CHAPTER 3 AZEGOUR SECTOR

In this sector, detailed geological survey and geochemical survey were carried out in the first phase. On the basis of the results of above surveys, geophysical survey by CSAMT method and drillings by B.R.P.M. were carried out in the second phase. (Refer to Fig.8).

1) Geology ang geological structure

This sector is composed of schists of the Paleozoic CIII Formation distributed from south to north inserting limestone layer of 80 ∿ 150 meters in thick, the Azegour Granites intruding them and the Mesozoic Cretaceous Formation covering uncomformably the peneplane of above rocks.

The schists of CIII Formation consist of pelitic schist, spotted schist, gneissose schist and calcareous schist. The limestones are well continuous, having swells and pinches of width of 80 to 200 meters. They are traceable several kilometers from the southern end to the northern end of the surveyed area.

The Azegour Granites are biotite granites characterized by alkali-feldspar, and widely distributed in the form of stocks. They are also recognized in the form of dykes intruding in the direction of north and south, with the width of several meters and several 10 meters.

The geological structure in this sector is characterized by the monoclinic structure of Paleozoic CIII Formation dipping about 70° to the east.

The geological structure is also characterized by the development of the fissures in the direction of ENE-WSW, by the intrusion of granitic bodies, by the existence of the peneplain of the Paleozoic massif and by the sedimentation of the Cretaceous System on the peneplain with gentle dipping.

However, by the detailed observation of the limestone contained in the metamorphic rocks which have apparent monoclinic structure, several small folding structures are recognized with the axis trending north and south and dipping gently to the north, and it has been evidenced that the structures is not necessarily monotonous. Also, in the north of this sector, the limestone forms a large scaled anticline evidently. The axis of this anticline is trending almost north and south, and is dipping gently to the north. It is noted that the repetition of synclines and anticlines is recognized in the west of this anticline. Accordingly, it is possible that the metamorphic rocks in this area would occupy a part of the east wing of the above anticlinorium.

From the results of the present surveys and from the old records of the underground of the Azegour Mine, it is thought that the granitic body in this area is dipping with an angle of 30° to 50° to the east. Also, the dykes of the granite are predominantly trending in the direction of north and south, with the steep dipping. These facts are thought to reveal that the periods of the intrusion of the granites would have been after the completion of the folding movement of the Cambrian System of the Paleozoic Group.

There are several faults dipping steeply to the north, with the strikes in the direction of ENE-WSW,and it is evident that the blocks in the north side of these faults had been dislocated to the west. The intrusion of porphyrite dykes are recognized along part of these faults in the same direction.

The Cretaceous formations accumulated on the peneplain of the basement are gently dipping toward the south monotonously. This fact is thought to be revealing that only the tilting of the formation occurred after the sedimentation of the Cretaceous System.

2) Mineralization

The mineralization in this sector is represented by the skarn type ore deposits of copper, molybdenum and tungsten in the Azegour Mine and by the disseminated ore deposits of molybdenum in the skarnized zone which is distributed along the limestone bed of the approximate width of 80 meters, extending northward from the Azegour Mine. The Azegour Mine has produced approximately 900,000 tons of crude ores of the grades of Cu: 1.4 ∿ 2.8%, MoS_2: 0.2 ∿ 0.7% and WO_3: 0.35%. The area for the mineralization to be emplaced is 1,300 meters in northsouth and about 150 meters in east-west, and the difference between the surface outcrop and the developed lowest level is about 200 meters. The skarnization is more intense in the deeper part, where the limestones are wholly skarnized, while the skarnization is recognized in two zones of the approximate width of 15 meters in the upper part. There are over 10 orebodies in the skarnized zones. The sizes of these orebodies are 20 ∿ 50 meters in major axis and 5 ∿ 20 meters in minor axis.

The skarnization in the northern area is recognized up to around Entifa which is located about 4 km north of the Azegour Mine. The skarnized zones are recognized as wide as 0.3 ∿ 1.0 meters, along the hanging and the foot walls of the limestone as well as along its boundary planes with other rocks. The intense skarnization is recognized along the fissures trending in ENE-WSW direction and in such area tight folds are recognized. In such area, the width of the skarnized zones is up to 10 meters to 30 meters. As a whole, the skarnization becomes less intense gradually toward the north, and the northern limit of the skarnization is thought to be around Entifa.

The molybdenum mineralization is recognized in many places from the Azegour Mine to around Entifa. Especially, the mineralization is intense in the area from the southeast of the Tizgui village to the midway of Entifa and Tizgui. The indication of molybdenum mineralization on the surface at the east of the Tizgui village is recognized to be as wide as 0.6 meters with the grade of MoS_2: 0.13%, while, on the level at the depth of 200 meters in the underground, the mineralization extends 15 ∿ 35 meters with the approximate width of 1.5 meters, having the ore grades of MoS_2: 0.26 ∿ 0.56%. It is thought that the molybdenum mineralization is more intense in the deeper part, as is the east of the skarnization.

The factors controlling the mineralization in this sector are thought to be the form of the limestones and the fissure systems in the direction of ENE-WSW.

3) Results of geochemical survey

By the results of the geochemical survey, it is remarkable that the Mo anomalies are reflecting the indications of molybdenum mineralization in the skarnized zone. There is a tendency that the Cu anomalies are concentrated in the northern side of the above-stated faults. Anomalous values of Pb and Zn are recognized to be related to the molybdenum mineralization. The anomalous values of Pb are scatteringly distributed, while the anomalous values of Zn are concentrated in the central part of this sector. Anomalous values of Fe are concentrated around the Azegour Mine area, and they are not obviously related to the indications of molybdenum mineralization. The distribution of W anomalies has similar pattern to that of Mo and Cu anomalies.

4) Results of SIP Survey

According to the geophysical exploration applying SIP method (on 4 traverse lines), it was revealed that resistivities of the north-south trending limestone layer, which is the host rocks of the ore deposit, are low and indicating 1/2 to 1/5 (200 Ωm - 300 Ωm) of those obtainable in other rock layers. However, the resistivities in the east side of several granite

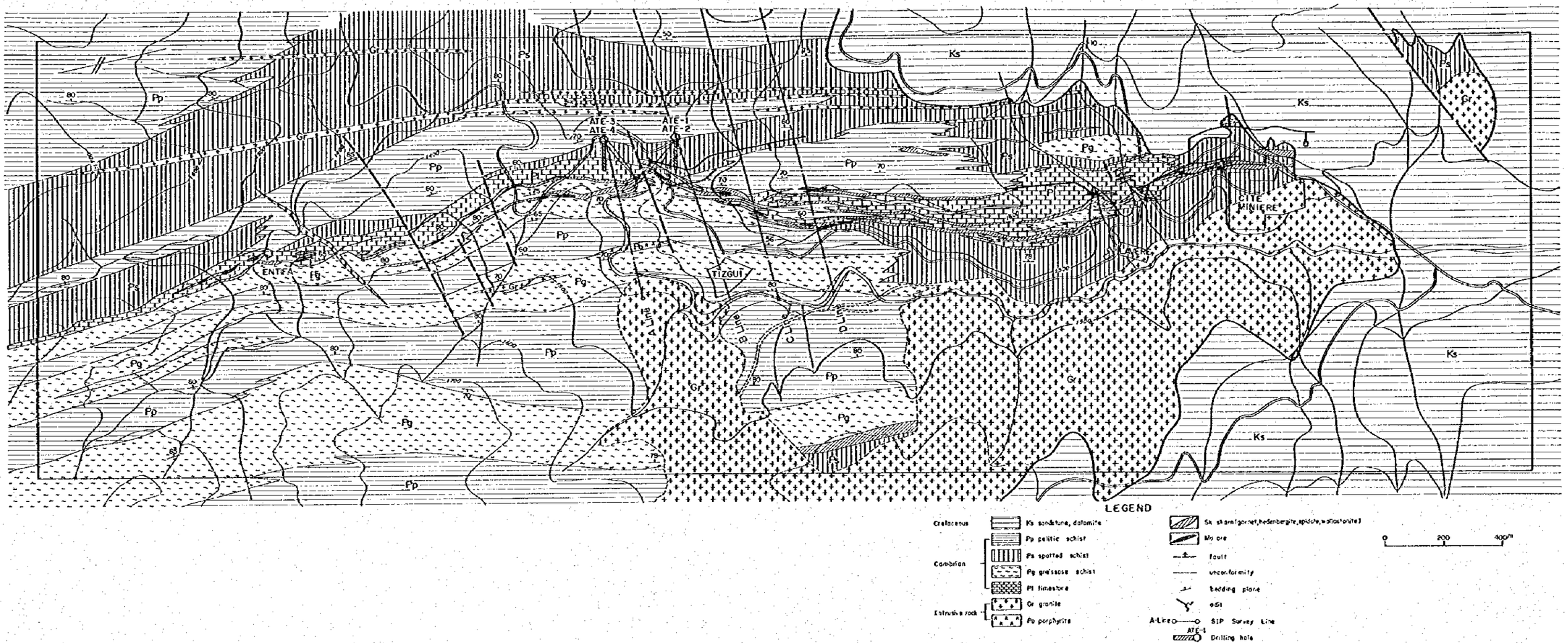


Fig.8 Index Map of Azegour Sector

dykes in the eastern part of the sector are higher over 1 KΩm.

The formation having the IP effect widely distributed as a whole in this sector. Especially, remarkable IP effect is observed at the west side of the above granite dykes. This indicates the conformity to the results of geological surveys reporting that slight pyrite dissemination was observed in the formation widely distributed in this sector. This suggests that the formation of west wide of granite dykes is stronger pyritized than east side formation.

It is considered that strata of high PFE value, those which indicate high IP effect in other words, should be limestone which is the host rock of the deposits in this sector. 1 - 2% higher PFE values than those obtained in the peripheral area are obtained in the distribution area of limestone in this survey sector. Especially, high PFE values are obtained in the line A and in the line B (northern part).

Since comparatively high resistivities were obtained in this sector (all of the apparent resistivities are higher than 200 Ωm), almost the same tendencies were observed in all phase pseudo sections (especially in those of below 1 Hz) and in PFE pseude sections. Furthermore, it was impossible to obtain characteristic tendency for identifying kinds of minerals by spectral classification in Cole-Cole curve.

According to the results of SIP survey carried out in this sector, it is revealed that tracing existence of limestone layers and surveying distribution of mineralization or iron pyrite in this sector are possible. However, it is found impossible to clarify locations of skarnized zone and mineralization of molybdenum. Especially, it is still unknown if detailed information regarding mineralization could be obtained by carrying out spectral measurements.

5) Results of drillings

According to the results of drilling operations carried out in this sector, it was revealed that skarnization and mineralization of molybdenum tend to become stronger to the depth at the south side of the east-northeast trending fault. In contrary, skarn zone and mineralization of molybdenum were scarcely observed at the northern side of the fault except silicification and pyritation in limestone.

From the above results, it was clarified that the skarnization and the mineralization of molybdenum might possibly be improved downward at the south side of the east-northeast trending faults.

CHAPTER 4 AGADIR SECTOR

On the basis of the results of the reconnaissance geological survey in the second phase, semi-detailed geological survey, geochemical survey, magnetic survey and IP survey were carried out in the third phase in this sector.

Clarified geology, geological structure and mineralization in this sector by above surveys are as follows (Refer to Fig.9, Fig.10).

1) Geology and geological structure

This sector is geologically composed of Paleozoic Group, Mesozoic Group, and intrusive rocks of Hercynian age. The Paleozoic Group consist of CII, CIII and CIV Formations. The CII Formation mainly consists of pelitic schist, is distributed in the western part in this sector trending from north to south. The lower part of this formation shows frequently gneissose rock facies affecting by the granite intrusion.

The CIII Formation is widespreaded whole of the sector, and consists of the alternation of conglomeratic green schist, psammitic schist, pelitic schist, crystalline limestone and calcareous schist. The CIV Formation consist of thick pelitic schist and distributed in the eastern marginal part and its outer area of this sector. These formations generally show the strikes of NE-SW trending and dipping 50° ∿ 70° eastward, but partially shows NW-SE direction.

The intrusive rocks are composed of the stocks and dykes of granite and of dykes of porphyrites. The granites are composed largely of fine to medium grained biotite granites, and some of them shows aplitic and porphyritic textures. Especially, the widespread exposure of granite which is the eastern margine of the Tichka Granites (diameter: about 20 km) is observed in the western part of this sector. These granites affected the thermal metamorphism to the surrounding rocks. Dikes of granite of which several meters to several 10 meters in width, are observed all over the sector. And some of them shows steep inclination, and others shows low angle (10° ∿ 20°) inclination.

2) Mineralization

The mineralizations in this sector, are observed the copper-tungsten-molybdenum-iron skarn ore deposit (Agadir ore deposit) near the Agadir village, the copper-iron vein ore deposit (Mauass ore deposit) of the west of the Agadir village, the molybdenum-copper vein ore deposit near the Ikissane village and copper-lead vein deposit (Tizi-n-Izrakine ore deposit) near the Tizi-n-Izrakine. However, all vein-type ore deposits except the Agadir skarn ore deposit are formed of several 10 centimeters in width and 10 meter to several 10 meters in length, and the grades of ore are shown low grade, therefore, it hardly seems possible that these ore deposits will be of large scaled and high grade ore deposits.

It is considered that the Agadir ore deposit is to be the important ore deposit on the basis of its scale and grade.

Agadir ore deposit is composed of several skarn zone in the limestone which is trending from north to south and 400 meters in width.

Mineralizations mainly consists of pyrrhotite and chalcopyrite are recognized in several parts of skarn zone. Skarnizations are recognizable in the area of about 2 km north-south centering the Agadir village.

Skarnized zones are formed the layers of several meters to 30 meters in width and 10 meters to 500 meters in length. Especially, they have a tendency to be enlarged at the portion of hanging and foot wall of the limestone and at the contact zone with granites.

Mineralizations recognized in the skarn are of a scale of several meters to 20 meters and more in width and 15 meters to 100 meters in length, the predominant mineralization has been observed at the riverside.

The grades of this outcrop were obtained at Cu: 0.60%, Mo: 0.01% and W: 0.03%.

The Mauass ore deposit located about 1 km west of this outcrop is the chalcopyrite-pyrrhotite vein ore deposit of less than 1 meter in width, but accompanied a little amount of skarn minerals.

3) Results of geochemical survey

As the results of the geochemical survey by rock sampling in the area including the Agadir and Mauass ore deposits, strong anomalies of Cu are shown the distribution correspond to the mineralized skarns and veins and weak anomalous zone are well corresponded to the skarn itself. However, it is not clear that the correspondence between W and Mo anomalies and mineralizations because to the most of samples were shown less than detectable values.

4) Results of Magnetic Survey

As the results of magnetic survey carried out in the area of about 8 km^2 including geochemical survey area, the long waved - large amplitude anomalies and the short waved - medium amplitude anomalies were detected. The former anomalies were observed in the distribution area of the conglomeratic green schist. They are less correspond to the mineralizations. It is considered that these anomalies might be reflected the high magnetic igneous rock or the high magnetic schist in the underground.

The later anomalies observed in the limestone area were well corresponded to the mineralized skarn layers. However, The later anomalies observed in the conglomeratic green schist area were not recognized clear the correspondence to the ore veins. It is considered that these anomalies have a possibility of the correspondence to the high magnetic materials concerning mineralizations or high magnetic schist.

5) Results of IP survey

As the results of IP survey, three anomalous zone in the skarn area and an anomalous zone in the Mauass area were detected.

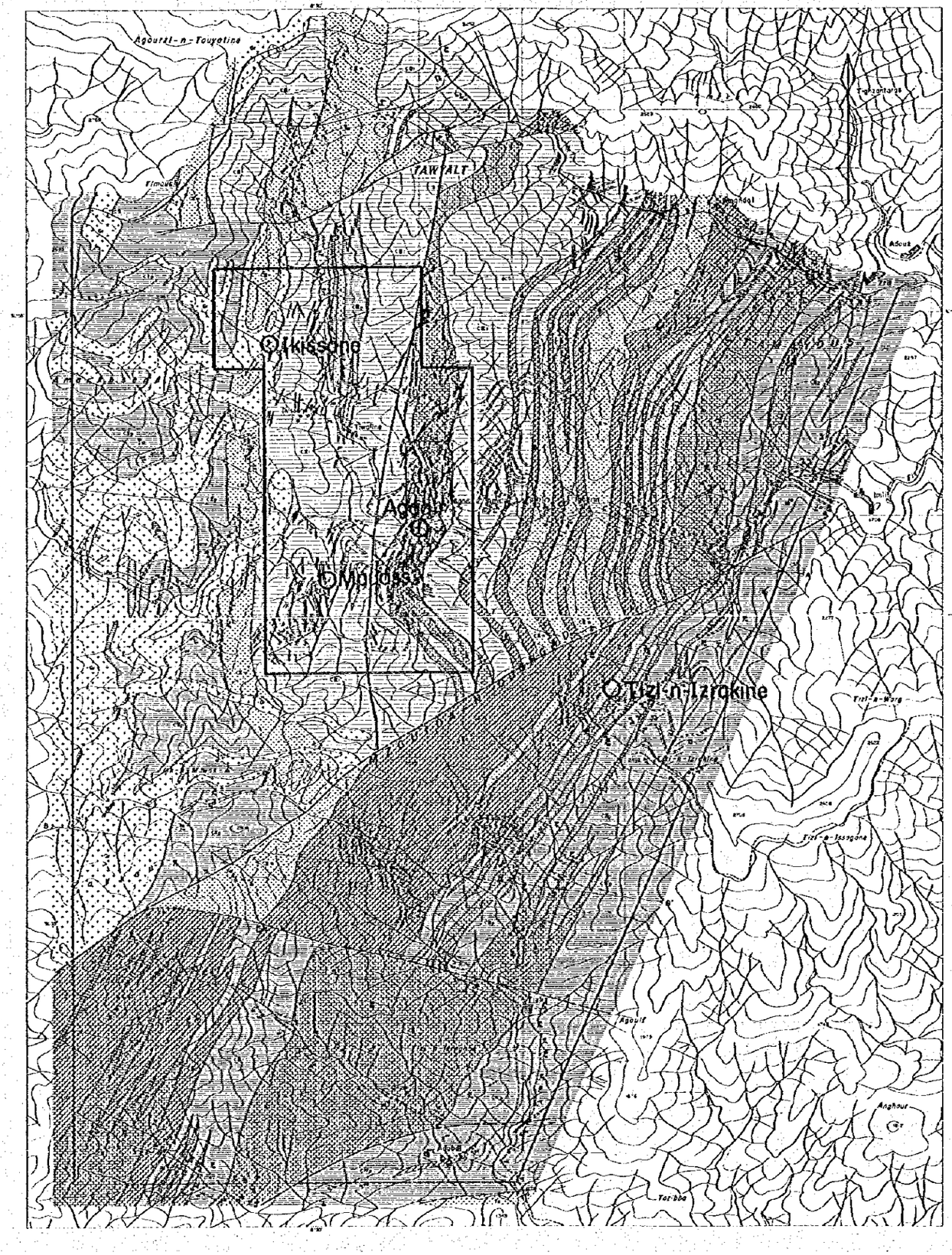
All of the former shows low resistivity and high FE value, the anomalous zone at the riverside of about 200 meters southwest of the Agadir village is distributed in the area of a scale of 200m x 200m, this anomalous zone correspond to several mineralized skarns and it has been considered the IP correspondence showing swell and shrink form (a little more than 100 meters) laterally and vertically exist.

The slightly small scaled anomalous zone at 600 meters SSW side of the village were corresponded to the small scaled several skarn zones, and it suggests the existence of weak mineralization. However, the middle scaled anomalous zone at 600 meters southwest of the village were not clear corresponded to the skarn because to this area was hardly exposed in the surface. It suggests the existance of small scaled mineralized skarn in the ground.

The IP anomaly in the vein ore deposit area indicating high resistivity and high FE value was nearly corresponded to the vein ore deposit in the surface. However, since no anomaly has been detected in the vein ore deposit area of southwest of this anomaly, this anomaly suggests the alteration or weak mineralization rather than the existence of vein ore deposits.

From the results of the various kind of survey, it can be said that the Agadir skarn ore deposits will be favorable emplacement deposits on their scales and grades.

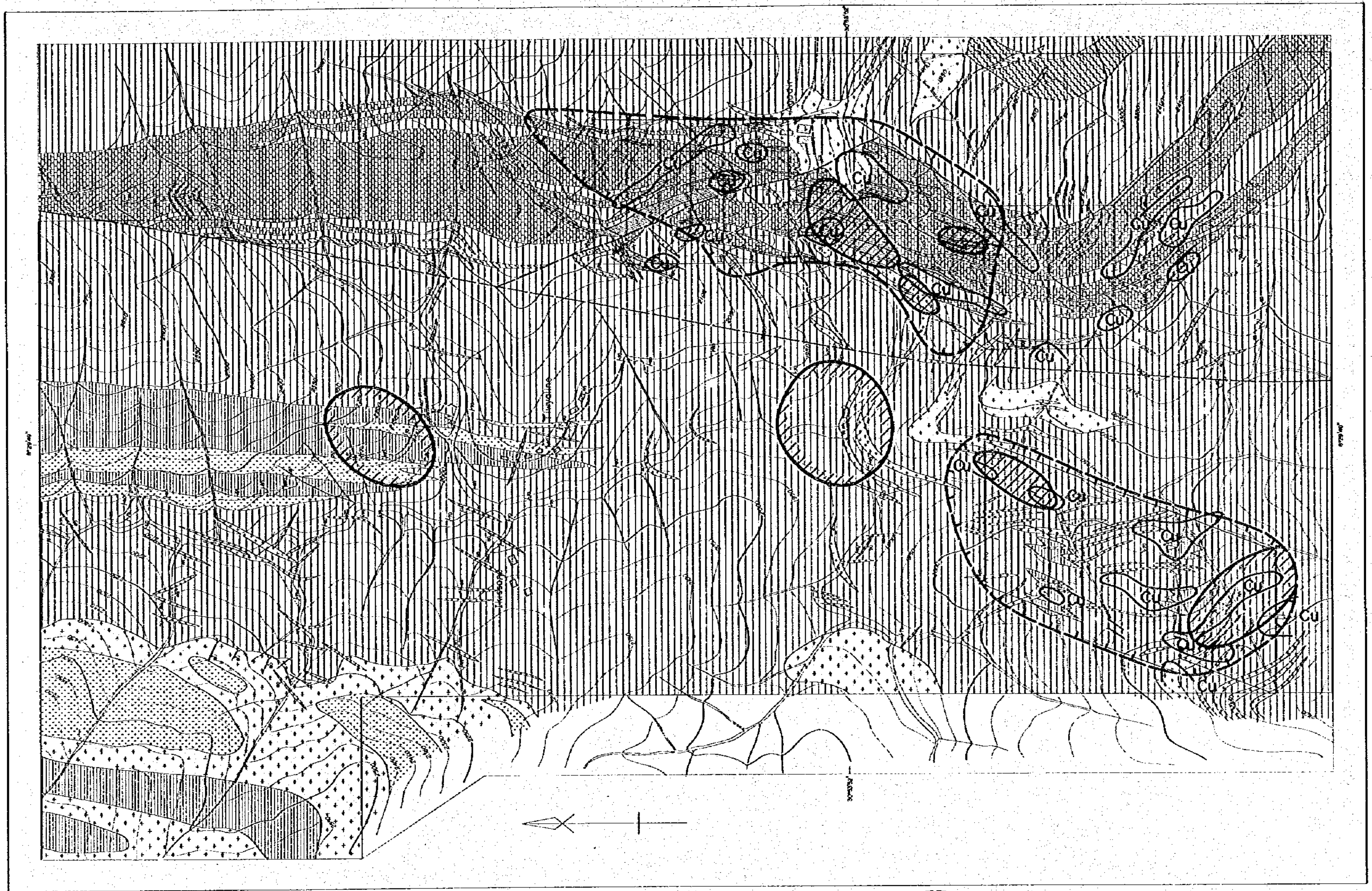
The factors of geological control for mineralization in this area are presumed the hanging and foot wall of limestone and the contact zone of limestone and granites.



LEGEND

- Triassic
  - Ts sandstone, siltstone
- Ordovician-Cambrian
  - CIV Formation
    - CIVp pelitic schist
  - CIII Formation
    - CIIIl limestone
    - CIIIc calcareous schist
    - CIIIp pelitic schist
    - CIIIm psammitic schist
    - CIIIt green schist (tuff, tuff breccia)
  - CII Formation
    - CIIp pelitic schist
- Intrusive rocks
  - Gr granite
  - Po porphyrite
  - Ap aplite
  - skarn
- fault
- bedding plane
- adit
- detailed geological survey sector
- ore deposits mineral showings

Fig. 9 Index Map of Agadir Sector (1)



LEGEND

green schist (tuff, tuff breccia)	granite		Magnetic anomalous area with many short wavelength anomalies
pelitic schist	porphyrite		Magnetic anomaly of long wavelength
psammitic schist	skarn		IP anomaly
limestone	fault		
calcareous schist	ore vein	Cu	Geochemical Cu anomaly

0 — 500m

Fig.10 Index Map of AGADIR SECTOR (2)

Though the outcrops of skarn and mineralization at the riversides in the neighborhood of the Agadir village are slightly poor in their grades, it has been assumed that the ore deposit will be continued intermittently in lateral and vertical, according to the results of geochemical and geophysical surveys.

CHAPTER 5 IGUIDI SECTOR

In this sector, it has been considered that the large potentiality of emplacement of mineralization exists according to the results of second phase survey, therefore, the semi-detailed geological survey and the geochemical survey were carried out in the third phase.

1) The geology, the geological structure and the mineralization clarified by the above surveys in this sector are follows (Refer to Fig.11).

This sector consits geologically of the Pre-Cambrian andesites, the Paleozoic CI Formation and the intrusive dolerite.

The CI Formation either is in fault contact with or unconformably overlies the Pre-Cambrian andesites.

The CI Formation is distributed in the southeast side of the fault having the N50°E trend, and consists of three dolomite layers (upper, middle and lower) and the siltstones.

Each dolomites show 2 ∿ 30 meters of the upper, 20 ∿ 70 meters of the middle and 500 meters over of lower in their thickness, and continued 2 km and over in length.

The geological structure of this sector is characterized by the relative subsidence of southeastern block caused by the above fault, by the monoclinic stracture of the CI Formation and the existence of faults strike N10°E.

These N10°E trending faults displaced the layers and cut the major fault.

The fissures of NS system and NE-SW system are observed in the dolomite layers.

2) Mineralization

The mineralizations in this sector are recognized as the stockworks of copper quartz veinlets, which is located along the NS and NE-SW system's fissures in the upper and the middle dolomites.

Ore minerals are mainly composed chalcopyrite, malachite and chalcocite.

The mineralizations are observed about 2 Km along the dolomite and recognized especially the enrichment of ore mineral near the N10°E faults and NS fissures.

The ore deposit at the western old adit was formed a scale of 250 meters in length and 1.5 ∿ 15 meters in width, with the copper grade of 1.3%, and centering on the N10E fault in the middle dolomite layer.

3) Results of geochemical survey

As the results of the geochemical survey, the anomalous zones of Cu are nearly corresponded to the mineral indications in the surface such as near the old adits in the western part, along the N10°E fault in the central part and at the eastern margine in the middle dolomite.

Especially, the weak anomalies in the upper dolomite are recognized in the easter part.

According to the results of above surveys, it has been considered that the mineralizations in this sector are geologically controled by the existence of N10°E faults, by the selectivety for dolomites and by the existance of the NS and NE-SW fissures.

It is presumed that the mineralization has been made up by the ascensive mineral solution through the N10°E faults as the results of the post igneous activities of dolerite which is located in the western part of this ore deposit.

Though the grades of ore deposit in the surface are slightly low, it can not be deny that the mineralization will be enriched and continued to the deeper part.

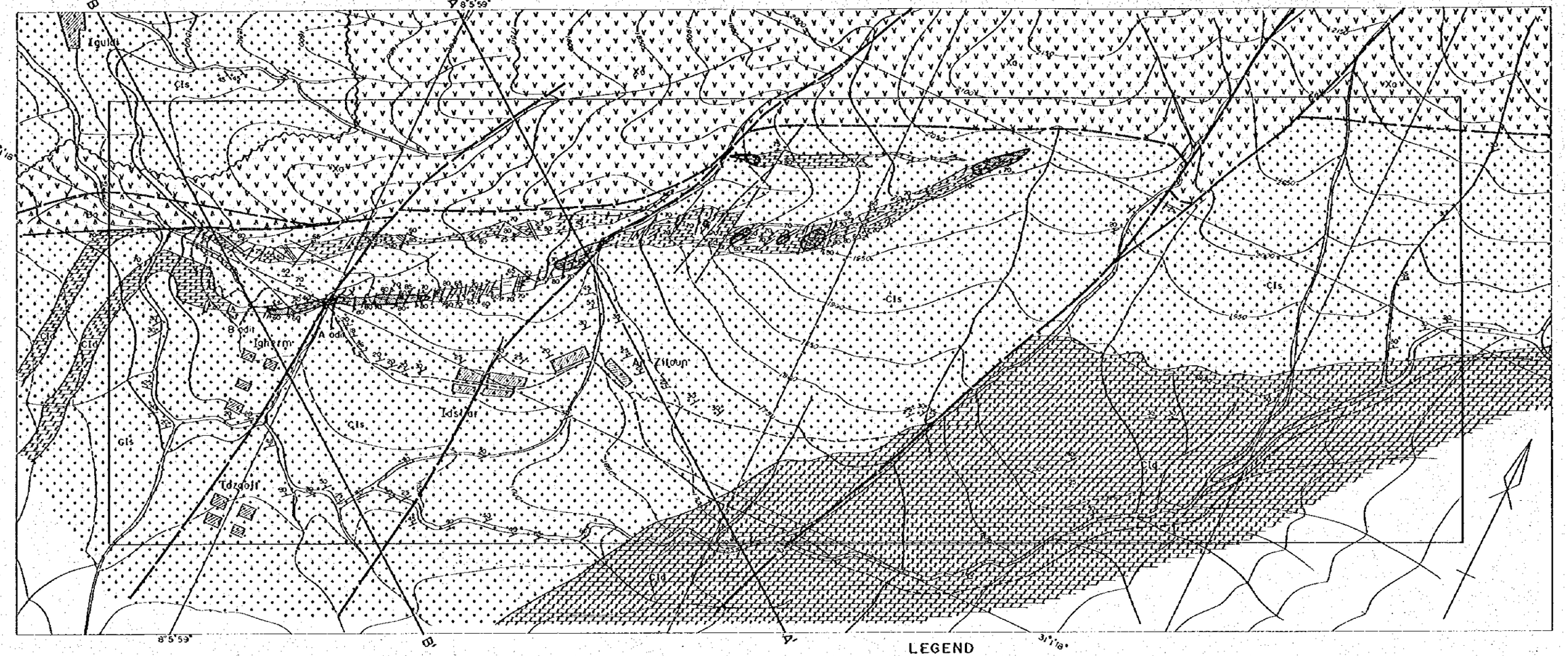


Fig.11 Index Map of Iguidi Sector

CHAPTER 6 TADDART SECTOR

In this sector, it has been sonsidered that the possibility of the emplacement of ore deposit is large according to the results of second phase surveys, therefore, the semi-detailed geological survey and geochemical survey were carried out in the third phase.

The geology, the geological structure and the mineralization in this sector by the above surveys are as follows (Refer to Fig.12).

1) Geology and geological structure

This sector is geologically composed of the Paleozoic green schist, psammitic schist and limestone which is correlated to the CII and CIII Formations.

These formations strike generally NS to N30°E and dips 30° ∿ 70° east ward.

The geological structure in this sector is characterized by the monoclinic structure of Paleozoic formations and by the block movement caused by the faults trending EW, NE-SW, NW-SE and NS directions.

Especially, the limited area (about 400m x 400m) by the faults in which numerous fissures of various trends are aggregated is recognized in the western part in this sector.

2) Mineralization

The mineralization in this sector is represented by the vein type ore deposit of copper associated with quartz in the above stated fissures.

The fissure-aggregated area is about 400m x 400m in a scale. The silicified rocks are recognized along the eastern and the western margine of this area, and numerous quartz veins are also obserbed in this area. These veins are in a scale of several centimeter to several meters in width and of several 10 meters to several 100 meters in length, they strike various directions such as EW, NS, NE-SW and NW-SE etc., and the mineralizations are partially observed in them.

The ore minerals consist of chalcopyrite, malachite and chalcocite. The grade of these ore veins is generally of Cu: 0.5% to 4.0%, and the average grade of them is of Cu: 2.5% and Ag: 20 g/t.

3) Results of geochemical survey

As the results of geochemical survey subjected the veins by the rock sampling, both of Cu and Ag elements shows the same behavior. From this fact it is clarified that this ore deposits are made by Cu-Ag mineralization.

The strong anomalous zones are distributed along the eastern and southern margine in this sector and generally correspond to the mineralized veins elucidated by geological survey.

According to the above stated results of survey, it has been clarified that the mineralizations in this area are geologically controled by the secondary aggregated fissures caused by the fault movements.

Though the ore veins in the surface are of thin width and their grades is slitely weak, the possibility of enrichment and enlargement of these ore veins in the underground has been remained.

LEGEND

Ordovician ~ Cambrian

- CIIIp pelitic schist
- CIIIm psammitic schist
- CIIIt green schist (tuff, tuffbreccia)
- CIIl limestone
- CIIIo calcareous schist
- CIIp pelitic schist
- CIIm psammitic schist

Intrusive rock

- Gr granite
- Po porphyrite
- silicified zone
- bedding plane
- quartz vein
- fault
- stratigraphic boundary
- detailed geological survey sector

Fig.12 Index Map of Taddart Sector

PARTICULAR 3

CONCLUSION AND RECOMMENDATION

CHAPTER 1 CONCLUSION

According to the various method survey carried out during the three years in the Haut Atlas Occidental area of Morocco, the geology, the geological structure, and the emplacement states of ore deposit in this area has been clarified. And the relationship between the mineralizations and the geological structure has been elucidated.

This area is underlain, geologically, by the Pre-Cambrian Group, the Paleozoic Group, the Mesozoic Group, the Cenozoic Group and the Intrusive Rocks intruded during Hercynian Period.

The Pre-Cambrian Group, which is the basements of this area, is mainly composed of the andesitics.

The Paleozoic Group, which is characterized by the higher metamorphism and the more strict folding structure in ascending order, consists of the sedimentaries, the volcanics and the schists.

The Intrusive rocks of the Hercynian period consist of the granites and the dolerite. Especially, besides the granites from the stocks such as the Tichka Granites and the Azegour Granites, dikes of granites are distributed at the many places in this area. It is clarified that the intrusive rocks intruded after the folding movement of the Paleozoic Group.

The Mesozic Group, which uncomformably overlies on the peneplane of the before Mesozoic formations, consits of the Triassic System, the Jurassic System and the Cretaceous System.

They are distributed in the areas of the topographical high and in the inserted area by the faults with gently dips.

The Tertiary System also conformably overlies the Mesozoic Group and distributed at the parts of the Mesozoic distribution area in a small scale. The alluvium deposit is distributed along the rivers.

Many faults of NE-SW, EW, NNE-SSW etc. are recognized in this area, and the displacements and the drug foldings are observed. These facts show that the strict block movement took place in this area, and it is considered that this movement occured at the end of the Alpine orogenic movement.

Although there are several ore deposits which have been produced in the past in this area, the mineralizations and the mineral indication confirmed in this surveys are reached over seventy in numbers. This facts indicated that this area is the faverable area of strong mineralizations.

All of the mineralization exist in the formations and the igneous rocks before Mesozoic. As the types of ore deposit, vein type ore deposits, skarn-type ore deposits and stockwork type ore deposits were observed.

Since the hercynian intrusive stocks and dykes are observed in the surroundings of these ore deposits, it is suggest that these ore deposit have been made by the post igneous activity of the intrusive rocks.

The vein-type ore deposit has a close relationship to the faults system in the Paleozoic Group, that is, the relationship of same direction or secondary shear faults and fissures of the major faults are recognized.

The skarn ore deposits are observed in the Azegour Sector and in the Agadir Sector, the former is located near the Azegour Granites and the later is situated in the surroundings of the Tichka Granites. Therefore, it suggest that the relationship between the granits and skarn ore deposit is very close.

The stockwork ore deposit is recognized only in the Iguidi Sector, and the dolerite intruded near the ore deposit are observed. This mineralization has been controled geologically by the faults and the fissures in the dolomite layers.

In the five sectors which are considered the favorable area of emplacement of ore deposits, geological surveys, geochemical surveys, geophysical

surveys and drilling were carried out repeatedly to elucidate the more detailed geological situations and the conditions of emplacement of ore deposit.

As the results, the clarified relationship between the mineralization and geological structure are as follows.

1) Erdouz Sector

The ore deposits in this sector, are copper-lead-zinc vein ore deposits in the limestone predominant CIII Formation of Paleozoic Group. The north ore deposit and the south ore deposit were recognized. The emplaced area of the north ore deposit is about 100m x 100m. The ore deposit consist of several ore bodies of about 10 meters in length and about 10 centimeters in width, and the grades of ore bodies are assumed Cu: 0.4% ±, Pb: 8% ±, Zn: 8 ∿ 10% Ag: about 100 g/t. The emplaced area of the south ore deposits is 150m x 200m. The ore deposit consists of several ore bodies of 10 ∿ 20 meters in length and 10 ∿ 50 centimeters in width, and their grades are assumed Cu: 0.8% ±, Pb: 2% ±, Zn: 7 ∿ 10%, Ag: about 90 g/t. As the geological factors controled the mineralization in the Erdouz Sector, the selectivity of the host rocks (limestone), the fissure system and the folded structure were clarified, and it is considered that each of south and north ore deposit were made independently.

2) Azegour Sector

The ore deposit in this sector is the copper-molybdenum-tungsten skarn ore deposit replaced the limestone of the Paleozoic CIII Formation. The Azegour Mine, located in the south in this sector, has produced approximately 900,000 tons of crude ores.

The skarnized zone is located about 4 km north of the Azegour Mine and the molybdenum mineralization is recognized in many places of it. The limestone bed of the swelling width of 100 ∿ 200 meters, is extending several km northward as the host rocks.

The skarnized zones are recognized as wide as 0.3 ∿ 1.0 meters, along the hanging and foot wall of the limestone as well as along its boundary planes with other rocks.

Especially, in the area near Tizgi village the skarnization and mineralization is more intense in the deeper part, that is, the mineralization on the surface is recognized to be as wide as 0.6 meters with the grade of MoS_2: 0.13%, while, on the level at the depth of 200 meters in the underground, the mineralization extends 15 ∿ 35 meters with the approximate width of 1.5 meters with the grade of MoS_2: 0.26 ∿ 0.56%.

As the geological factors controled the mineralization in the Azegour Sector, the boundary of limestone and other rocks, the fissure predominant in the direction of ENE-WSW were clarified.

As the result of this surveys, the molybdenum mineralization in this part is small and low grade.

In the deeper part of the areas to be satisfied above geological condition, the tendencies of intense mineralization are recognizable. However, it is hardly expected that the large-scaled and high grade of mineralizations exist.

3) Agadir Sector

The ore deposits in this sector are Agadir skarn ore deposit (Cu, W, Mo, Fe), Ikissane vein ore deposit (Cu, W), Mauass vein ore deposit (Cu, Fe) and Tizi-n-Izrakine vein ore deposit (Cu, Pb). However, it is hardly possible that these ore deposits will be of large scaled and high grade ore deposit, except the Agadir ore deposit, from the view point of their scales and grades.

The Agadir ore deposit is the skarn ore deposit in the limestone of Paleozoic CIII Formation which is trending NS and 400 meters in width.

The skarnized zone are formed several layers of several meters to 30 meters in width and 10 to 500 meters in length, and the skarnizations are recognizable in the area of about 2 km north-south centering the Agadir village. Especially, the predominant mineralization has been observed at the reverside in the neighborhood of the Agadir villages. The grades at this outcrops were obtained of Cu: 0.60%, Mo: 0.01%, W: 0.03%.

As the geological factors controled the mineralizations in the Agadir Sector, the boundary of limestone and other rocks and the contact zone with the granites were clarified.

The riverside is presumed the center of the mineralization, and it is considered that the ore deposit in this part will be continued intermittently in the deeper part.

4) Iguidi Sector

The ore deposit in this sector is the copper stockwork ore deposit in the dolomites of the Paleozoic CIII Formation. Two dolomite beds are recognized as the host rocks. The mineralizations associated with quartz veinlets are observed near the fissures of NS and NE-SW directions, and recognized about 2 km along the dolomites.

The ore deposit at the western old adit was formed of a scale of 250 meters in length and 1.5 ∿ 15 meters in width, with the grades of Cu 1.3%, and centering on the N10°E fault in the middle dolomite layer.

As the geological factors controled the mineralizations in the Iguidi Sector, the selectivity of the host rocks (dolomite), the faults of N10°E direction, the fissures of NS, NE-SW direction were clarified.

Though the grades of ore deposit in the surface are slightly low, the continuity of ore deposit and the rise of the grades are expectative.

5) Taddart Sector

The ore deposits in this sector are the silver-copper-quartz vein ore deposits in the conglomeratic green schist of the Paleozoic CIII Formation.

The Paleozoic formations show the monoclinic structure and affected the block movement caused by the faulting of EW, NE-SW, NW-SE, NS directions.

The mineralization are concentrated in the quartz vein aggregated area of about 400m x 400m at the western part in this sector. These ore veins are in a scale of several centimeters to several meters in width and of several 10 meters to several 100 meters in length.

The strikes of these veins show the various directions such as of EW, NS, NE-SW, NW-SE etc.

The mineralization of chalcopyrite, malachite and chalcocite are recognized in the part of these veins. The grades of these ore veins is generally of Cu: 0.5 ∿ 4.0%, but the average grade of them is of about Cu: 2.5%, Ag: 20 g/t and average width is 30 centimeters. As the geological factors controled the mineralizations, the secondary aggregated fissures caused by the fault movement was clarified.

Because the ore veins on the surface are of thin width and their grades are slightly low, these ore deposits could not to be the subject for production. However, the possibility of the enrichment and enlargement of these ore veins in the underground has been remained.

CHAPTER 2 RECOMMENDATION

The subject area, the Haut Atlas Occidental area can be said the most favorable area of emplacement of mineralization in the Morocco from the view point of number of ore deposit and the history of their production of ore. However, it is considered that these ore deposits has been explorated entirely owing to this area has the good exposure and the long history of exploitation. And it is presumed that the remained ore deposits have a small amount ore.

As the results of the survey, five sectors has been selected as the favorable area of emplacement of mineralization.

The grade of ore deposit on the surface is less generally, therefore, no available ore deposit to produce immediately exist in this area. However, from the geological factors controled mineralization in this area has been clarified by these years surveys, the continuities and the enrichments of their mineralizations in the deeper part of the following three sectors are expectable.

Therefore, the surveys in the following area are recommended as the further investigation program if possible.

1) Agadir Sector: Drillings downard at the riverside of the Agadir village, to confirm the continuity of the skarn ore deposit.

2) Iguidi Sector: IP survey and drillings near the N10°E fault and NS fissures on the dolomite to confirm the continuity of stockwork ore deposit.

3) Taddart Sector: Ip survey and drilling at the aggregated vein area, to confirm the continuity and the enrichment of the vein type ore deposit in the deeper part.

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