎	◎		※	※
P-05	MJNM-3	63.55			◎		

◎: abundant ○: common ※: poor
abbreviations: Gn: Galena Sp: Sphalerite Ds: Descloizite Cv: Covelline

Table II - 1 - 9 Result of X-ray Diffractometry

Samples				Silicate Minerals: Clay Minerals									Silicate Minerals				Carbonate Minerals				Ore Minerals			Remarks
No.	Well No.	Depth	Rock Name	Montmollironite	Saponite	Chlorite/Mont.	Sericite/Mont.	Chlorite	Sericite	Kaolin	Palygorskite	Hydrated halloysite	Talc	Quartz	K-Feldspar	Albite	Calcite	Dolomite	Cerussite		Pyrite	Pyrrhotite	Galena	
1	MJMN-1	89.0 m	Reddish argil					△			△			◎										
2	MJMN-1	112.3 m	Sillicification						△					◎				◎	△			?	△	
3	MJMN-1	257.4 m	Dolospar											◎				◎						
4	MJMN-3	63.1 m	Dolospar + Sp											?			△	◎						
5	MJMN-4	134.0 m	Sericitic dolomite	△				△	△				○	◎				◎						

Abbreviation
◎:Abundant ○:Medium △:Minor +:Existent

Table I - 1 - 10 Result of Chemical Assays

No.	Sample No.	Hole No.	From (m)	To (m)	Width (m)	CHEMICAL ASSAY (ppb for Au, ppm for others) Au	Ag	Cu	Pb	Zn	Cd	Ga	V
1	A-01	MJNM-1	101.86	102.26	0.40	<1	2.18	14	1710	851	4	<1	4
2	A-02	MJNM-1	104.01	104.41	0.40	<1	0.50	6	154	107	<1	<1	49
3	A-03	MJNM-1	104.41	104.66	0.25	<1	0.50	30	605	244	1	<1	42
4	A-04	MJNM-1	106.70	107.00	0.30	<1	0.50	4	99	35	<1	<1	12
5	A-05	MJNM-1	110.81	110.94	0.13	<1	0.20	4	85	35	<1	<1	25
6	A-06	MJNM-1	111.09	111.29	0.20	<1	1.49	7	374	139	2	<1	42
7	A-07	MJNM-1	111.58	111.69	0.11	<1	7.06	12	14500	1420	5	<1	7
8	A-08	MJNM-1	112.30	112.62	0.32	<1	19.00	59	45200	15800	32	<1	<1
9	A-09	MJNM-1	113.94	114.15	0.21	<1	0.60	5	161	43	<1	<1	16
10	A-10	MJNM-1	123.88	124.08	0.20	<1	0.30	8	136	226	<1	<1	28
11	A-11	MJNM-1	141.55	141.93	0.38	18	0.79	25	267	909	15	<1	27
12	A-12	MJNM-1	143.70	144.00	0.30	<1	0.89	9	150	3500	12	<1	13
13	A-13	MJNM-1	157.25	157.88	0.63	<1	0.70	8	128	49	<1	<1	12
14	A-14	MJNM-1	158.08	158.78	0.70	<1	0.70	3	69	67	<1	2	11
15	A-15	MJNM-1	211.57	211.77	0.20	<1	2.10	8	102	302	2	1	13
16	A-16	MJNM-1	211.91	212.08	0.17	<1	1.80	11	147	998	5	<1	27
17	A-17	MJNM-1	213.00	213.15	0.15	<1	2.90	13	605	5710	21	<1	57
18	A-18	MJNM-1	217.15	217.30	0.15	<1	0.80	8	86	55	<1	<1	12
19	A-19	MJNM-1	222.60	222.85	0.25	<1	2.00	32	156	2300	10	1	7
20	A-20	MJNM-1	223.07	223.67	0.60	<1	0.80	22	165	3160	15	<1	9
21	A-21	MJNM-1	242.76	242.97	0.21	<1	5.49	16	4280	179	3	<1	31
22	A-22	MJNM-1	245.75	246.25	0.50	<1	4.00	29	1990	17600	46	1	8
23	A-23	MJNM-1	246.25	246.65	0.40	13	4.57	20	781	22800	74	<1	13
24	A-24	MJNM-1	246.92	247.17	0.25	2	1.69	13	172	6110	24	1	2
25	A-25	MJNM-1	258.95	259.50	0.55	<1	3.48	19	353	7610	29	1	30
26	A-26	MJNM-1	263.20	264.04	0.84	<1	1.39	6	539	137	<1	1	36
27	A-27	MJNM-1	268.10	268.20	0.10	<1	0.79	4	114	49	<1	1	20
28	A-28	MJNM-1	271.50	271.58	0.08	<1	7.25	18	4960	183	1	<1	13
29	A-29	MJNM-1	273.64	273.69	0.05	<1	5.46	7	4870	33	<1	<1	13
30	A-31	MJNM-1	185.93	186.07	0.14	1	0.60	5	85	72	<1	<1	13

II-1-7. Discussion

II-1-7-1. Mineralisation

Lead and zinc mineralisation similar to that of MJNM-1 is reported to occur throughout the Otavi Mountainland area The occurrences as described in previous exploration reports are listed below. The heading number corresponds to those in Fig.II-3-1.

(1). Harasib 317- Nosib block III 655

Lead -zinc occurrences hosted by the Elandshoek Formation are present on the farm Harasib 317 and three smaller deposits of the same type occur on the farm Nosib Block III 655. One of these prospects is situated on the southern limb of a syncline and consist of a brecciated zone within the Elandshoek Formation dolomite. Mineralisation intersected by diamond drilling assayed from 0.1 to 8.0% lead, and 0.1 to 5.7% zinc over widths ranging from 1.0 to 6.0 m.

(2). Nosib block III 648

Disseminated galena and sphalerite are exposed in a prospecting shaft in the Karuchas zone of the Elandshoek Formation. Underground prospecting showed vanadium ore averaging 7% lead and up to 13.5% zinc.

(3). Driehoek 768-Gauss 46

These farms, situated about 15 km north of Kombat and a number of lead-zinc occurrences are present on them. Concentrations of up to 3% were intersected within the uppermost 65 m of a biohermal dolomite of the Abenab Subgroup.

(4). Border prospect

This prospect is situated in the southeast of Nosib Block III 655. This area is underlain by a lower dolomite, a fine-grained limestones and an upper massive, quartz-rich dolomite. The main ore minerals are sphalerite and galena with minor chalcopyrite and very minor tetrahedrite and pyrite. The mineralisation occurs within highly brecciated zones and ore and gangue minerals fill the interstices of the fragments. The mineralised zones are stratigraphically controlled and occur principally in the upper, massive dolomites. The mineralisation control is modified by jointing striking north-northwesterly. A reserve of 30 million t at a cut-off grade of 5.8% lead and zinc combined has been calculated.

(5). Olifansfontein 9

A number of lead-zinc occurrences in different geologic settings are present on this farm. They occur on both limbs of the Harasib-Olifansfontein syncline and notably in the Elandshoek Formation.

The six major prospects are described briefly below:.

South Ridge Prospect: A diamond hole intersected 1 m of patchy galena mineralisation at a depth of 200m at the upper contact of unit B.
Pickaxe Prospect: A number of trenches revealed high-grade pockets of galena and sphalerite, accompanied by descloizite in massive dolomite of the Elandshoek Formation. Mineralised quartz veins show the same mineral assemblage.
Tiger Tunnel Prospect: Mineralised zones totaling 43 m in thickness and averaging 0.3% lead and 3.2% zinc were intersected in a diamond drill hole at depths between 120 and 200 m. The zinc mineralisation occurs as smithonite and zincite.
Butterfly Prospect: Patchy concentration of galena and sphalerite occur immediately below a zone of stratiform stromatolite and chert concretions. Patches of chalcocite and malachite occur within quartz veins.
Dogleg Prospect: A prominent clast-supported mineralised breccia occurs here.
Hambone Prospect: Mineralisation is associated with a prominent lithological break in the dolomites along the limestone/dolomite interface of the Maieberg Formation.

No characteristic structures such as karst breccias and sand pipes which are associated with the Tsumeb and Kombat-type ore deposits, were intersected by MJNM-1 hole. The mineral assemblage may also suggest that the mineralisation is of different type from that of Tsumeb and Kombat. Detailed observations of the mineralised sections of cores and observations under microscope revealed that the lead and zinc minerals are associated with fine chalcedonic quartz which has formed in separate stages. It is thus believed that the mineralisation is of classic Mississippi Valley-type which implies mineral precipitation at comparatively low temperature during diagenesis. Schematic mineralised sections are shown in Fig.II-1-5. The sketches indicate that galena and sphalerite occur as fillings in microfractures, subparallel to the stylolitic planes. Microfractures cutting the stylolitic planes are rare and intermittent. It is therefore suggested that the mineralisation appears to be restricted to a specific stratigraphic horizon or lithofacies.

The occurrences related to the strata-bound MVT are hosted by dolomites of the Gauss Formation, Abenab Subgroup through to the Huttenburg Formation of the Tsumeb Subgroup. Most frequently these occur within the Elandshoek Formation of middle Tsumeb Subgroup. Combined lead and zinc ore grade of the occurrences varies from less than 5 % to 10 %. In the recent years ore reserve estimates and a feasibility study was done on one prospect only, but the results obtained were negative. .However, the known zone of MVT type occurrences covers the Khusib Springs copper deposit which has been recently developed. The mineral assemblage of this deposit, which consists of chalcocite, tetrahedrite, chalcopyrite and pyrite indicates that the deposit is obviously different from MVT deposit. It is thus possible that in the survey area, both copper ore deposits and MVT deposits could occur in close proximity.

II-1-7-2. Structural geology

The interpretation of subsurface geological structure is difficult due to the limited outcrop. The only outcrop occurs in the vicinity of the drill hole MJNM-4. However, the geological structure around drill holes, which is inferred from the angles between drill cores and the beds, is conformable to that deduced from the airborne magnetic lineaments. MJNM-1 is located at the synclinal axis plunging west and MJNM-2 is situated in the south limb of a synclinorium which is also transected by some faults. Steeply dipping formations were recorded in this borehole. MJNM-3 and MJNM-4 are situated respectively on the northern and the south limbs of the same synclinorium.

The MVT deposits and the Khusib Springs copper deposit are hosted in the dolomites of the Abenab and Tsumeb Subgroup which form the Harasib-Olifantsfontein syncline. The eastern extended of this syncline seems to have lesser ore potential as the syncline is plunging westwards. The aeromagnetic survey indicates a shallow depth to basement in this area which means that overlying Damara sequence rocks are thinner. The Tsumeb syncline which hosts the Tsumeb deposits probably extends to the east. Based on the geological map and aeromagnetic anomaly map, the orientation of the fold axes is seen to change towards the east-northeast and back to the east again.. The Tsumeb deposit is located in the fold axis and the Abenab ore deposits in the south limb of the syncline. Based on the combined interpretation of the resistivity and aeromagnetic anomalies, the eastern extension of the syncline, in the vicinity of boreholes MJNM-1 and MJNM-2 is targeted for additional drilling during Phase III.

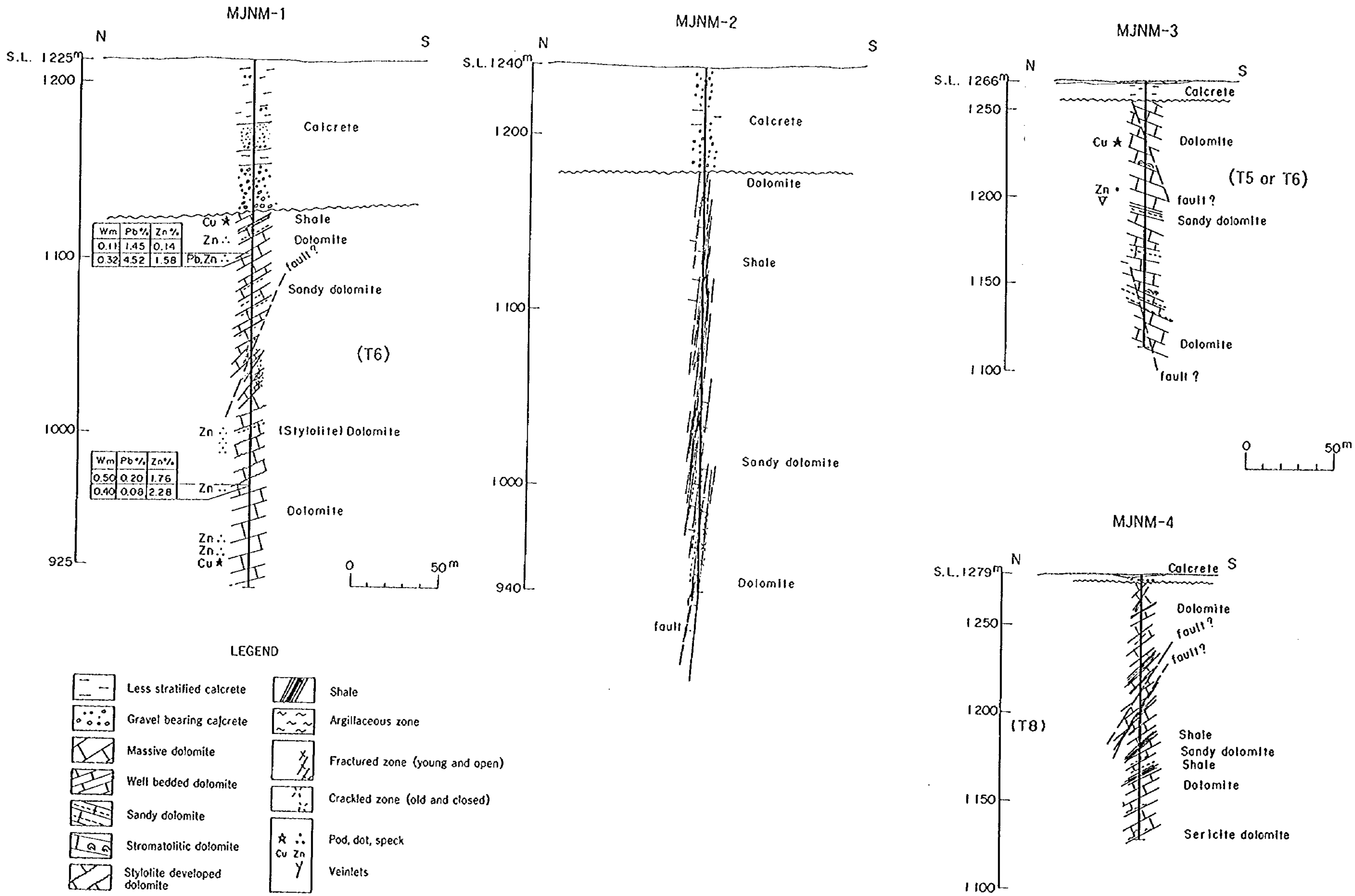


Fig. II - 1 - 4 Geologic cross section of drill holes

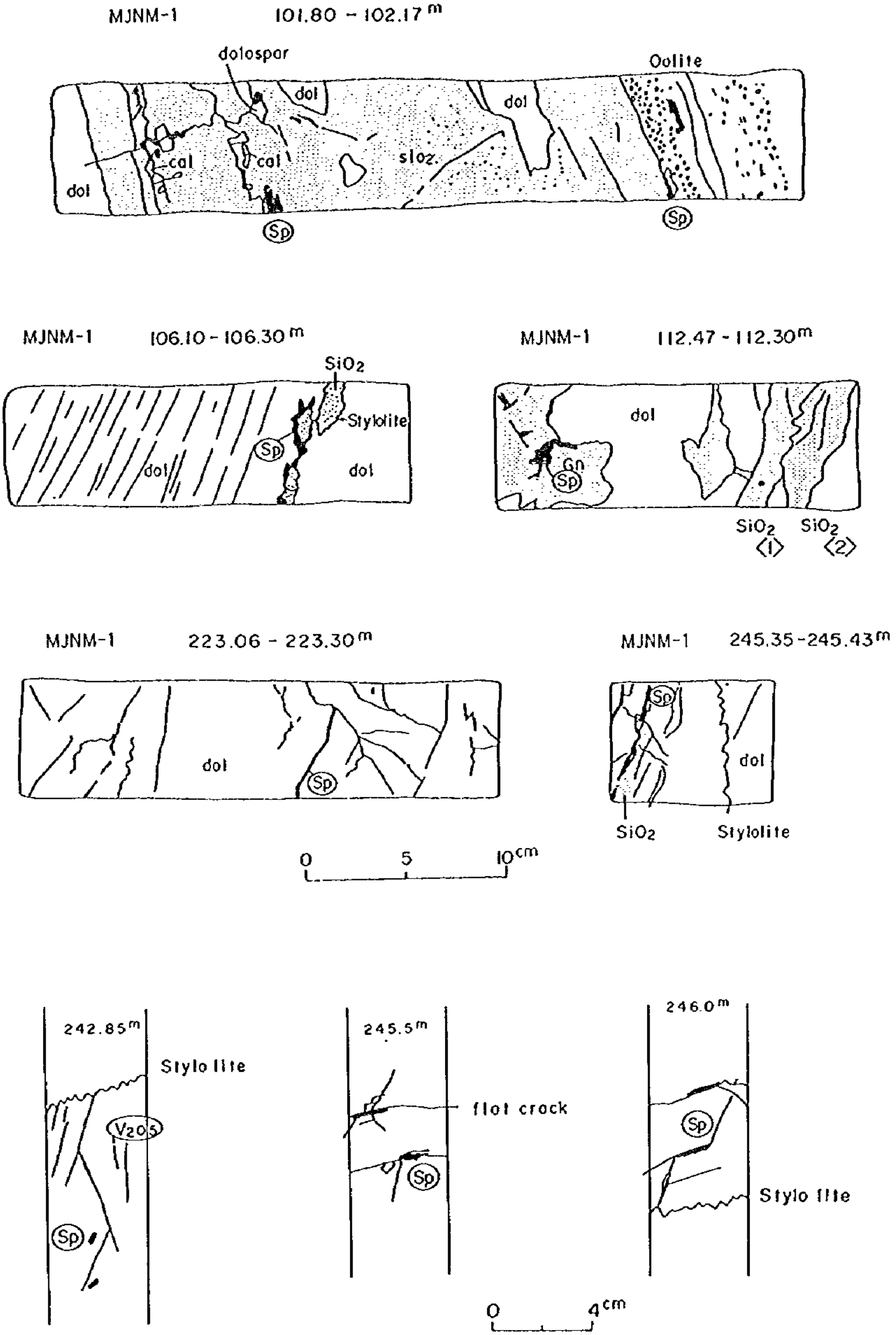


Fig. II - 1 - 5 Sketch of mineralised cores