vicinity of the village of Kotodesh in the northern part thereof, where the variation can even be said to be extreme. The scope of extreme variation in magnetic susceptibility in that vicinity roughly matches the distribution of the short-wave anomaly cluster arranged in the east-west direction that is to be seen on the total magnetic intensity map.

Furthermore, as far as one can tell from the 92 outcrops in the two areas for which magnetic susceptibility was measured, no significant different in magnetic susceptibility is to be noted between the harzburgite and the dunite.

2-4-4 Analysis of Magnetic Survey

(1) The Pishkash Area

In this area as a whole the predominant direction in which magnetic anomalies run is north-south. However, at some places in the north and south parts of the area there are anomalies in the NW-SE direction, and a short-wave anomaly cluster is distributed in the northwest part. In that area of short-wave anomaly cluster distribution there is considerable variation in magnetic susceptibility: 1 x 10^{-3} SI to 10 x 10^{-3} SI, and it is considered that that is partly the reason for the short-wave anomaly cluster. Furthermore, in view of the results of measurement of remnant magnetization, it is surmised that the area to an extreme extent underwent block formation in terms of geological structure, with two main magnetization directions: -80° and 39°.

Since the No. 48 and No. 49 chromitite showings, the Pishkash-5 deposit and other chromitite deposits and showings are distributed within the scope in which short-wave anomalies are noted in the northwestern part of the area, it is considered that chromitite mineralization is responsible for the variation in magnetic susceptibility distribution.

In the case, as well, of the high and low magnetic anomalies that run in the north-south direction in the part of the area that includes Guri i Pishkashit, there is very great variation in magnetic susceptibility: 2 x 10^{-3} SI to 28 x 10^{-3} SI. Although chromitite deposits and showings other than the Guri i Pishkashit deposit have not been confirmed there, similarity with the pattern of distribution of magnetic susceptibility in the short-wave anomaly cluster of the northwestern part is to be noted, and there is a possibility that such magnetic anomalies are an indication of chromitite mineralization.

The magnetic anomaly at point PM-1, which is located south of Guri i Pishkashit, is one of the magnetic anomalies running in the north-south direction that are characteristic of this area. The remnant magnetization of the samples collected in the vicinity of that magnetic anomaly indicates that the rocks in that vicinity are magnetized in a direction approximately 90° off present magnetic north, and that result is in harmony with the direction in which the magnetic anomaly runs.

(2) The Kotodesh Area

This area is clearly divided into the east half, which is a high anomaly zone, and the west half, which is a low anomaly zone. In the east half are to be noted three still higher magnetic anomalies running in the NW-SE direction. However, since no significant variation in magnetic susceptibility is to be noted, it is considered that those three high anomalies reflect distribution of highly magnetized rock at a shallow level below the ground.

In the western half, the zone of low anomaly, a short-wave anomaly cluster is to be noted in the northwestern part of the area north of measuring line K15, and many chromitite showings have been confirmed in the scope of distribution of that anomaly cluster. There is also great variation in

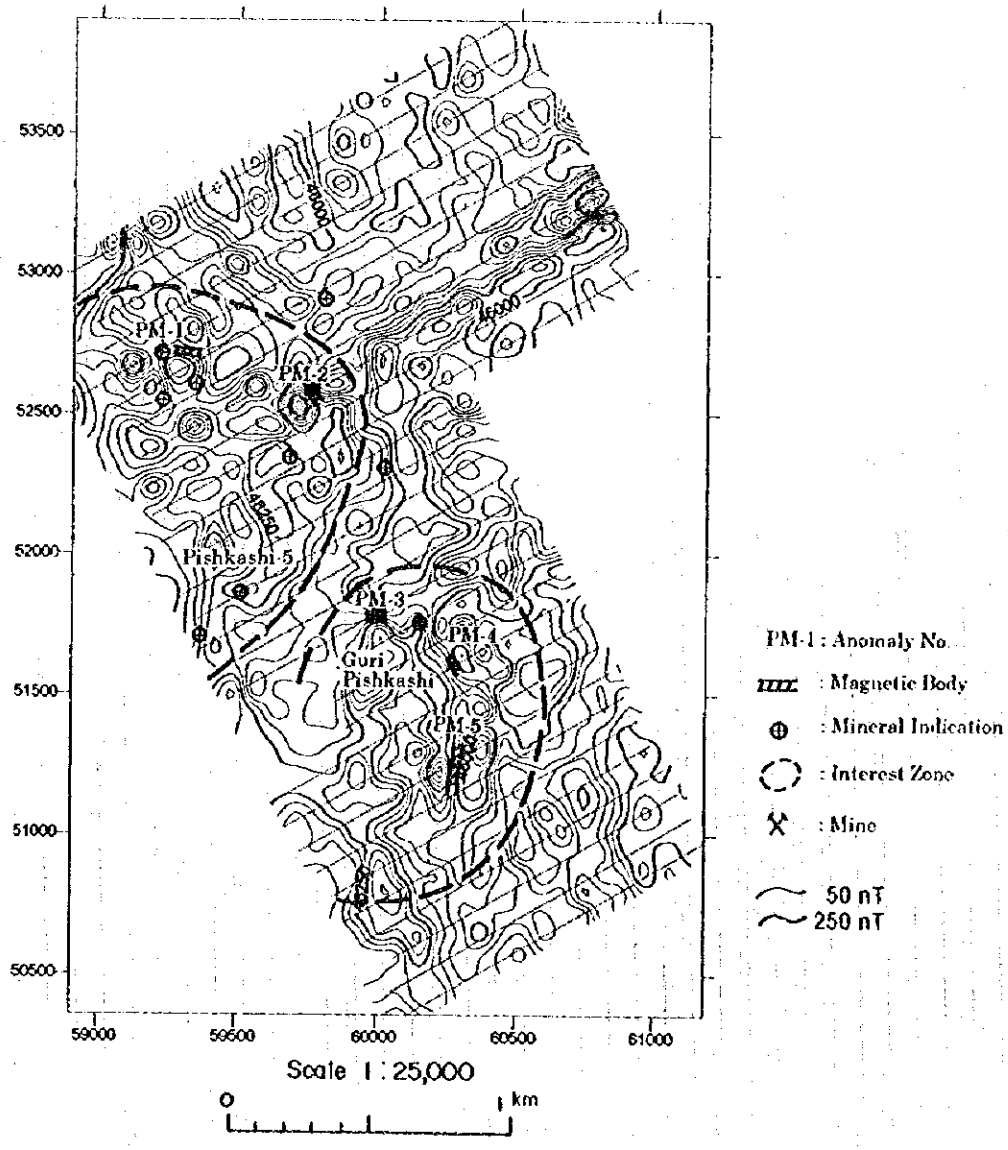


Fig. 2–4–13 Magnetic interpretation map of Pishkash area

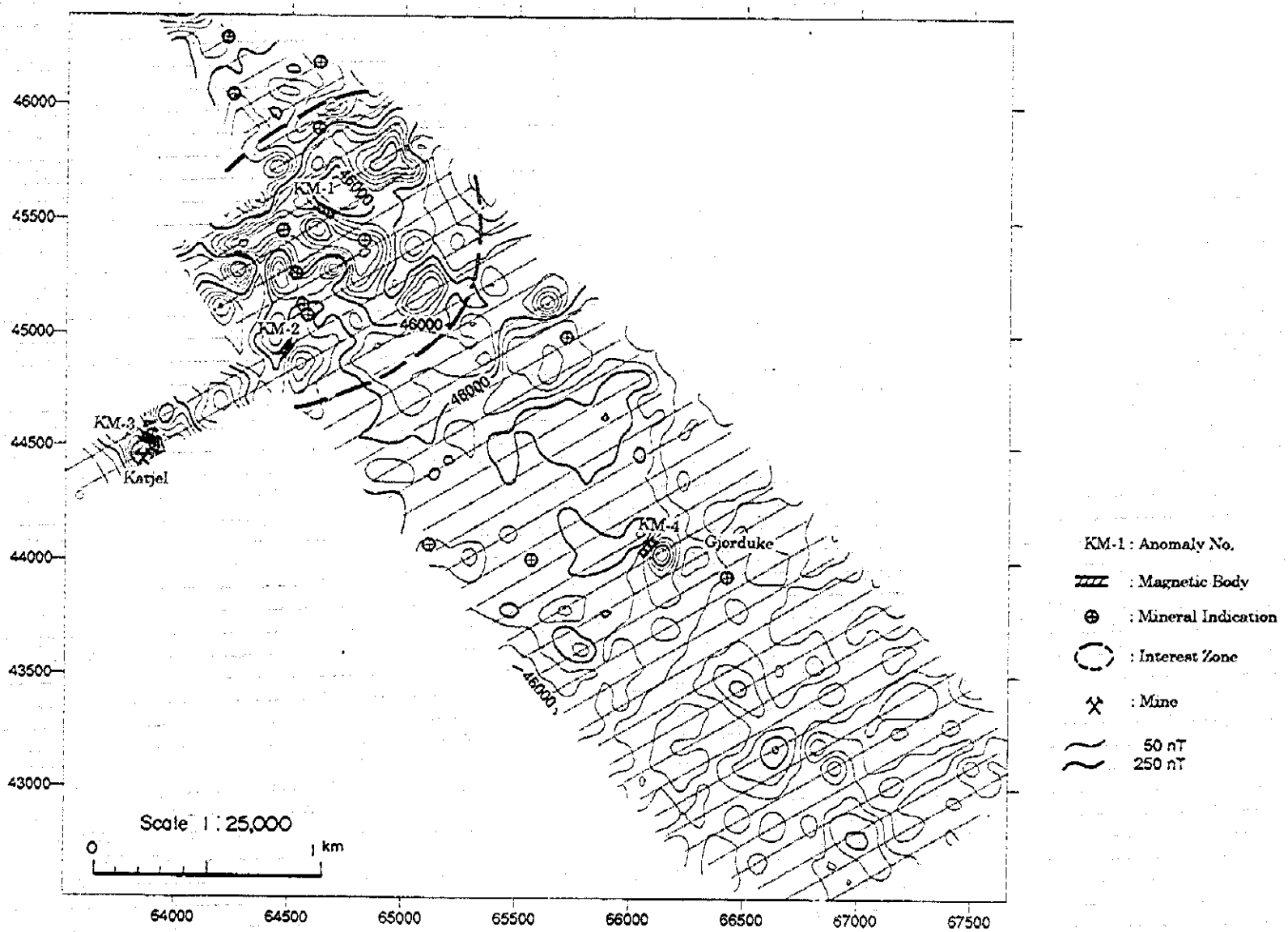


Fig. 2-4-14 Magnetic interpretation map of Kotodesh area

magnetic susceptibility in that short-wave anomaly cluster, and, as in the case of the anomaly cluster in the Pishkash area, it is considered to be very probable that that anomaly cluster, too, is related to chromitite mineralization.

Furthermore, on measuring lines K9 and K10, which run over the Katjel deposit, a clear positive high magnetic anomaly was detected directly above the deposit.

The following conclusions can be drawn from the results of the ground magnetic survey of the two areas presented above:

1. It is considered that the short-wave magnetic anomaly clusters might be related to change in magnetic susceptibility due to chromitite mineralization.
2. The fact that a clear magnetic anomaly was detected directly over the Katjel deposit indicates that ground magnetic survey is effective in exploration for chrome deposits.

Chapter 3 Comprehensive Consideration of the Survey Results

Chapter 3 Comprehensive Consideration of the Survey Results

3-1 Summary of the Survey Results

(1) Satellite Image Analysis

The project area was divided into 22 units on the basis of the results of photogeological interpretation of the Internal Albanides using LANDSAT TM images.

On the LANDSAT TM images it is easy to distinguish between the sedimentary rocks of the Mirdita zone, consisting mainly of flysch, and the massive formations such as ultrabasic rocks and carbonate rocks, but it is difficult to distinguish small rock masses from surrounding units. Although it is basically possible to distinguish between ultrabasic rocks and carbonates, but in some cases it is hard to discern the boundary between the two.

As regards geological structure, it is possible to clearly interpret the structures of the ultrabasic massifs stretching roughly in the north-south direction and the Tertiary deposit basins. However, although it is possible to tell that the boundary of the Internal Albanides, which are obduced over the Internal Albanides, is a zone with a high density of lineaments in the NNW-SSE direction, that boundary is not clearly readable.

The N 20° W to N 70° E lineaments are predominant, very few of them running in the east-west direction.

Many of the copper deposits distributed in the Mirdita zone in the northern part of the Internal Albanides are situated on, or on the extensions of, lineaments running in the north-south direction, which suggests a close relationship between fault systems and copper mineralization. However, no relationship worth mentioning is to be noted between chrome and nickeliferous laterite deposits and lineaments and other elements of geological structure.

(2) Analysis of Pre-Existing Data

For the purpose of prospecting for nickeliferous laterite and chromite deposits in the Shebenik-Pogradec ultrabasic massif in the Shebenik area regional surveys on a scale of 1:50,000 to 1:10,000 covering the entire area (geological and geophysical surveys), semi-detailed surveys of main chromite showings on a scale of 1:5,000 to 1:2,000 (geological and geophysical surveys) and detailed surveys on a scale of 1:500, including drilling, in promising zones of deposit endowment have been carried out in the past, and ore reserves have been calculated for many zones.

Ore reserves of nickeliferous laterite deposits were confirmed at approximately 260 million tons (average Ni content of 0.98%), and they were developed on a large scale starting in 1986, the Shebenik area playing a central role in Albania's nickel industry up to 1990.

As regards chrome deposits, some 300 showings were discovered, and comprehensive surveys, including drilling, were carried out with respect to 33 of them, resulting in confirmation of ore reserves amounting to approximately 1.7 million tons (average Cr_2O_3 grade of 32.2%). More than 14 deposits were exploited, including Katjel, Pojske, Pishkash-4, Guri Pishkash, Bushtrice and Menik, and the Katjel, Pojske and Pishkash-4 deposits are continuing to be worked even today.

(3) Geological Surveys

The geology of the Shebenik are can be divided into the Lower Triassic to Lower Jurassic (schists, flysch, volcano-sedimentary rocks and limestones), the Shebenik-Pogradec ultrabasic massif,

the Cretaceous (limestones), the Tertiary (Eocene, Oligocene and Neogene systems) and the Quaternary (moraine, landslide deposits and alluvial deposits).

The Lower Triassic to Lower Jurassic and the Shebenik-Pogradec ultrabasic massif were strongly affected by the geological restructuring caused by the Alpine orogeny that began in the Mesozoic and the convergence of plates that took place in the Jurassic, and as a result they are extremely deformed. The Cretaceous, or the formations deposited after transgression that occurred over a wide range, was deformed by the Alpine orogeny of the Cenozoic. The Tertiary, formations deposited by filling the intermontane lowlands formed by the Alpine orogeny of the Cenozoic, are molasse consisting mainly of conglomerate.

In terms of rock facies the Shebenik-Pogradec ultrabasic massif can be roughly divided into the lower level consisting of harzburgite accompanied by dunite, the middle level characterized by harzburgite accompanied by dunite intercalation and the upper level consisting of harzburgite frequently accompanied by gabbro and pyroxenite with accompaniment of lherzolite at some places. The rock facies of the lower level is mainly distributed throughout the Pogradec massive and in the southern part of the Shebenik massif where there is deep erosion along the Bushtrice River, the rock facies of the middle part is mainly distributed from the southeastern part to the northern part of the Shebenik massif, and the rock facies of the upper part is mainly distributed in the northwestern part of the Shebenik massif. However, it is difficult to clearly divide them, and the boundaries between them are rather arbitrary.

The 300-odd chrome showings discovered within the Shebenik-Pogradec ultrabasic massif are distributed practically throughout the Shebenik massif other than its northwestern part, and the relatively large ones tend to be distributed particularly in the western half of the two massifs. They consist of chromitite accompanied by dunite that occurs in harzburgite.

The dunite has diverse in mode of occurrence, including dike-, vein-, lenticular- and pipe-forms, and normally it relates to the harzburgite by gradual transition. The dunite most often running in the N 30° W direction, which roughly matches the structure of the harzburgite, but dike- and vein- formed dunite with directions intersecting with that are also frequently observed, and there are even complex zones in which the dunite and harzburgite occur in complicated fashion. The chromitite also has diverse forms of occurrence, including massive, banded, nodular, disseminated and schlieren. The ore bodies are for the most part under 2 m in thickness, with a envelope of dunite measuring from several centimeters to 10-odd centimeters in thickness around the chromitite. As for the scale of the chromitite ore bodies, the Katjel deposit is the largest (ore reserves of approx. 820,000 t and an average Cr_2O_3 content of 42.1%), followed by the Pojske deposit (ore reserves of approx. 443,000 t and an average Cr_2O_3 content of 35.7%). The other deposits each have ore reserves of under 100,000 tons.

(4) Laboratory Tests

(4)-1 Microscopic Observation of Rock Thin Sections and Ore Polished Thin Sections

The ultrabasic rock of the Shebenik area has generally been strongly subjected to serpentinization. But some of the samples are considered to have retained their primary information, including harzburgite that has hardly undergone any deformation, dunite in which the olivine has not been altered and chromitite in which a fresh matrix consisting mainly of olivine and including pyroxene and hornblende remains.

Almost all of the harzburgite except for that of the lherzolitic harzburgite in the northwest part of the Shebenik massif is characterized by high depletion in melt constituents. The chrome spinel is comparatively euhedral, which is considered to be due to crystallization from orthopyroxene at subsolidus. Although only very rarely, it is noteworthy that the chrome spinel crystals can in some cases contain mica, hornblende and other hydrous minerals.

The dunite consists mainly of olivine and contains euhedral chrome spinel with a high Cr#.

The chromitite contains large quantities of euhedral chrome spinel, and its content varies considerably. Most of the chrome spinel has not undergone alteration to ferrite chromite, etc., and uvarovite and the like have not been produced.

It might be added that the harzburgite of the northwestern part of the Shebenik massif is accompanied by small quantities of chalcopyrite, pentlandite, pyrrhotite and other sulfide minerals.

(4)-2 Chemical analyses of Rock and Ore

The harzburgite, dunite and chromitite have different chemical characteristics from one another, although the harzburgite and dunite have similar chemical compositions. The harzburgite tends to have somewhat more Al_2O_3, Fe_2O_3, SiO_2 and CaO and somewhat less Cr_2O_3 and MgO than dunite, their respective average Cr_2O_3 contents being 0.4% and 0.78%. Both are low in K_2O, Na_2O, MnO, P_2O_5 and TiO_2.

The chromitite has a high average Cr_2O_3 content of 40%. Its Al and Fe contents are extremely low in comparison with the harzburgite and dunite.

As for the metallic element contents of the rocks forming the Shebenik-Pogradec ultrabasic massif, the Ni and Co contents of the harzburgite and dunite are comparatively high at 0.2-0.25% and 0.01-0.02%, respectively, but their Mn content is only about 0.06-0.10%. The chromitite has a comparatively high Ni content of 0.05-0.37%, but its Mn content is extremely low.

The platinum group assays of the chromitite that occurs in the ultrabasic rock of the west zone and that that occurs in the east zone at the Bulqiza mine and in the ultrabasic rock of the Shebenik area show that the chromitite of the west zone has higher concentrations of Pt, Pd, Os and Au than that of the east zone, some samples containing 3.08 g/t of Pt and 4.34 g/t of Os.

(4)-3 EPMA Tests

From the results of research to date on the chrome spinel in ultrabasic rock, four important geochemical indices for indication of formation of large deposits of chromitite have been identified:

1) The Cr# of the chrome spinel in harzburgite is 0.4 to 0.5 in the vicinity of large-scale chrome deposits throughout the world and never higher than about 0.65.
2) The Ti content of the chrome spinel in the harzburgite and dunite is an intermediate value somewhat closer to that of the chrome spinel in the chromitite.
3) The Fe^{+3}# of the chrome spinel in the harzburgite and dunite is also an intermediate value somewhat closer to that of the chrome spinel in the chromitite.
4) Regarding the V_2O_3 content and the Cr# of the chrome spinel in the harzburgite and dunite, it can be expected that selective fusion of the orthopyroxene of the harzburgite in the melt has resulted in comparatively lower V_2O_3 and comparatively high Cr#.

Therefore it is thought to be likely that there will be comparatively large concentrations of chromitite in the vicinity of harzburgite and dunite containing chrome spinel that meets the above

four criteria regarding composition.

The Shebenik-Pogradec ultrabasic massif was divided into zones I-VI from north to south for the purpose of convenience, and the frequency of samples with values for the above indices that are favorable to concentration of Cr were sought. The results were as follows: Zone I (northeastern part of the Shebenik massif), Zone II (north to central part of the Shebenik massif) and Zone IV (south part of the Shebenik massif south of Skroske) has low frequencies of 5.0-10.3%. On the other hand, Zone III (both sides of the Bushtrice River, including Gobilla and Govates), Zone V (north half of Pogradec massif) and Zone VI (south half of Pogradec massif) have high frequencies of 25.5%, 21.4% and 18.8%, respectively. It might be added for the sake of comparison that the samples from the Bulqiza mine have an extremely high frequency of 37.5%.

Those indices are met with the highest frequencies by the samples from the Bushtrice and Menik deposits in Zone III and the Bregu i Pishes and Shulleri i Kaprit showings in Zone IV, followed by the samples from the Qarri i Zi deposit and the Mbi Shtepite e Celes showing of Zone III, the Guri Pellumbit showing of Zone V and the Qershori Pojske deposit and Cervenake and Kroi i Farkuar showings of Zone VI, in that order. It is a noteworthy fact that all of those deposits and showings are located in the western half of the Pogradec ultrabasic massif.

The conclusions drawn after considering the chrome spinel of the Shebenik area with respect to those indices are:

(1) Judging from the Cr# of the harzburgite of the project area, the probability of finding concentrations of chromitite in the project area of a scale the same as or greater than the Bulqiza mine is low.

(2) However, if there are zones in which there is wide distribution of harzburgite with the same Cr# in the vicinity of deposits and indications with values for the above-mentioned indices that are favorable to concentration of chromitite and in the vicinity of points where the Cr# of the harzburgite is below 0.6 and in which dunite also occurs in concentrated fashion, it is possible that such zones are endowed with ore bodies comparable to that of the Bulqiza mine.

(5) Magnetic Survey

(5)-1 The Pishkash Area

The trend of this area regarding magnetic anomalies is mainly anomalies with a north-south direction. But in the north part and some places in the south part the direction of the anomalies is NW-SE. The magnetic anomalies that are noted are a cluster of short-wave anomalies in the north-western part of the area and high and low magnetic anomalies extending in the north-south direction and including Guri i Pishkashit.

The cluster of short-wave anomalies in the northwest part has considerable variation in magnetic susceptibility: 1×10^{-3} SI to 10×10^{-3} SI. It is considered very probable that such variation is a reflection of chromitite mineralization, including the No. 48 and No. 49 chrome showings and the Pishkash-5 deposit.

There is even greater variation in magnetic susceptibility as regards the high and low magnetic anomalies running in the north-south direction and including Guri i Pishkashit: 2×10^{-3} SI to 28×10^{-3} SI. Although, other than the Guri i Pishkashit deposit, no showings have been confirmed there, a similarity with the cluster of short-wave anomalies in the northwest part as regards magnetic susceptibility distribution pattern is noted, and therefore it is considered to be possible that the

magnetic anomalies in question indicate chromitite mineralization. In particular, the magnetic anomaly of point PM-1 south of Guri i Pishkashit lies astride 3 measuring lines south of Guri Pishkash, and it is considered to be highly possible that it is an expression of variation in magnetic susceptibility connected with chromitite mineralization.

The results of measurement of remnant magnetization show that the rocks of the area have two main directions of magnetization, -80° and 39°, and that geological structure of the area is characterized by a high degree of block formation.

(5)-2 The Kotodesh Area

This area is divided into the high-anomaly eastern half and the low-anomaly western half.

In the eastern half of the area there are three still higher magnetic anomalies running in the NW-SE direction. But since no appreciable variation in magnetic susceptibility is noted for those three high anomalies, it is considered that they reflect highly magnetic rock bodies at a shallow level underground.

In the low-anomaly western half of the area a short-wave anomaly cluster is noted in the northwestern part north of measuring line K15, in the vicinity of which many confirmed chromitite showings are located. Since there is great variation in magnetic susceptibility in that short-wave anomaly cluster, it is very possible that that anomaly cluster, as in the case of the Pishkash area, is related to chromitite mineralization.

In addition, a clear positive magnetic anomaly was detected directly above the Katjel deposit on measuring lines K9 and K10.

The conclusions that can be drawn from the results of the magnetic prospecting in the two areas are as follows:

(1) The short-wave magnetic anomaly clusters are thought to be related to variation in magnetic susceptibility due to chromitite mineralization and can be used as a criterion for selection of areas for detailed surveys.

(2) The fact that a clear magnetic anomaly was noted directly above the Katjel deposit indicates that ground magnetic survey is an effective means of prospecting for chrome deposits.

3-2 Analysis Concerning Chromitite

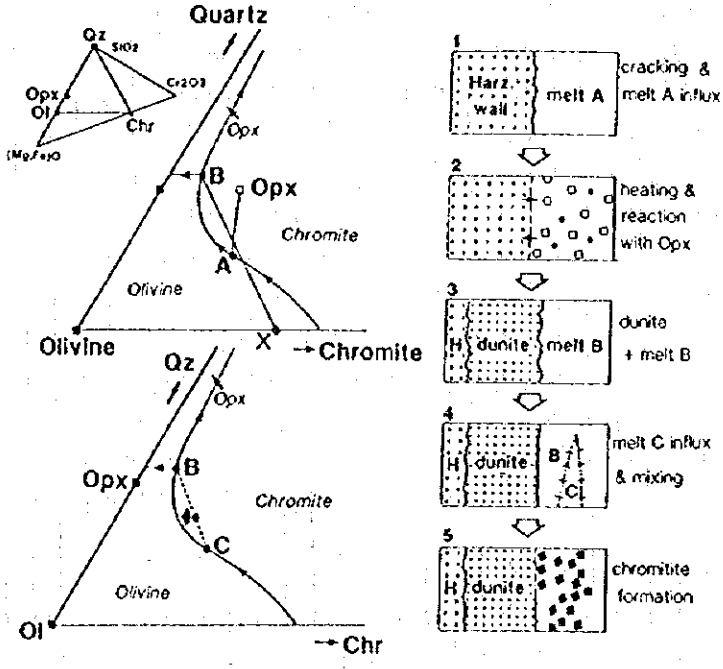
In the past there has been systematic surveying of the chromitite occurring in the Shebenik-Pogradec ultrabasic massif, and such efforts have yielded considerable fruit, including discovery of the Katjel and Pojske deposits. Basically, such fruit has been obtained by pursuing chromitite mineralization horizons from the viewpoint of structural geology on the basis of the hypothesis that chromitite concentrations resulted from sinking by gravity of chrome spinel crystallized at the time of consolidation of ultrabasic rocks from magma.

However, in particular the results of geochemical study of the spinel by EPMA in the present survey show considerable difference in Cr#, Fe^{+3}#, V_2O_3 content and TiO_2 content of the spinel depending on whether it is found in harzburgite or in dunite and chromitite. That suggests the possibility that when the spinel crystallized, the melt composition in equilibrium with it differed between harzburgite, on the one hand, and dunite and chromitite, on the other, and the possibility that the melts that produced the two were formed in different environments.

Furthermore, according to field observation, in the vicinity of occurrence of chromitite dunite frequently occurs in multiple stages in dike-to-vein form in disharmony with the structure of the

harzburgite, forming complex zones, and dunite also occurs in vein form in pyroxenite dikes intruded in the harzburgite. In both cases the relationship between the harzburgite and the dunite is one of gradual transition, that is to say, there is an eventual change to dunite from harzburgite or pyroxenite through gradual deduction of the quantity of pyroxene. That indicates that the dunite occurred in the harzburgite epigenetically.

Those survey results support the recently advanced hypothesis concerning the origin of chromitite of the Alpine podiform type (Arai et al., 1994; Arai, 1995; Zhou et al., 1994; Matsumoto, 1996; etc.). That hypothesis holds that interaction occurred between the host rock and the melt when the melt introduced in the harzburgite, causing the orthopyroxene containing Cr in the harzburgite of melt out into the melt, which changed the composition of the melt to higher SiO_2 and Cr contents and that, as indicated by Irvine (1975), subsequently supplied, more primitive melt mixed with that melt, resulting in precipitation and concentration of chromitite when the composition of mixed melt shifted to the precipitation domain of chrome spinel as shown in Fig. 3-2-1.



A magma-mixing model for the genesis of podiform chromitite. At the first stage a melt (A) of deep origin is intruded into shallow mantle harzburgite (stage 1). Melt A reacts with orthopyroxene (open squares) in the harzburgite (stages 2 and 3) to produce olivine (+ spinel) and a secondary Si-rich melt (B), which may precipitate spinel only if mixed with successively supplied relatively primitive melt (C) (stages 4 and 5). Thin straight lines in the upper left panel indicate pairs of reactants (Opx and melt A) and products (crystal mixture X—olivine + spinel—and melt B) of the interaction. The thin dotted line in the lower left panel denotes the mixing of B (secondary silica-rich melt) and C (primitive melt). Primary liquidus fields are indicated by italicized minerals. Chr = chromite, Ol = olivine, Opx = orthopyroxene, Qz = quartz. Phase diagrams modified from Irvine (1977).

Fig.3-2-1 A magma-mixing model for genesis of podiform chromitite (After Arai, 1994)

Furthermore, Arai (1995; 1996) has pointed out the observed fact that the Cr# of the chrome spinel in the harzburgite in the vicinity of large chrome deposits throughout the world has a value of 0.4-0.5 and never higher than about 0.65 and that at the same time the Cr content of the orthopyroxene in the harzburgite is higher, the higher the degree of depletion of the rock, there being

a negative correlation between it and the Cr# value of the coexisting chrome spinel. From those latest hypothesis and observed facts it follows that melts for which there was wider interaction between the rock and the melt were capable of resulting in greater precipitation of Cr and that places with a deep structure capable of producing melt in a continuing fashion had better conditions for precipitation of chromitite. Furthermore, at the time of interaction between the host rock and the melt, components that more readily melted out into the melt, such as TiO_2, were added to the melt, and, on the contrary, there were low values in the melt of V_2O_5 and other components that did not readily melt out into the melt, and from that it follows that such change in the composition of the melt is reflected in the composition of the chrome spinel that crystallized from it and that the range of occurrence of such interaction between the rock and the melt can be identified by the harzburgite containing chrome spinel with intermediate values of Fe^{+3}# and TiO_2 content. For those reasons Cr#, Fe^{+3}# and the TiO_2 and V_2O_5 contents are considered to be important indices in evaluation of results of analysis by EPMA.

However, at the same time one must not overlook Albania's experience and achievements in prospecting and development of chromitite deposits: the Kalimash, Kam Tropoja, Bulqiza, Ternove, Bater, Klos, Vlahne, Katjel, Pojske and many other large chromitite deposits were discovered and developed through Albania's own prospecting efforts in the ultrabasic massif belonging to the east zone of the Mirdita zone, with the result that in the latter half of the eighties Albania ranked third in the world in chromitite production. Those very fruitful prospecting and development efforts being focused on the harzburgite intercalated with dunite and the harzburgite accompanied by dunite below it that are situated in the lower level of Albania's ultrabasic massifs with cumulate rock facies (accompanied by gabbro, pyroxenite, lherzolite, etc.) and particularly on the upper part of that latter harzburgite. From the standpoint of the above-mentioned latest theory about the origin of chromitite of the podiform type, that fact can be interpreted as meaning that the horizon prospected thus far represent comparatively large dunite bodies in harzburgite with comparatively favorable Cr# values, and in fact the samples taken from the Bulqiza deposit have an extremely high frequency of indication of Cr#, Fe^{+3}# and TiO_2 and V_2O_5 contents favorable to large concentrations of chromitite. That fact, in turn, suggests the possibility that the Cr content of the orthopyroxene contained in the harzburgite of the ultrabasic massifs of the east zone of the Mirdita zone is heterogeneous as a result of restriction due to horizon of the ultrabasic rock, in other words, the possibility that harzburgite rich in Cr exists at particular places (positions in the order of strata) in the upper mantle. Furthermore, the fact that the ultrabasic massifs of the east zone have a more depleted chemical composition than the west zone is considered to be an important element in making it possible for their harzburgite to be rich in Cr.

It should be noted that many questions still remain to be resolved, such as where the above-mentioned interaction between rock and melt took place (in the upper mantle below the spreading ridge or in the upper mantle in an island arc environment), whether there are heterogeneity of distribution of Cr in the upper mantle and the connection between such heterogeneity and places of concentration of chromitite. Fortunately, many surveys from the viewpoint of structural geology have been carried out with respect to the Shebenik-Pogradec ultrabasic massif, and some of the samples taken in this project are considered to have retained the primary information that they contained at the time of crystallization of the chromitite. Moreover, it is very possible that samples suitable for resolving such questions will be obtained in the subsequent stages of the project.

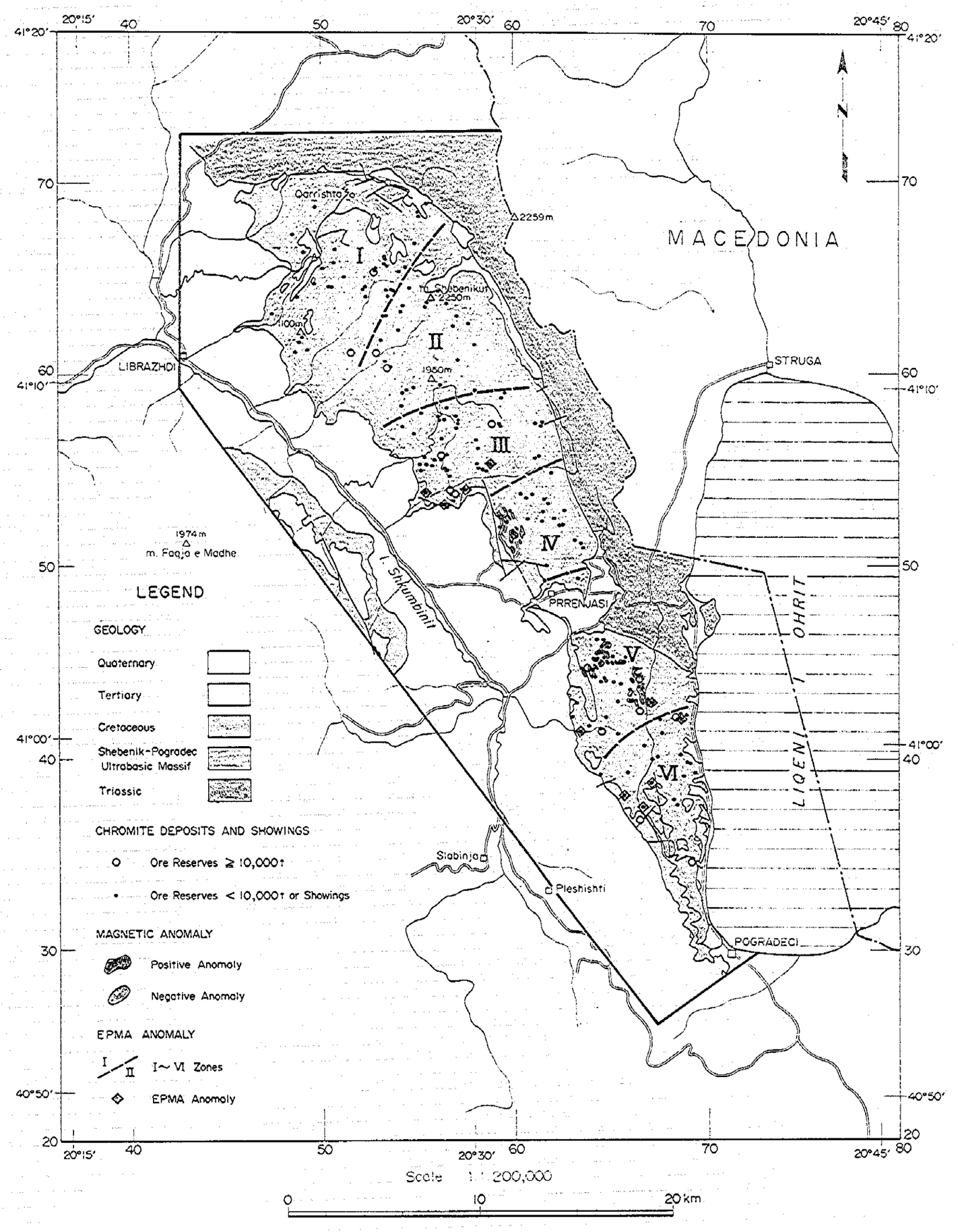


Fig. 4-1-1 Integrated interpretation map by exploratory works in 1995 fiscal year

Chapter 4 Conclusion and Recommendation

Chapter 4 Conclusion and Recommendation

4-1 Conclusion

From the above survey results and comprehensive analysis it would appear that the Shebenik-Pogradec ultrabasic massif is endowed with many podiform type chromitite deposits and showings that are thought to have accompanied the pyrogenic activity that produced dunite. Considering the Cr# of the chrome spinel of the harzburgite host of chromitite accompanying the dunite and other factors, the probability of discovering new large chrome deposits, although not as large as some in the Bulqiza ultrabasic massif and elsewhere, can be said to be fairly high.

Almost all of the comparatively large chrome deposits discovered so far are located in the western half of the Shebenik-Pogradec ultrabasic massif, more precisely in the south part of the Shebenik massif and in the Pogradec massif, and in the geochemical study of the chrome spinel in this project as well indices favorable to concentration of chromitite have been obtained over about the same geographical scope. Furthermore, from Albania's rich past experience in exploration and exploitation of chromitite it is considered that zones with distribution of rock species of the relatively lower level of the Shebenik-Pogradec massif, from the harzburgite strata accompanied by dunite intercalation to the harzburgite strata accompanied by dunite below them, have conditions favorable to the existence of chromitite concentrations.

From those viewpoints the southern part of the Shebenik massif, starting from south of the tributary basins on the north side of the Bushtrice River, and the entire Pogradec massif, particularly the western half of both, come into the spotlight as promising areas for further prospecting.

However, regarding the Pogradec massif, rock species of the lower level of the ultrabasic massif are widely distributed in it, and many systematic prospecting campaigns, ranging from regional surveys to exploration involving drilling and galleries, have been carried out in the past. Therefore it is considered that for the most part the stage of discovery of new deposits by surface surveys has already been passed. On the other hand, in the southern part of the Shebenik massif from north of Prenjas to the tributary basins on the north side of the Bushtrice River adequate prospecting has been carried out only along both sides of the Bushtrice River because of terrain restrictions, and therefore there is still room left there for exploration by surface surveys, including geophysical prospecting. Furthermore, since favorable indices were not obtained by EPMA in the northern and central parts of the Shebenik massif, it is assumed that the strata favorable to concentration of chromitite lie at a considerable depth below the ground, and besides that, the terrain conditions there are extremely unfavorable to transportation of the heavy equipment that would be needed in order to carry out prospecting to great depths.

From the above circumstances our conclusion is that future prospecting in the project area should be limited to the southern half of the Shebenik massif and to the Pogradec massif. Furthermore, in the future prospecting it is important that besides geological surveys, there be adequate inclusion of magnetic prospecting, which have proven itself to be effective, and drilling surveys for the purpose of confirming the state of chromitite endowment below the surface of the ground as well as adequate inclusion of geochemical studies of the rock by EPMA and chemical analyses for the sake of making the present project more fruitful.

4-2 Recommendation

In continuing the surveys in the southern half of the Shebenik massif and in the Pogradec massif it is important to fully consider the circumstances of exploration carried out in the project area in the past, particularly what they involved and what results were obtained and whether or not there is still room for more exploration or for improvement of exploration technology. In other words, it is desirable that drilling be done only on the basis of judgment as to whether or not there is still room for further exploration in zones where drilling has already been carried out, that the survey work consist mainly of drilling in zones where surface surveys and geophysical exploration have already been carried out and that semi-detailed geological and magnetic surveys be carried out in zones where geophysical exploration has not yet been done and even geological surveys have not yet been carried out in sufficient detail.

Considering the above, the following survey methods are proposed for the different parts of the project area:

1) Semi-detailed Geological Surveys and Geophysical (Magnetic) Survey

a) Southern Half of the Shebenik Area Starting From South of the Tributary Basins on the North Side of the Bushtrice River

- Scope: Geological surveys: approx. 22 km^2, Magnetic surveys: approx. 12 km^2
- Reasons for selection: This area corresponds to the northern extension of the zone extending from the western part of the Pogradec massif through Pishkash and on to Bushtrice in which many chromitite showings are distributed. Furthermore, many favorable indices have been obtained for those showings by EPMA as regards topology and geological situation. However, terrain restriction have prevent adequate exploration up to now.
- Restricting conditions: The access road is in very bad condition, and it will therefore be necessary to pitch a camp in the mountains.

b) Western Side of Southern Part of the Pogradec Massif

- Scope: Geological surveys: approx. 10 km^2, Magnetic surveys: approx. 5 km^2
- Reasons for selection: There are many showings along the western edge of the Shebenik massif, and favorable indices were obtained by EPMA from 3 samples from a compact zone. However, the zone has not yet been sufficiently explored for chromitite, one reason being that the ultrabasic massif is covered by nickeliferous laterite strata.
- Restrictive conditions: Since the access road is fairly good, the surveys can be carried out using Pogradec as a base. However, nickeliferous laterite strata and Cretaceous rocks are distributed nearby.

2) Drilling Surveys

There is still considerable room for drilling surveys in this area. It has already undergone surveys as a promising zone, including use of trenches, shallow galleries and drilling, but there are showings where there is still room for exploration as well as many deposits and showings whose shallow parts have been exploited but for which lower prospecting has not been carried out, making it impossible to evaluate their potential, and showings and other places where anomalies have been noted nearby in magnetic prospecting.

It is therefore considered to be necessary to continue exploration by drilling, the most important places in that respect being as follows:

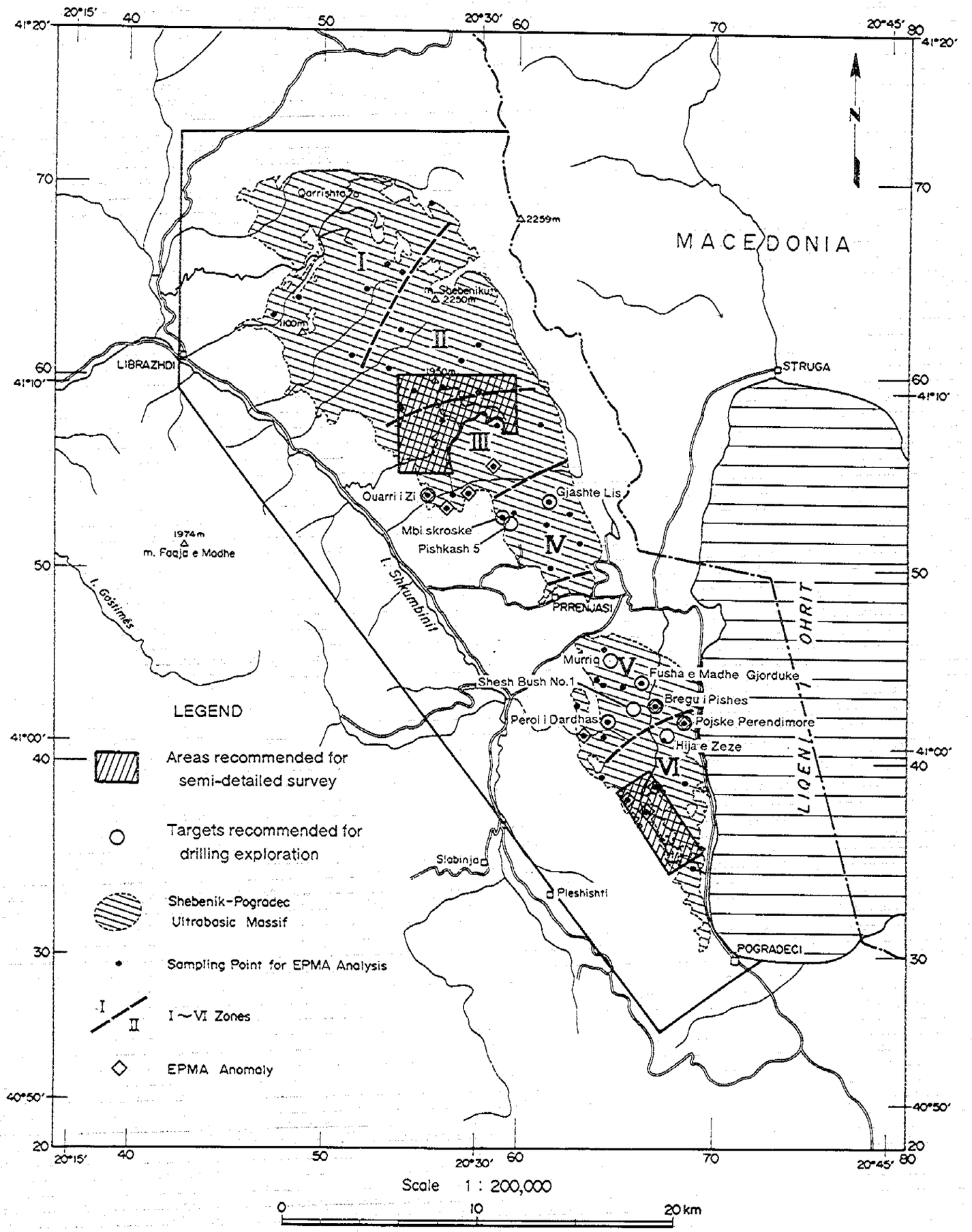


Fig. 4–2–1 Location of the recommended targets

a) Chromitite showings that have been surveyed but for which there is still room for prospecting: Bregu i Pishes, Fushe e Madhe, Shesh Bush No. 1, Pojske Perendimor, Perroi Dardhas, Hija e Zeze, etc.

b) Deposits which have been exploited to a shallow depth but for which prospecting farther down has not yet been undertaken: Qarri i Zi and others.

c) Zones whose potential cannot be evaluated because deep prospecting has not been carried out: Gjashte Lis in the vicinity of Rajce and many other showings.

d) Showings for which anomalies have been noted in magnetic prospecting: Mbi Skroske, Pishkash-5, Guri Pishkash, Murriq, etc.

Of them, favorable indices have been obtained by EPMA for Qarri i Zi and Bregu i Pishes. It might be added that the Bregu i Pishes, Fushe e Madhe, Shesh Bush No. 1, Pojske Perendimor Hija and Zeze showings are all located within a zone about 2 km wide and 3 km long.

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Appendices

Apx. 1 List of data collected during the survey

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
HARTA SRUKOCHR SHEBENIK TRUKTURORE. PJESA JUGORE	1 : 10000	1990	F. BALCERI
HARTA STRUKTURORE MASNI SHEBENIK PJESA JUGORE	1 : 1000	1990	F. BLACERI
HARTA GJEOLOGJIKE OBJEKTI MEMLIJHT 4	1 : 2000	1980	S. PLAKU
HARTA KJNIPLEKSE GJEOLOGO-GJEOFIZIKE NIE PUNINIE SHFAQIA"KASOLLET E HONIEZHIT"	1 : 500	1990	DH. KONOMI. A. KOSPIRI
HARTA GJEOLOGO-GJEOFIZIKE(KONIPLEXE) "KOSHARISHTE 1(11)"	1 : 500	1990	DH. KONOMI. A. KOSPIRI
HARTA KONIPLEKSE GJEOLOGO-GJEJFIZIKE NIE PUNIME "KOSHARISHTA 3"	1 : 500	1990	DH. KONOMI. A. KOSPIRI
PLANIMETRIA E PUNIMEVE SHFAQTA E KROMIT NR. 11 KOSHARISME	1 : 500		
HARTA GJEOLOGO-STRUKTURORE OBJEKTI KROMIT KUDNISHT LINDOR 1	1 : 1000	1994	D. GEGA
HARTA GJEOLOGJIKE "KUNJI OZUNIT"	1 : 2000		F. BLACERI
HARTA GJEOLOGO-STRUKTURORE RAJONI "LUQINJE"	1 : 2000	1993	DH. KONOMI. A. MALAEKL. V. DIJH
HARTA E GRAFIKEVE TE ANJNALIVE TE FORCES SE GRAVITACIONIT ME KORIGJIM BUGE"LUQINJE"	1 : 2000	1991	J. DIJNNICA
SHFAQET E MINERALIZUARA 37. 38 VENDBURIMI KROMIT Luquinje	1 : 1000		
MENIK III/2 – III/2	1 : 200		
MENIK	1 : 500		
MENIK	1 : 500		
HARTA GJEOLOGJIKE E ZONES PISHKASH SHFAQIETE MINERALIZ. 46. 47. 48. 49. 50	1 : 2000	1980	L. LPPOLLARI
VERTICAL PROJECTION OF THE "PISHKASH-4" DEPOSIT	1 : 500		
GURI PISHKASHIT PROFILI II – II	1 : 200		
GURI PISHKASHIT PROFILI III – III	1 : 200		
V. R. KROMIT GVRI PISHKASHIT PROFILI IV – IV	1 : 200		

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
MINISTRIA E MBROJTJES POPULLORE MINIERA E KROMIT PRRENJAS SEKTORI GURI PISHKASHT Degezimi veri-jug M980	1 : 200	1988	
MINIERA E PERRENJAS VENDBURIMI Guri PishKash PLANIMETRIA E NENKATIT I H-940-VERI	1 : 200	1989	
MINIERA E PERRENJAS VENDBURIMI "Guri PishKash"	1 : 200		
MINIERA E PERRENJAS VENDBURIMI "Guri PishKash"	1 : 500		
"GURI I PISHKASHIT" OBJECT P. 1-C	1 : 500		
PARAQITJA NE HAPSIRE VENDBURIMIT TE KROMIT PISHKASHI NR. 4	1 : 1000		
"GURI I PISHKASHIT" OBJECT	1 : 200		
PROJEKSIONI VERTIKAL I VENDBURIMIT TE KROMIT GURI I PISHKASHIT AZ. 330	1 : 500		
PROJEKSIONI VERTIKAL	1 : 2000	1986	A. KAJACKA
PROJEKSIONI VERTIKALI VENDBIMEVE "GURI I PISHKASHIT. BISHKASHI NRS DHE PISHKASHI NR. 4	1 : 2000		
HARTA GJEOLOGJIKE. VB. KROMIT POJSKE	1 : 2000	1993	S. HOXHA:P. LLAKMANI
PRERJA TERTHORE XIX-XIX	1 : 1000	1993	S. HOXHA:P. LLAKMANI
PROJEKSIONI VERTIKAL TRUPI LINDOR	1 : 1000	1993	S. HOXHA:P. LLAKMANI
HARTA GJEOLOGO-GJEOFIZIKE RAJONI "POJSKE"	1 : 10000	1990	E. ZHUKRI. A. NAZREKU. A. LULO
HARTA GJEOLOGJIKE DHE E MINERALEVE TE DOBISHNIE RAJONI "POJSKE"	1 : 10000	1990	E. ZHUKRI. A. NAZREKU. DH KONOMI
HARTA GJEOLOGO-STRUKTURORE RAJONI "POJSKE"	1 : 10000	1990	E. ZHUKRI. A. NAZREKU. DH KONOMI
HARTA GJEOLOGO-STRUKTURORE VENDBURIMI "IQERSHORI" JEKTORI POJSKE	1 : 2000	1989	E. ZHUKRI. A. NAZREKU. DH KONOMI
HARTA E POLARIZUSHMIERISE ZONA "POJSKE"	1 : 2000	1990	N. KASTRATI. A. LULO
HARTA E INTESITETIT TE PLOTE TE FUSHES GJEOMIAGNETIKE RAJONI "POJSKE" (FL. 2)	1 : 2000	1990	P. KOSHO. A. LULO
HARTA E KOMPONENTIT TE PLOTE TE FUSHES GJEOMAGNETIKE RAJONI "POJSKE"	1 : 10000	1990	A. LULO

Apx. 1 List of data collected during the survey

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
HARTA E INTESITETIT TE PLOTE TE FUSHES GJEONIAGNETIKE ZONA "POJSKE" (FL.1)	1 : 2000	1990	P. KOSHO, A. LULO
HARTA E MATERIALIT FAKTIK RAJONI "POJSKE"	1 : 10000	1988-1989	E. ZHUKRI, H. MAZRELO
HARTA E MATERIALIT FAKTIK RAJONI "POJSKE"	1 : 2000	1958-1989	E. ZHUKRI, H. MAZRELO
HARTA GJEOLOGJIKE ESEKTORIT "POSHTE GOVATE"	1 : 2000	1987	L. ZYQOLLARI; F. BLACERI
HARTA GJEOLOGO-STRUKTURORE POSHTE GOVATES	1 : 2000		F. BLACERI
"WESTERN POJSKA OBJECT" H. 1234	1 : 500		
HORIZONTAL PROJECTION OF THE "WESTERN POJSKA" OBJECT H.1234 AND 1264	1 : 500		
VERTICAL PRJECTION OF THE OBJECT "WESTERN POJSKA"	1 : 200		
WESTERN POJSKA P.4	1 : 200		
"WESTERN POJSKA" OBJECT H956	1 : 500		
WESTERN POJSKA H 956.911	1 : 500		
THE VERTICAL PROJECTION OF "EASTERN POJESKA" DEPOSIT (IQERSHORI)	1 : 500		
"EASTERN POJSKA" (IQERSHORI) DEPOSIT P14	1 : 200		
"EASTERN POJSKA" (IQERSHORI) DEPOSIT P15	1 : 200		
"EASTERN POJSKA" (IQERSHORI) DEPOSIT P16	1 : 200		
"EASTERN POJSKA" (IQERSHORI) DEPOSIT P17	1 : 200		
"EASTERN POJSKA" (IQERSHORI) DEPOSIT P18	1 : 200		
"EASTERN POJSKA" DEPOSIT H800	1 : 200		
"EASTERN POJSKA" DEPOSIT H745	1 : 200		
"EASTERN POJSKA" DEPOSIT H770A	1 : 200		

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
"EASTERN POJSKA" DEPOSIT H770B	1 : 200		
HORIZONTAL PROJECTION OF THE "EASTERN POJSKA" (IQERSHORI) DEPOSIT	1 : 500		
HARTA GJEOLOGJIKE MBI PRENJAS	1 : 2000	1989	A. KAJACKA
HARTA GJEOLOGO-STRUKTURORE RAJONI PRENJAS-RAJCE	1 : 2000	1990	F. BLACERI
HARTA GJEOLOGJIKE MBI PRRENJAS	1 : 2000		
PRERJA TERTMORE 1.2.3.4/S. VENDBURIMI PISHCOCH MBI PRRENJAS	1 : 500	1990	A. TAJACTA
REPUBLIKA POPULLORE SOCIALISTE E PERISE SURA E MBROJTJES POPULLORE KROMIT PRRENJAS	1 : 1000	1990	S. HIDA
REPUBLIKA POPULLORE SOCESHQIP MINISTRIAE MBROJTJES POPCILLORE MINIERA E KROMIT PERRENJAS	1 : 200		S. HIDA
VENUBURIMI PRRE MOAJ H-592	1 : 200		S. HIDA
PROJEKSIONI VENTILUET SFEYJE E KROMIT PRRENJAS	1 : 500		
REPUBLIKA POPULLORE SOC SHQIPERISE MINISTRIA MBROJTJES POPULLORE MINIERA KROMIT PRRENJAS VENDBURIM PRRENJAS M592	1 : 200	1990	S. HIDA
HARTA KOMPLEKSE GJEOLOGO-GJEOFIZIKE NIE PUNIME "PROI THELLE" 1 DN82	1 : 500	1990	DH. KONOMI, A. KOSPIRI
HARTA GJEOLOGJIKE E VB. PROI GOVATES	1 : 1000	1976	S. PLAKU
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT "PROI I COVATES"	1 : 1000		
HARTA GJEOLOGO-STRUKTURORE RAJONI QAFA E DINARIT(AHUIVETEU-GOBILL)	1 : 2000	1986	F. BLACERI
HARTA GJEOLOGO-STRUKURORE RAJONI "QARRI IZI, OLUNE, MNIK	1 : 2000	1986	F. BLACERI, E. ZYQOLLARI
HARTA E GRAFIKEVE TE FORCES SEGRAVITACIONIT ME KORIGJIM OBJECT "RAJCE"	1 : 2000	1990	V. DISHNICA
HARTA E GRAFIREVE TE FORCES SE GRAVITACIONIT ME KORIGJIM BUGE OBJEKTI "RAJCE"	1 : 2000	1990	V. DISHNICA
HARTA GJEOLOGJIKE E MASIVIT ULTRABAZIK SHEBENIK-POGRADEC	1 : 25000	1983	K. DHIMA
HARTA GJEOLOGJIKE E MASIVIT ULTRABAZIK SHEBENIK-POGRADEC	1 : 10000	1985	K. DHIMA

Apx. 1 List of data collected during the survey

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
SHFAQJET E MINERALIZZIARA DHE VENDBURIMET KROMIT NE MASIVIN SMEBENIK-POGRADEC	1 : 200000		
HARTA GJEOLOGO-STRUKTURORE	1 : 10000	1989	F. MUSTAFA; F. MYOERIZI
PRERJET TERTHORE VII – VII : VI – VI	1 : 10000		F. BLACERI etc.
HARTA GJEOLOGO-FACIALE E PJESE QENPRORE TE MASIVIT TE SHEBENIKUT(VERIORE)	1 : 10000	1990	F. BLACERI
HARTA GJEOLOGO-FACIALE E PJESES JUGORE TE MASIVIT TE SREBENIKUT	1 : 10000	1990	F. BLACERI
HARTA E PERMAPIESSE FUSHAVE DHE SHESHEVE PERSPEKTIVE	1 : 25000		F. BLACERI
HARTA GJEOLOGIKE SHESH-BUSH	1 : 2000	1993	B. KADILLI
PROJEKSIONI VERTIKAL I TRUPIT NR. 1	1 : 500	1993	B. KADILLI
PLANIMETRIA E PUNIMEVE TRUPI NR. 1	1 : 500	1993	B. KADILLI
PLERJA TERTHORE 3-3; 5-5 TRUPI NR. 1	1 : 500	1993	B. KADILLI
HARTA GJEOLOGIKE-GJEOFIZIKE RAJONI SHESH-BUSH	1 : 2000	1977	K. DHIMA; A. BRACE
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT SHESH-BUSH TRUPI NR-1 SHF. 24	1 : 500		
PROJEKSONI VERTIKAL OBJEKTI I KROMIT SHESH-BUSH TRUPI NR-1	1 : 500		
PLANIMETRIA E PUNIMENE OBJECTI I KROMIT SHESH-BUSH. TRUPI NR. 4. 5. 6	1 : 500		
HARTA GJEOLOGIKE SKEMATIKE E SHFAQIEVE KROMITIKE TOLLOVICE	1 : 2000	1977	S. PLAKU
PLANIMETRIA E PUNIMEVE OBJECTI I KROMIT MAJHA E KOLNEKUT TOLLOVICE SHF. 16	1 : 500		
PLANIMETPIA E PUNIMEVE OBJECTI I KROMIT BREGU I TOLLOVICES SHFAQJA NR-14	1 : 500		
HARTA GJEOLOGO-STRUKTURORE OBJEKTI GJORDUKE	1 : 2000	1994	A. KAJACKA
OBJECTI KROMIT "POSHTE GJORDUKES" SHFAQJA NR. 213	1 : 500		
HARTA GJEOLOGO-STRUKTURALE RAJONI BUZGARE-LUGU I BUKUR	1 : 2000	1986	F. BLACERI

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
HARTA GSEOLOGJIKE	1 : 1000	1995	S. HOXHA; B. KADILLI
PROJEKSIONI VERTIKAL	1 : 500	1995	S. HOXHA; B. KADILLI
PRERJET TERTHORE V – V ; VI – VI ; VII – VII	1 : 500	1995	B. KADILLI
PROJEKSIONI VERTIKAL OBJECTI I KROMIT "BREGU I PISHES"	1 : 500		
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT "BREGU I PISHES"	1 : 500		
V. B. BUSHTRICE	1 : 500		
V. B. BUSHTRICE	1 : 500		
V. B. BUSHTRICE	1 : 500		
V. B. BUSHTRICE	1 : 500		
V. B. BUSHTRICE HORIZONBI 420	1 : 200		
V. B. BUSHTRICE 3-3	1 : 500		
V. B. BUSHTRICE	1 : 500		
PLANIMETRIA E PUNIMEVE VENDBURIMI KROMIT BUSHTRICE	1 : 500	1990	
PLANIMETRIA E PUNIMEVE	1 : 500	1988	S. PLAKU; S. HOXHA
PROJEKSIONI HORIZONTAL	1 : 500	1990	A. LURAKU
PROJECSIONI VERTIKAL TRUPI NR. 1	1 : 500	1988	S. PLAKU; S. HOXHA
PROJECSIONI VERTIKAL TRUPI NR. 2	1 : 500	1988	S. PLAKU; S. HOXHA
PLANIMETRIA E PUNIMEVE OBJECTI I KROMIT MASHA CERVENAKE SHFAQJA NR. 4	1 : 500		
REPUBLIKA E SHQIPERISE MINISTIA E BURIMEVE MIN MINERAB KROMIT DRRENJAS P PROGRAMI VITIT 1993 PRERJET TERTHORE OBJEKTI KROMIT FUND-FUSHE	1 : 500	1992	S. HIDA
OBJEKTI KROMIT FUND-FUSHE HOTOLISHT PRERJA TERTHORE 1-1	1 : 500	1992	S. HIDA

Apx. 1 List of data collected during the survey

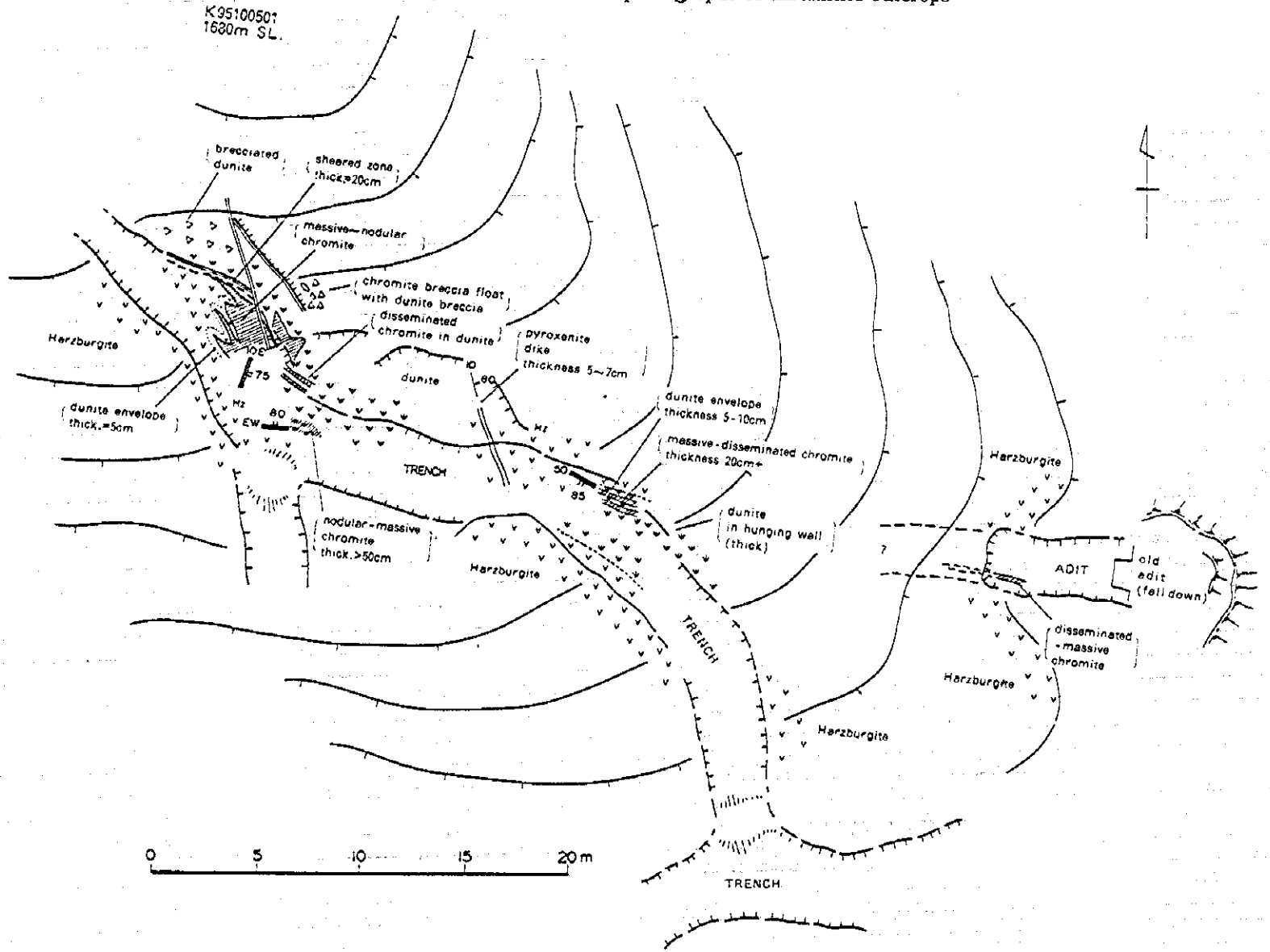
EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
REPUBLIKA E SHQIPERISE MINISTRIA E BURIMEVE MIN MINERA E KROMIT PRERJAS HARTA GJEOLOGJIKE E BJEKTIT FUND-PUSHE	1 : 2000	1992	S. HIDA
VERTICAL PROJECTION OF THE GJORDUKE-PUSHA E MADHE OBJECTS	1 : 500		
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT PUSHA E MADHE GJORDUKE SHP. 25	1 : 500		
HARTA GJEOLOGO-STRUKTURORE MEMLISHT-GURI SHPUAR	1 : 2000	1990	L. ZYQOLLARI
PLANIMETRIA E PUNIMEVE SHFAQJA E KROMIT NR 611 GURI I SHPUAR	1 : 500		
HARTA GJEOLOGJIKE	1 : 2000	1993	A. HAMZALLARI
PLANIMETRIA E PUNIMEVE	1 : 500	1993	A. HAMZALLARI; A. KAJACKA
PROJEKTIONI VERTIKAL I TRUPIT	1 : 500	1993	A. HAMZALLARI; A. KAJACKA
PLANIMERIA E PUNIMEVE OBJEKTI I KROMIT "GRADISHTE" SHFAQJA NR-5	1 : 500		
PROJEKSIONI VERTIKAL OBJEKTI I KROMIT "GRADISHTE"	1 : 500		
HARTA SKEMATIKE GJEOLOGJIKE	1 : 2000	1994	A. HAMZALLARI
PLANIMETRIA E PUNIMEVE	1 : 500	1994	A. HAMZALLARI
PROJEKSIONI VERTIKAL PRERJA 1-1	1 : 500	1994	A. HAMZALLARI
HARTA KOMPLEKSE GJEOLOGO-GJEOFIZIKE RAJONI "JUGU POJSKES" (1)	1 : 2000	1989	DH. KONOMI. A. KOSDIRI
HARTA KOMPLEKSE GJEOLOGO-GJEOFIZIKE RAJONI "JUGU POJSKES" (2)	1 : 2000	1989	DH. KONOMI. A. KOSPIRI V. DISHN
HARTA E GRAFIKEVE TE INTESITETIT TE PLONE TE PUSHES GJEOMIAGNETIKE "JUGU POJSKES"	1 : 2000	1989	A. KOSPIRI
HARTA E GRAFIKEVE TE "Nd" "JUGU I POJSKES" (2)	1 : 2000	1989	A. KOSPIRI
HARTA E GRAFIKEVE TE "Nd" "JUGU I POJSKES" (1)	1 : 2000	1989	A. KOSPIRI
HARTA E GRAFIKEVE TE ANOMALIVE TE FORCES TEGRAVITACIONIT ME KORICJINI BUGE "JUGU POJSKES"	1 : 2000	1990	A. KOSPIRI
HARTA GJEOLOGO-STRUKTURORE OBJEKTI KALISHTE	1 : 2000	1991	L. ZYQOLLARI

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
PLANIMETRA E PUNIMEVE SHFQJA E KROMIT NR-8 KALISHT	1 : 500		
PLANIMETRIA E PUNIMEVE SHFAQJAE KROMIT NR. F. 7. 11 KALISHT	1 : 500		
PRERJA TERTHORE 14 KATJEL	1 : 1000	1986	A. HAMZALLARI
PRERJET TERTHORE V – V ; IV – IV ; II – II	1 : 10000		F. BLACERI
HARTA GJEOLOGO-STRUKTURORE KATJEL-SHESHBUSH	1 : 2000	1983	A. HAMZALLARI
HARTA GJEOLOGO-STRUKTURORE VB. KATJEL	1 : 2000	1978-1984	A. HAMZALLARI F. BLACERI S. HOXHA
VENDBURIMI I KROMIT KATJEL PRERJA 4	1 : 500		
VENDBURIMI I KROMIT KATJEL PRERJA 5	1 : 500		
VENDBURIMI I KROMIT KATJEL PRERJA 6	1 : 500		
VENDBURIMI I KROMIT KATJEL PRERJA 7	1 : 500		
HARTA E IZOPERMB AJTJAVE Cr_2O_3 NEN HORIZONTIN+555 NE ZONEN JUGLINPORE NE VENDBURIMIN E KROMIT KATJEL BARAZLARGESIA 1%	1 : 1000		
PARAQITJA GRAFIKE E IZOPERMBAJTJEVE TE Cr_2O_3 NEN DYSHEMENE E TEKTONIKES A NE VENDBURIMIN E KROMIT KATJEL BARAZLARGESIA 1%	1 : 1000		
PLANIMETRIA E PUNIMEVE VENDBURIMI I KROMIT KATJEL	1 : 3000		S. HIDA
PROJEKSIONI VERTIKAL I VENDBURIMIT TE KROMIT KATJEL	1 : 3000		S. HIDA
PARAQITJA NE HAPSIRE E PJESES SE SIPERME TE VENDBURIMIT KATJEL			
REPUBLICA E SHQIPE RISE MINISIRIA E BURIMEVE MINERARE DHE ENERGJITIKE PROFILI-8-8 KATJEL DEPOSIT	1 : 500	1994	S. HIDA
REPUBLIKA E SHQIPERISE MINISTRIA E BURIMEVE MINERARE DHE ENERGJITIKE PRERJET TERTHORE V.B KATJEL PROFILI II – II	1 : 500	1994	S. HIDA
REPUBLIKA E SHQIPERISE MINISTRIA BURIMEVE MINERARE DHE ENERGJITIKE MINIE E KROMIT PRRENJAS PRERJET TERTHORE TE V.B KATJEL PROFILI	1 : 500	1994	
REPUBLIKA E SHQIPESISE MINISTRIA E BURIMEVE MINERARE DHE ENERGJITKE NDERMARKJA E KROMIT PERRENJAS PRRJET TERTHORE TE V.B KATJEL PROFILI 14-14	1 : 500	1994	S. HIDA

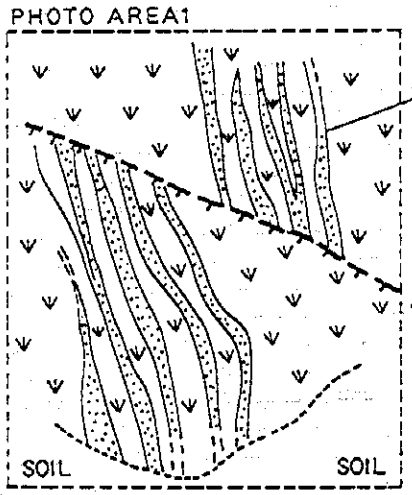
Apx. 1 List of data collected during the survey

EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
REPUBLIKA E SHQIPESISE MINISTRIA E BURIMEVE MINERARE DHE ENERGJITKE NDERMARRJA E KROMIT PERRENJAS PREJET TERTHORE TE V.B KATJEL PROFILI 16-16	1 : 500	1994	S. HIDA
REPUBLIKA E SHQIPESISE MINISTRIA E BURIMEVE MINERARE DHE ENERGJITKE NDERMARRJA E KROMIT PERRENJAS PREJET TERTHORE TE V.B KATJEL PROFILI 9-9	1 : 500	1994	S. HIDA
REPUBLIKA E SHQIPESISE MINISTRIA E BURIMEVE MINERARE DHE ENERGJITKE NDERMARRJA E KROMIT PERRENJAS PREJET TERTHORE TE V.B KATJEL PROFILI 10-10	1 : 500	1994	S. HIDA
REPUBLIKA E SHQIPESISE MINISTRIA E BURIMEVE MINERARE DHE ENERGJITKE NDERMARRJA E KROMIT PERRENJAS PREJET TERTHORE TE V.B KATJEL PROFILI 12-12	1 : 500	1994	S. HIDA
MINISTRIA BURIMEVE MINERARE NDERMAARJA E KROMIT PRRENJES H555 VB. KATJEL	1 : 1000	1994	S. HIDA
MINISTRIA BURIMCE MINERARE NDERMAARJA E KROMIT PRRENJES H530 VB. KATJEL	1 : 1000	1994	S. HIDA
PROJEKSIONI VERTIKAL V.B. QARRI I Z I	1 : 500		
PLANIMERIA HORIZONTALE E HORIZONTIT-615	1 : 200		
PLANIMETRIA HORIZONTALE E H-650	1 : 200		
PLANIMETRIA HORIZONTALE E H-670	1 : 200		
NKATI IRE HORIZONTI 665	1 : 200		
SHFAQJA E MINERALIZUAR QARRI I Z I PLANIMERIA E VENDSJE SE PUNMEVE	1 : 200	1979	K. DHIMA
PRERJA 2-2			
PROJEKSIONI VERTIKAL I VENDBURIMI TE KROMIT MENIKAZ. 24	1 : 500		
OBJEKTI KROMIT "QUMESHTI I GRAVE" SHFAQJA NR. 203	1 : 500		
OBJEKTI KROMIT "KOMKICKE" SHFAQJA NR. 212/1	1 : 500		
OBJEKTI KROMIT "GROPA E BOJES" SHFAQJA NR. 9	1 : 500		
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT MOCAL SHFAQJA NR-126	1 : 500		
PLANIMETRIA E PUNIMEVE SHFAQJA E KROMIT NR. 208 GROPAT E PALIT	1 : 500		

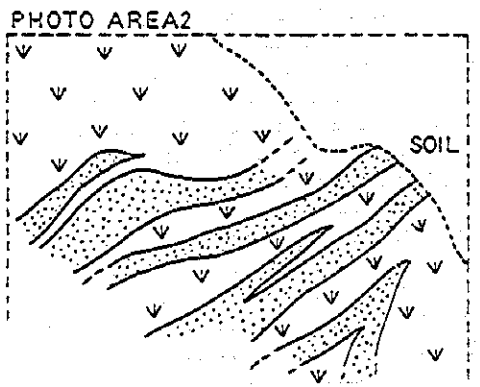
EMERTIMI I OBJEKTIT	SHKALLA	VITI	AUTORI
PLANIMETRIA E PUNIMEVE SHFAQJA E KROMIT NR-209 PROI I DARDHES	1 : 500		
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT "MIVREL" SHFAQJA NR. 212	1 : 500		
PLANIMETRIA E PUNIMEVE SHFAQJA E KROMIT NR. 129 KROI I ARIUT	1 : 500		
PLANIMETRIA E PUNIMEVE OBJEKTI I KROMIT HUDENISHT-2. SHFAQJA NR-19	1 : 500		
PLANIMETRIA E PUNIMEVE SHFAQJA E KROMIT NR. 130 GRADONAT	1 : 500		

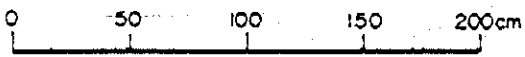

K9510050
1680m SL.
brecciated dunite
sheared zone thick.≈20cm
massive~nodular chromite
chromite breccia float with dunite breccia
disseminated chromite in dunite
pyroxenite dike thickness 5~7cm
Harzburgite
dunite
dunite envelope thick.≈5cm
dunite envelope thickness 5~10cm
massive-disseminated chromite thickness 20cm+
TRENCH
nodular-massive chromite thick.>50cm
dunite in hanging wall (thick)
ADIT
old adit (fell down)
disseminated ~massive chromite
0 5 10 15 20m

OUT CROP
IN A TRENCH
K951022-03
1020m SL



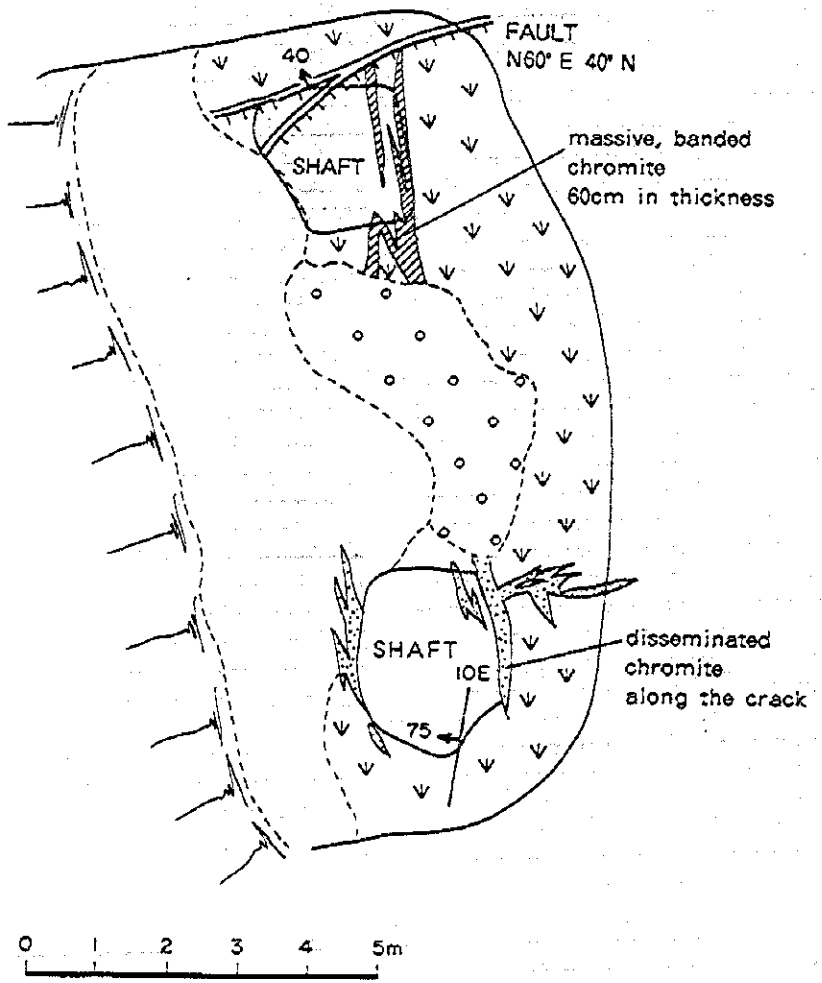
COVERED BY SOIL

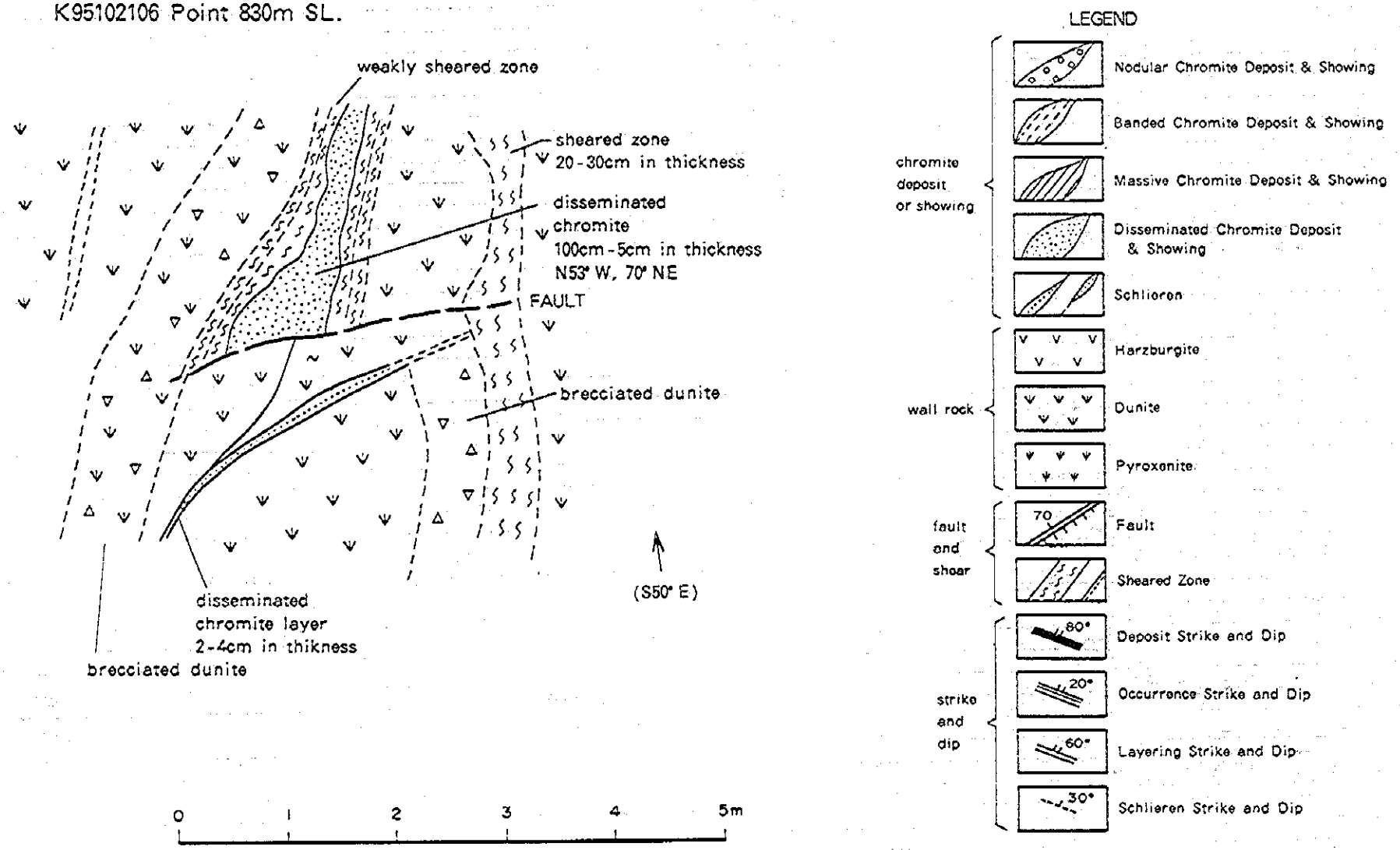




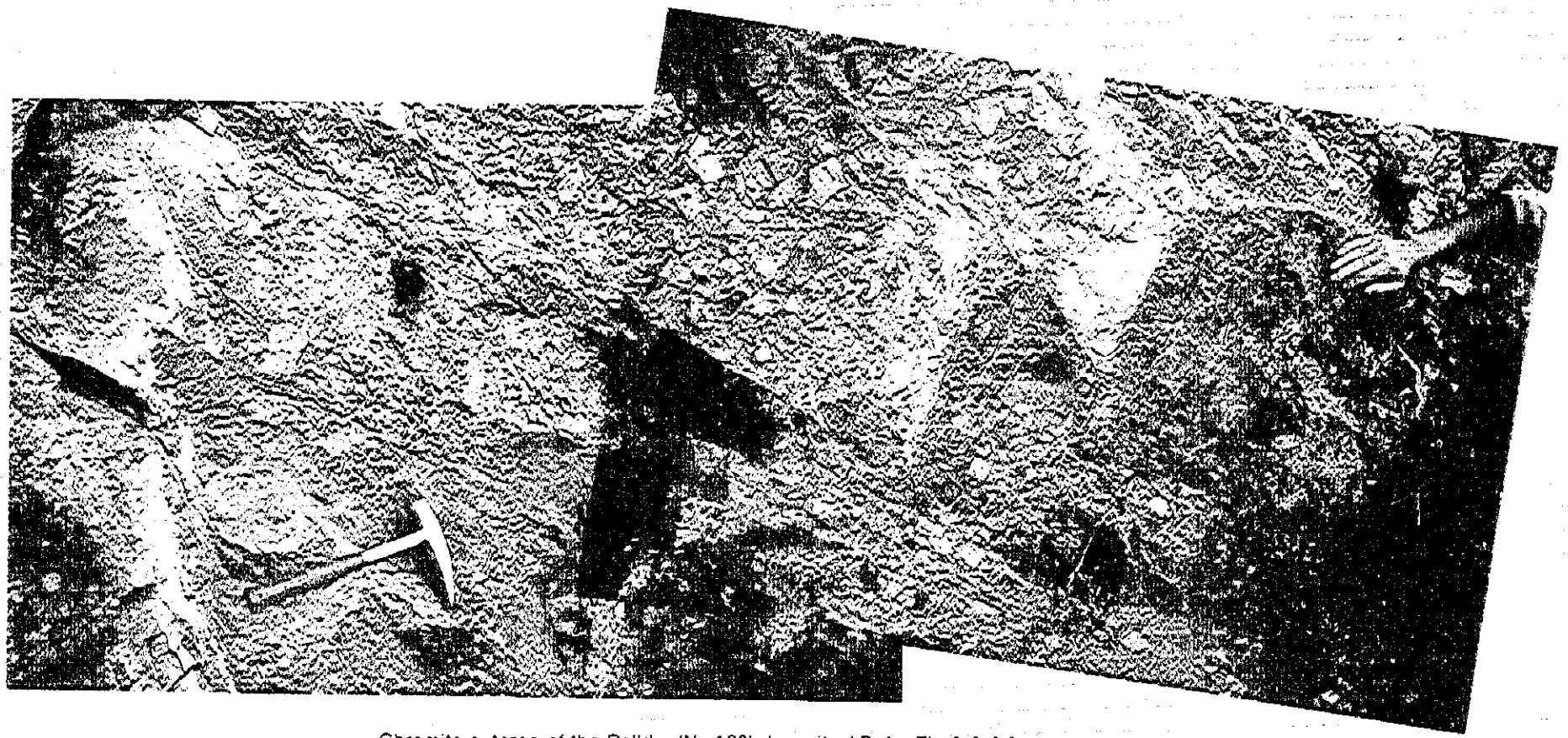
E95102101
1080m SL
N30° E 80° E

(No.7 Chromite Showing)




K95102106 Point 830m SL.
weakly sheared zone
sheared zone
20-30cm in thickness
disseminated
chromite
100cm-5cm in thickness
N53° W, 70° NE
FAULT
brecciated dunite
(S50° E)
disseminated
chromite layer
2-4cm in thikness
brecciated dunite
0
1
2
3
4
5m
LEGEND
chromite deposit or showing
Nodular Chromite Deposit & Showing
Banded Chromite Deposit & Showing
Massive Chromite Deposit & Showing
Disseminated Chromite Deposit & Showing
Schlieren
wall rock
Harzburgite
Dunite
Pyroxenite
fault and shear
70
Fault
Sheared Zone
strike and dip
80°
Deposit Strike and Dip
20°
Occurrence Strike and Dip
60°
Layering Strike and Dip
30°
Schlieren Strike and Dip

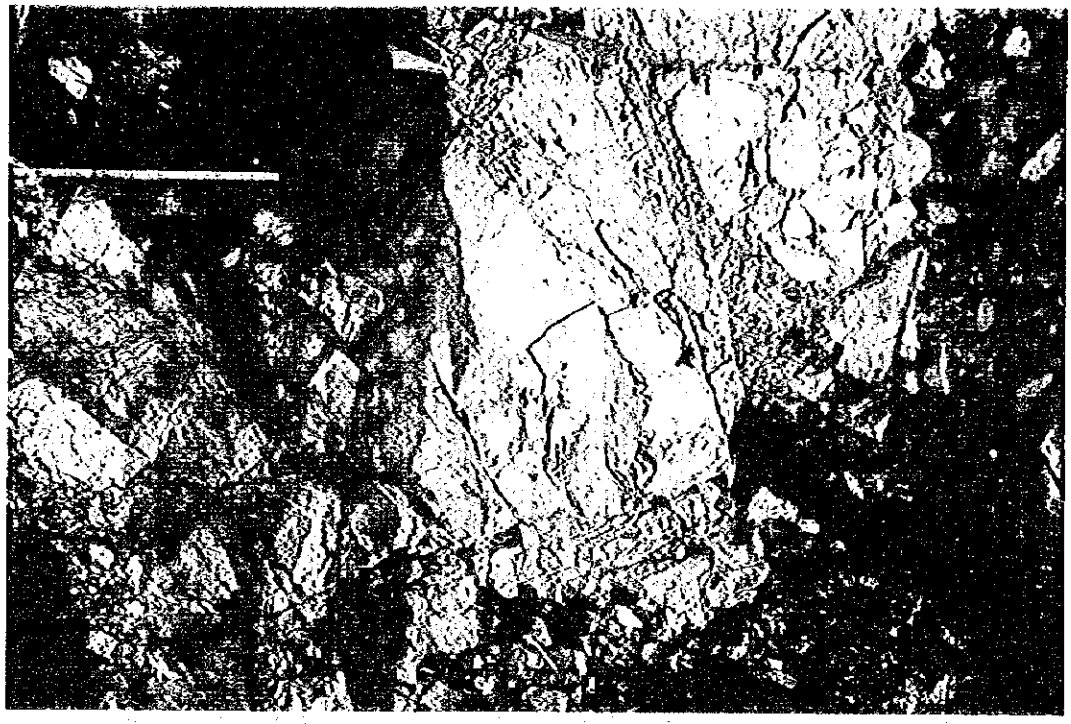
Apx. 2 Sketches and photographs of chromitite outcrops



Chromite outcrop of the Balldre (No.160) deposit (Refer Fig.2-3-2(3))

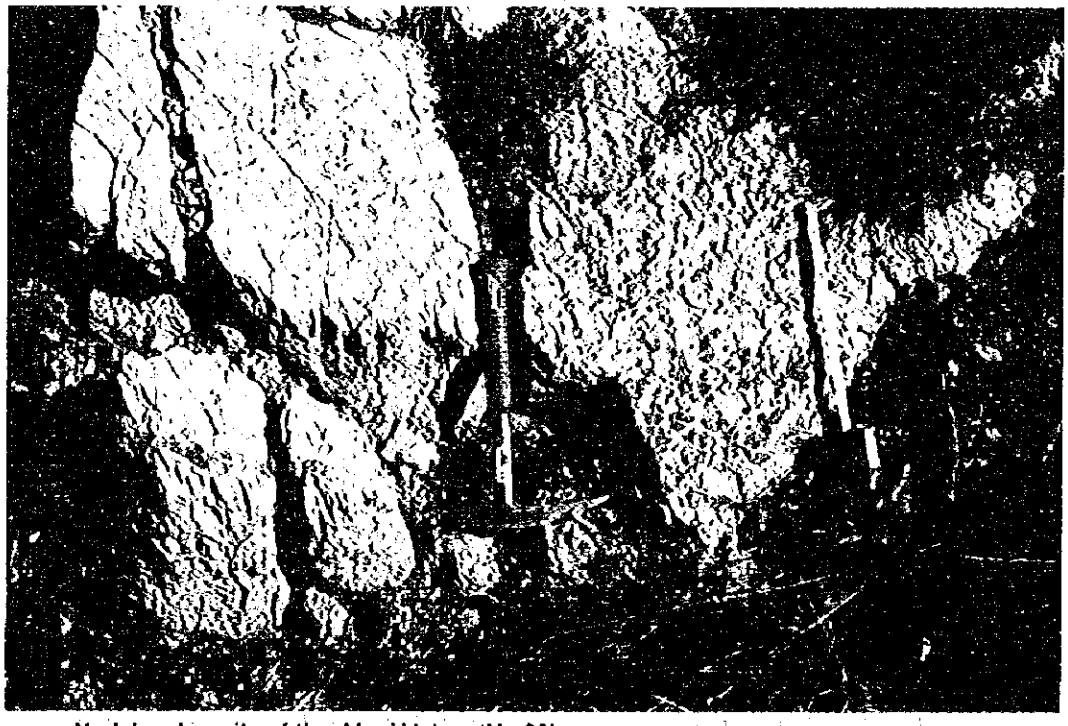
Various types of chromite as massive, nodular, disseminated and banded forms occur at this outcrop. They are cut and removed as blocks separated by frequent closely spaced faults or slipping planes. Relationships between Harzburgite, Dunite and Chromite are not so clear. But in the left margin of this outcrop, the original relationship is preserved and shows the ordinary zonal occurrence of Chromite Ore - Dunite Envelope -Harzburgite wall rock from inside to outside.

Some chromite ore is brecciated, crushed or sheared in secondary movements.



Chromite outcrop of the Fund Fusha (No.97) deposit (Refer Fig.2-3-2(1))

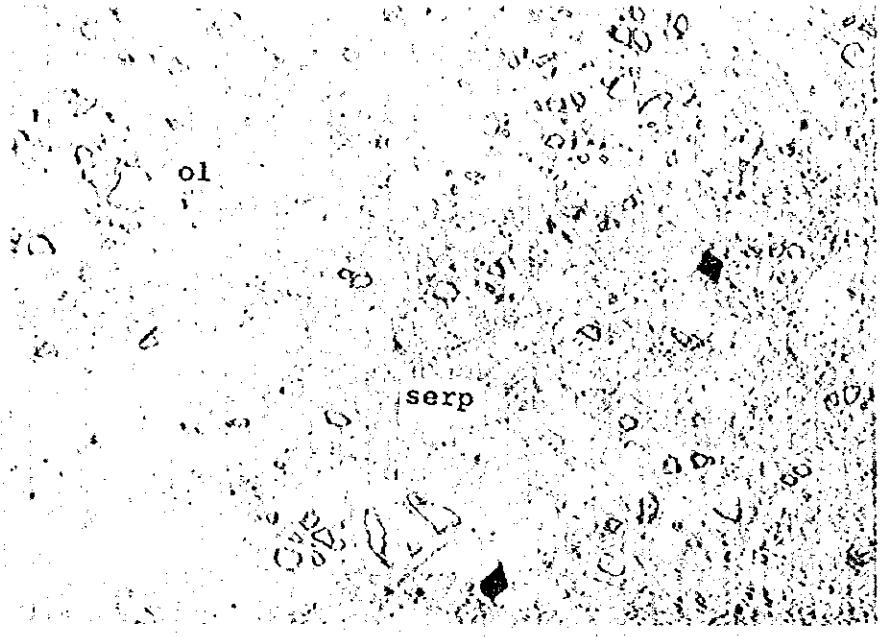
The main chromite layer is cut by secondary chromite layers with enveloped dunite. But the parallel chromite and dunite layers to the secondary chromite are also cut by the main chromite layer. These relations suggest complex and multiple mineralizations in plural stages.



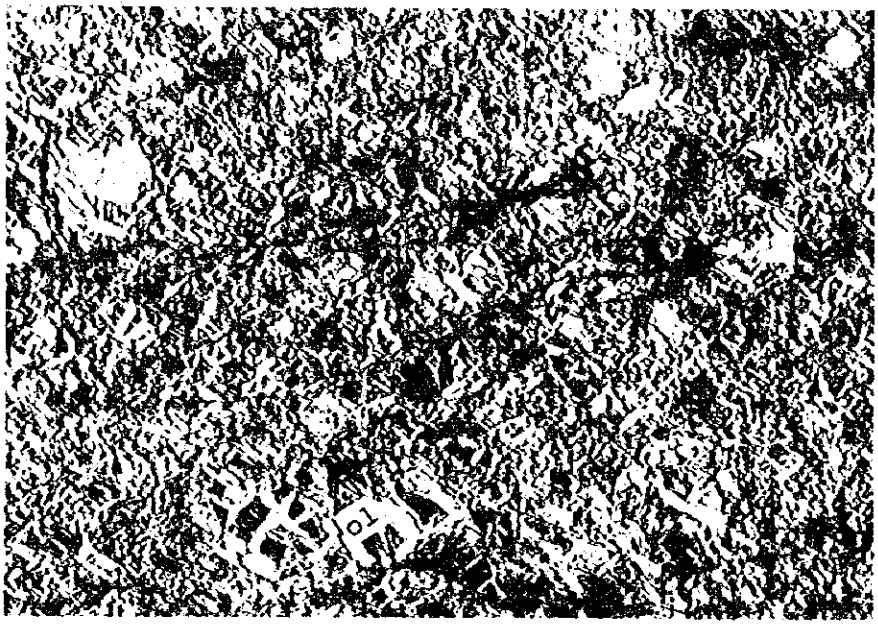
Nodular chromite of the Ahu i Vetem (No.82)

Nodular chromite (right block of the outcrop) and thin massive chromite layer (left block of the outcrop) occur in thick dunite in a oriented direction of 150° in strike and 70° NE in dip. Nodular chromite is elongated concordantly to the strike of massive chromite layer.

Apx. 3 Microphotographs of thin sections



open nicol

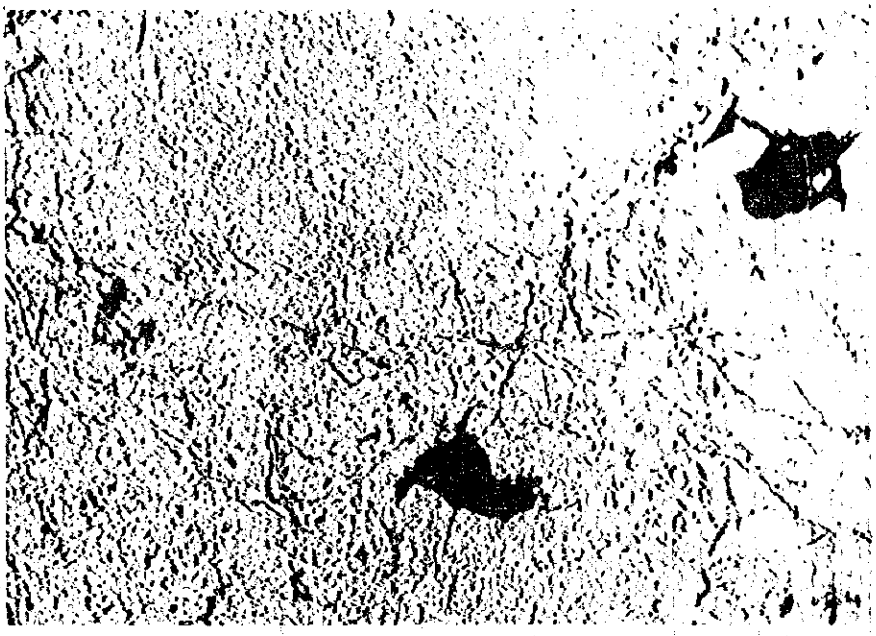


cross nicol

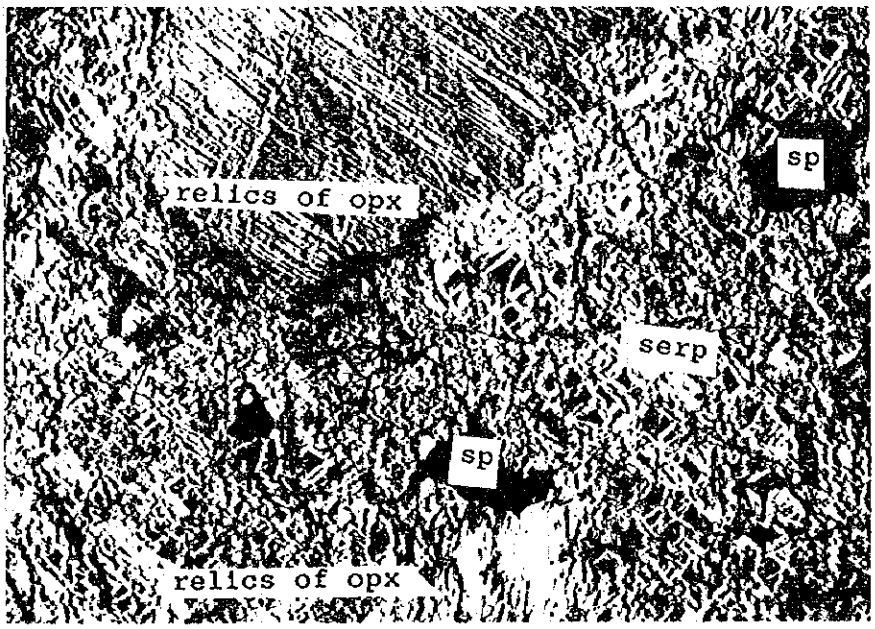
0.5mm

No.18
Sample number : M95101703 DU
Rock : Serpentinized dunite
This consists of serpentine minerals (85%), olivine (10%) and chrome spinel (5%), similar to No.2 sample.

Apx. 3 Microphotographs of thin sections

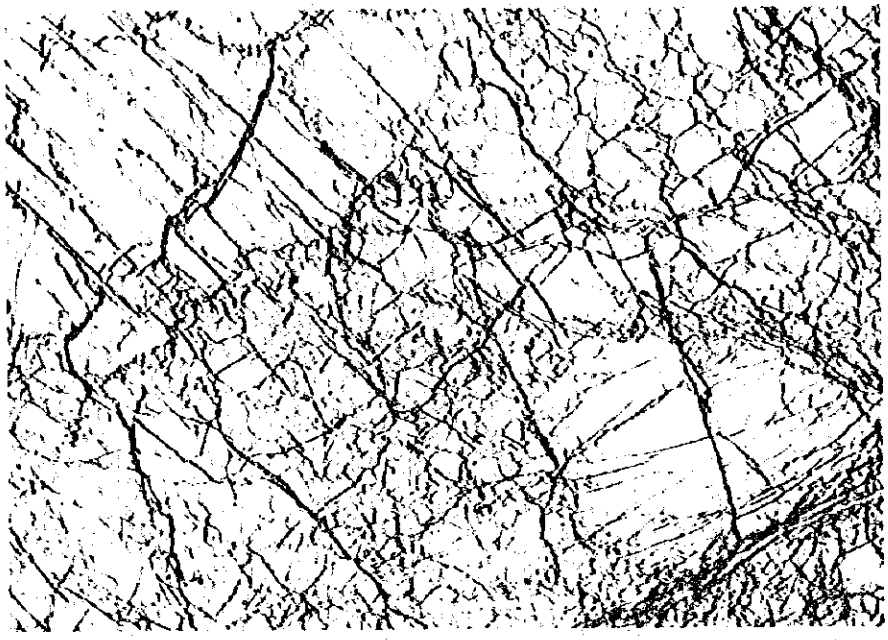


open nicol

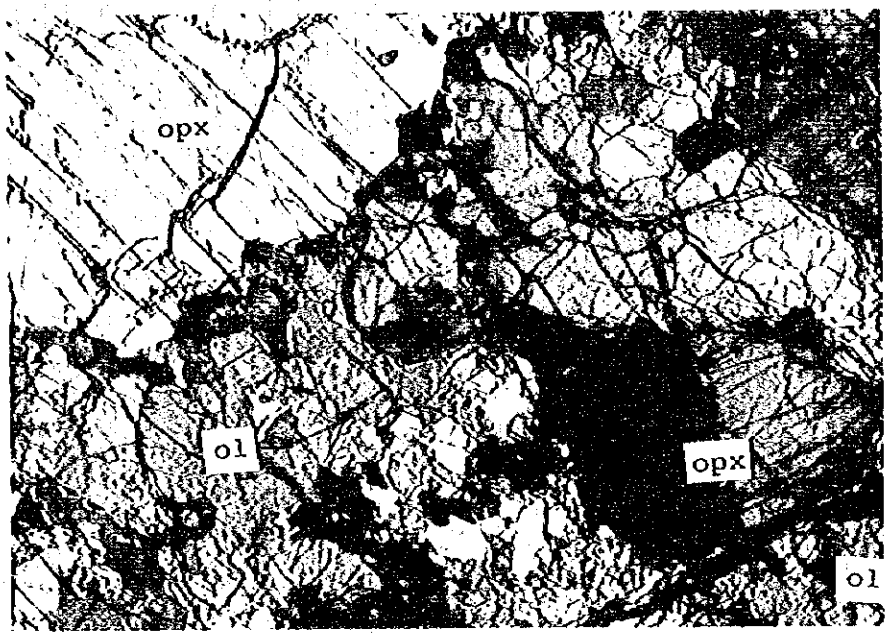


cross nicol 0.5mm

No.33
Sample number : K950930005 11Z
Rock : Serpentinized harzburgite
This thin section is composed of serpentine minerals (85%), relics of orthopyroxene (10%) and residual chrome spinel (5%), similar to No.1 sample.



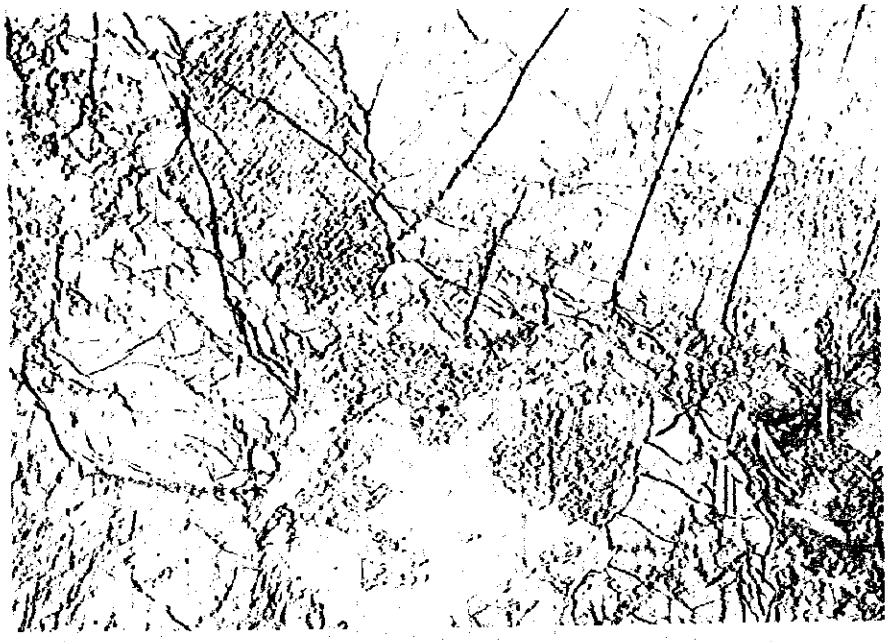
open nicol



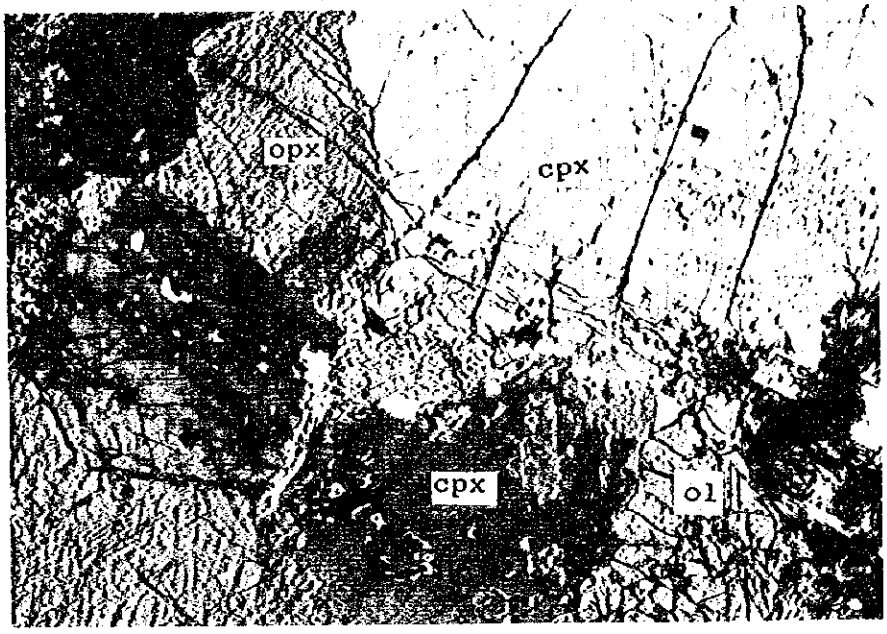
cross nicol 0.5mm

No.34
Sample number : E95100407 DU
Rock : dunite
This thin section consists of olivine (85%), orthopyroxene (10%) and chrome spinel (5%), showing granular texture.

Apx. 3 Microphotographs of thin sections



open nicol

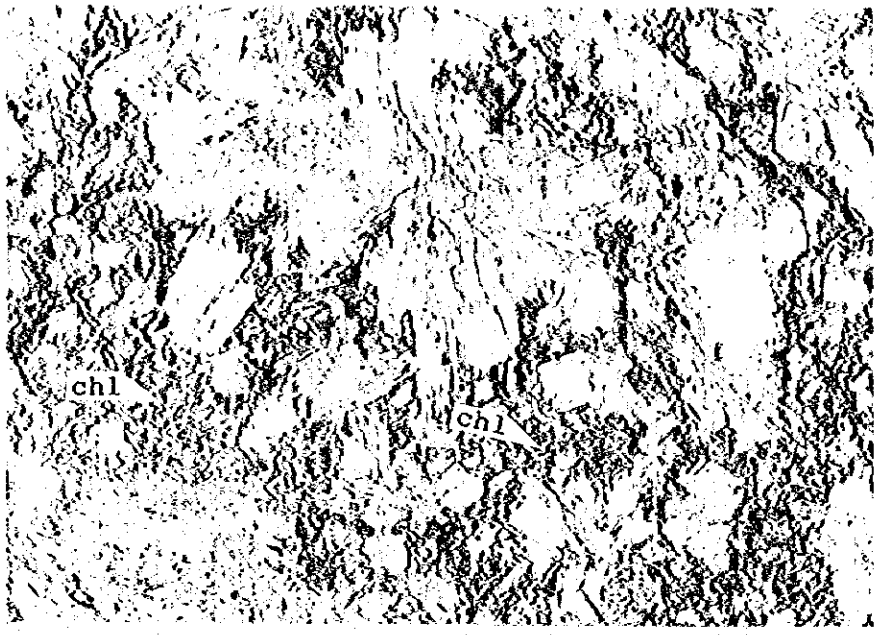


cross nicol

0.5mm

No.42
Sample number : M95100205 PX
Rock : pyroxenite
This thin section consists of orthopyroxene (40%), clinopyroxene (40%), olivine (10%) and hornblende (10%), showing granular texture.

Apx. 3 Microphotographs of thin sections



open nicol

cross nicol

0.5mm

No.47
Sample number : N95100503 GB
Rock : metagabbro
This thin section is composed of greenish hornblende (60%), albite-rich plagioclase (15%), chlorite (15%), epidote (5%) and titanite (sphene)(5%). Plagioclase is suassuritized to albite with epidote and chlorite.

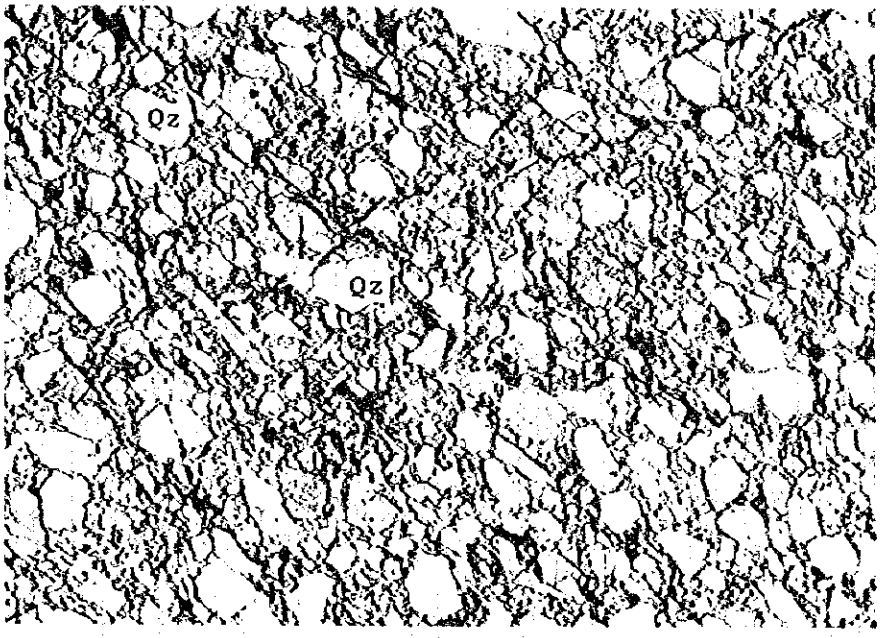
Apx. 3 Microphotographs of thin sections

open nicol

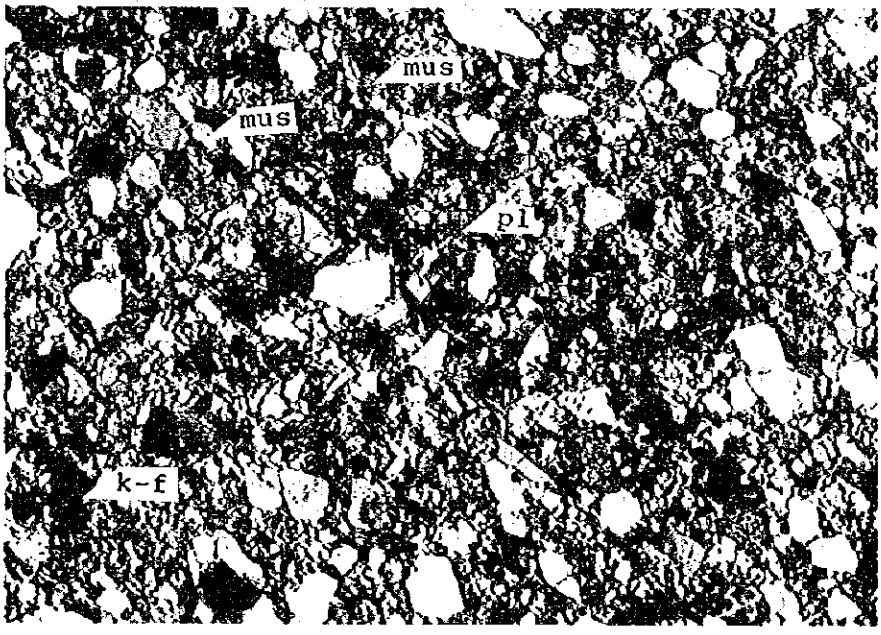
cross nicol

0.5mm

No.48
Sample number : N95101703 BT
Rock : greenstone (metabesalt)
This thin section consists of clinopyroxene (30%), carbonate minerals (30%), albite-rich plagioclase (20%), chlorite (10%), epidote (5%) and opaque minerals (5%). Relics of clinopyroxene grains and secondary diopsidic clinopyroxene are present. This may be one of upper members of the ophiolite.



open nicol

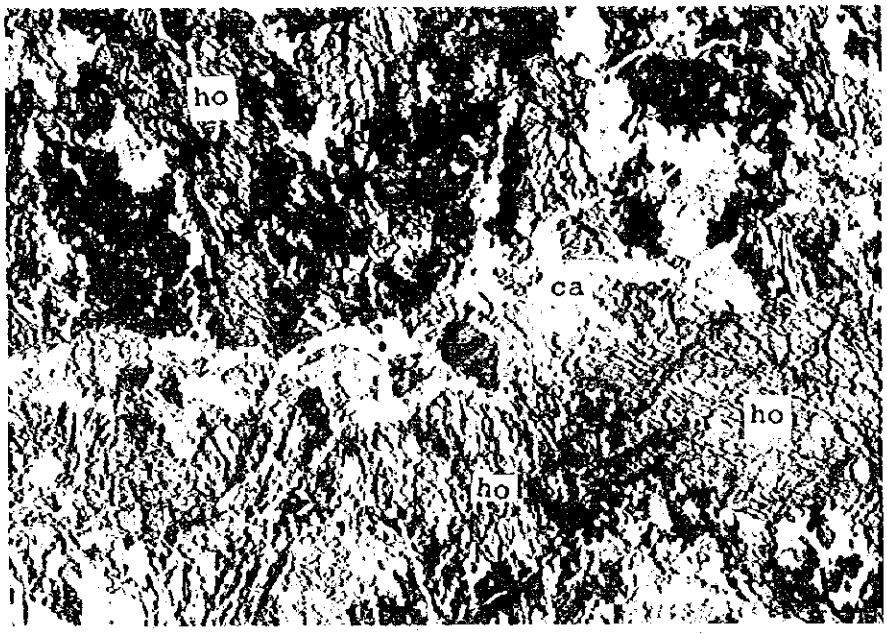


cross nicol

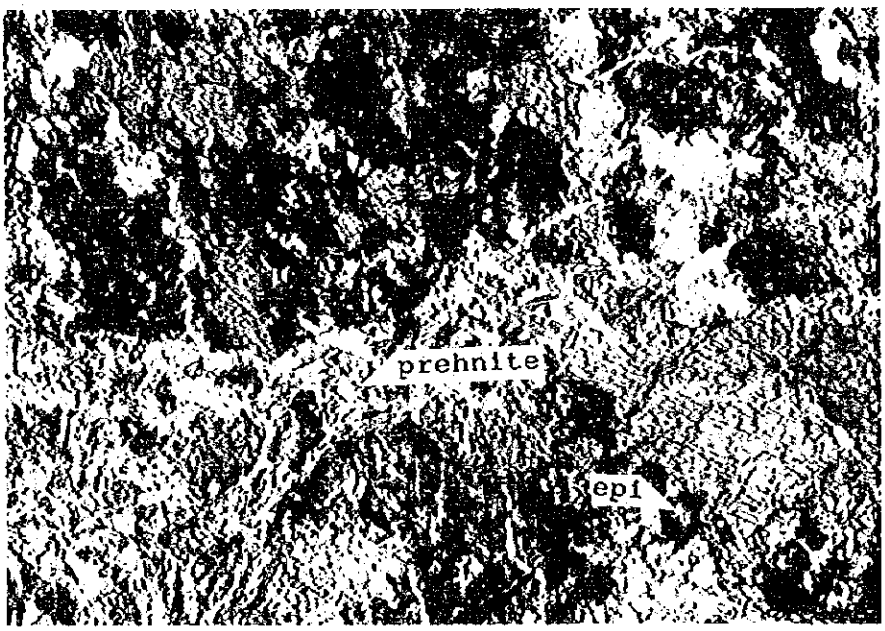
0.5mm

No.49
Sample number : K95102302 BT
Rock : sandstone
This thin section is composed of quartz (40%), plagioclase (5%), K-feldspar (5%), muscovite (5%), opaque minerals (5%), lithic fragments (5%) and cement materials (35%).

Apx. 3 Microphotographs of thin sections



open nicol

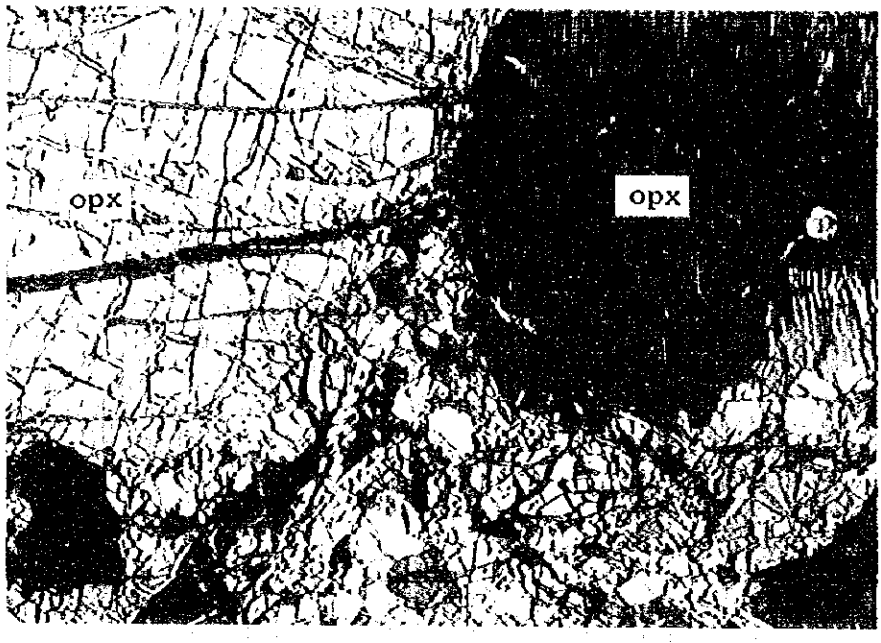


cross nicol

0.5mm

No.50
Sample number : K95102307 GB
Rock : hornblende gabbro
This thin section consists of greenish hornblende (50%), anorthite-rich plagioclase (20%), prehnite (10%), epidote (10%) and carbonate minerals (10%). Prehnite and epidote occur as veinlets.

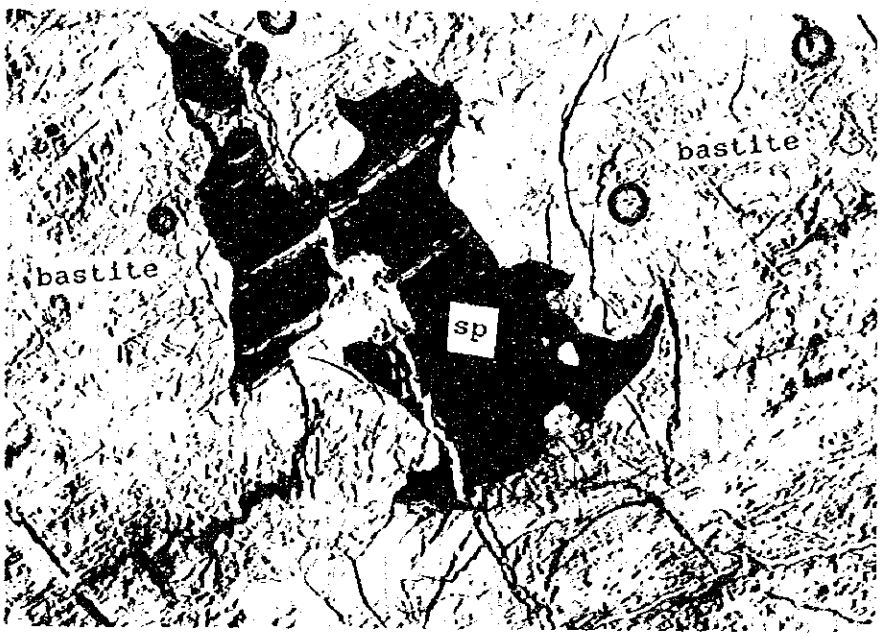
Apx. 4 Microphotographs of polished-thin sections



cross nicol

0.5mm

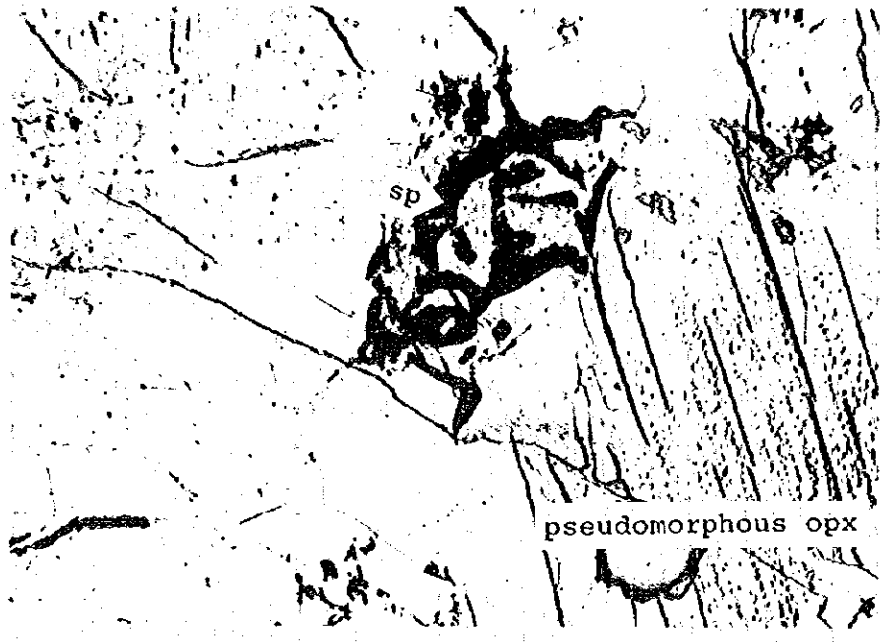
Sample Number : E95100201 HZ
Rock : harzburgite
porphyroclastic texture (orthopyroxene)



open nicol

0.5mm

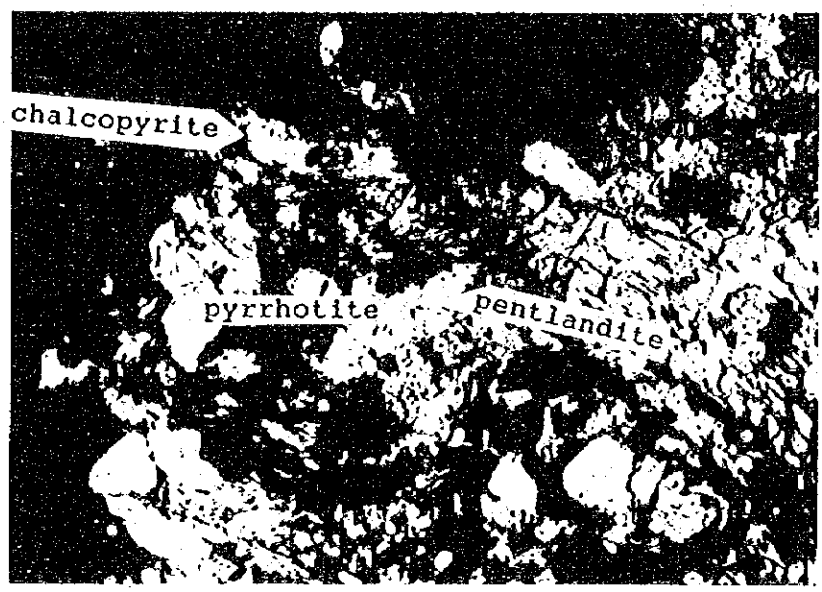
Sample number : E95110101 HZ
Rock : Serpentinized harzburgite
anhedral spinel and "bastite" (pseudomorphous orthopyroxene)



open nicol

0.5mm

Sample Number : K95003005 HZ
Rock : Serpentinized harzburgite
vermicular spinel and pseudomorphous orthopyroxene



polished section

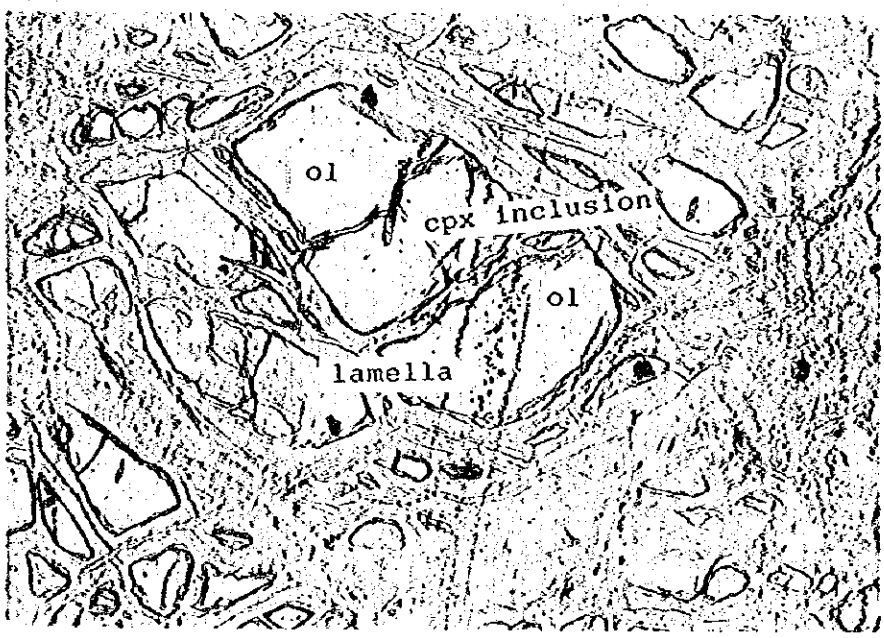
0.5mm

Sample number : N95106504 HZ
Rock : Serpentinized harzburgite
white : pentlandite
pink : pyrrhotite
yellow : chalcopyrite

Apx. 4 Microphotographs of polished-thin sections

open nicol 0.5mm

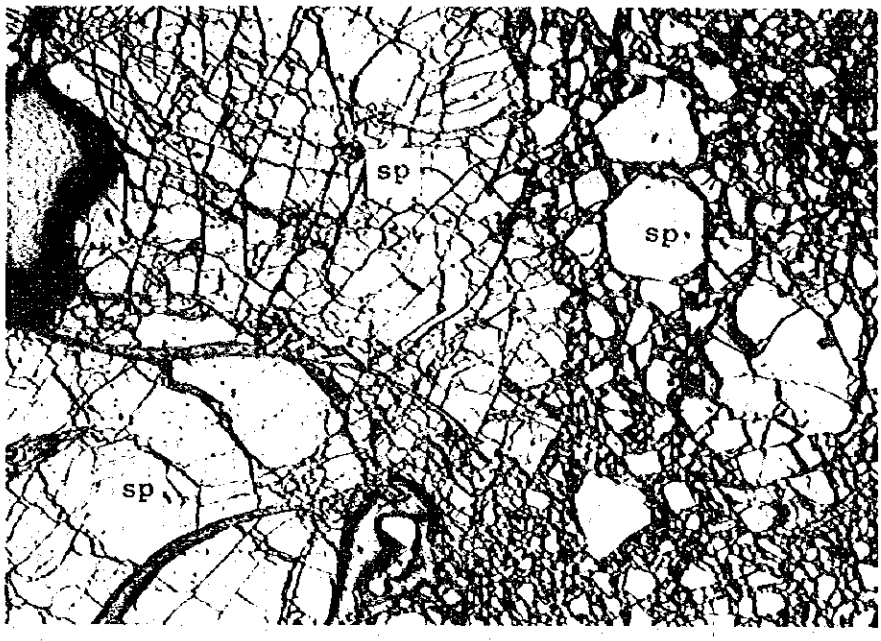
Sample Number : M95101507 CR
Rock : olivine chromitite
clinopyroxene inclusions in spinel



open nicol 0.5mm

Sample number : K95092505 HZ
Rock : Serpentinized harzburgite
spinel lamella and relic fluid inclusions in olivine

Apx. 4 Microphotographs of polished-thin sections



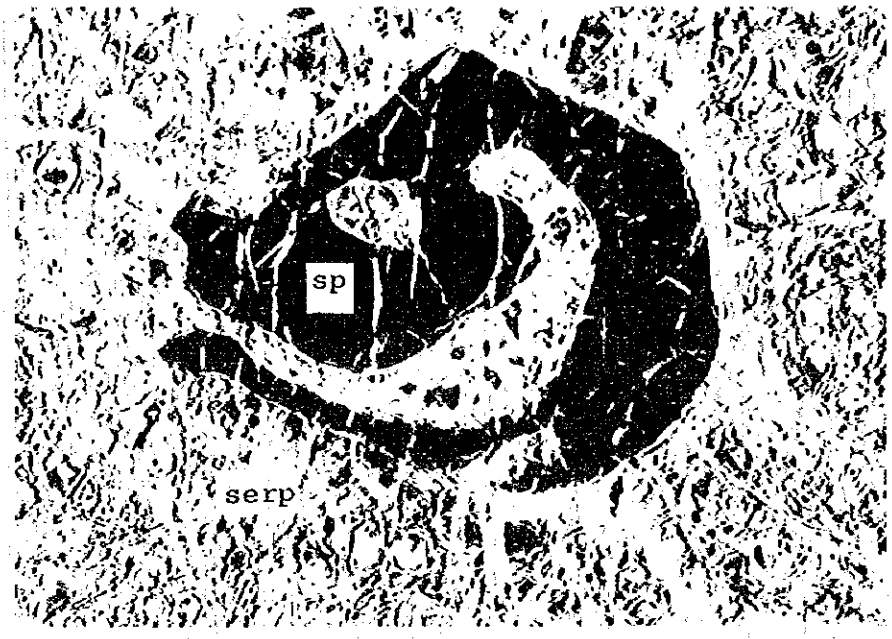
polished section 0.5mm

Sample Number : M95102203 CR
Rock : chromitite
crushed spinels

polished section 0.5mm

Sample number : K95092912 CR
Rock : Serpentinized spinel-rich dunite
various sizes for spinels

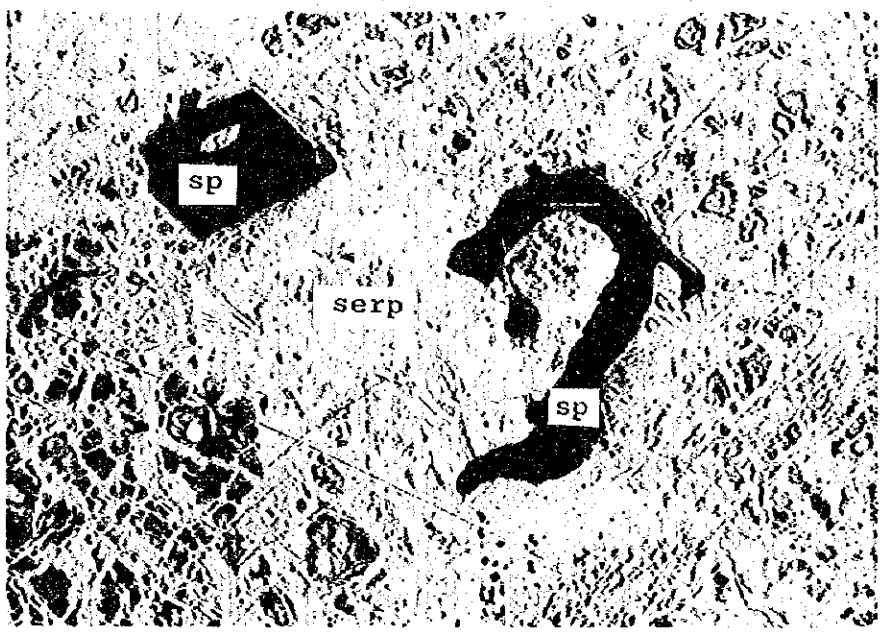
Apx. 4 Microphotographs of polished-thin sections



open nicol

0.5mm

Sample Number : E95102101 DU
Rock : Serpentinized dunite
Spinel shows spiral form

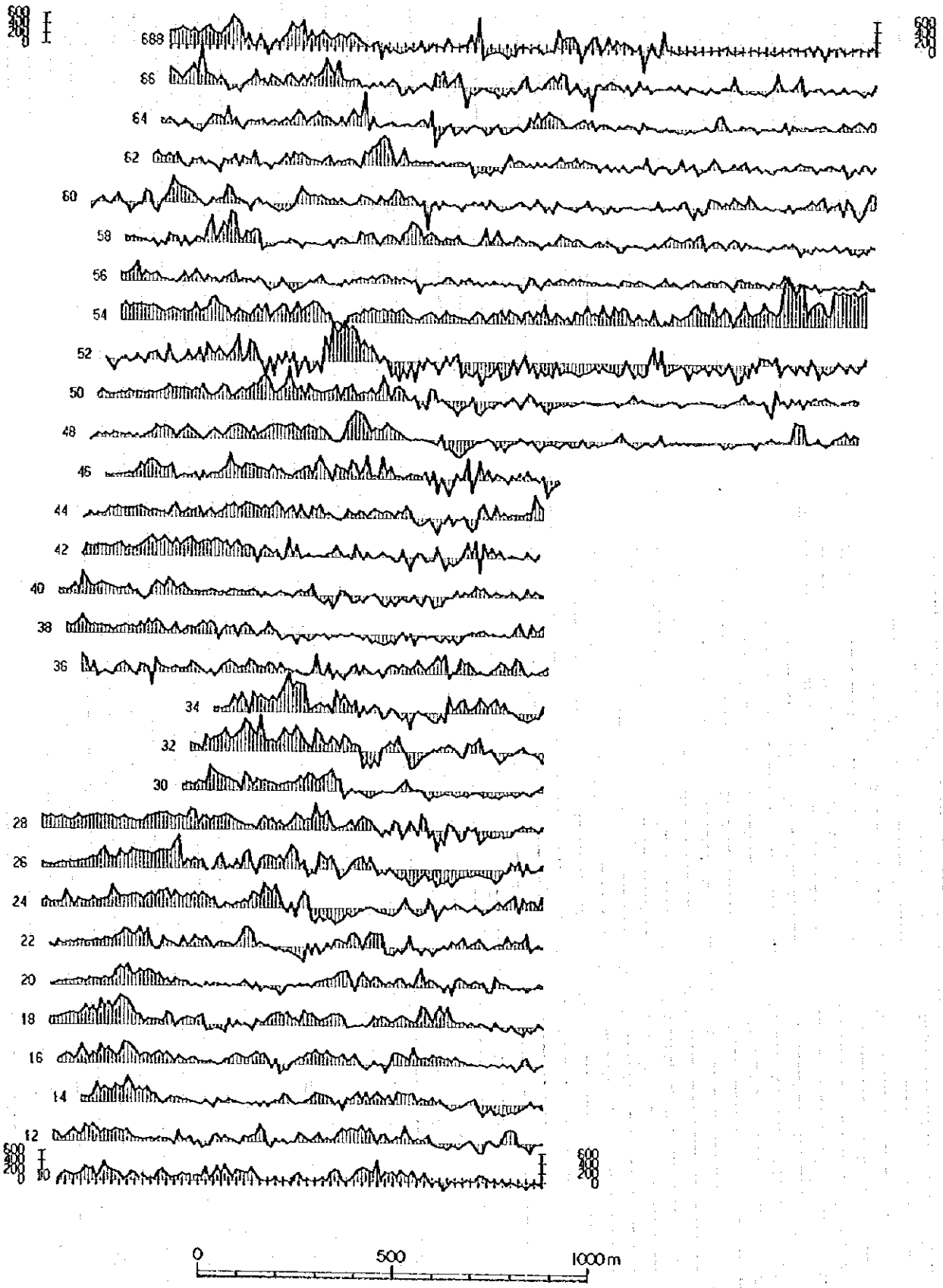


open nicol

0.5mm

Sample number : M95101704 DU
Rock : Serpentinized dunite
euhedral and anhedral spinels

Apx. 5 Magnetic profile of Pishkash area



Apx. 6. Magnetic profile of Kotodesh area

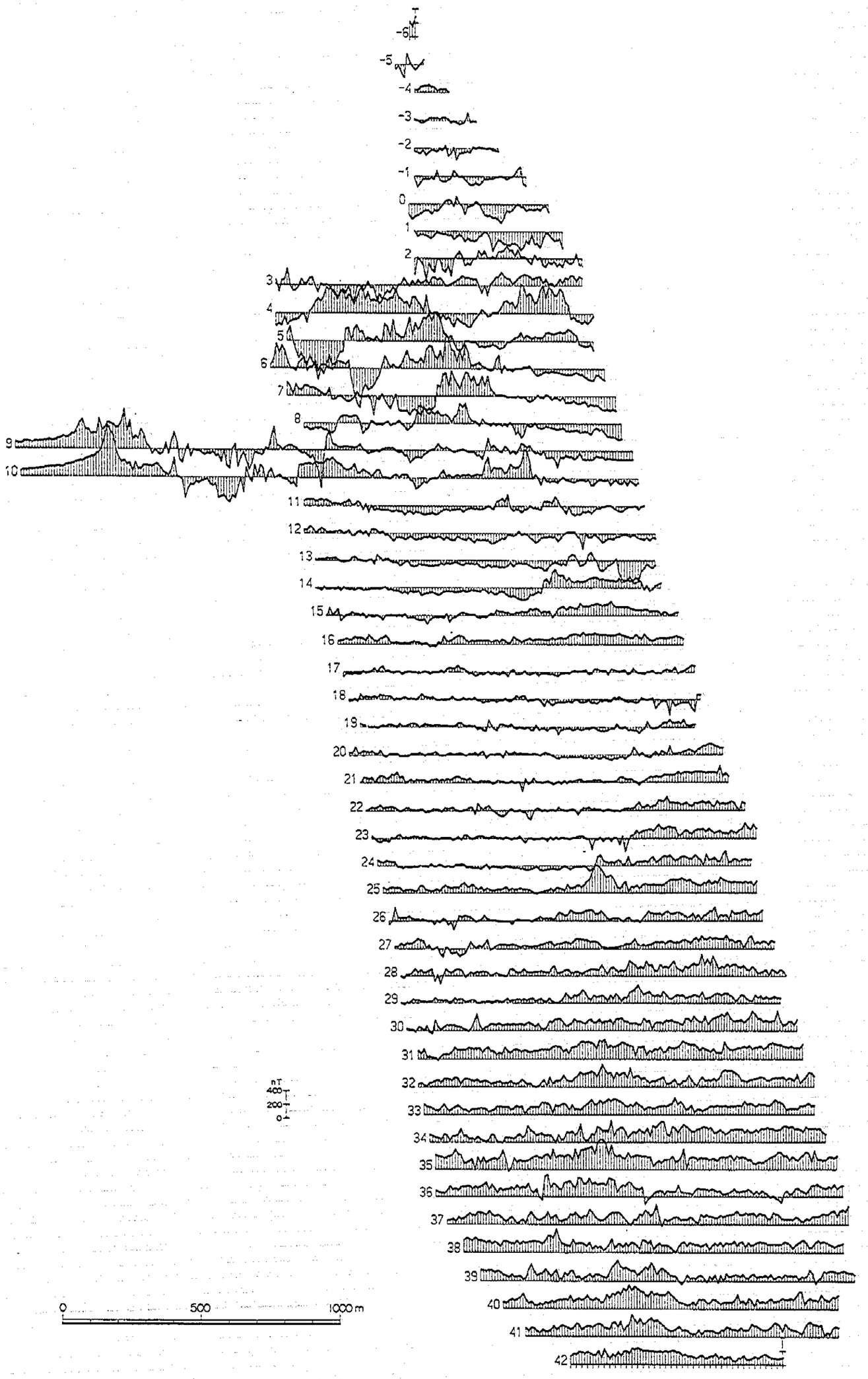
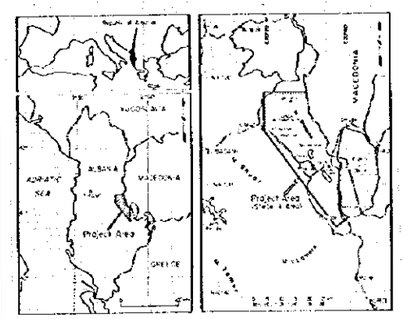


Plate 2-1-1

Report on the Mineral Exploration
in
the Shebenik Area, Republic of Albania
(Phase I)

Photogeological Interpretation Map of Internal Albanides

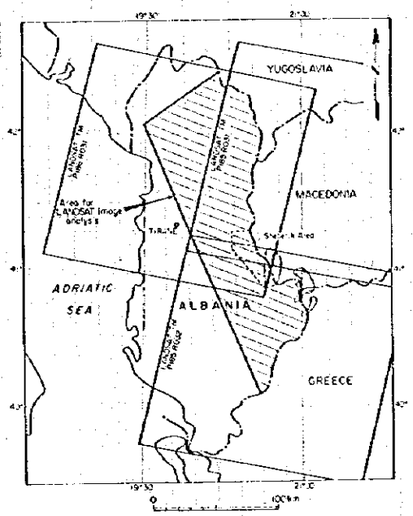


Japan International Cooperation Agency
Metal Mining Agency of Japan

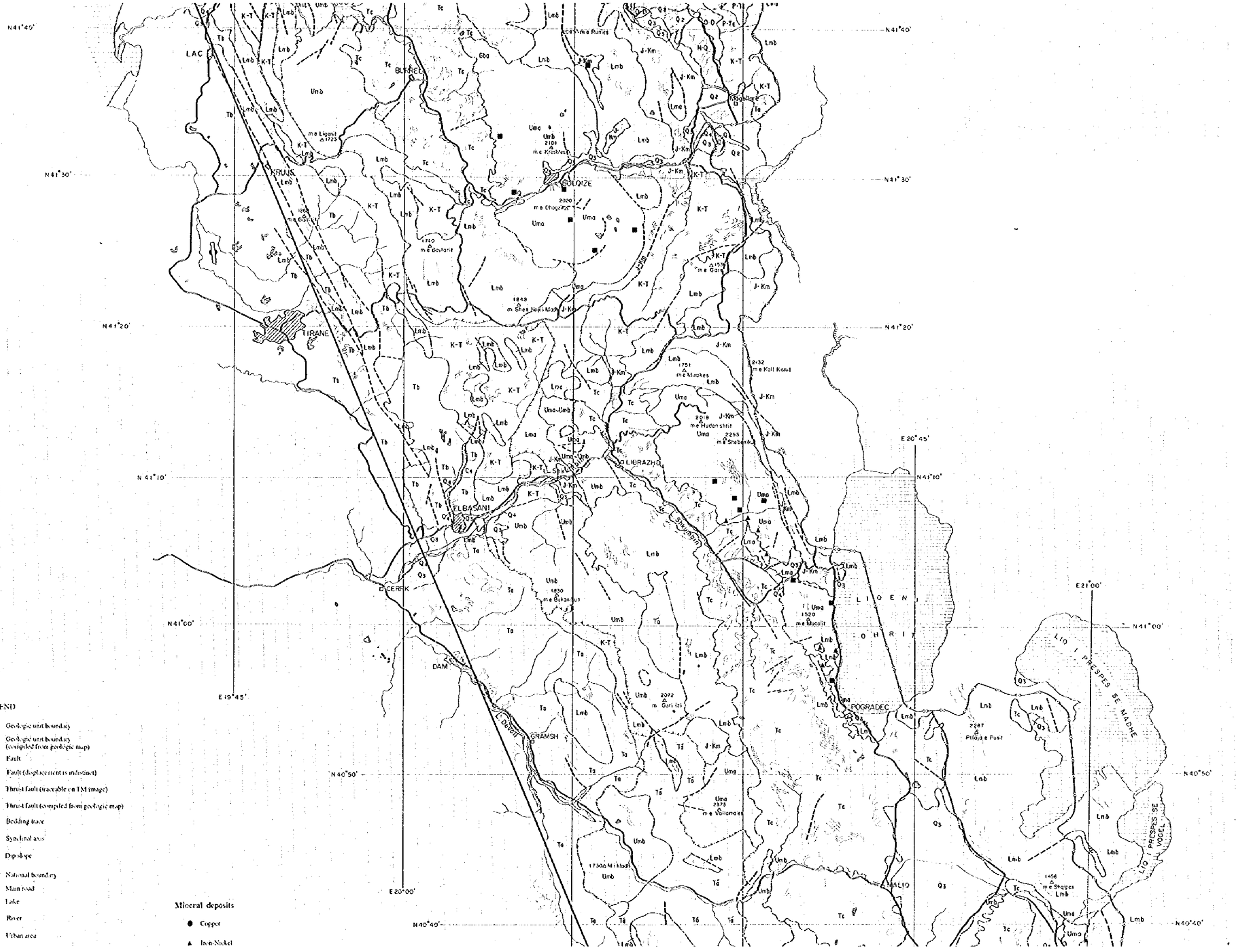
February 1996

Scale 1 : 200,000

0 4 8 12 16 20 km



Map showing the study area for photo geologic interpretation

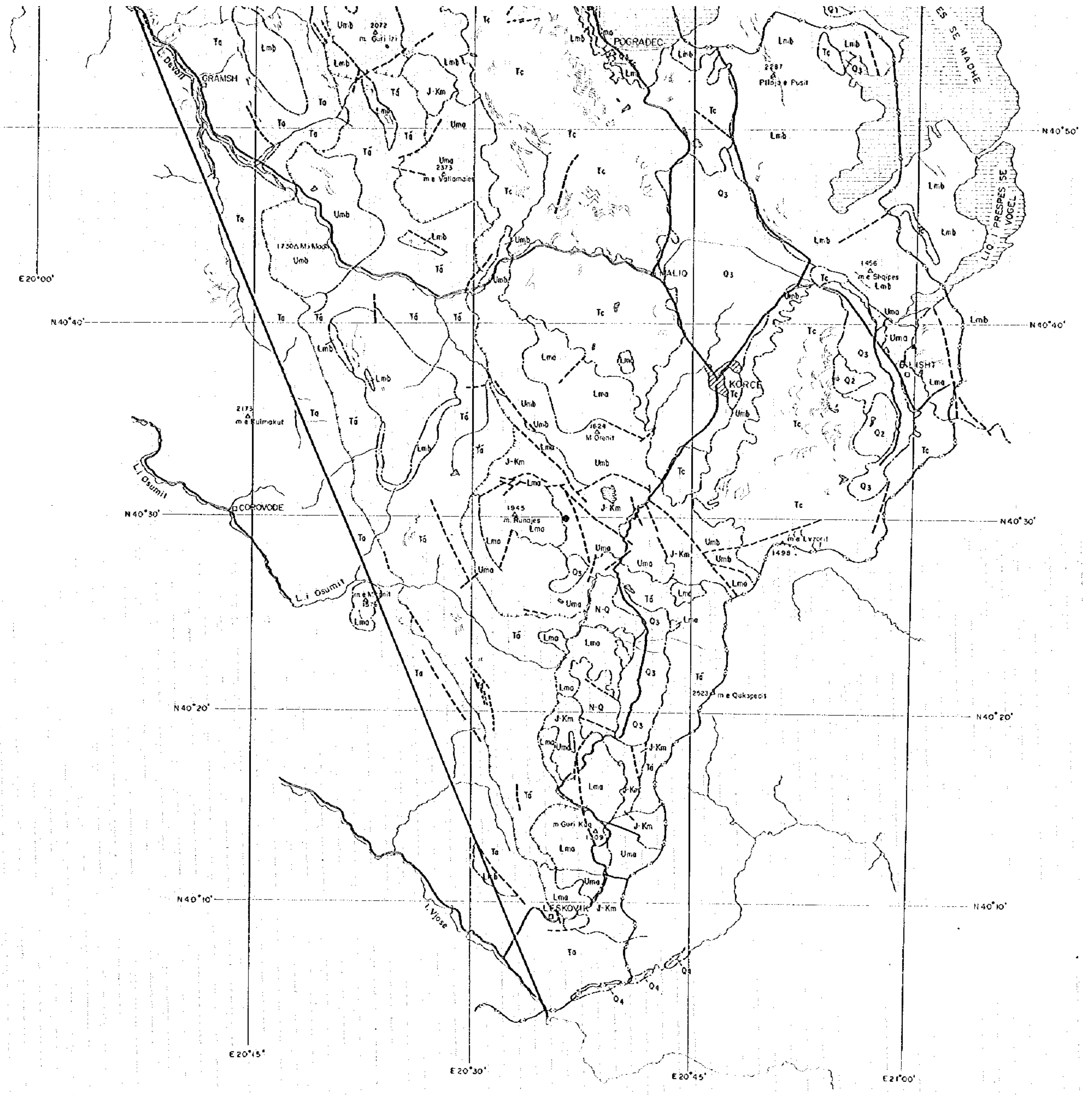

LAC
BURREL
KRUJE
TIRANE
BOLQIZE
ELBASANI
DIBER
DAM
GRAMSH
LIBRAZHD
PEQIN
FOGRADEC
LIQENI I OHRIT
LIQENI I PRESPES SE MADHE
LIQENI I PRESPES SE VOGEL
MALIQ
N41°40'
N41°30'
N41°20'
N41°10'
N41°00'
N40°50'
N40°40'
E19°45'
E20°00'
E20°45'
E21°00'
LEGEND
Geologic unit boundary
Geologic unit boundary (compiled from geologic map)
Fault
Fault (displacement is indistinct)
Thrust fault (traceable on TM image)
Thrust fault (compiled from geologic map)
Bedding trace
Synclinal axis
Dip slope
National boundary
Main road
Lake
River
Urban area
Mineral deposits
Copper
Iron-Nickel

LEGEND

- Geologic unit boundary
- Geologic unit boundary (compiled from geologic map)
- Fault
- Fault (displacement is indistinct)
- Thrust fault (traceable on TM image)
- Thrust fault (compiled from geologic map)
- Bedding trace
- Synclinal axis
- Dip slope
- National boundary
- Main road
- Lake
- River
- Urban area
- Towns and villages
- Airport
- △1352 Mountain (elevation in meters)

Mineral deposits

- ● Copper
- ▲ Iron-Nickel
- ■ Chromite



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: 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, [illegible]
Tc	light green, deep red, vivid reddish orange	coarse to medium	dendritic	medium to high	low	partly bedded to well bedded		dense to moderate	N2-N1-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
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	[illegible] Middle to upper Jurassic volcanic rocks
Ji	reddish orange	fine	dendritic	medium	low	none		sparse	Ji: 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	Cr2-Pg1 2 Cr2 etc. Upper Cretaceous to Paleogene flysch deposit
P-Tvc	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	J2, Jurassic granite, diorite etc
Gba	reddish pink, pale green	medium to coarse	dendritic	medium	high to moderate	massive		moderate to dense	[illegible] Jurassic gabbro, [illegible] etc
Gbb	pale green, light grey, reddish pink	coarse	dendritic	medium to high	moderate to low	none		sparse	[illegible] Jurassic gabbro, [illegible] etc
Uma	dark blue green, deep red	fine to medium	dendritic	low	moderate to high	massive		sparse to moderate	[illegible] Jurassic ultramafic rocks
Umb	dark blue green, deep red	fine to medium	dendritic	medium	moderate	massive		sparse to moderate	[illegible] Jurassic ultramafic rocks