NO. 13

REPORT

ON

THE COOPERATIVE MINERAL EXPLORATION

IN

SHEBENIK AREA, THE REPUBLIC OF ALBANIA

CONSOLIDATED REPORT

MARCH 1999

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

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PREFACE

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

The JICA and MMAJ sent to the Republic of Albania survey teams consisting geologists and geophysicists in 1995, 1996, 1998 and 1999.

The team conducted a field survey in the Shebenik Area and completed it in cooperation with the Ministry of Public Economy and Privatisation, and the Albanian Geological Survey.

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 Albania for their close cooperation extended to the team.

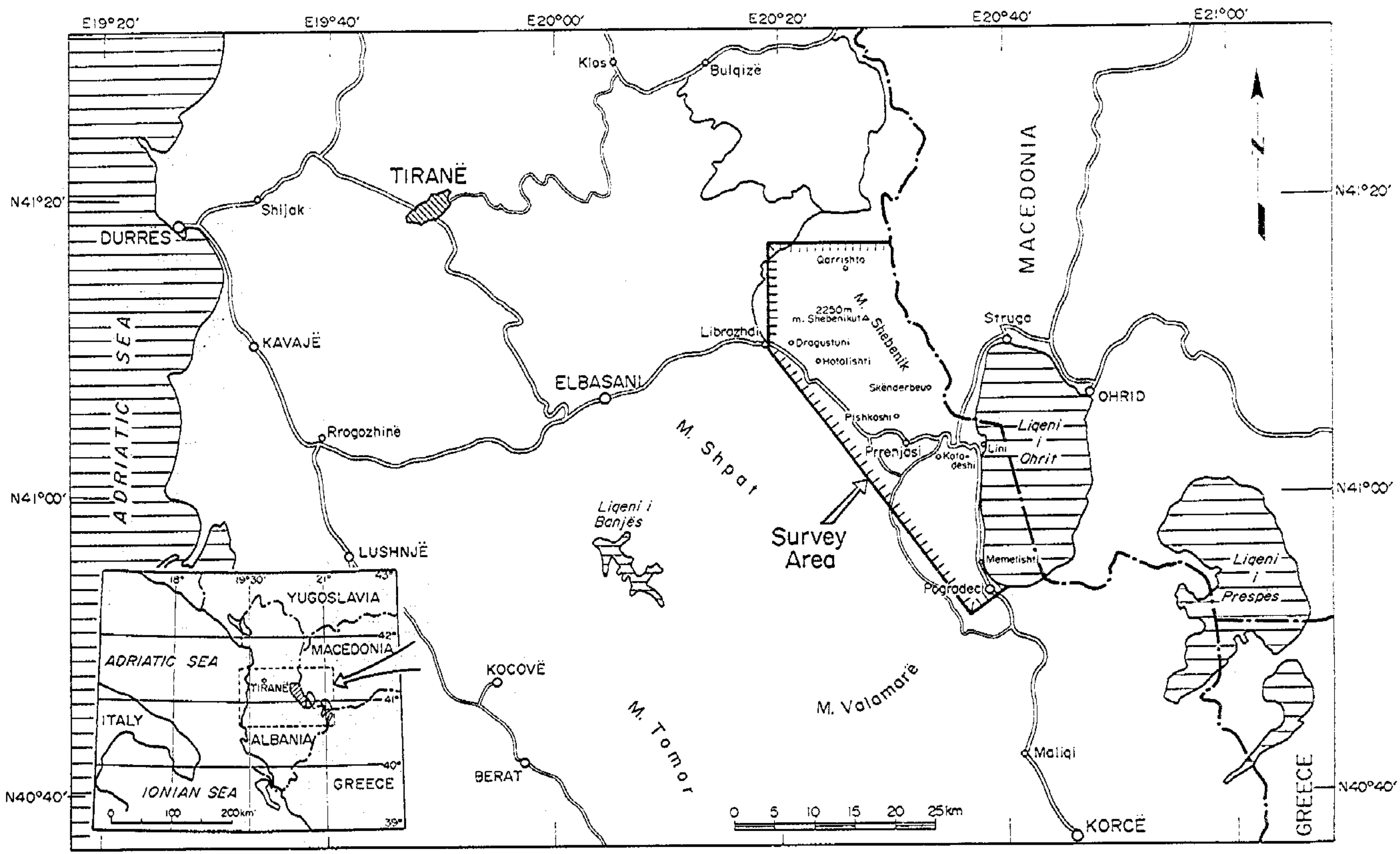
March 1999

Kimio Fujita

Kimio FUJITA
President
Japan International Cooperation Agency

Hiroaki Hiyama

Hiroaki HIYAMA
President
Metal Mining Agency of Japan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Dragustuni
Hotolishti
Skënderbeu
Pishkoshi
Prrenjasi
Kala-deshi
Lini
Struga
OHRID
MACEDONIA
Liqeni i Ohrit
Memelishti
Pogradeci
Survey Area
M. Shpat
Liqeni i Banjës
M. Tomor
M. Valamarë
KOCOVË
BERAT
Maliqi
KORCË
Liqeni i Prespes
GREECE
0 5 10 15 20 25km
YUGOSLAVIA
MACEDONIA
ADRIATIC SEA
TIRANË
ITALY
ALBANIA
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GREECE
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19°30'
21°
43°
42°
41°
40°
39°

SUMMARY

The Cooperative Mineral Exploration in Shebenik Area, the Republic of Albania was implemented in the period between the Japanese fiscal years of 1995 and 1998. The objective of the Exploration was to identify new chromium resources by clarifying the relationship between the geological structure and the mineralization in Shebenik Area. The exploration work comprised LANDSAT image analysis, review and compilation of the existing data, surface geological and geochemical prospecting (reconnaissance and semi-detailed), ground magnetic survey and exploratory drilling.

The geology of Shebenik Area comprises the upper Triassic to lower Jurassic Series consisting of limestone / volcano-sedimentary units and ultramafic-mafic complexes, unconformably overlain by the subsequent Cretaceous, Tertiary and Quaternary sedimentary units. The ultramafic-mafic complexes, named Shebenik-Pogradec Complexes, occupy the major part of the Area for this exploration project and are the principal host rocks for the chromium mineralization in the general area. The known chromium ore deposits and indications are distributed mostly in the southeastern part of the Shebenik-Pogradec Ultramafic Complexes.

The Ultramafic Complexes are mainly composed of harzburgite and often contain dunite, accompanying minor pyroxenite, lherzolite and gabbro in part. Harzburgite, lherzolite and dunite are commonly serpentinized in variable degrees. Dunite occurs as sheets or dikes conformable with the structure of harzburgite and is sometimes interlayered with harzburgite.

The chromium mineralization in the Project Area is categorized into a podiform type hosted by harzburgite and occurs as chromespinel concentrations (chromitite) in forms of disseminations, bands, masses or nodules within dunite envelopes. Sizes of unit ore bodies considerably vary in thickness from several centimeters to two meters and in strike and down-dip lengths from several tens to several hundreds of meters. Those which have been exploited to-date, have ordinarily thickness exceeding 1 or 1.5m. The thickness of dunite envelopes containing chromitite ranges from several tens of centimeters to several tens of meters. The ore deposits which are currently being mined, comprise mainly massive chromium ores indicating average grades in excess of 25 to 30% Cr_2O_3.

The ground magnetic survey was carried out in four target areas. Anomalous magnetic lows are often found in association with dunite envelopes or chromitite, and may be related to inversely magnetized rocks or geologic units. The places where anomalous magnetic lows or pairs of magnetic high and low are indicated may be of significance for chromium mineralization.

EPMA analysis of chromespinel was carried out for the samples of drill cores and outcrops. According to the result of the EPMA analysis, EPMA anomaly for chromium deposit exploration can be defined using the following indices for chromespinel compositions; 0.150 wt% V_2O_3 or less in dunite, 0.020 or higher Fe^{3+} # in harzburgite and 0.6 or lower Cr # in harzburgite. EPMA anomaly in various indices are more frequently observed in association with dunite and harzburgite in the Southern Shebenik and Northern-Central Pogradec Districts than those in other districts. However, only a few harzburgite samples have indicated values of Cr # equal to or less than 0.60. EPMA anomaly has been also identified in core samples from the holes which have intersected chromitite. In conclusion, chemical composition of chromespinel is considered an effective exploration indicator for Alpine type chromium mineralization in the general area.

Drilling exploration was carried out in the 13 selected target areas, 3 in the Central Shebenik, 4 in the Southern Shebenik and 6 in the Northern Pogradec Districts. A total of 34 holes were drilled with an aggregated length of 3,708.4m. Of these holes, 12 holes intersected chromitite; 2 in Bregu i Pishes and 2 in Hija e Zeze of the Northern Pogradec, 2 in Qarri i Zi of the Southern Shebenik and 5 in Ahu i Vetem and 1 in Lugu i Batres of the Central Shebenik Districts. The characteristics of the ores intersected by these holes are summarized as follows;

* Bregu i Pishes: core length of ore sections = approx. 1m, disseminated to massive, 34 to 50% Cr_2O_3
* Hija e Zeze: core length of ore sections = 0.2 to 1.1m, massive, 36 to 42% Cr_2O_3
* Qarri i Zi: core length of ore sections = several centimeters to less than 1m (several layers), disseminated, 22 to 40% Cr_2O_3
* Ahu i Vetem
  Shallow Ore Body: core length of ore sections = less than 0.5m, massive, 35% Cr_2O_3
  Deep Ore Body: core length of ore sections = 1 to 5m, disseminated to banded, 15 to 26% Cr_2O_3
* Lugu i Batres: core length of ore sections = 0.3m, massive, 39% Cr_2O_3

All the chromitite sections occur within dunite (dunite envelopes) of variable thickness. The dunite envelope containing the low grade chromitite (Deep Ore Body) of Ahu i Vetem is far thicker than those found in other holes in other target areas.

The Cr # of chromian spinel in harzburgite indicates from 0.60 to 0.40 near the large scale chrome ore deposit of podiform type. The Cr # of chromian spinel in harzburgite in the Project Area is generally high and almost samples indicate more than 0.60 in Cr #. Therefore, the possibility to locate large scale ore deposit in the

Project Area comparable to those of the Bulqiza Mines appears to be rather limited based on the result of the EPMA analysis to date. The chromium deposits which have been exploited to-date have a thickness exceeding 1m, an area exceeding several tens meters by a hundred meter and an amount of ore more than several thousands tons. The same scale ore deposit as the above-mentioned exploited ones is expected to be located in three target areas of Ahu i Vetem, Bregu i Pishes and Hija e Zeze among 13 areas where the drilling survey was carried out in this Project.

The following target areas will be recommended for follow-up drilling exploration;

(1) Hija e Zeze: down-dip and northern extensions of the drill-indicated ore body

(2) Ahu i Vetem: north northeastern extension of the drill-indicated Deep Ore Body and northwestern extension of the drill-indicated Shallow Ore Body

(3) Bregu i Pishes: to the depth and north of the portion drill-explored in the third Year Campaign

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Figures and Tables

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PART I

Part I General

Chapter 1 Project Overview

1-1 Background

This Project was implemented in Shebenik Area in the southeastern part of the Republic of Albania according to the 'Scope of Work' agreed upon and signed between Japan International Cooperation Agency and Metal Mining Agency of Japan for Japanese Side and Ministry of Mineral Resources and Energy and Albanian Geological Survey for Albanian Side, on July 5^{th}, 1995.

The Project commenced in the fiscal year 1995 and continued to the year 1998, with a period of intermission due to the domestic dispute in Albania in 1997, for the actual project duration of 3 years.

1-2 Objectives

The objectives of the Project was to identify new chromium ore resources by clarifying the relationship between the geology-geological structure and the mineralization in Shebenik Area and also to transfer technology related to mineral exploration to the relevant counterpart institutions in the course of project implementation.

1-3 Project Components

The Project comprised LANDSAT image analysis, review and compilation of the existing data, geological and geochemical reconnaissance and ground magnetic survey in the first Year, semi-detailed geological and geochemical prospecting, additional ground magnetic survey and exploratory drilling in the second Year, and additional exploratory drilling in the third Year Campaigns. The Project location is shown in Figure 1-1-1.

The kinds and amounts of field works are tabulated in Table 1-1-1, and those of laboratory tests for the samples generated from the field works, in Table 1-1-2. The work flow is illustrated in Figure 1-1-2 and the procedure to select target areas, in Figure 1-1-3.

1-4 Progress of the Project

(1) first Year

- LANDSAT Image Analysis: from Aug. 25 to Nov. 25, 1995

Table 1-1-1 Survey Content and Amount

Fiscal Year	Survey Content	Area	Amount
1995	Satellite Image Analysis	Whole	12,000 km^2
	Geological Survey (general)	Whole	270 km^2
	Magnetic Survey	South Shebenik	4.2 km^2, 2187 points
		North Pogradec	5.6 km^2, 2835 points
1996	Geological Survey (semi-detailed)	Central Shebenik	22 km^2
	Magnetic Survey	Central Shebenik	10 km^2, 5165 points
		North Pogradec	0.52 km^2, 378 points
	Drilling Survey	South Shebenik	8 holes, 1012.25m
		North Pogradec	11 holes, 1321.16m
1998	Drilling Survey	Central Shebenik	9 holes, 900.0m
		South Shebenik	2 holes, 235.0m
		North Pogradec	4 holes, 270.0m

Table 1-1-2 Content and Amount of Laboratory Tests

Fiscal Year	Content	Amount
1995	Chemical analysis of ores (Cr_2O_3, SiO_2, Al_2O_3, Fe_2O_3, MnO, CaO, Na_2O, MgO, K_2O, P_2O_5, TiO_2, LOI)	60 pcs
	EPMA analysis (TiO_2, Al_2O_3, Cr_2O_3, Fe_2O_3, V_2O_3, FeO, MnO, MgO)	121 pcs
	Chemical analysis of rocks (Al, Ba, Be, Bi, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Ag, Na, Sr, Ti, W, V, Zn)	40 pcs
	Thin section of rocks	50 pcs
	Polished thin section of ores	121 pcs
	Natural magnetic remnant	20 pcs
	Magnetic susceptibility	98 pcs
1996	Chemical analysis of ores (Cr_2O_3)	50 pcs
	Chemical analysis of ores (Os, Ir, Ru, Rh, Pt, Pd, Au, Re)	32 pcs
	EPMA analysis (TiO_2, Al_2O_3, Cr_2O_3, Fe_2O_3, V_2O_3, FeO, MnO, MgO)	75 pcs
	Chemical analysis of ores (Al, Ba, Be, Bi, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Ag, Na, Sr, Ti, W, V, Zn)	57 pcs
	Thin section of rocks	49 pcs
	Polished thin section of ores	51 pcs
	Natural magnetic remnant	20 pcs
	Magnetic susceptibility	149 pcs
1998	Chemical analysis of ores (Cr_2O_3, Al, Ba, Be, Bi, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Ag, Na, Sr, Ti, W, V, Zn)	30 pcs
	EPMA analysis (TiO_2, Al_2O_3, Cr_2O_3, Fe_2O_3, V_2O_3, FeO, MnO, MgO)	26 pcs
	Chemical analysis of ores (Al, Ba, Be, Bi, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Ag, Na, Sr, Ti, W, V, Zn)	13 pcs
	Thin section of rocks	13 pcs
	Polished thin section of ores	33 pcs

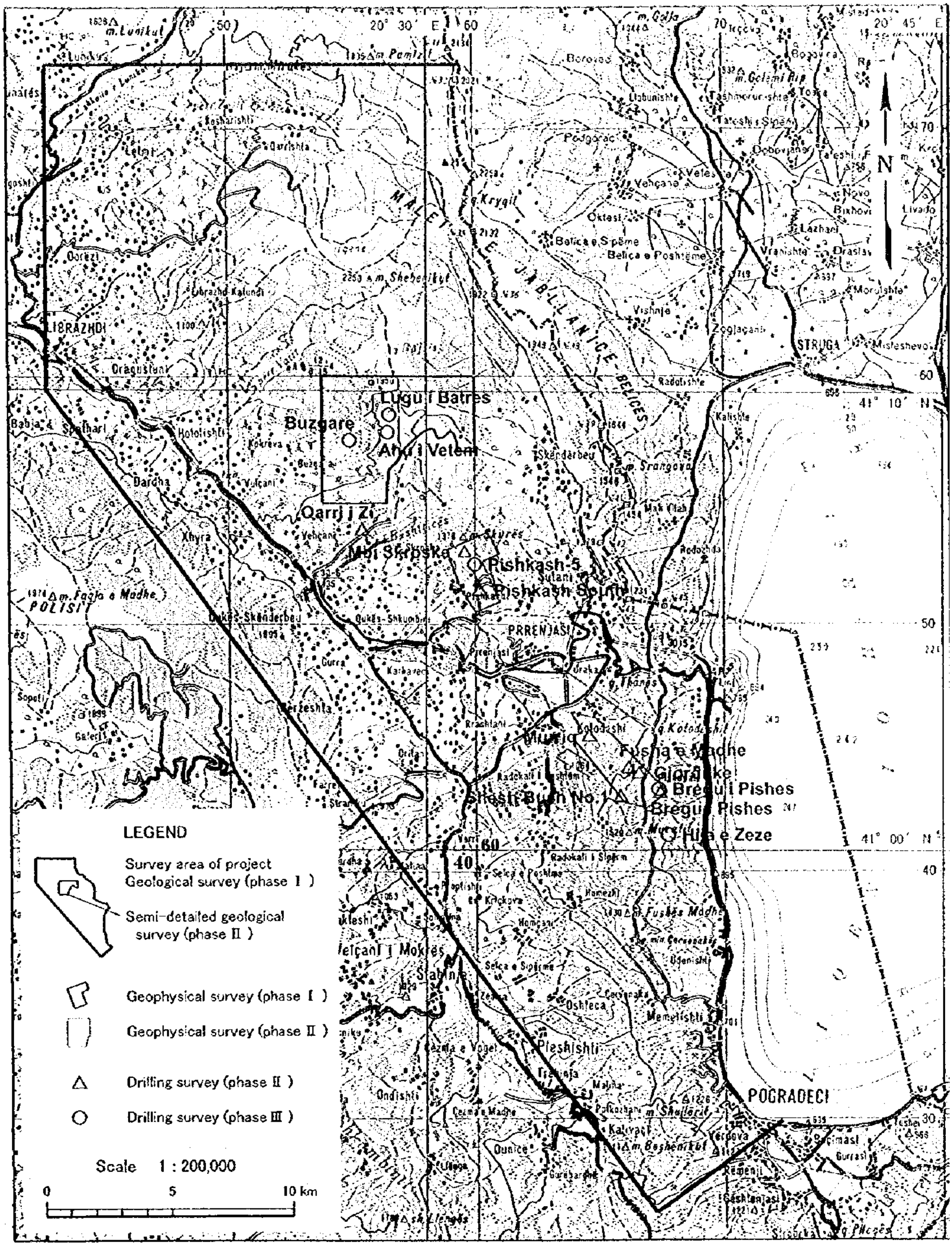


Figure 1-1-1 Location map of the survey area

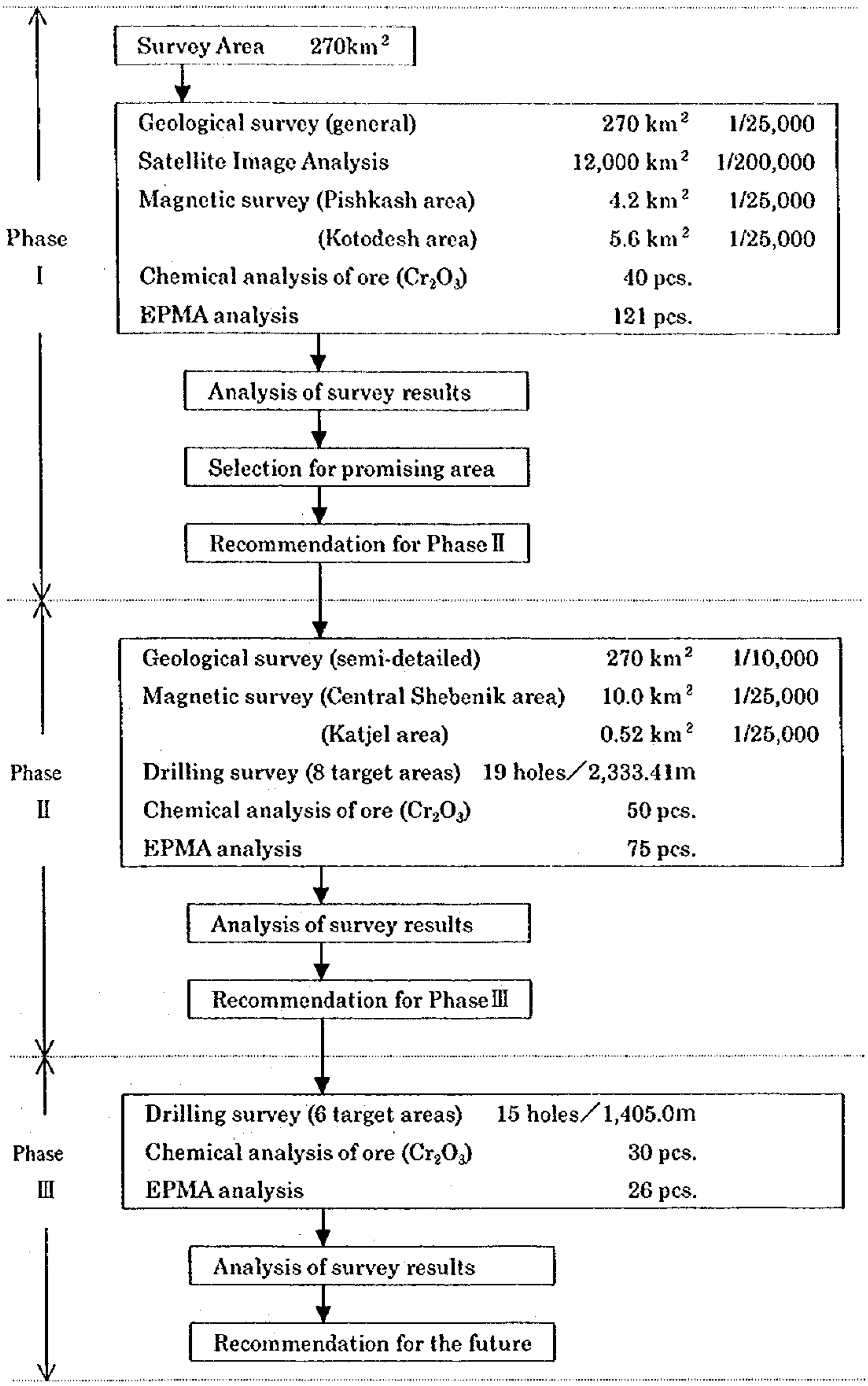


Figure 1-1-2 Flow sheet of the project

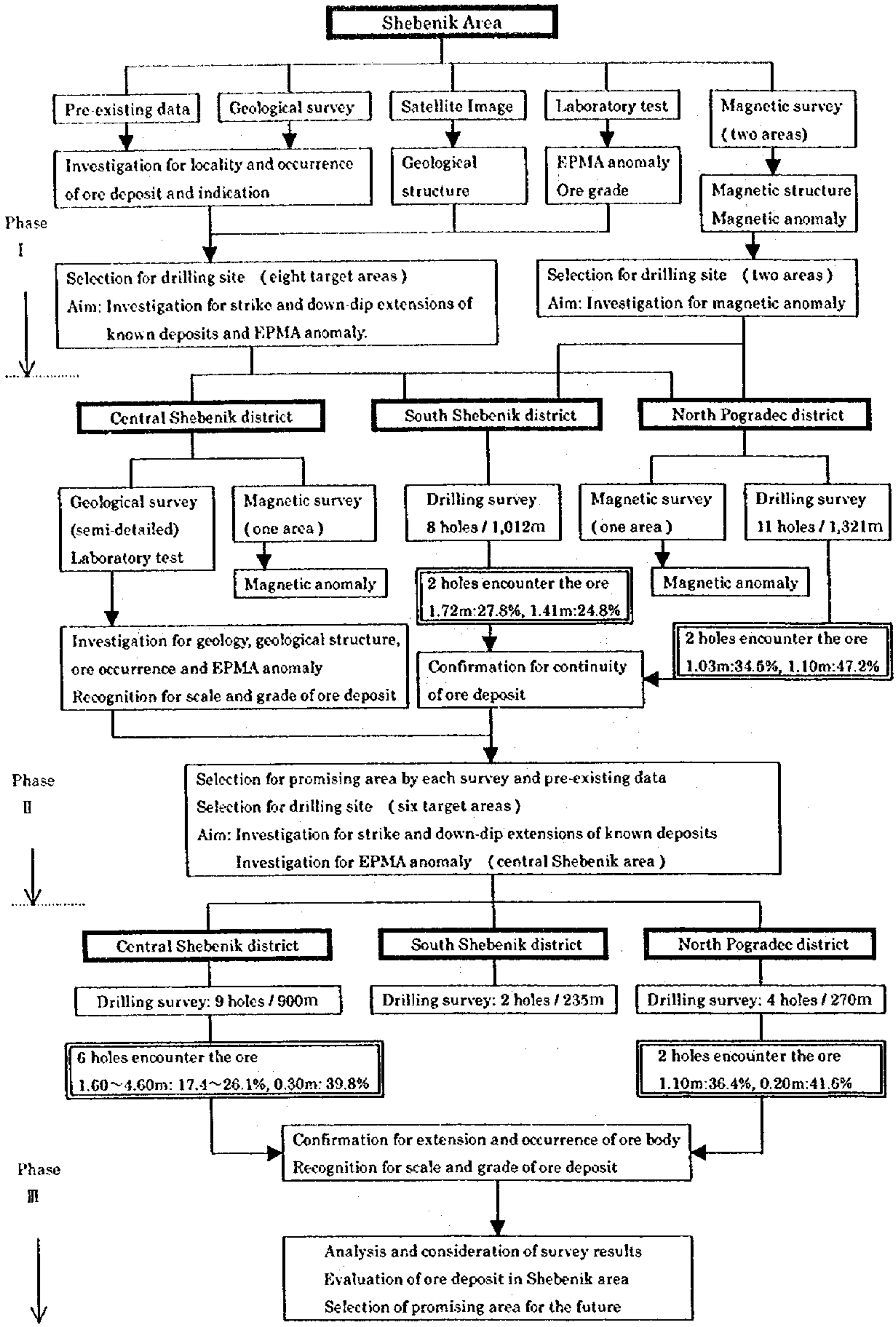


Figure 1-1-3　Flow chart for selection of promising area

Table 1-1-3 Personnel

Japanese side	Albanian side
• Negotiation (1995)	
Mr. Toyo MIYAUCHI, MMAJ Mr. Yoichi FUJIIE, MFA Mr. Nozomu KIKUCI, MITI Ms. Kazuko MATSUMOTO, JICA Mr. Yoshiaki IGARASHI, MMAJ	Mr. Vasil GRILLO, AGS Mr. Vaxhid TAHSINI, AGS Mr. Adil NEZIRAJ, MMRE Mr. Alaudin KODRA, Geological Institute, AGS Mr. Spartak KASAPI, Geoph. & Geoch. Centre, AGS
• Field survey (1995)	
Leader Mr. Hiroshi MIYAJIMA, SMC Geologist Mr. Kazuo SANO, SMC Mr. Eitaro SATO, SMC Mr. Norihiro NAGANO, SMC Geophisysist Mr. Takao OGAWA, SMC Mr. Mitsuru KATSUDA, SMC Mr. Koji Morimoto, SMC	Mr. Kristaq DHIMA, Geological Institute, AGS Mr. Fatmir BLACERI, Pogradec Enterprise, AGS Mr. Besnik POJANI, Korce Enterprise, AGS Mr. Agim MAZREKU, Geophysical Center, AGS Mr. Petrika KOSHO, Geophysical Center, AGS Mr. Gezim KALLOANI, Geophysical Center, AGS Mr. Apollon DILO, Geophysical Center, AGS Mr. Gani SHEHU, Geophysical Center, AGS Mr. Xhevair QERAJ, Geophysical Center, AGS Mr. Ali HIBI, Pogradec Enterprise, AGS Mr. Ali HASA, Geophysical Center, AGS
• Field supervise (1996)	
Mr. Yoshiaki IGARASHI, MMAJ	Mr. Vasil GRILLO, AGS Mr. Vaxhid TAHSINI, AGS
• Field survey (1996)	
Leader Mr. Hiroshi MIYAJIMA, SMC Geologist Mr. Norihiro NAGANO, SMC Mr. Ichiro MATSUMOTO, SMC Geophisysist Mr. Hiroyuki Ii, SMC Mr. Mitsuru KATSUDA, SMC Mr. Daijiro UEHARA, SMC	Mr. Kristaq DHIMA, Geological Institute, AGS Mr. Besnik POJANI, Geophysical Center, AGS Mr. Fatmir BLACELI, Pogradec Enterprise, AGS Mr. Aleksander KOSPIRI, Geophysical Center, AGS Mr. Gani SHEHU, Geophysical Center, AGS Mr. Apollon DILO, Geophysical Center, AGS Mr. Albi KOSPIRI, Geophysical Center, AGS Mr. Agron FESHTI, Geophysical Center, AGS
• Pre-field survey negotiation(1997)	
Mr. Natsumi KAMIYA, MMAJ Mr. Toru NAWATA, JICA Mr. Osamu YAMADA, MFA Mr. Takeshi YAMADA, JICA Mr. Takeshi HARADA, MMAJ Mr. Hiroshi MIYAJIMA, SMC	Mr. Viktor DODA, MPEP Mr. Mehmet ZACAJ, AGS Mr. Irakli PREMTI, AGS Mr. Kristaq DHIMA, Geological Institute, AGS Mr. Mark PEPKOLA, ALBKROM
• Pre-field survey negotiation(1998)	
Mr. Natsumi KAMIYA, MMAJ Mr. Toru NAWATA, JICA Mr. Osamu YAMADA, MFA Mr. Takeshi YAMADA, JICA Mr. Yoshitaro WATANABE, JICA Mr. Takashi KAMIKI, MMAJ Mr. Takeshi HARADA, MMAJ	Mr. Mehmet ZACAJ, AGS Mr. Irakli PREMTI, AGS Mr. Kristaq DHIMA, Geological Institute, AGS Mr. Mark PEPKOLA, ALBKROM Mr. Zyko ZEQOLLARI, Pogradec Enterprise, AGS
• Field supervise (1998)	
Mr. Takeshi HARADA, MMAJ	Mr. Mehmet ZACAJ, AGS Mr. Irakli PREMTI, AGS Mr. Kristaq DHIMA, Geological Institute, AGS Mr. Zyko ZEQOLLARI, Pogradec Enterprise, AGS
• Field survey (1998)	
Leader Takumi ONUMA, SMC Geologist Mr. Norihiro NAGANO, SMC Mr. Atsushi NINOMIYA, SMC	Mr. Kristaq DHIMA, Geological Institute, AGS Mr. Kujtim KOCI, Geological Institute, AGS Mr. Lutfi MUSTAFA, AGS Mr. Murat LEKA, AGS

MFA: Ministry of Foreign Affair Japan,
MITI: Ministry of Trading and Industry Japan
SMC: Sumiko Consultants Co., Ltd.

MMRE: Ministry of Mineral Resources and Energy,
MPEP: Ministry of Public Economy and Privatisation
AGS: Albanian Geological Survey,

- Geological and Geochemical Reconnaissance: from Sep. 4 to Nov. 13, 1995
- Ground Magnetic Survey: from Oct. 30 to Dec. 3, 1995
- Data Analysis and Report Preparation: from Dec. 3, 1995 to Feb. 23, 1996

(2) second Year

- Geological and Geochemical Prospecting: from Jun. 17, to Jul. 27, 1996
- Ground Magnetic Survey: from Jul. 15 to Aug. 24, 1996
- Exploratory Drilling: from Jun. 17 to Dec. 21, 1996
- Data Analysis and Report Preparation: from Jul. 28, 1996 to Feb. 23, 1997

(3) third Year

- Exploratory Drilling: from Aug. 24 to Mar. 20, 1999
- Data Analysis and Report Preparation: from Sep. 24, 1998 to Mar. 26, 1999

1-5 Survey Team

The Japanese and Albanian members of the Survey Team who have contributed to the project in the management, planning, field operations and so forth, are listed in Table 1-1-3.

Chapter 2 Regional Geology

The geology of Albania can be regionally divided into the Alban Outer Zone, along the west coast facing Adriatic Sea, and the Alban Inner Zone, in the eastern mountainous region. The geological map of the entire Albania and that of the Project Area are shown in Figures 1-2-1 and 1-2-2 respectively.

(1) Alban Outer Zone

The Alban Outer Zone comprises folded formations of Silurian and Devonian periods and overlying Permian to Cretaceous sedimentary rocks, which are overlain by Tertiary formations consisting of molasse, flysch, carbonate rocks and so forth. Of these, the Cretaceous formations, which have been formed by a regional transgression and are characterized by their abundance in carbonate sediments, occupy a substantial area of this Zone.

The formations in the Alban Outer Zone, as a whole, are gently folded and have undergone weak regional metamorphism. The mineral resources in this Zone include such exogenetic deposits as bauxite, rock salt, phosphorite, mineral sands, silica sands, fossil fuels and so forth.

(2) Alban Inner Zone

The Alban Inner Zone have undergone severe tectogenesis and metamorphism

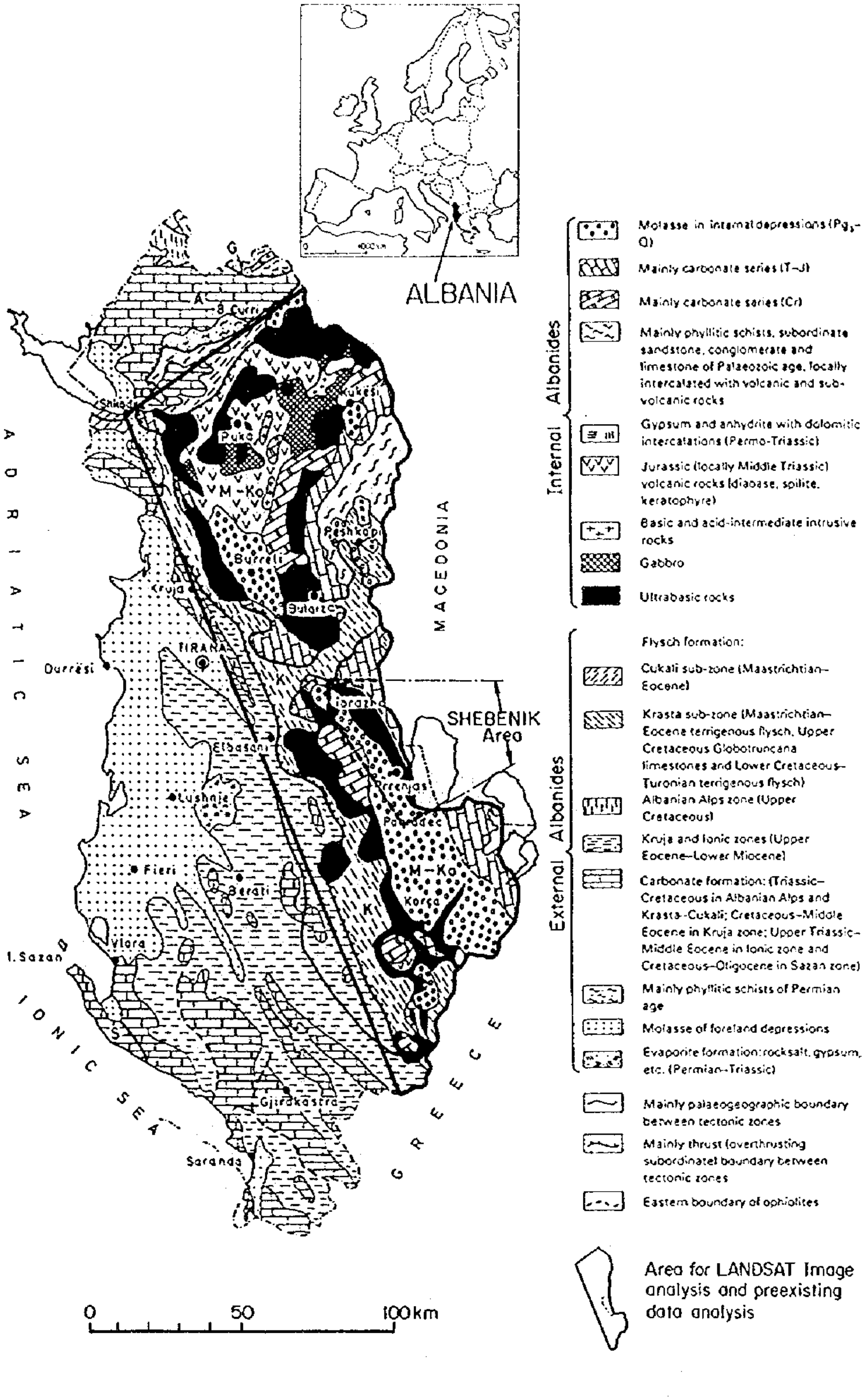


Figure 1-2-1 Geological map of Albania

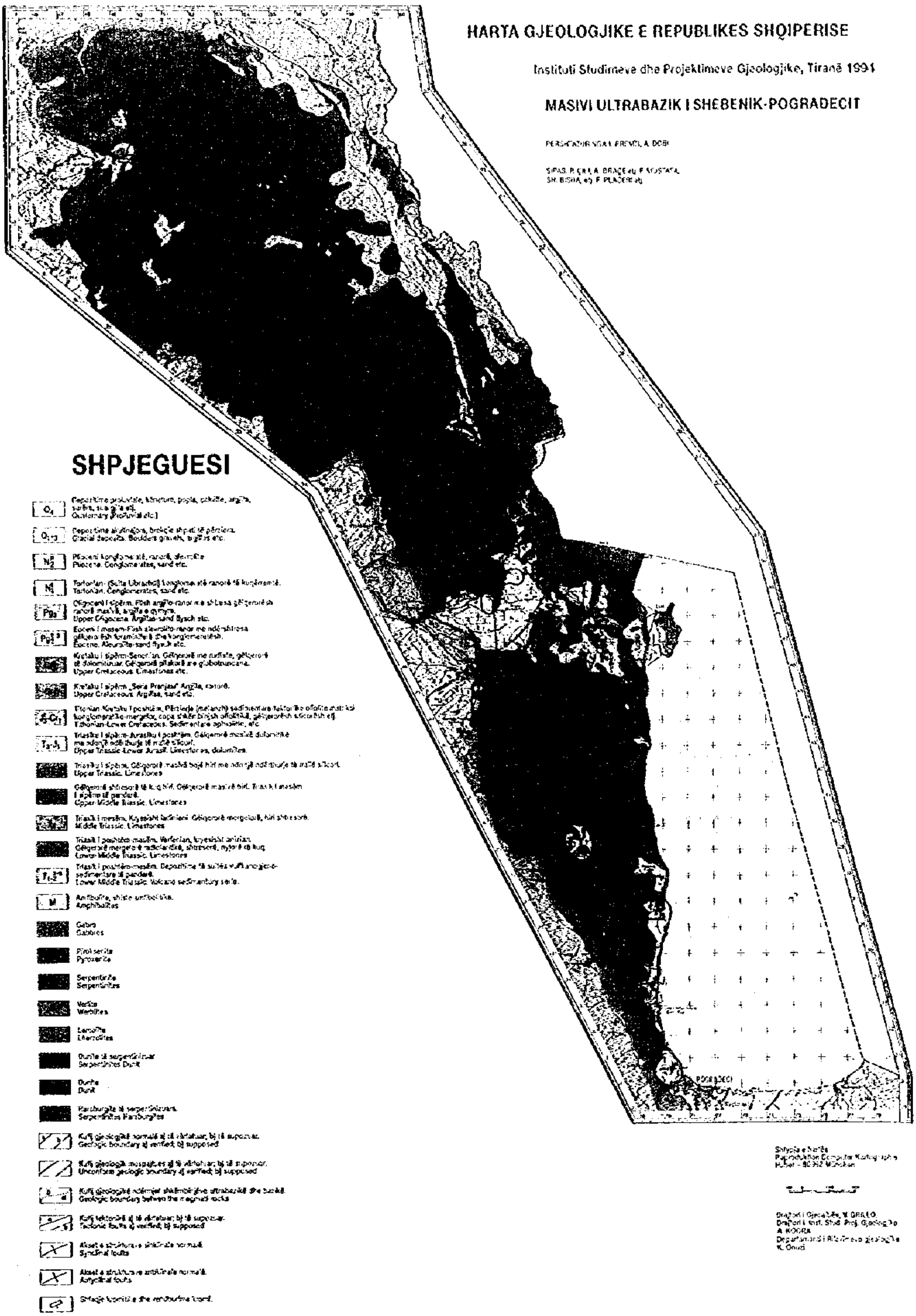


Figure 1-2-2 Geological map around the survey area

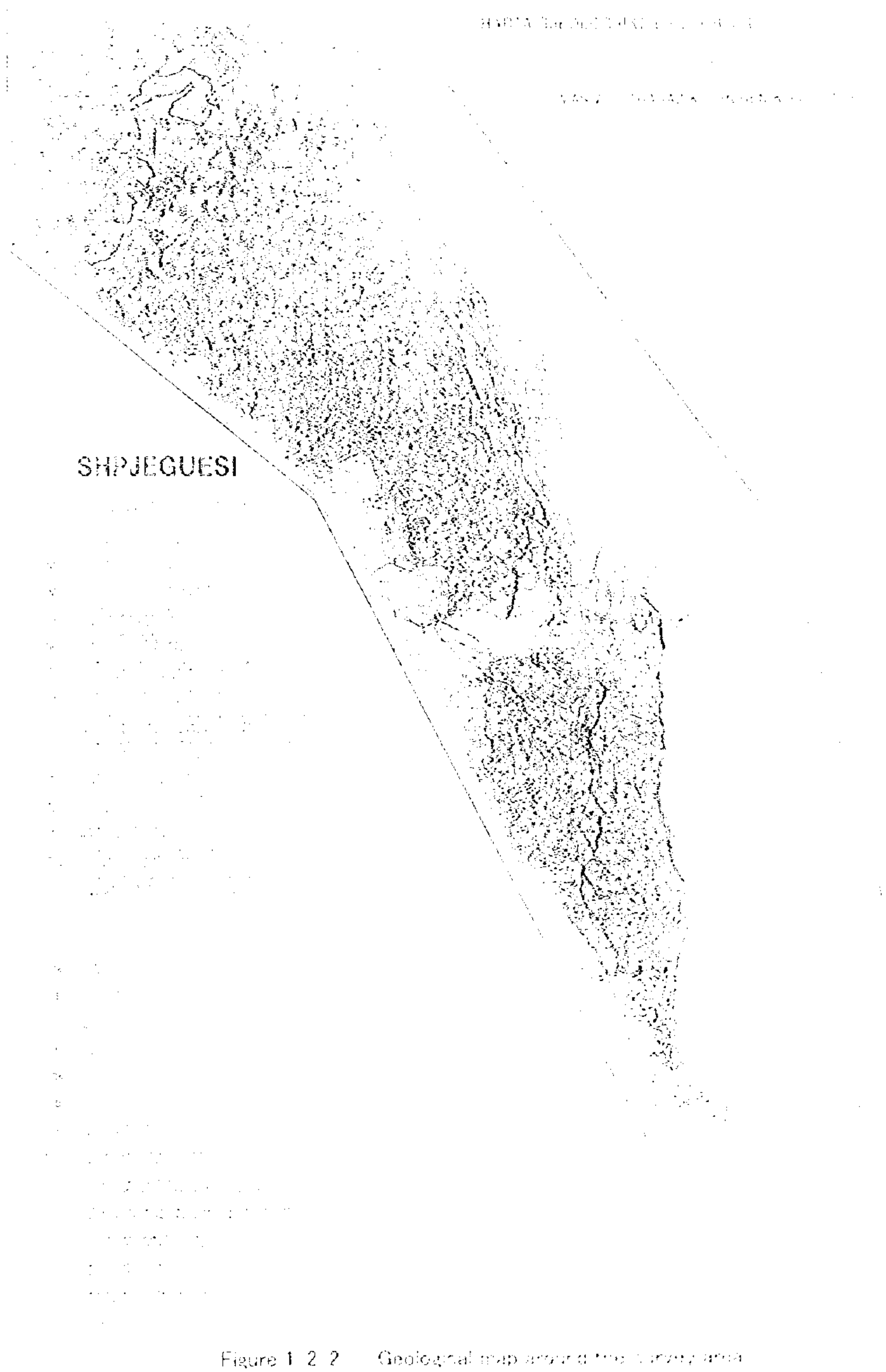


Figure 1 2 2 Geological map around the survey area

of the Hercynian orogeny and particularly of the subsequent Alpine orogeny having initiated in Mesozoic, and have been subjected to complete reformation of its geologic structure in the event of collision of the Eurasian and the African Plates in Jurassic. The Alban Inner Zone thrusts over the Cukali Zone of the Outer Zone along the major fault shallowly inclining to the east.

The Inner Zone can be geographically divided into the Gash Zone, in the northernmost part of Albania, and the Korabi-Mirdita Zone, in the eastern mountainous region. The Project Area is located in the latter Zone. The Korabi-Mirdita Zone comprises phyllitic to schistose sedimentary rocks, limestones and volcano-sedimentary rocks of Paleozoic and ophiolite of Jurassic. Within the ophiolite, ultramafic complexes are distributed in two separate lineal zones, the eastern and the western zones. A ultramafic complex unit has, in general, an overall cumulated structure consisting of, from the bottom upwards, harzburgite, pyroxinite-dunite cumulate, gabbro with cumulate structure, massive basalt or basalt dikes/dike swarms and pillow lavas.

The ultramafic complexes in the eastern zone are named, from north to south, Tropoja, Kukes, Bulqiza, Shebenik and Pogradec, which are well known for their abundance in chromium ore deposits with high chromium contents. In addition, a number of lateritic nickel ore deposits are associated with these ultramafic complexes. Those in the western zone contain high aluminum chromite and accompany mineralization of copper and platinum group elements. Copper and other base metal mineralization is associated with the volcano-sedimentary rocks of the Gash and the Korabi-Mirdita Zones.

As above mentioned, the Alban Inner Zone is characterized by its abundance in copper, nickel, chromium and other metallic mineralization.

Chapter 3 General Features of the Project Area

3-1 Location

The Project Area (Shebenik Area) is located in the mountainous region in the southeastern part of the Republic of Albania, bounded to the east by the international border with Macedonia and by the coast of Ohrit Lake (Figure 1-1-1). The cities of Librazhd at the northern end and Pogradec at the southern end of the Area are the centers of transportation, communication and industry in the general region. The Survey Team stationed in Pogradec during most of the field operation periods.

3-2 Access

Pogradec, one of the major cities in the Shebenik Area, is located approximately 80km southeast of Tirana, the capital of Albania and can be reached by a paved national trunk road. The national road runs through the major industrial cities of Elbasan, Librazhd and Perrenjas, and leads to the border with Macedonia and Greece. It takes 3 to 4 hours by driving from Tirana to Pogradec.

A wide-gauge railway, starting from Tirana, passes through the Port of Durres, the largest in Albania, runs along Shkumbin River and reaches Pogradec via Elbasan, Librazhd and Perrenjas. The railway is one of the important public means for passenger transportation and also utilized for hauling chromium ores from the operating mines. In the past, lateritic nickel ores were transported using this railway.

All the access roads to the Project Area, which is located in the axial zone of the Shebenik-Pogradec Range, are unpaved. Although those which lead to operating chromium mines are reasonably well maintained, others are extremely poor in their conditions and only 4-wheel vehicles can pass them.

3-3 Topography

The Shebenik Area is located in the mountain range in the southeastern part of Albania, which continues to the Dinar Range in the western part of the former Socialist Federal Republic of Yugoslavia. Its topography is, accordingly, characterized by ragged mountains of a maturity stage extending in the NNW-SSE direction and by intermontane depressions developed in-between. The Shebenik Range in the northern half of the Project Area is principally composed of ultramafic rocks of the Shebenik Complex, having the highest peak with the elevation of 2,262m. Glacial landforms are preserved in part of mountains higher than 1,500m in elevations. The southern half, facing Ohrit Lake, is also located in the ultramafic terrain of the Pogradec Complex, and has the highest peak with the elevation of 1,530m. A plateau with elevations of some 600m is developed centering Perrenjas in the middle of the Project Area and divides the two Ultramafic Complexes.

Shkumbin River flows to the north northwest along the intermontane depression developed in the NNW-SSE direction to the west of Shebenik Range. The River, one of the major water courses in Albania, changes its course to the west at Librazhd and flows into Adriatic Sea via Elbasan. All rivers and streams in the Shebenik Area belong to the Shkumbin drainage basin, except those small streams directly flowing into Ohrit Lake. Other major water courses are Qarriste River bounding the northern limit of the Shebenik Complex, Bushtrice River which flows to the south along the eastern margin of the Complex and then cut across it to the east, and tributaries of Shkumbin River collecting minor streams developed in the western slope of the Pogradec Complex. These water courses well reflect the regional geological structures trending in the NNW-SSE and the NNE-SSW directions and have been formed by intense downward erosion along these directions. Remarkable cliffs are commonly developed along the water courses showing great elevation differences sometimes in excess of 1,000m. Courses of tributaries flowing into the major rivers are also controlled by these geological structures, along which downward erosion is considerable.

3-4 Climate and Vegetation

The most part of Albania belongs to the Mediterranean Climatic Zone, having hot-dry summer and warm winter. High mountains in the eastern mountainous region is categorized into a warm-humid climatic zone and has a notable amount of snowfall in the winter season. Monthly averages of daily mean temperature, relative humidity and precipitation in the Capital City, Tirana, are shown in Table 1-3-1.

Table 1-3-1 Monthly climate condition in Tirana

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Temperature (℃)	6.2	7.7	9.6	13.3	17.6	21.9	24.2	23.6	20.1	15.6	11.6	8.4	15.0
Humidity (%)	74	73	70	72	71	69	62	64	71	70	76	79	71
Precipitation (mm)	164.9	144.4	93.3	95.2	105.6	66.7	32.1	37.9	76.8	102.8	158.2	160.9	103.2

Note: Statistical period; temperature and precipitation: 1951-1968, humidity: 1963-1967

The vegetation in the Shebenik Area is characterized by mixture of conifers and broadleaf trees, typical of a temperate zone. Superb natural forests are well preserved in mountains at elevations between 1,500 and 1,800m. The timberline is situated at an elevation of approximately 1,800m, above which shrubs and lichens are predominated. Grazing cattle, sheep and goats is popular practices in mountains above the timberline.

Chapter 4 Conclusion and Recommendation

4-1 Conclusion

(1) Geological and Geochemical Investigation

The most part of the Project Area is underlain by ultramafic rocks, named the Shebenik-Pogradec Ultramafic Complex as a whole, which are grouped into the Shebenik Complex in the northern half and the Pogradec Complex in the southern half. Although chromium ore deposits and indications are distributed in the entire Ultramafic Complex except in the northeastern part of the Shebenik Complex, a majority of them are located in the southwestern part of the Shebenik Complex and in the Pogradec Complex.

The Ultramafic Complex comprises mostly harzburgite, accompanying subordinate dunite, lherzolite, pyroxinite and gabbro. Harzburgite, lherzolite and dunite are mostly serpentinized. Fresh harzburgite and dunite are found only in the northern part of the Pogradec Complex and in the southeastern margin of the Shebenik Complex, and possibly represent the lower part of the Ultramafic Complex.

All of the chromium ore deposits in the Project Area are categorized into a podiform or Alpine type, and consist of chromespinel concentrations, in forms of dissemination, band, mass or nodule, within dunite envelopes in harzburgite.

Sizes of unit ore bodies range from 0.1 to 2m in thickness, from several tens to hundreds of meters both in strike and down-dip lengths. Thickness of dunite envelopes containing chromium ore bodies ranges from several tens of centimeters to several tens of meters. The mines being presently operated produce mainly massive ores with average grades ranging between 25 and 30% Cr_2O_3.

Important indicators for chromium ore deposit exploration are as follows;

- chromium ore bodies occur in dunite envelopes in serpentinized harzburgite
- all chromium ore bodies are enveloped by dunite
- textures of chromespinel arrangement are often parallel to inclinations of relevant chromium ore bodies
- chromium ore bodies continue in their plunge directions for appreciable distances.

(2) Ground Magnetic Survey

Magnetic survey was carried out in 4 target areas of Pishkash, Kotodesh, Katjel and Central Shebenik.

A test magnetic survey, which was carried out over the chromitite outcrops of Katjel ore body, has identified a low magnetic anomaly in association with the ore body and the dunite envelope containing the ore body. The known ore indications in each area were recognized as " a group of anomalies " where a lot of high and low anomalies located together or a pair of high and low anomaly which continued well. These anomalies are presumed to indicate the blocks of ultramafic rocks with different orientations in remnant magnetization or dunite envelopes inversely magnetized.

According to the result of the magnetic survey, drilling survey was carried out in three magnetic anomalous areas of Pishkash South (Pishkash), Mbi Skroske (Pishkash), Fusha e Madhe (Kotodesh). However no chromitite was intersected in drill holes of these area. These magnetic anomaly is thought to be caused by the fault contact of blocks with different orientations in remnant magnetization.

(3) Drilling Exploration

The drilling exploration, comprising a total of 34 holes, was carried out for the 13 selected target areas in the Central Shebenik, Southern Shebenik and Northern Pogradec Districts. Of the 34 holes, 12 holes for the 5 target areas, namely Bregu i Pishes, Qarri i Zi, Ahu i Vetem, Lugu i Batres and Hija e Zeze, intersected chromitite. The sections directly above and below chromitite consist of dunite in every hole. The thickness of dunite envelopes varies considerably from hole to hole. However, the dunite envelope in association with the low grade chromitite in Ahu i Vetem is apparently thicker than those in other target areas.

1) Bregu i Pishes

Of the 5 holes drilled (MJAS-1, 2 3, 34, 35), 2 holes (MJAS-1 and -2) have intersected disseminated and massive ores with thickness of about 1m. The Cr_2O_3 grades are 34 to 38% for the disseminated ores and 50% for the massive ores. It is observed in one hole (MJAS-2) that the chromitite contacts foot-wall harzburgite bounded by a fault.

The 2 holes are located closer to the known ore body than other 3 holes which have failed to intersect chromitite. The ore body, being cross-cut by a number of faults, consists of a number of faulted segments which are arranged en echelon, and may have been dislocated for a distance greater than anticipated in the proximity of the drill locations of the other 3 holes.

2) Qarri i Zi

Of the 3 holes drilled (MJAS-8, -9 and -10), 2 holes (MJAS-8 and -9) have intersected several layers of disseminated ores with thickness ranging from a few centimeters to less than one meter. The ore grades generally range between 21 and 27% Cr_2O_3 except for one layer having indicated 39% Cr_2O_3. The thickness of the dunite envelope is estimated at 10m or more.

The 2 holes having intersected the ores were targeted to the down-dip extension almost directly below the known ore body, while the hole having missed ores was drilled to its strike extension at depth. The continuation of the known ore body has been identified to some extent by the drilling. However, its strike extension, which has been missed by the third hole may have been dislocated by faults for a certain distance.

3) Ahu i Vetem

All the 5 holes (MJAS-23 through -27) drilled have intersected the deep ore body and 2 of them (MJAS-25 and -26) have encountered the shallow ore body. The deep ore body consists of disseminated or banded ores with thickness ranging from about 1m to 5m indicating Cr_2O_3 grades ranging from 15 to 26%. The shallow ore body consists of thin massive ores with thickness less than 5 centimeters indicating Cr_2O_3 grades of about 35%. The thickness of the dunite envelope for the deep ore body varies from more than10m to about 50m for the deep ore body, while that for the shallow ore body is estimated at 3m or less.

The ores intersected by the 5 holes indicate similar modes of occurrence and Cr_2O_3 grades to those known for the deep ore body by the past exploration and are correlated to its strike extension, judging from the positions of intersections. Because all the 5 holes having intersected ores for appreciable lengths exceeding 2m, it is expected that the deep ore body extends to its strike direction for a substantial distance.

On the other hand, only two of the 5 holes which were targeted to the down-dip extension of the shallow ore body as well, have intersected very thin ores at the correlative positions. Accordingly, the down-dip continuation of the shallow ore body is considered to be insignificant.

4) Lugu i Batres

One (MJAS-28) of the two drill holes (MJAS-28 and -29) have intersected ores for a length of 0.3m with a Cr_2O_3 grade of 39%. The thickness of dunite envelope is estimated at about one meter. The hole was intended to confirm the down-dip continuation of the central part of known ore body, while the other hole was targeted to its western strike extension. Although the down-dip continuation has been confirmed, the extent of the ore body appears to be very limited because its eastern strike extension has not been indicated by the past exploration.

5) Hija e Zeze

Both of the two holes (MJAS-36 and -37) drilled in this target area have intersected massive ores for lengths of 0.2 and 1.1m with respective Cr_2O_3 grades of 36 to 42%, within a dunite envelope of one to three meter thick. The ores indicate similar modes of occurrence and Cr_2O_3 grades to those known for the ore body by the past exploration and are correlated to its strike extension, judging from their positions of intersections.

The drilling result suggests that the ore body continues further in its strike direction for an appreciable distance, which will lead to substantial increase in ore resources.

6) Other Target Areas

One to three holes each for other eight target areas (Buzgare, Mbi Skroske, Pishkash South, Pishkash-5, Fusha e Madhe, Gjorduke, Shesh Bush No.1 and Murriq) were drilled in order to identify down-dip or strike extensions of the known ore bodies or to verify causative bodies for surface magnetic anomalies. None of the drill holes, however, have encountered any chromitite.

The reasons why the holes located in the neighbors of the known ore bodies have failed to intersect chromitite may be attributed either to greater dislocation of the ore bodies by faults than anticipated or to their limited extensions. Numerous faults are developed in extremely complicated patterns, affecting positions of faulted segments of the ore bodies. Therefore, it is often very difficult to estimate the amount and direction of dislocation of ore bodies by faults.

One or two holes each for three target areas (Pishkash South, Mbi Skroske and Fusha e Madhe) were drilled with intention to pass through below surface magnetic anomalies. However, none of the holes was successful to verify their causative bodies.

(4) EPMA Analysis

EPMA analysis were made for chromespinel in samples of drilled cores and outcrops. The aim of the examination for chemical composition of chromespinel by EPMA analysis is to determine the wall rock containing chromium ore deposit by its chemical characteristic. The following four indices indicate the existence of large scale chromium ore deposit (MITI 1994; 1995, Matsumoto 1996, Arai 1994, and so on). The threshold value used in this Project are shown within the parentheses. The formulas of atomic number are as follows; Cr # =Cr/(Cr+Al), Mg # =Mg/(Mg+Fe^{2+}), Fe^{3+} # =Fe^{3+} /(Cr+Al+ Fe^{3+}).

- harzburgite indicating relatively low Cr # (0.4~0.6)
- harzburgite indicating high TiO_2 wt% (0.05 or higher)
- dunite and harzburgite indicating high Fe^{3+} # (0.030 or higher for dunite and 0.15 or higher for harzburgite)
- dunite and harzburgite indicating high Cr # and low V_2O_3 wt% (0.7 or higher in Cr # and 0.2 or lower in V_2O_3 wt% for both dunite and harzburgite).

Especially EPMA anomaly in high Cr # and low V_2O_3 wt% (hereinafter described as V_2O_3－Cr #) is presumed to reflect the composition of the melt which is created as a result of the alternative reaction between melt and mantle to occur the podiform type chromium ore deposit. The V_2O_3－Cr # anomaly is a common feature to the dunite containing chromitite (or intermediate rock facies between dunite and hartzburgite). Surface rock samples indicating V_2O_3－Cr # anomaly distribute in the ore indications of the Central Shebenik District as Ahu i Vetem, Lugu i Batres, Gobille, Buzgare and so on, of the South Shebenik District as Qarri i Zi and so on, and of the North Pogradec District as Bregu i Pishes and so on.

As a result of drilling survey which had been recommended by EPMA analysis for the surface samples, chromitite was intersected in holes drilled in some target areas. The drill core samples in Qarri i Zi, Bregu i Pishes, Ahu i Vetem and Hija e Zeze where chromitite was encountered also indicated V_2O_3－Cr # anomaly. Therefore, the chemical composition of chromespinel will be one of the effective indicators for chromium ore deposit exploration in the Project Area. As the same anomaly was detected in Pishkash South and Mbi Shkroske, there is the possibility that the chromium ore deposit would exist around these target areas.

Hartzburgite and dunite indicating high Fe^{3+} # and hartzburgite indicating high TiO_2 wt% are possibly received the reflection of the melt. These samples distribute in the region from the Central Shebenik to the South Shebenik District.

Cr # of chromespinel in harzburgite ranges between 0.4 and 0.5 (up to mid-0.6s in the highest case) in the vicinity of sizable chromium ore deposits. It is, however, generally high in the Project Area and exceeds 0.6 in most harzburgite samples. Only a few samples with Cr # less than 0.6 are sporadically distributed. Therefore, the possibility to locate large scale chromium ore deposit comparable to those of the Bulqiza Mines appears to be rather limited based on the result of the EPMA analysis to date. Nevertheless, it may still be possible to locate the ore deposit, which contains resources of several tens thousands to several hundreds thousands tons as estimated by the drilling survey, in the region where a lot of samples indicating EPMA anomaly are located.

4-2 Recommendation

The following target areas are recommended for the follow-up drilling exploration;

- Hija e Zeze: the down-dip and northern extensions of the drill-indicated ore body
- Ahu i Vetem: the north northeastern extension of the drill-indicated part of the deep ore body and the northwestern extension of the shallow ore body

- Bregu i Pishes: the down-dip and western extensions of the drill-indicated part of the known ore body

In these target areas, lateral and down-dip extensions will be drilling targets since the drilling exploration of the current Project has confirmed the ore bodies with thickness exceeding 1m.

As for Hija e Zeze, the drilling exploration of the current Project is the first instance of this kind and has successfully identified the ore body with an appreciable size and grade, in spite of the scarce existing information. This area is well located for its accessibility and topography, and is economically advantageous for exploitation where promising results are obtained by the future exploration.

The deep ore body of Ahu i Vetem is rather low in its overall Cr_2O_3 grade but is superior in its size to those in other target areas. The ore body drill-indicated in the current Project is highly probable to continue further to the north. Since it includes higher grade portions in part, its economic value may improve depending on the result of future exploration.

The third Year drilling operation in Bregu i Pishes failed to prove the strike extension of the ore body further to the north of the portion drill-indicated in the second Year operation. However, the result is inconclusive for the continuation of the ore body in the strike direction. There remains a possibility to locate a fault-dislocated portion of the ore body by the follow-up drilling exploration.

PART II

Part II Detailed Report

Chapter 1 Result of the Project

1-1 Satellite Image Analysis

Photo-geological analysis was made using the LANDSAT TM image in order to interpret the geology and geological structure of the Project Area. The objective of the analysis was to clarify the relationship between the geology – geological structure and the known mineral deposits in the Alban Inner Zone. Three scenes of the LANDSAT TM false color image, as shown in Figure 2-1-1, were used for the analysis. The false color image was synthesized using the bands 2, 3 and 4 assigned to blue, green and red respectively. The analysis was made with reference to the existing geological map (scale: 1 to 200,000). The result is illustrated in an image analysis map shown in Figure 2-1-2.

(1) Geology

The area for the image analysis can be differentiated into 22 geologic units according to their photo-geologic appearances, such as color tones and textures, and to their morphological characteristics, such as their drainage patterns and resistance to erosion. As the result, these geologic units are correlated to those differentiated in the geologic map.

It is generally easy in the Alban Inner Zone to distinguish sedimentary rocks of a flysch type from massive ultramafic or carbonate rocks with few exceptions in places. However, it is difficult to distinguish small units of strata or rock masses with dimensions less than several kilometer squares within large scale geologic units.

The units, Uma and Umb, can be correlated to ultramafic rocks. In general, the unit, Uma, shows wider distribution than the unit, Umb, in the Eastern Belt, and vice versa in the Western Belt.

(2) Geological Structure

The morphologic features, trending nearly in the north-south direction, are most distinctive in the satellite image and are associated with ultramafic complexes or Tertiary sedimentary basins in the Alban Inner Zone. However, the thrust dividing the Inner and Outer Zone is very indistinct in the image, in spite of its prominent geologic feature, and is very difficult to continuously trace for a significant distance. Most lineaments trend in directions of N20° W to N70° E with few trending in the E-W direction. They can be traced for distances up to some 5km but only a few of them continue for more than 10km. Lineaments running in the NNE-SSW direction are most predominant in the Shebenik Area. Ultramafic complexes are featureless with relatively poor development of lineaments within their insides. Lineaments are rather well developed near contacts of the complexes to surrounding sedimentary rocks.

(3) Relationship between Mineral Deposits and Geological Structure

Among copper ore deposits distributing in the northern part of Albania, those in the Mirdita Zone are located in association with lineaments trending in the N-S and NNW-SSE directions, which suggests that the copper mineralization is genetically related to the fracture systems of these directions. No specific relation with particular lineaments is observed for chrome and nickel-iron ore deposits.

1-2 Review of Existing Data

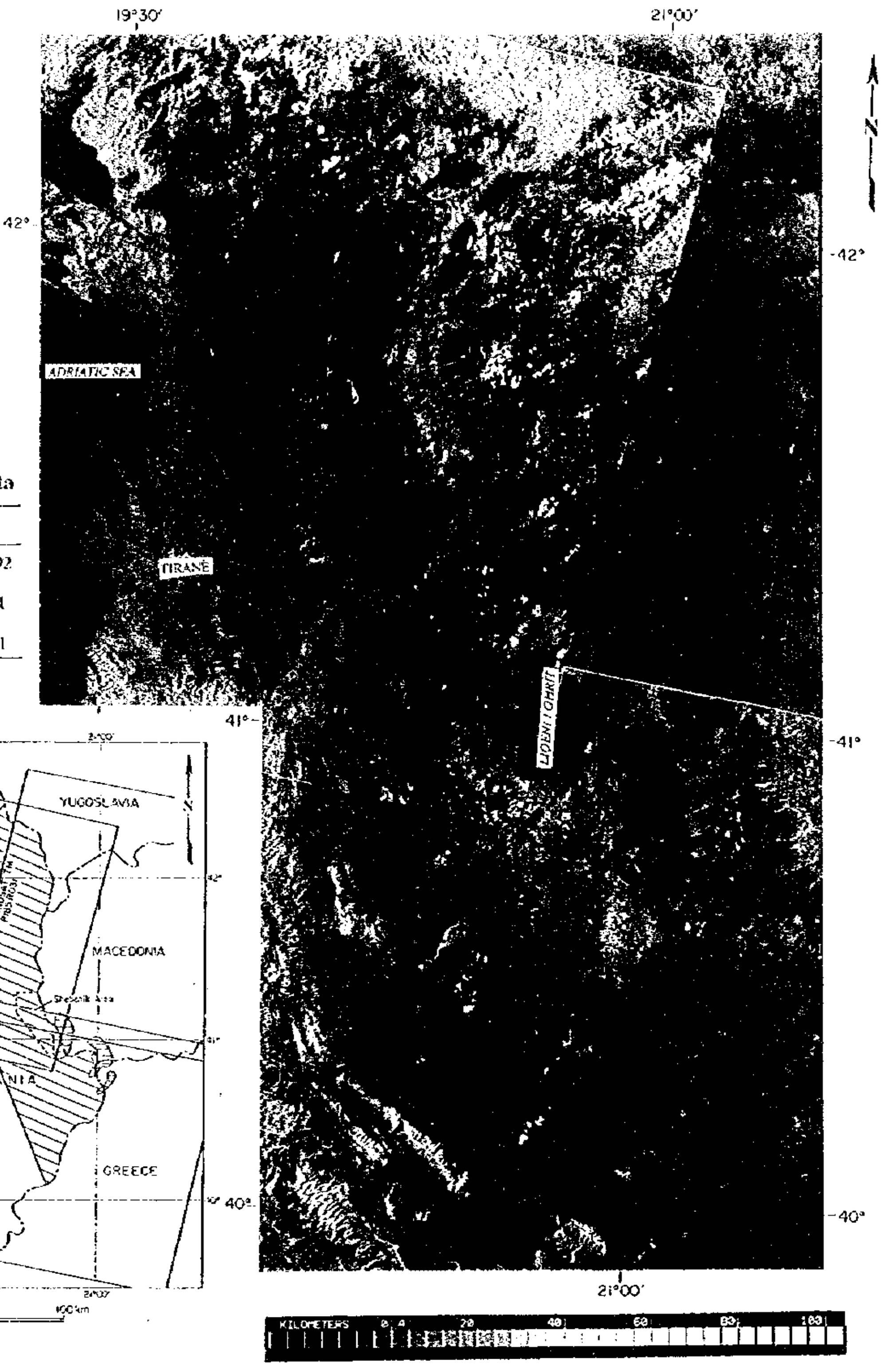
Prior to the field geologic investigation, existing information and data, with respect to the geology and chromium mineralization in the Shebenik Area, were collected and reviewed.

1-2-1 Mineral Resources in the Alban Inner Zone

Within the Alban Inner Zone, there are metallic mineral resources such as chrome, copper, iron-nickel and titanium as well as non-metallic mineral resources such as asbestos, talc, kaolin, gypsum and anhydrite.

(1) Chromium

A number of chromium ore deposits have been known in association with the Tropja, Kukes, Bulqiza and Shebenik-Pogradec Ultramafic Complexes in the Eastern belt of the Alban Inner Zone. The chromium ore resources of Albania were initially explored by Italians during the World War II, which lead to exploitation of some deposits for small scale operations with annual production rates at several thousand tons of ores. After the War, a systematic exploration was initiated in the Alban Inner Zone and resulted in discovery and subsequent exploitation of new ore deposits. Since then, the chromium ore production of Albania climbed to an order of a million tons per annum in the period between 1985 and 1990, and was ranked at the third largest in the world. The ore resources were estimated at some 37 million tons at the end of 1991. However, the production started declining in 1990 due to obsolete facilities and deteriorated working conditions with deepening underground mining levels. The decline was further accelerated by economic turmoil in the course of reformation of the national economic system to the free trade economy since 1991. The annual production decreased to 230,000 tons by 1994.



List of LANDSAT TM data

PATH	ROW	DATE
186	31	07 AUG 1992
185	32	27 JUN 1991
185	31	27 JUN 1991

R, G, B = 4, 3, 2

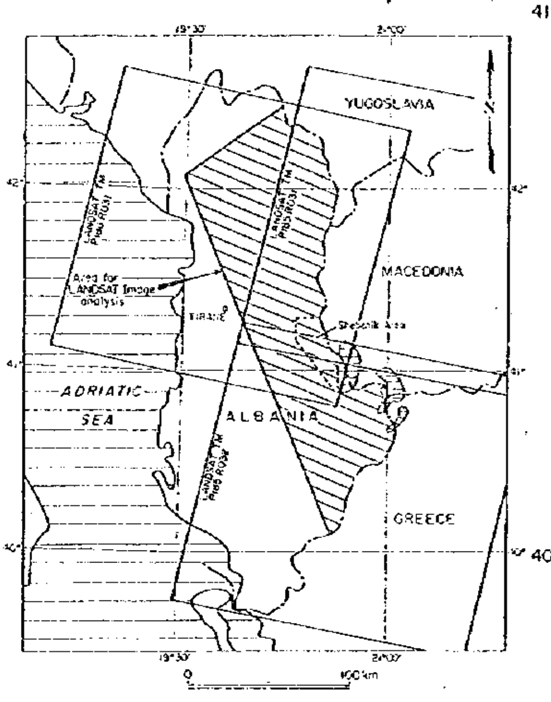
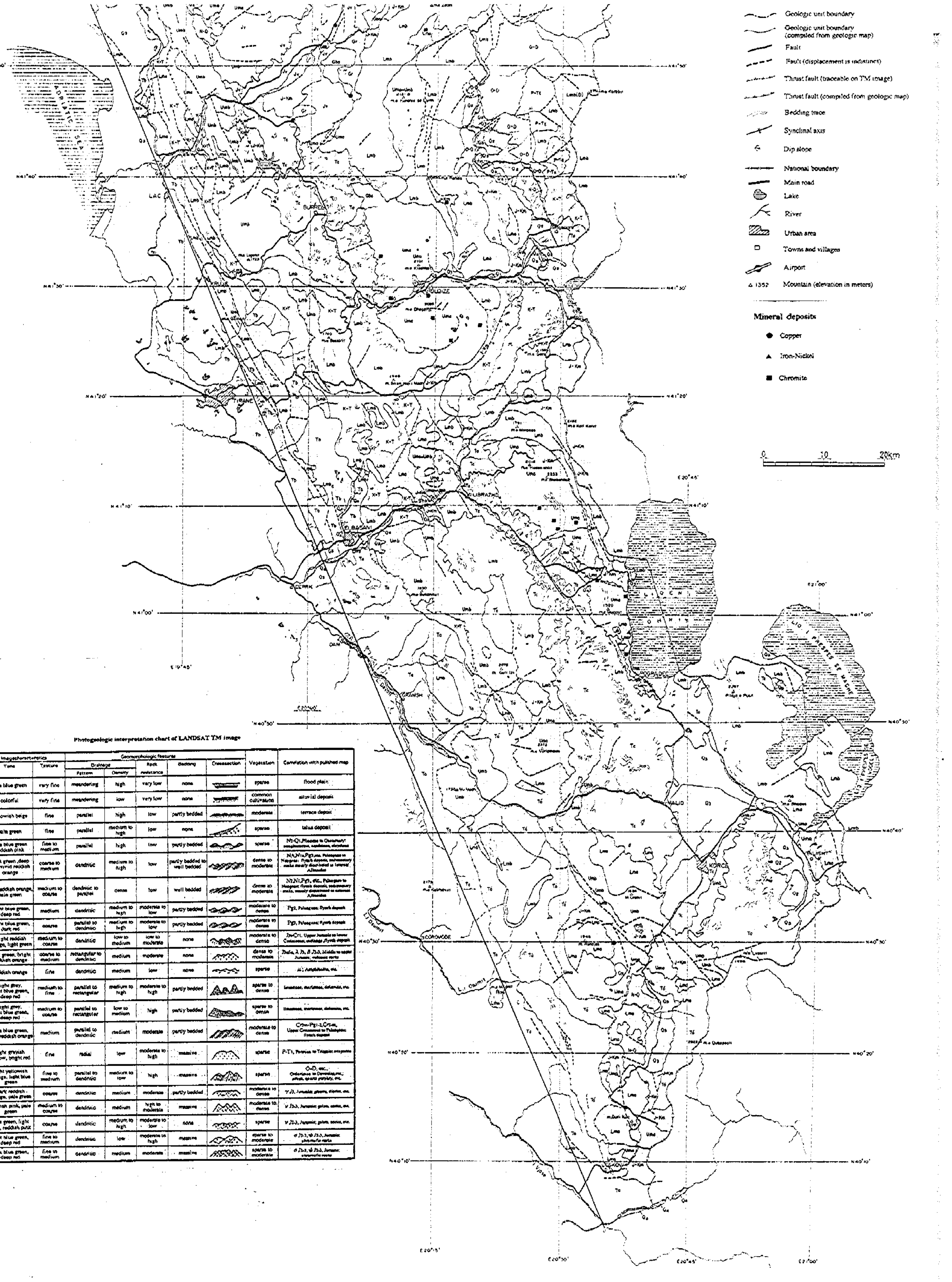


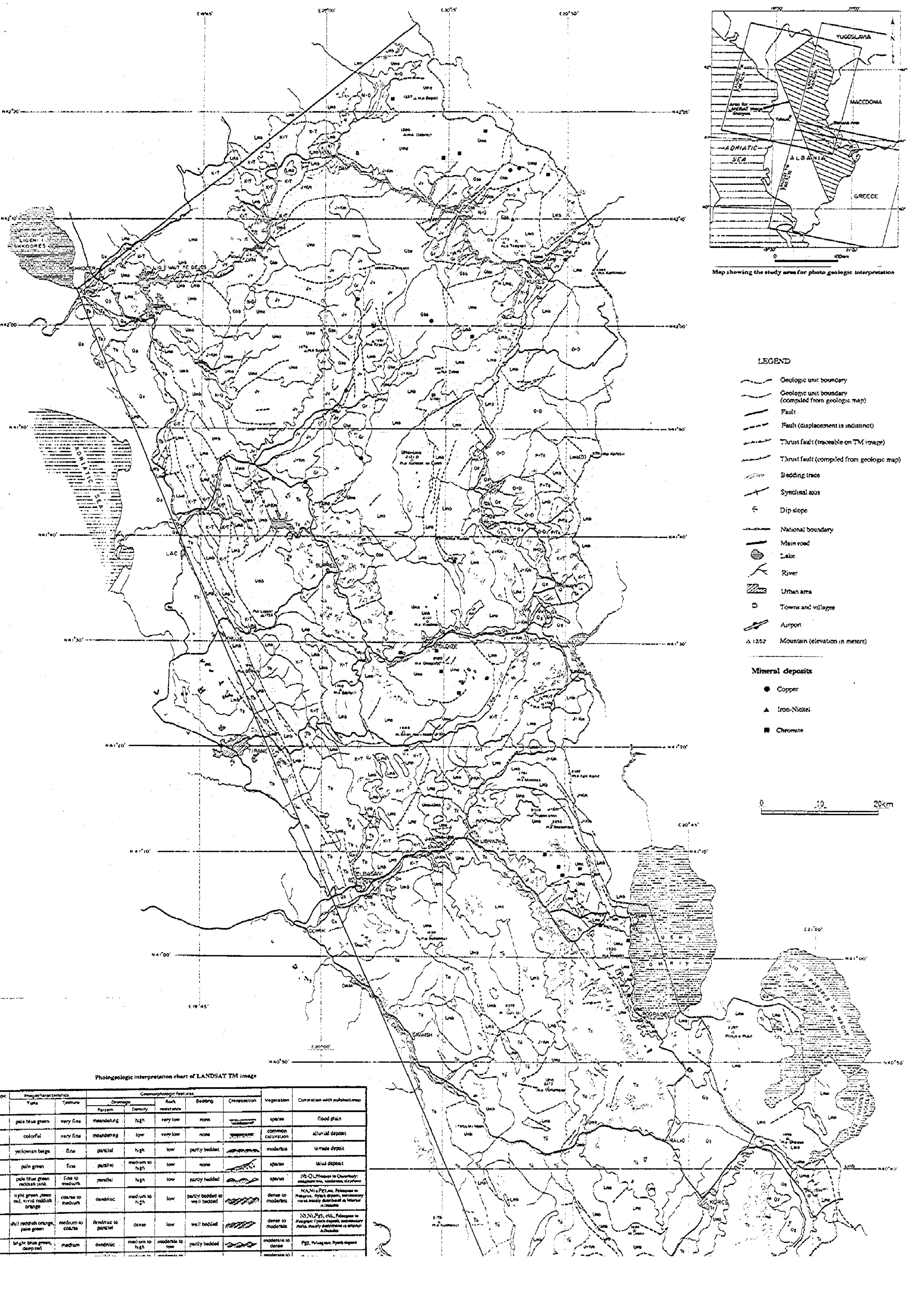
Figure 2-1-1　LANDSAT mosaic image



Photogeologic interpretation chart of LANDSAT TM image

Photogeologic Unit	Image characteristics: Tone	Image characteristics: Texture	Geomorphologic features: Drainage Pattern	Geomorphologic features: Drainage Density	Geomorphologic features: Rock resistance	Geomorphologic features: Bedding	Geomorphologic features: Crossection	Vegetation	Correlation with published map
Q4	pale blue green	very fine	meandering	high	very low	none		sparse	flood plain
Q3	colorful	very fine	meandering	low	very low	none		common cultivation	alluvial deposit
Q2	yellowish beige	fine	parallel	high	low	partly bedded		moderate	terrace deposit
Qt	pale green	fine	parallel	medium to high	low	none		sparse	talus deposit
N-Q	pale blue green reddish pink	fine to medium	parallel	high	low	partly bedded		sparse	N2-Q1, Pliocene to Quaternary: conglomerates, sandstone, claystone
Tc	light green, deep red, vivid reddish orange	coarse to medium	dendritic	medium to high	low	partly bedded to well bedded		dense to moderate	N1,N1a,Pg3, etc. Paleogene to Neogene: flysch deposits, sedimentary rocks mostly distributed in internal Albanides
Tb	dull reddish orange, pale green	medium to coarse	dendritic to parallel	dense	low	well bedded		dense to moderate	N2,N1,Pg3, etc., Paleogene to Neogene: flysch deposits, sedimentary rocks, mostly distributed in external Albanides
Ta'	bright blue green, deep red	medium	dendritic	medium to high	moderate to low	partly bedded		moderate to dense	Pg2, Paleogene: flysch deposit
Ta	bright blue green, dark red	coarse	parallel to dendritic	medium to high	moderate to low	partly bedded		moderate to dense	Pg3, Paleogene: flysch deposit
J-Km	bright reddish orange, light green	medium to coarse	dendritic	low to medium	low to moderate	none		moderate to dense	J3-Cr1, Upper Jurassic to lower Cretaceous: melange, flysch deposit
Jv	light green, bright reddish orange	coarse to medium	rectangular to dendritic	medium	moderate	none		dense to moderate	βαJ2, λJ2, βJ2-3, Middle to upper Jurassic: volcanic rocks
μ	reddish orange	fine	dendritic	medium	low	none		sparse	μ; Amphibolite, etc.
Lma	light grey, light blue green, deep red	medium to fine	parallel to rectangular	medium to high	moderate to high	partly bedded		sparse to dense	limestone, marlstone, dolomite, etc.
Lmb	light grey, light blue green, deep red	medium to coarse	parallel to rectangular	low to medium	high	partly bedded		sparse to dense	limestone, marlstone, dolomite, etc.
K-T	pale blue green, light reddish orange	medium	parallel to dendritic	medium	moderate	partly bedded		moderate to dense	Cr2m-Pg1-2,Cr2m, Upper Cretaceous to Paleogene: flysch deposit
P-Tre	light greyish yellow, bright red	fine	radial	low	moderate to high	massive		sparse	P-T1, Permian to Triassic: evaporite
O-D	light yellowish orange, light blue green	fine to medium	parallel to dendritic	medium to low	high	massive		sparse	O-D, etc., Ordovician to Devonian, etc.: schist, quartz porphyry, etc.
Gr	dark reddish orange, pale green	coarse	dendritic	medium	moderate	partly bedded		moderate to dense	γJ3, Jurassic: granite, diorite, etc.
Gba	reddish pink, pale green	medium to coarse	dendritic	medium	high to moderate	massive		moderate to dense	νJ2-3, Jurassic: gabbro, norite, etc.
Gbb	pale green, light grey, reddish pink	coarse	dendritic	medium to high	moderate to low	none		sparse	νJ2-3, Jurassic: gabbro, norite, etc.
Uma	dark blue green, deep red	fine to medium	dendritic	low	moderate to high	massive		sparse to moderate	σJ2-3, ψJ2-3, Jurassic: ultramafic rocks
Umb	dark blue green, deep red	fine to medium	dendritic	medium	moderate	massive		sparse to moderate	σJ2-3, ψJ2-3, Jurassic: ultramafic rocks

Figure 2-1-2 Interpretation map of satellite image



Photogeologic interpretation chart of LANDSAT TM image

Photogeologic Unit	Image characteristics: Tone	Image characteristics: Texture	Geomorphologic features: Drainage Pattern	Drainage Density	Rock resistance	Bedding	Crosssection	Vegetation	Correlation with published map
Q4	pale blue green	very fine	meandering	high	very low	none		sparse	flood plain
Q3	colorful	very fine	meandering	low	very low	none		common cultivation	alluvial deposit
Q2	yellowish beige	fine	parallel	high	low	partly bedded		moderate	terrace deposit
Q1	pale green	fine	parallel	medium to high	low	none		sparse	talus deposit
N-Q	pale blue green reddish pink	fine to medium	parallel	high	low	partly bedded		sparse	N2-Q1,Pliocene to Quaternary: conglomerate, sandstone, clayslate
Tc	light green, deep red, vivid reddish orange	coarse to medium	dendritic	medium to high	low	partly bedded to well bedded		dense to moderate	N1,N1a,Pg3,etc. Paleogene to Neogene; flysch deposit, sedimentary rocks mainly distributed in internal Albanides
Tb	dull reddish orange, pale green	medium to coarse	dendritic to parallel	dense	low	well bedded		dense to moderate	N2,N1,Pg3, etc., Paleogene to Neogene: flysch deposit, sedimentary rocks, mainly distributed in external Albanides
Ta'	bright blue green, deep red	medium	dendritic	medium to high	moderate to low	partly bedded		moderate to dense	Pg2, Paleogene; flysch deposit

Produced chromium ores have been shipped to ferro-chrome factories with in the country. The chromium ore deposits which have been found and exploited to-date in the Alban Inner Zone are associated with the ultramafic complexes in the Eastern Belt and belong to a podiform type (Alpine type), containing Cr-rich chromite. On the other hand, those found in association with the ultramafic complexes in the Western Belt contain Al-rich chromite. However, they are too small in size and too low in grade for economic exploitation, though potential may still remain for locating economically exploitable ore deposits.

(2) Laterite Nickel

Laterite nickel ore deposits are known as one of the most popular types of metallic mineral resources in Albania and occur in close association with the ultramafic complexes in the Eastern Belt of the Alban Inner Zone. The laterite nickel resources, estimated at 368 million tons, had been identified by 1991 and are associated with the Kukes, Shebenik-Pogradec and Korce Ultramafic Complexes. These ore deposits have been formed in weathered crusts of ultramafic rocks and secondarily enriched in nickel as lateritic nickel or garnierite ores. They have clear hanging-wall contact with overlying Cretaceous limestone or Eocene calcareous sediments of a molasse type. Their foot-walls gradually change into weathered ultramafic rocks with a typical vertical zonation of lateritic nickel ore, garnierite on the top and serpentinized ultramafic rocks at the bottom.

Produced nickel ore used to be exported to Czechoslovakia in part and to be shipped to the nickel smelter in Elbasan after concentration at the ore dressing plant attached to the Guri i Kuq Mine. The smelter in Elbasan was shut down after having introduced the free trade economy and, moreover, the export to Czechoslovakia was also terminated in 1990. Accordingly, none of the lateritic nickel/garnierite mines is now in operation.

1-2-2 Geologic Investigation and Mineral Exploration in the Shebenik Area

(1) Past Exploration

Systematic mineral exploration has been carried out on a number of occasions in the Shebenik Area because of its wealthy mineral resources. Figure 2-1-3 compiles major exploration activities in the past and localities of identified chromium deposits.

The comprehensive mineral exploration, including geochemical prospecting for groundwater and stream sediments and geological mapping, was carried out for the Shebenik-Pogradec Ultramafic Complex with the aid of the former USSR during the period of 1950s after the World War II. Its result was incorporated in the report

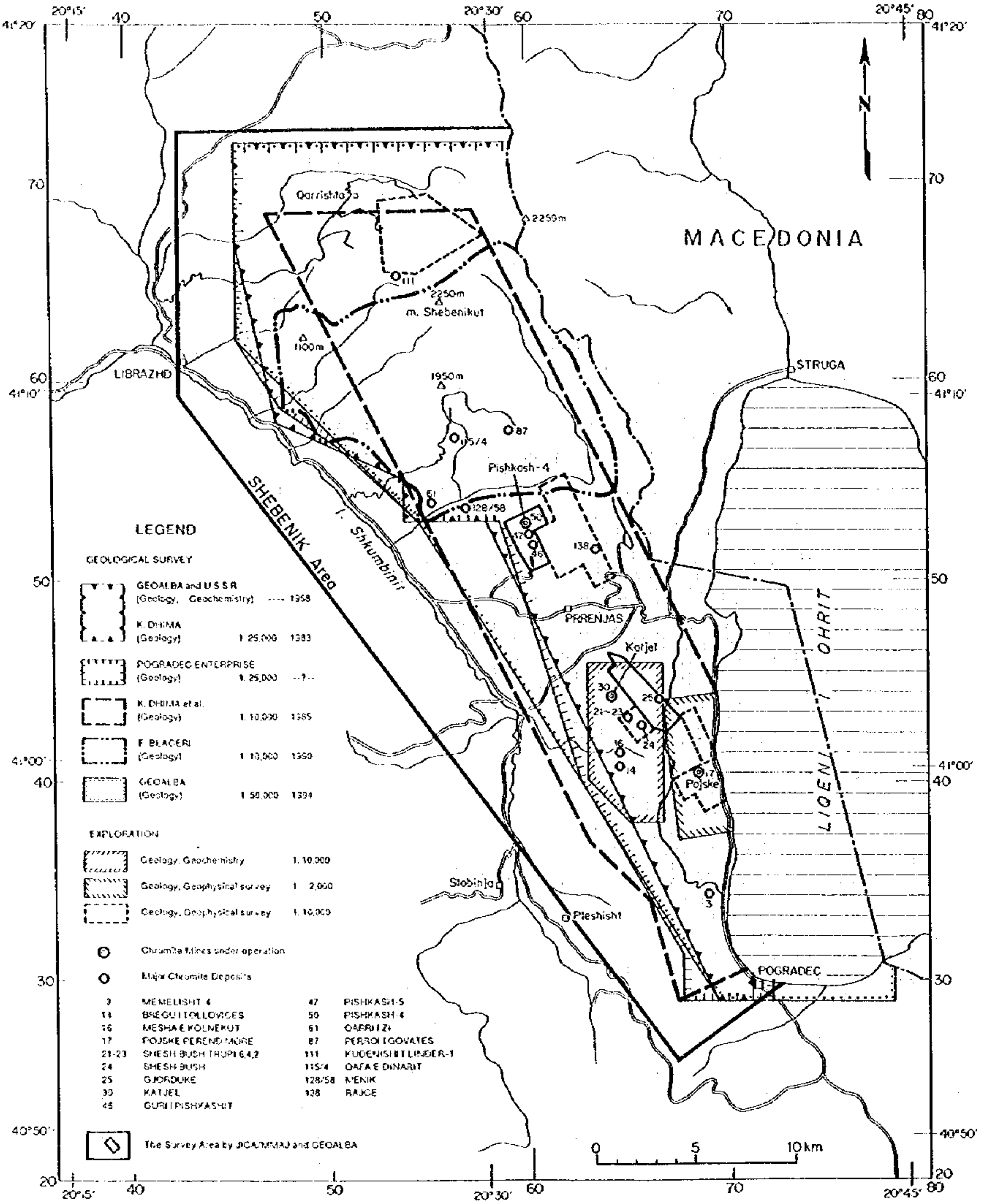


Figure 2-1-3 Major past exploration and chromium deposit in the Shebenik area

prepared sometime in 1960. As the consequence of the exploration, exploitation of lateritic nickel deposits made a remarkable advance since 1960, as well as discovery and development of new chromium ore deposits.

Thereafter, the Geological Survey of Albania and its branch offices in Librazhd and Pogradec carried out a comprehensive regional exploration, including magnetic surveys, geological and geochemical prospectings and scout drilling, followed up by detailed investigations such as trenching, tunneling and closely spaced drilling for selected targets.

(2) Chromium Ore Deposit Exploration

Numerous indications of chromium mineralization have been located in association with the Shebenik-Pogradec Ultramafic Complex. Of these, 33 indications have proved to form ore deposits with some economic significance, the chromium ore resources of which are estimated based on the result of detailed exploration. Three of ten ore deposits, which have ever produced, namely Pishkash-4, Qershori Pojske and Katjel are still in operation. The total production from the ten ore deposits is estimated at approximately 700,000 tons of chromium ores to date.

The Geological Survey of Albania summarized its findings with respect to the chromium ore deposit exploration for the Shebenik-Pogradec Ultramafic Complex in 1985 as follows;

1) the Complex, forming an anticlinorium, consists of dunite and harzburgite along anticlines where erosion has advanced to the extent to expose the lower sequence, and consists of lherzolite, pyroxinite and gabbro, the upper sequence (laterally correlated to the northern part), along synclines where erosion has less advanced.
2) the lower sequence comprises three layers, namely harzburgite, serpentinized harzburgite-dunite, and serpentinized harzburgite with dunite interlayers in ascending order, of which the latter two layers are important from the chromium ore deposit exploration point of view,
3) the area, which is attractive for the chromium ore deposit exploration, is the axial zone of the anticlinorium of the Complex, extending from Memlisht-Katjel, via Pishkash-Gobille, to Qarrishte in the NNW-SSE direction,
4) recommendations are exploratory and structural drillings in the active mines, prospecting for extensions of the known ore bodies and investigation of platinum group elements occurring in the Complex.

The exploration for chromium mineralization in the Shebenik-Pogradec Complex has continued to the present time on the basis of the above findings. In spite of the effort, however, the chromium ore production of the Republic have declined sharply since 1990 due to the adverse incidents as above-mentioned.