NO.

REPORT
ON
THE MINERAL EXPLORATION
IN
THE KRIB-MEJEZ EL BAB AREA
THE REPUBLIC OF TUNISIA

(PHASE III)

MARCH 2002

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

M P N
JR
02-062

Preface

In response to the request of the Government of the Republic of Tunisia, the Japanese Government decided to conduct a Mineral Exploration in the Krib-Mejez el Bab 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 to the Republic of Tunisia a survey team consisting of one geologist and three geophysicists from August 26, 2001 to January 25, 2002.

The team conducted a field survey in the Krib-Mejez el Bab Area and completed it in cooperation with the Ministry of Industry and National Office of Mines.

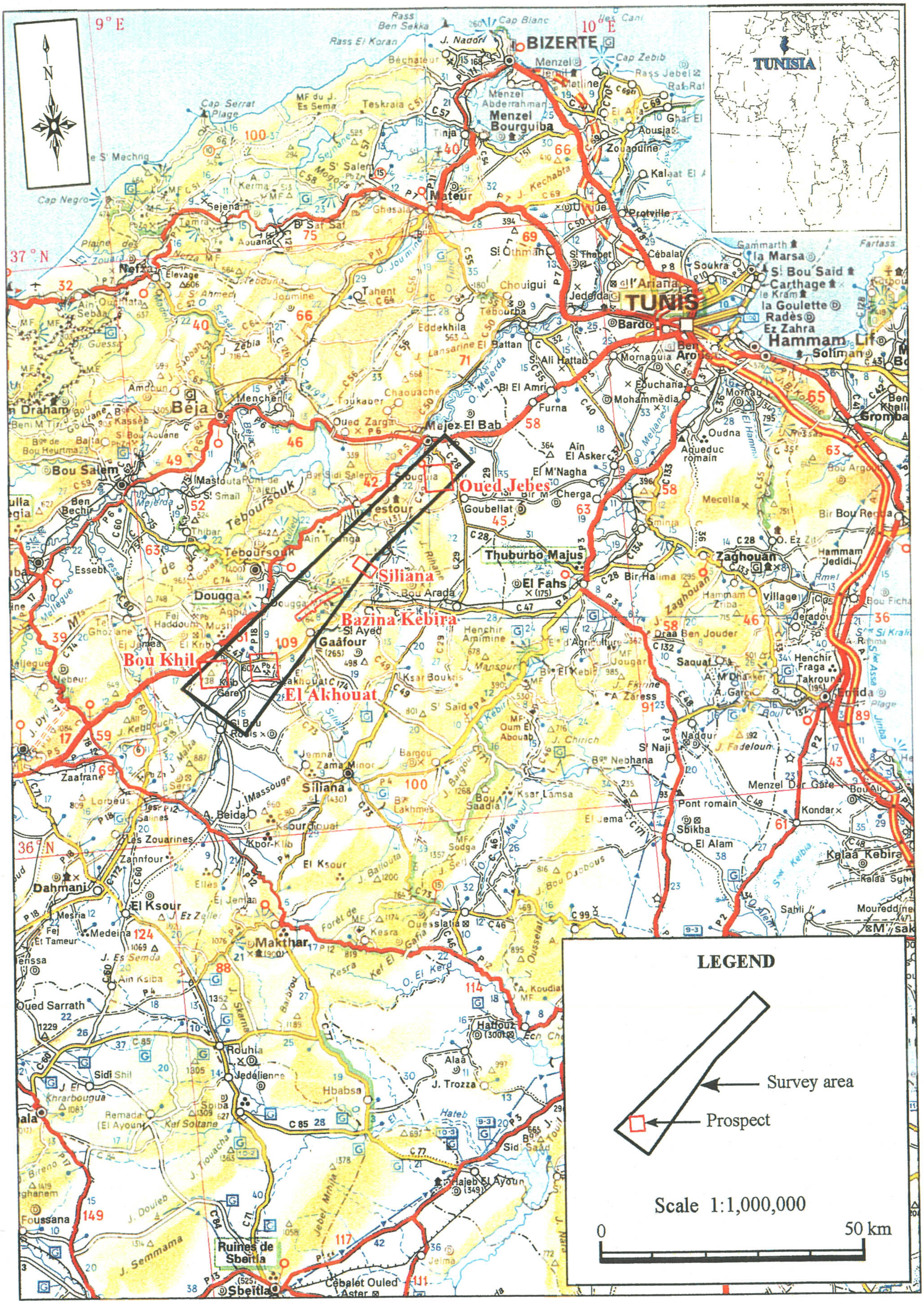
We hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

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

February 2002

Takao KAWAKAMI
President
Japan International Cooperation Agency

Norikazu MATSUDA
President
Metal Mining Agency of Japan



Location map of survey area

Summary

This report is prepared to describe the result of the 3rd Year Campaign of the Mineral Exploration Project for the Krib-Mejez el Bab Area, the Republic of Tunisia.

The on-site investigation of the 3rd Year Campaign was carried out in the period between August 26, 2001 and January 25, 2002, by the Survey Team dispatched by Japan International Agency and Metal Mining Agency of Japan, in cooperation with the Ministry of Industry, the Republic of Tunisia.

The 3rd Year's exploration work comprised the geophysical prospecting (gravity and IP methods) and the drilling investigation. The geophysical prospecting was conducted in the Oued Jebes and the El Akhouat-Argoub Adama prospects for the total area of approximately 8 km^2, which included known mineral indications. The drilling investigation was carried out in the Siriana, Bazina Kebira and the El Akhouat-Argoub Adama prospects for the targets that were selected based on the results of the 2nd and 3rd Year Campaigns. Five drill holes, totaling 1487.10m in length, were completed during the 3rd Year Campaign.

The mineralization in the Project Area is of a Mississippi Valley or Carbonate Hosted Pb-Zn type. As the results of the geological investigation and the geophysical prospecting combining the plural number of techniques(gravity and IP methods) in the 2nd and 3rd Year Campaigns, the geophysical anomalies, which would have suggested presence of mineralization, were selected for the drilling targets. The drilling exploration resulted in locating new zones of weak mineralization in association with Cretaceous carbonate rocks in 5 holes, MJTK-A1, MJTK-C1, MJTK-L5 and MJTK-O1 in the Siriana, the Bazina Kebira, the El Akhouat-Argoub Adama and Oued Jebes Prospects respectively. Chargeability anomalies, which were selected for drilling targets, indicated mineralization as well as pyritization in association with limestone and marl in some cases.

The potential of the Project Area for the mineralization is proved to be significant, since the mineral indications have been identified in the 4 selected prospects as the result of the current exploration project. Some of geophysical anomalies and mineral indications remain untested by the drilling exploration of the current project. Accordingly, there will be still chances for locating new mineralization in the Project Area. For example, no drilling exploration is conducted on the Bou Mous and Rag el Bagrat showings in the Oued Jebes Prospect, even though chargeability anomalies have been identified in association. In addition, the Dar Chebka showing of this prospect, where drill-explored in the current campaign, is worth for further

exploration.

The discovery of the new mineralization zones through the 3-Year Period Exploration proved that the geological investigation and the geophysical prospecting combining the plural number of techniques were effective to locate possible mineralization concealed in the subsurface in the Project Area. This prospecting approach is being established theoretically and practically for future application to the exploration of the similar type of mineralization concealed in the subsurface in the general area. Further, it will be a recommendable exploration strategy to conduct follow-up investigations for the new mineralization zones in the Project Area, in order to verify their shapes, sizes and degrees of mineral concentrations.

Contents

List of Figures, Tables and Appendixes

PART I

PART Ⅰ Project Overview

Chapter 1 Introduction

1.1 Background and Objectives

In response to the request by the Government of the Republic of Tunisia, Japanese Government decided to execute a mineral exploration project in the Krib- Mejez el Bab Area in accordance with the Scope of Work agreed upon between the two Governments on the day of 17th December, 1999. The details of implementation program were further discussed between the two Governments, represented by Japan International Cooperation Agency (JICA) and Metal Mining Agency of Japan (MMAJ) for Japanese side and by Ministry of Industry and National Office of Mines for Tunisian side, and were signed by both sides upon agreement. The Mineral Exploration Project in the Krib- Mejez el Bab Area was commenced for its third year's investigation according to the agreed implementation program in the Japanese fiscal year of 2001 ending February 28th, 2002.

The objectives of the Project are to comprehend the geology and mineralization in the Krib- Mejez el Bab Area and to transfer technology for mineral resource development to engineers and scientists of pertinent institutions of the Republic of Tunisia.

1.2 Conclusions and Recommendation of the Phase Ⅱ Survey in 2000.

1.2.1 Conclusions

Potential mineralization in the Project Area is categorized into the Mississippi Valley or Carbonate Hosted Pb-Zn type.

Exploration principles are set up based on the second Year's result as follows;

(1) Geophysical Prospecting

① Bazina Kebira Prospect

No chargeability anomaly exceeding 10 mV/V has been detected in Bazina Kebira prospect. Therefore, no exploration target that can be compared to those in the Bou Khil and the El Akhouat-Argoub Adama in terms of intensity of chargeability has been delineated. However, the four mineral indications except the Bazina Kebira show relatively high chargeability compared to that in other part of the prospect. Chargeability exceeding 5 mV/V at an elevation of 300m is observed only in two localities, in the vicinities of the H'Zamel indication and the Koudiat Soda deposit, respectively in the southwestern and the northeastern parts of the Project Area.

The chargeability anomaly associated with the H'Zamel indication is located in the Cretaceous system close to the contact to the Triassic system that indicates a fair agreement with the position of the resistivity discontinuity. This location of the chargeability anomaly corresponds to the part of the gravity anomaly(gravity high) jutting out southwestwards towards the El Aroussa plain from the Djebel Ech Chied Hills. This feature relative to the gravity structure is resemble to that of the chargeability anomaly associated with the old workings of Bou Khil Mine. In addition, this chargeability anomaly is located in a part of a local high of residual resistivity suggesting a transition zone. The chargeability anomaly is, however, bounded by low resistivity outlined by the 1Ωm contour, which should be taken into account in planning a drilling exploration program for hole locations, directions and inclinations.

The chargeability anomaly associated with the Koudiat Soda deposit is located along the contact of the Triassic system to the Cretaceous and Tertiary systems. The associated residual gravity structures and resistivity distribution are very complex. The laboratory test of the ore samples collected from the Koudiat Soda deposit has indicated the maximum of 100 mV/V, which suggests that the anomaly may have been caused by mineralization. The anomaly is located along the baseline, C0, extending from the intersection of the baseline and the measuring line, C15, on the northeastern slope. Though being located in the high resistivity zone, the anomaly is surrounded by low resistivity anomalies outlined by the 1Ωm contour, which should be taken into account in planning a drilling exploration program for hole locations, directions and inclinations.

② Siliana Prospect

Chargeability of Siriana prospect is very low, even lower than in Bazina Kebira prospect, without yielding any measurements exceeding 5 mV/V. No chargeability anomaly has been detected in association with the two mineral indications in the prospect, which suggests that the mineralization is very much limited in its extent for both indications, if any. Weak chargeability anomalies outlined by the 4 mV/V contour at an elevation of 150m are located only at the northeastern end of the measuring line A6 and at the intersection of the baseline A0 and the measuring line A7 with limited extensions. These anomaly are situated in zones of high residual gravity and high resistivity in the Cretaceous system and associated with calcite veins carrying minor galena at the latter location. It may be implied, therefore, that the anomalies may be related to mineralization regardless of its intensity and extension. A subsurface chargeability anomaly is also outlined by the 4 mV/V contour at depth between the stations 70 and 80 of the measuring line A5. This anomaly is associated with a high resistivity anomaly surrounded by low resistivity anomalies and is situated in close proximity to a subsurface diapir interpreted from the gravity cross-section analysis.

This implies that the anomaly may be an indication of a transition zone.

③ El Akhouat-Argoub Adama Prospect

In El Akhouat-Argoub Adama prospect where mineralized zones were intersected by drilling in the 2nd Year Campaign, a chargeability anomaly outlined by the 10 mV/V contour extends in an appreciable area centering the hole location of MJTK-L2, in the vicinity of which chargeability exceeds 20 mV/V. The geophysical prospecting of the 2nd Year Campaign was carried out to explore the southwestern extension of this chargeability anomaly. The result indicates that the anomaly continues southwestward for about 500 m only to the survey line L2 with its high chargeability zone being limited along the survey line L3. A lateral fault that runs between the two survey lines may bound the southwestern extension. It is necessary to carry out an IP survey along the line L6 in order to northwesterly track the high chargeability zone exceeding 20 mV/V. In the 1st Year IP survey, high chargeability better than 20 mV/V was recorded at the northwestern end of the line L6, as well as along the line L3. Therefore, the line L6 will have to be extended northwesterly for 500m in order to achieve this purpose.

(2) Drilling Investigation

① The hole MJTK-B1 that aimed at verification of the IP anomaly and exploration of the extension of the known deposit intersected the celestite mineralization with the width of 18m and the average grade of 17.19 % $SrSO_4$. The grade of marketable celestite should be 88 % $SrSO_4$ or higher. Therefore, exploitation of the celestite mineralization is regarded as economically inviable.

② The hole MJTK-B2 that aimed at verification of the IP anomaly failed to intersect any mineralization. Pb-Zn mineralization in the Tertiary system had been expected since the IP anomaly was associated with Tertiary formations. The cause of the IP anomaly is, however, proved to be pyrite in sandstone.

③ The hole MJTK-L1 aimed at verification of the IP anomaly and exploration of possible mineralization in the Cretaceous formations distributing around a diapir. This hole intersected only weak Pb-Zn mineralization. It is interpreted that the mineralization is weak because the Cretaceous formations distributing around a diapir belong to Aptian and are different from those hosting the major ore deposits in their stratigraphic positions. The cause of the IP anomaly is proved to be abundant pyrite contained in the formations comprising Aptian marl.

④ The hole MJTK-L2 was drilled to verify the new mineralization located in the course of the 1st Year Campaign. This hole intersected three mineralized zones with the widths of 16.0m (the average grade of 4.27 % Pb+Zn), of 11.8m (the average grade of 6.30 % Pb+Zn) and of 32.0m (the average grade of 4.14 % Pb+Zn) in the host rocks of Cretaceous carbonates in the interval between 225.50 and 382.90m. In addition, these mineralized zones include three 1m-sections of carbonate-hosted ores indicating 0.7 % Pb and 20.0 % Zn from 237.50 to 238.50m, 1.92 % Pb and 36.0 % Zn from 275.60 to 276.60m, and 3.45 % Pb and 16.0 % Zn from 379.90 to 380.90m. It is the most essential subject for the current exploration program to explore the continuities and the extensions of these mineralized zones.

⑤ The hole MJTK-L3 was drilled to explore mineralization in the Cretaceous system and to verify the IP anomaly detected by the 1st Year IP survey and the subsurface diapir interpreted from the result of the gravity survey. This hole intersected pyrite-calcite veinlets/networks carrying minor sphalerite and galena as well as celestite-calcite or pyrite-calcite veinlets/networks accompanying minor sphalerite in association with brecciated zones. However, no mineralization has been intersected with any significant concentration. The cause of the IP anomaly can be correlated to black compact dolomite accompanying a significant amount of pyrite within a diapir body. This diapir, in its position, corresponds to the interpreted subsurface diapir according to the result of the gravity survey.

⑥ The hole MJTK-L4 was drilled to explore the southwestern extension of the mineralization intersected by the hole MJTK-L2. This hole intersected mineralization that consists of pyrite-calcite veinlets/networks carrying minor galena and sphalerite. However, the mineralization indicates no significant concentrations in either lead or zinc. The cause of the IP anomaly can be attributed to marl accompanying abundant pyrite.

1.2.2 Recommendation

The geophysical prospecting carried out in the 2nd Year Campaign failed to indicate any significant chargeability anomaly either in the Bazina Kebira or in the Siriana prospect. No further geophysical exploration will be recommended for the two prospects. However, it may be worthwhile to track the anomalous chargeability detected at the northeastern end of the line A6 in the eastern Siriana prospect northeastwards to the Assioud mineral indication.

In the El Akhouat-Argoub Adama prospect, it will be necessary to apply the gravity and the IP methods to the lines L4, L9 and L10 that have been prospected only by the magnetic method. It will be also recommended to drill-explore the chargeability anomaly exceeding 20 mV/V, located along the line L6, and to extend the geophysical prospecting northwestward along this line.

Among the mineral indications in the Krib-Mejez el Bab Area, three indications, namely Jebel Bou Mouss, Kef Lasfer and Oued Jebes where no geophysical prospecting has been made will be worthwhile for geophysical prospecting. A new regional exploration scheme would be recommended for an area including these mineral indications.

1.3 Outline of Project

1.3.1 Project Area (Krib-Mejez el Bab)

The Project Area is located approximately 50 km southwest of Capital, Tunis, in the northern part of the Republic of Tunisia (Figure 1). It occupies an area of about 500 km^2 bounded by the latitudes of 36° 10′ and 36° 39′ N and by the longitudes of 09° 03′ and 09° 43′ E.

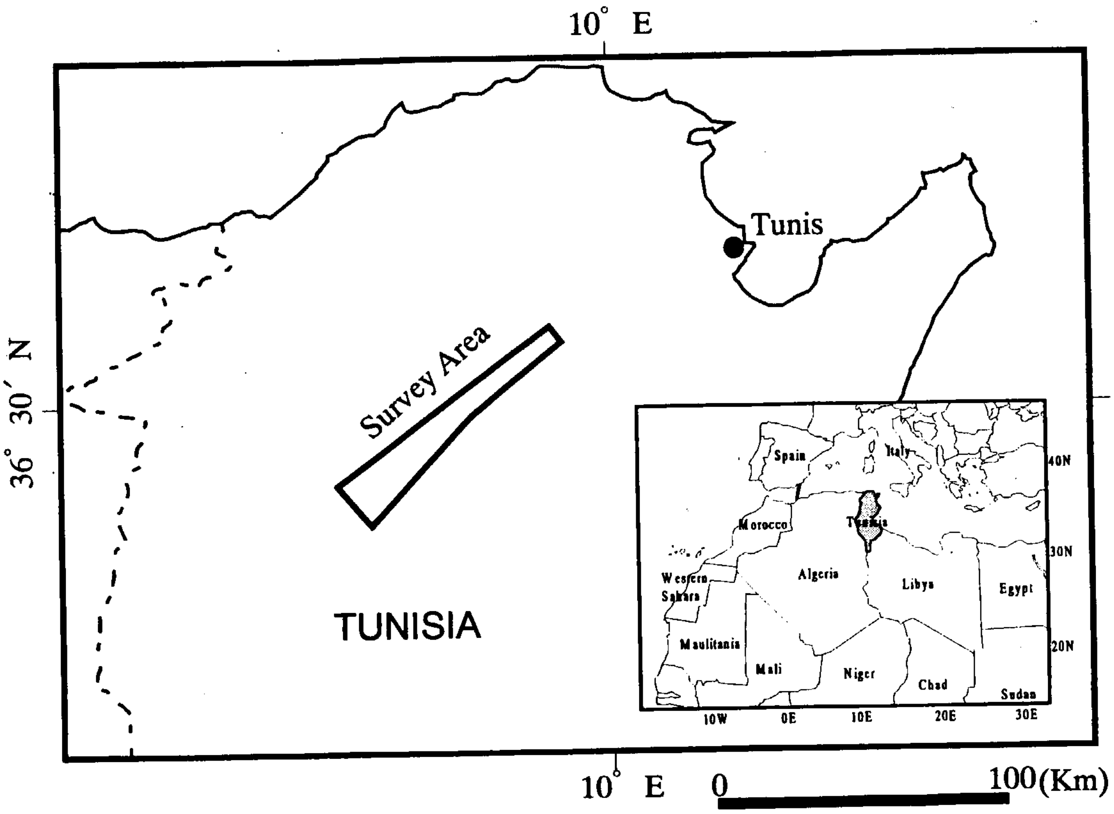


Figure 1 Location map of the survey area

1.3.2 Implementation Program

The kinds and amounts of work, which were implemented in the third Year's program, are presented in Table 1 for the geophysical prospecting and drilling investigation and in Table 2 for the laboratory tests.

Table 1 Drilling Investigation and Geophysical Prospecting

Kind of Work	Amount			
(1)Drilling Investigation	Drill Hole	Depth	Inclination	Direction
Siliana Prospect	MJTK-A1	198.8m	-70°	33.5°
Bazina Kebira Prospect	MJTK-C1	311.2m	-75°	130°
	MJTK-C2	385.0m	-65°	120°
El Akhouat-Argoub Adama Prospect	MJTK-L5	242.1m	-65°	118°
Oued Jebus Prospect	MJTK-01	350.0m	-80°	125°
(2) Gravity Survey	Rectangular Grid		Number of Measuring Points	
Oued Jebus Prospects El Akhouat-Argoub Adama Prospect	250m×250m		105	
(3) IP Survey	Total Traverse Length		Number of Measuring Points	
Oued Jebus Prospects El Akhouat-Argoub Adama Prospect	22.5km		648	

Table 2 Laboratory Tests

Kind of Work	Test Item	Amount
Drill Investigation	Microscopic Observation : Thin Sections	5 rock samples
	Polished Sections	5 ore samples
	Chemical Analysis (Cu, Pb, Zn, Fe, Mn, Cd, Mg, Ca, Sr, Ba)	60 ore samples
Geophysical Prospecting	Density Measurement	15 rock samples
(Gravity, IP)	Apparent Resistivity & Chargeability	15 rock samples

1.4 Project Team

The members, who have participated in the Project, are as follows.

(1) Field Operation Team

(a) Japanese Side

Atsushi Takeyama: Team Leader, General Assignment (Sumiko Consultants Co., Ltd.)

Akihiko Chiba: Geophysical Prospecting (Sumiko Consultants Co., Ltd.)

Tkao Ogawa: Geophysical Prospecting (Sumiko Consultants Co., Ltd.)

Norizo Saito: Geophysical Prospecting (Sumiko Consultants Co., Ltd.)

(b) Tunisian Side

Hammami Mongi (National Office of Mines)

Gharasallah Hedi (National Office of Mines)

Sellami Ahmed (National Office of Mines)

Kahlifa Faiheim (National Office of Mines)

(3) Supervision of Field Operation

Yasunori Nuibe (MMAJ)

1.5 Project Duration

The Third Year's program was implemented in the periods between August 26th, 2001 and January 25th, 2002 for the field operation and between January 26th and February 28th, 2002 for preparation of the report.

Chapter 2 Geography of Project Area

2.1 Location and Access

The Project Area is located to the southwest of the Capital, Tunis, in the northern part of the Republic of Tunisia and is bounded by the latitudes of 36° 10' N and 36° 39' N and by the longitudes of 9° 03' E and 9° 43' E. The base for this year's field campaign was set in the town of Gaafour, approximately 90 km south east of Tunis.

The national route No. 4, as well as associated trunk roads, runs through from Tunis to Gaafour, via le Fahs. It takes about one and a half hours from Tunis to Gaafour by driving. Trunk roads are available for the accesses from Gaafour to each prospect. It takes about 45 minutes for a distance of 45 km to Oued Jebus to the northeast, about 25 minutes for a distance of 25 km to Siliana to the northeast, about 10 minutes for a distance of 5 km to Bazina Kebira to the north, and about 15 minutes for a distance of 10 km to Lakhout-Argoub Adama to the southwest, from Gaafour by driving (see the location map of the survey area).

2.2 Topography and River System

The Project Area consists of mountainous or hilly areas, composed mainly of Triassic and Cretaceous systems, and low, flat lands. The mountainous-hilly areas are divided by major water courses into three districts, namely Jebel Ech Chied, Jebel Bou Khil and Jebel Mourra. Peaks of these mountainous- hilly areas range from 400 to 750 m in their elevations, with elevation differences of 200 to 550 m from their bottoms. The highest peak is the triangulation point of Jebel Ech Cheid at an elevation of 764 m above mean sea level, which is located in the southwestern corner of the central part of the Area. Taluses and colluvial slopes are often formed at foothills, while low, flat lands are largely composed of alluvial deposits (Figure 3).

Oued Silyana, Oued Khllau and Oued Malah are major rivers in the Area, which take considerably meandering courses. Oued Silyana runs northward for a distance of more than 6 km within the Area, changes its course eastward and then joins Oued Madjerda to the northeast. Oued Khllau flows northeastward along the northwestern flank of Jebel Ech Cheid and also joins Oued Madjerda. Oued Malah takes, on the contrary, a southeasterly course along the northwestern flank of Jebel Bou Khil (Figure 3).

2.3 Climate and Vegetation

The land of the Republic of Tunisia is divided into four climatic regions, namely Tell Atlas, the northwestern axial range, the eastern steppe and the southern desert. The Project Area, belonging to Tell Atlas, is characterized by a number of hills with affluent vegetation. Its climate is typically mediterranean with the hot-dry summer and mild-wet winter. Rainfall is annually totaled to 400 mm or more, with monthly precipitation exceeding 50 mm for the period from October to February and declining to 10 mm or less in the three month period of summer. Seasonal average temperatures are 24° C for spring, 30° C for summer, 25° C for autumn and 16° C for winter. The climatic record in Tunis is shown in Table 3.

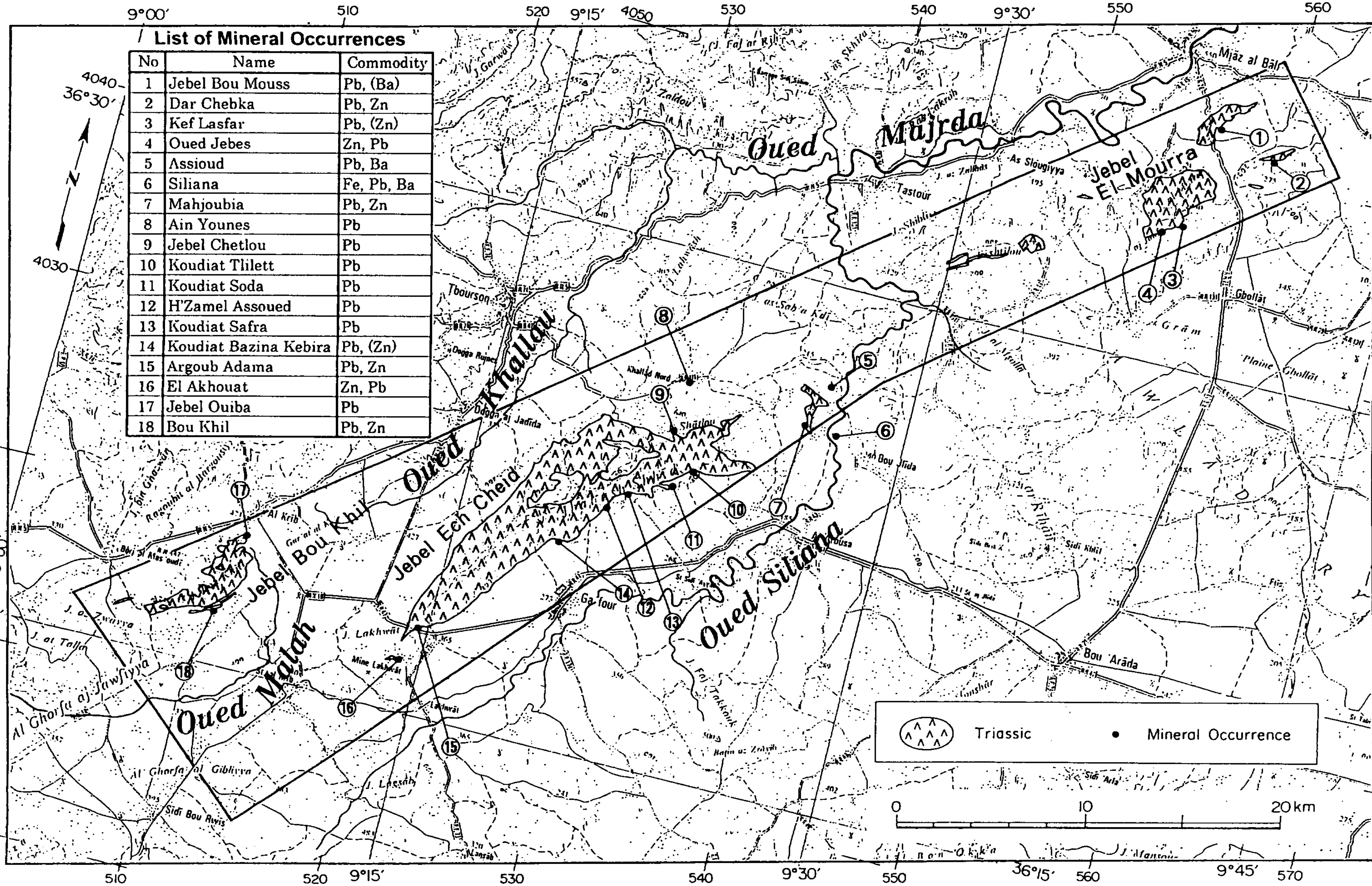
The vegetation is typically of a wet-winter climatic zone, characterized by evergreen, broad leaf species. Although individual trees may shed their leaves for a week or two in a year, no defoliation of forest as a whole is observed. The Project Area is generally well vegetated except in the circumstances of abandoned mine sites. Reforestation is being vigorously practiced around such mine sites.

Table 3 Climatic Record in Tunis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temp. (° C)	11.4	11.8	13.2	15.4	19.1	22.9	26.3	26.6	24.1	20.1	15.8	12.4
Precip. (mm)	56.4	59.0	45.3	38.2	24.3	10.7	2.4	6.3	35.3	69.8	57.8	61.9

Temp.; Monthly average temperature of daily mean

Precip.; Monthly total precipitation



List of Mineral Occurrences

No	Name	Commodity
1	Jebel Bou Mouss	Pb, (Ba)
2	Dar Chebka	Pb, Zn
3	Kef Lasfar	Pb, (Zn)
4	Oued Jebes	Zn, Pb
5	Assioud	Pb, Ba
6	Siliana	Fe, Pb, Ba
7	Mahjoubia	Pb, Zn
8	Ain Younes	Pb
9	Jebel Chetlou	Pb
10	Koudiat Tlilett	Pb
11	Koudiat Soda	Pb
12	H'Zamel Assoued	Pb
13	Koudiat Safra	Pb
14	Koudiat Bazina Kebira	Pb, (Zn)
15	Argoub Adama	Pb, Zn
16	El Akhouat	Zn, Pb
17	Jebel Ouiba	Pb
18	Bou Khil	Pb, Zn

Figure 2 Topographical map of the survey area

Chapter 3 General Geology of the Krib-Mejez el Bab Area

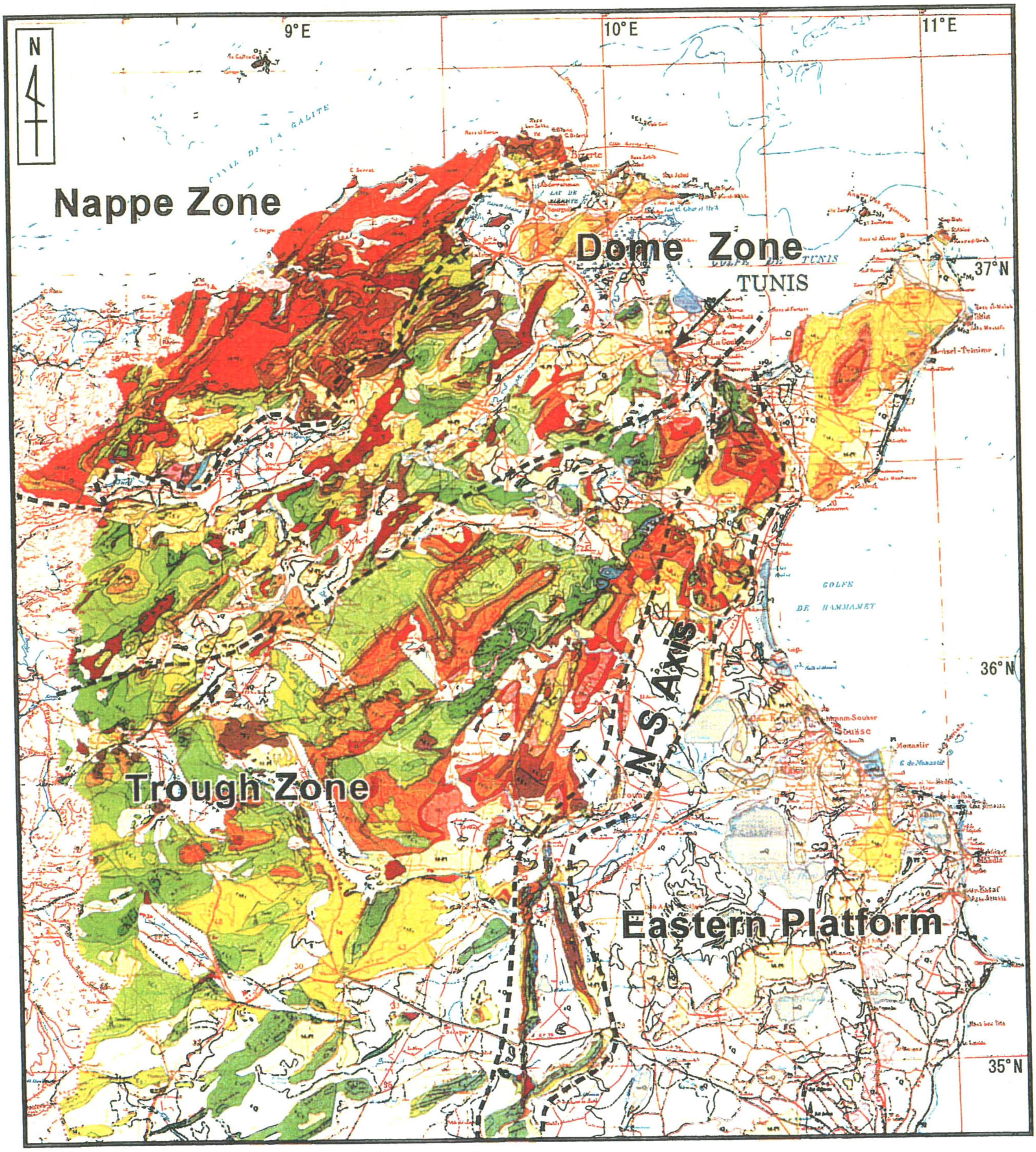
The Krib- Mejez el Bab Area is situated within the Dome zone, to the southwest of Tunis. The Dome zone is about 50 km wide and some 200 km long in the NE-SW direction, bounded by the Mediterranean Coast to the northwest, and continues southwestward across the international border to Algeria (Figure 4). A number of Triassic diapirs are discontinuously aligned in the NE-SW direction within the Dome zone, forming 3 or 4 major diapir alignments. The Project Area is located in the middle part of the southeastern-most alignment.

The geology of this Area comprises Triassic, Cretaceous, Palaeogene, Neogene and Quaternary systems in stratigraphically ascending order. The Triassic system forms diapirs which have intrusive contacts with the Cretaceous, Palaeogene and Neogene systems or partly overlie these systems. The geology is shown in Figure 5.

The Triassic system, comprising gypsum, clay, dolomite, argillite, sandstone and limestone, is generally inhomogeneous in its facies and often indicates disturbed sedimentary structures. No Jurassic system crops out in the Area. The Cretaceous system consists of stratigraphycally continuous successions of Barremian through Maastrichtian comprising limestone, marl, argillite, sandstone and dolomite. Beddings of these sedimentary rocks strike generally in the NE-SW direction, however, are often disturbed near contacts to diapirs or along faults. The Tertiary system also consists of stratigraphically continuous successions of Palaeocene, Eocene, Oligocene, Miocene and Pliocene series. The Palaeocene series is composed of argillite, the Eocene, of conglomerate and limestone, and the Oligocene, the Miocene and the Pliocene, of sandstone. The general strikes of beddings run in the NE-SW direction, however, vary near contacts to diapirs or according to structures of sedimentary basins. Strata of the Cretaceous and Tertiary systems are extremely turned over in the vicinity of diapir bodies, indicating vertical or reversed attitudes. The Quaternary system comprises sandstone, conglomerate, alluvial deposits, talus deposits and so forth.

There are three sizable diapir bodies in the Project Area and called Mourrha, Jebel ech Cheid and Bou Khil respectively from northeast to southwest. Several smaller diapir bodies are also known around these major diapirs and are mostly elongated in the NE-SW direction. A number of Pb-Zn ore deposits or mineral occurrences are located in association with these diapirs. They indicate specific spatial relationship with the diapirs, being mostly positioned at either edge of elongated diapirs or along their southeastern flanks. The modes of occurrences of the three major diapirs are summarized below.

- Mourrha: This diapir shows a 5x3 km rectangular form with rounded corners on



Structural division simplified is quoted from J.J. Orgeval (1994).

0 50 km

Geological base map is published in 1985 by Ministere de L'economie Nationale. (Legend of the map is shown in Figure 2)

Figure 4 Structural zones of northern Tunisia plan and a mushroom shape on cross section. Its southeastern flank contacts mainly with the Cretaceous system and partly with Eocene or Oligocene series. Other parts of its outer limit are covered by the Quaternary system. Kef Lasfar and Oued Jebes ore deposits are located along the southeastern flank.

- Jebel ech Cheid: This diapir is 23 km long and 5 km wide, and by far the largest of all in the general area. It takes a bamboo leaf form on plan and a mushroom shape on cross section. Its northeastern half contacts with the Eocene, Oligocene or Miocene series, while the southwestern half mostly contacts with the Cretaceous system. A roof-pendant of the Oligocene and Miocene series covers the top of the diapir body in its center. There are known a number of ore deposits and mineral occurrences along the southeastern flank of the diapir, such as Koudiat Tlilett, Koudiat Soda, H'Zamel Assoued, Koudiat Bazina Kebira and Argoub Adama. El Akhouat deposit is located in the vicinity of the diapir body, to the southwest of its southwestern edge.
- Bou Khil: This diapir body forms a crescent shape, 7 km long and 3 km wide. Its southeastern flank contacts with the Cretaceous system, Oligocene series or Pliocene series, while the northwestern flank is covered by the Cretaceous system. There is located Bou Khil deposit in the central southeast of the diapir body and Jebel Ouiba mineral occurrence at its northeastern edge.

In addition, Fedj el Adoum Mine, one of the two Pb-Zn mines being currently operated in Tunisia, is located about 10 km northwest of Bou Khil diapir, outside of the Project Area, and is associated with Fedj el Adoum diapir.

The diapirism, which initiated in mid-Cretaceous in this region, was upheaval of the Triassic system, containing evaporite components, into the overlying Cretaceous system mainly due to difference in density between the two systems. The upheaval in its early stage may have taken place in accordance with the morphology of the sedimentary basins or the prevailing stress field in those days. Most diapirs were emplaced during the period of late Cretaceous, as aforementioned. As the diapirism proceeded, sedimentation of the late Cretaceous sequences became slower nearing diapir bodies and faster away from them. It is also reported that some of diapirs emerged out of the sea bottom through the overlying Cretaceous system at some stages of the diapirism. The Alpine diastrophism reached its climax in Oligocene and tectonically affected the entire region and therefore emplacement of diapirs. Simple original forms of diapirs, such as domes or mushrooms, were deformed and dislocated by faulting, thrusting and folding under the compressive stress field in the NW-SE direction before taking the present forms and positions.

The Pb-Zn mineralization is categorized into the 'Mississippi Valley' or 'Carbonate

Hosted' type. It is interpreted that the mineralization is formed in the process that (1)intra-strata water dissolves Pb, Zn and other metals in sediments, (2) moves laterally along stratification, (3) ascends along diapirs and then (4) precipitates these metals in fractures, cavities or other open spaces within or in the vicinity of diapirs. Most Pb-Zn mineral occurrences are localized in the southeastern flanks of diapirs (in the right hand side in Figure 3). This implies that minor faults and fractures for sites of mineralization are well developed in the Cretaceous and Tertiary strata under diapir overhangs in the southeastern flanks due to over-folding. Another possibility may be that the southeastern flanks provide conduits favorable for ascending mineralized solutions and pressure and temperature conditions suitable for precipitation of metals.

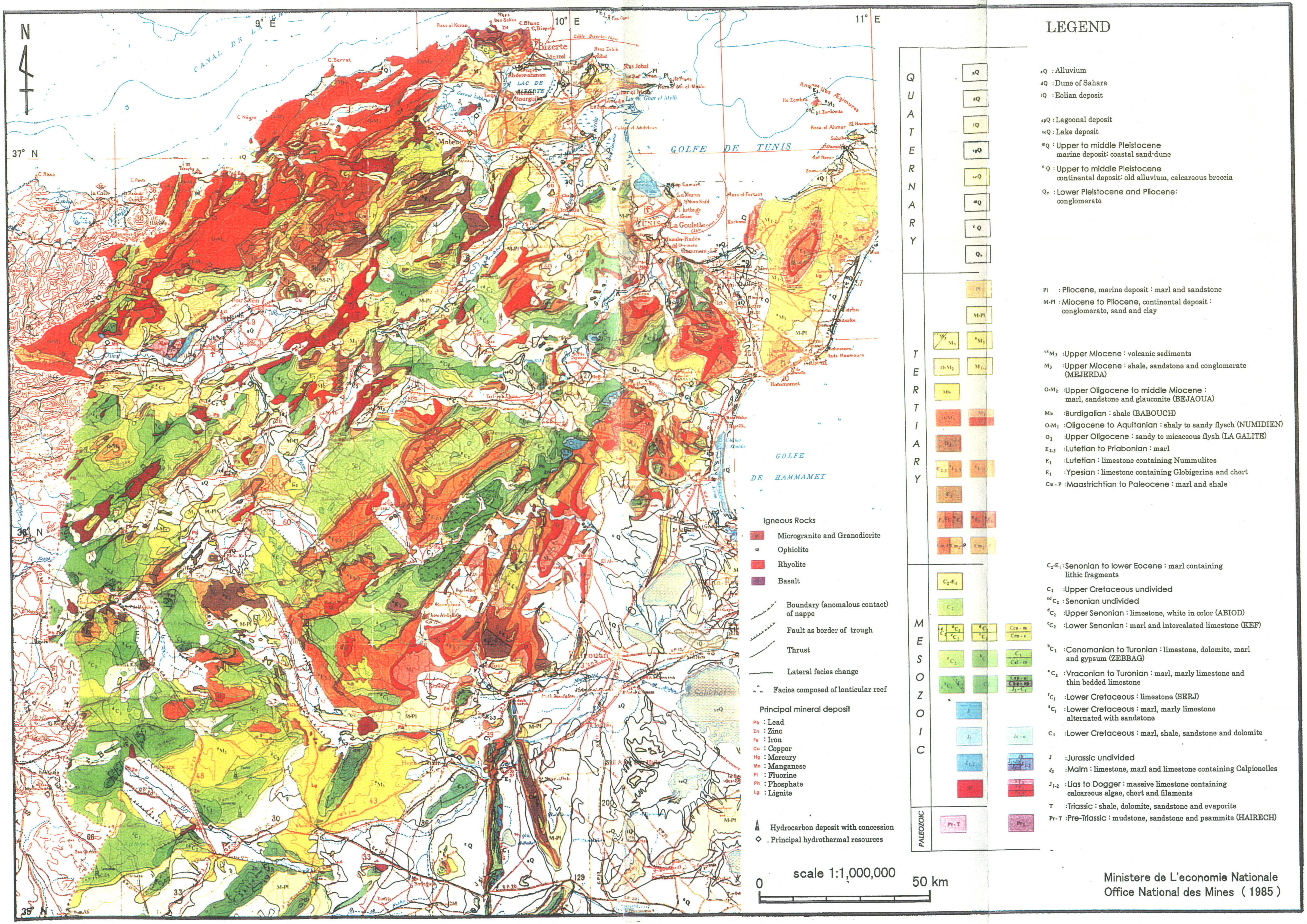


Figure 3 Geologic map of northern Tunisia