(2) Sfariat-Zednes

Sfariat-Zednes area is located about 200 km northeast of the Zouerate city. It takes 3 hours from Zouerate to Sfariat by vehicle. OMRG has carried out a geological survey for gold in this area by the financial support of EU. This area is located in the central zone of the Reguibat Shield. It is composed of gneiss, limestone, granitic rocks, migmatite and amphibolite of the Archean age (Fig 4.2.8). The area shows tectonic zone with faults developing NW-SE and WEW-ESE, and strongly sheared rocks. Sequence of three ranges of 10-30m thick BIFs extends 70km. The formation strikes N40-70W°, and dips 30-50° north. There is a scarce distribution of greenstone and alteration and mineralization are rarely found. Meanwhile, a part of BIFs distributed in the west changes to weak silicification, hematitization and limonitization, though copper mineralization represented by malachite is not found.

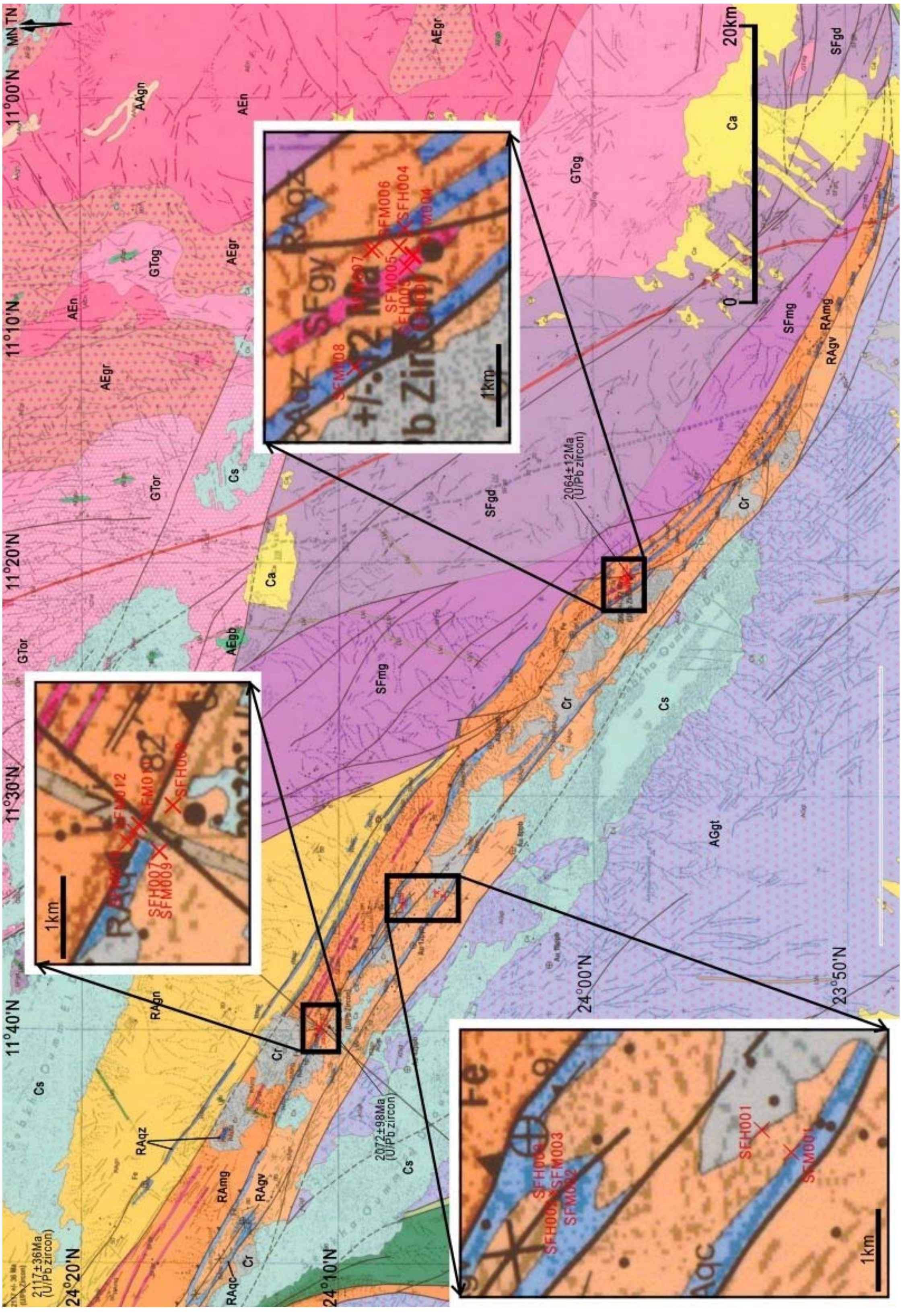


Fig. 4.2.8 Geological map of the Sfariat area

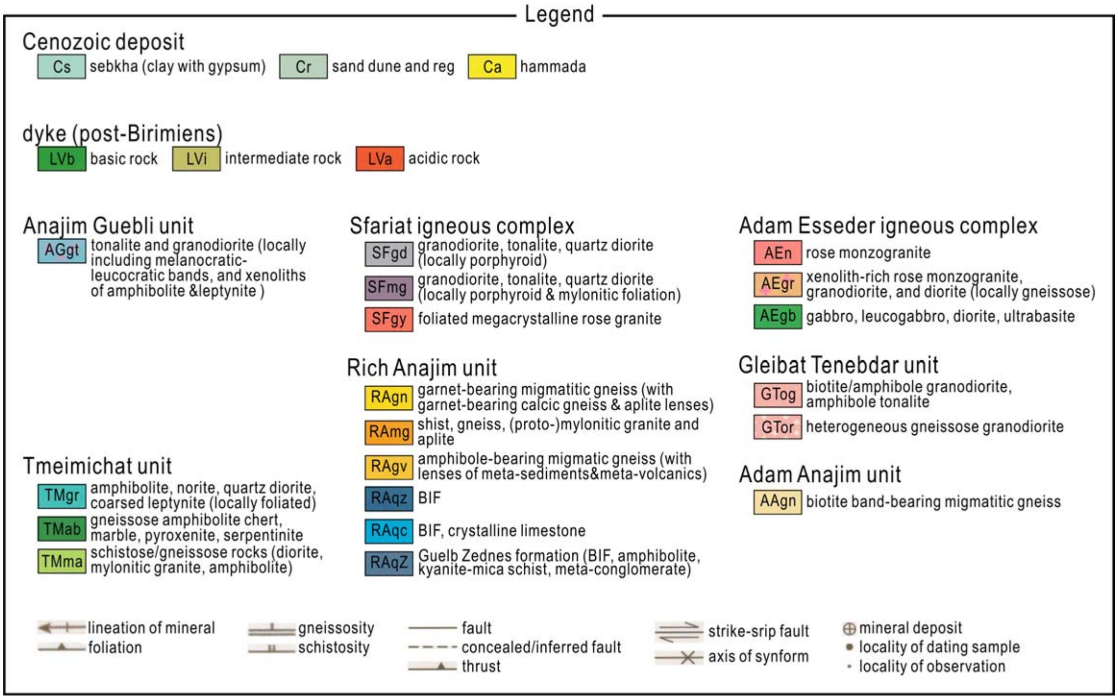


Fig. 4.2.9 Legend of the Geological map of the Sfariat area

(3) Tasiast area

The Tasiast area is located in about 300 km north to Nouakchott. It takes about 5 hours from Nouakchott to Tasiast, located in the southwestern end of the Reguibat shield. The area consists of gneisses, granites and greenstone belt trending N-S at the Amsaga basement. Until the beginning of the 1990s, this area had hosted an iron mineralization zone targeted for BIF. BRGM (1975) has calculated ore reserves of 30 million tones, assuming that the grade in low grade ore would be ranging from 44 to 48 % of Fe_2O_3 and that in high grade ore - 72 to 80 % of Fe_2O_3.

Recently orogenic gold deposits have been found in greenstone belt of the Archean in Canada, Australia and West Africa. Exploration for this type of deposit has become intense globally. Because this area also overlays greenstone belt containing BIF of the Archean, there is some possibility for an orogenic deposit to exist. From 1993 to 1996, OMRG conducted a geochemical prospecting for gold in cooperation with BRGM. The geochemical anomalies (50-200 ppb) of gold in the soil extend over an area of 150 km x 50 km, and gold mineralization processes are working in conjunction with BIF in the greenstone belt. Furthermore, the results of a trench survey on the gold geochemical anomaly area identified 3 gold deposition zones: a 14m-long zone with an average gold grade of 9.81g/t; an 8m-long zone with an average gold grade of 6.31g/t; : and a 13m-long zone with an average gold grade of 3.92g/t (Artignan et al., 2000).

That was followed by additional drilling and trench surveys in the deposit area, with total boring length reaching about 62,835m by foreign companies in cooperation with OMRG. The deposit includes gold-bearing quartz veinlets, gold-bearing quartz networks and dissemination. In April 2004, the confirmed values for gold ore were 12.07 million tons, grade of 3.06 g/t, with a total gold content of 1.185 million oz (36.8t), which were similar to the estimated values of 12.4 million tons, ore grade of 2.25 g/t and total gold content of 899,000 oz (27.9t). Presently, the Tasiast Mauritania Ltd. (Canada) is developing the mine to prepare for commencement of production in 2006.

In this study, Piment sector in the Tasiast area have been investigated. Owing to few outcrops in the Piment sector, the waste rocks and ores remaining from the trench survey can be mainly observed and collected as rock and ore samples. Characteristics of mineralization in the Tasiast Piment deposit are described in 4.3.

(4) Tijirit

The Tijirit area is located in about 410 km northeast to Nouakchott. It takes about 7 hours from Nouakchott to Tijirit by a 4-wheal vehicle. The area is situated in the southwestern part of the Reguibat shield, and in about 120 km east-northeast to the Tasiast deposit. It consists of basic volcanic rocks, amphibolites, serpentinites and schists of the probable Archean age (PRISM, 2004). NNE-SSW directed tectonic structure is remarkable and develops dikes of gabbro and andesite showing similar trend.

In Tijirit several quartz veins including Ator vein are confirmed. The Ator vein consists of gold-bearing quartz vein extending along a fissure belt in basalt and ophicalcite discovered in a 2001 OMRG regional survey. The quartz veins, composed of a NNE strike and a NNW strike that runs diagonally to it, form an echelon arrangement, with the quartz veins having a width of 0.4-3m and a maximum length of 200m. Seven veins have been confirmed within a 600 m x 400 m area. The present survey has been conducted around the Ator gold vein and found that the grade of the gold ore was very high – 15 g/t. The mineralization and its characteristics are described in 4.3.

(5) Guelb Moghrein

The Akjoujt area including Guelb Moghrein deposit is located in about 250 km northeast of Nouakchott; it takes approximately 3 hours from Nouakchott to Akjoujt by vehicle. The area lies in the north of the Mauritanides. The Guelb Moghrein deposit is in about 5km west to Akjoujt City. In the vicinity there is a peneplain of about 130m asl, but since the head of this deposit consists of siliceous gossan, there are two small but steep hills of about 80m and 90m in height there. From 1967-78, the Guelb Moghrein Cu-Au deposit mined at Akjoujt was Mauritania’s only working copper-gold mine. While this deposit is a hydrothermal magnetite-bearing copper-gold carbonate replacement, there may be a chance that it is an IOCG (iron-oxide copper gold)-type deposit (see Appendix I in the Interim Report).

General Gold International (GGI), Australia, carried out the downward drillings from the surface during 1994-1995. GGI has implemented drillings totaling 8,000m in the course of evaluating the ore reserves. Total measured and indicated resources of 23.6 million tons with 1.88% of Cu, 1.41 g/t of Au and 143 ppm of Co have been calculated and officially announced (Strickland and Martyn, 2001). Presently, a Canadian company is preparing for the redevelopment of the Akjoujt mine, which is currently closed. This deposit is detailed in 4.3.

(6) Tabrinkout

The Tabrinkout prospect is located in 35 km east of the Akjoujt city. The present study has investigated the Jean-Marie sector of Tabrinkout. This prospect was selected as tungsten occurrence, but the study has resulted in being regarded as a copper and gold prospect.

Around this prospect, chlorite schist and small block of carbonate rocks spread widely as at the Guelb Moghrein deposit. Gold-bearing malachite (Cu) quartz vein and malachite dissemination are found in chlorite schist.

Near the Tabrinkout prospect area there is an expansive green mudstone schist zone which includes numerous blocks of carbonate rock. The chlorite schist is regulated to an anticline with a NNE-oriented axis, with schistosity on the western side having a NNE-SSW strike, a 30-75° W dip, and a of 30-50° E dip on the east. The blocks of carbonate rock are 10-30m wide and 50-100m long, and generally extend toward NNE (Fig. 4.2.10).

The 20-30cm thick quartz veins of this prospect have a N-S strike in the chlorite schist, a dip of 50-70° E, and with the strike extending to 20-50m. Number of veins is not so abundant and alteration around vein is weak. In the 1990s, BRGM, with a target for gold in the area, conducted trench and drilling surveys (Marenthier, 1997). They confirmed that there were several grams of gold per ton here and poor gold assay generally revealed low grade in the vicinity (0.5km x 1km).

Tourmaline was found in quartz vein (TBH005) in the west of this vicinity under the microscope. Tungsten minerals, however, were not recognized (Appendix I-2.3). Fluid inclusion in quartz in the malachite-tourmaline bearing quartz vein ranges between 10 and 30 micrometer and is predominant in polyphase inclusions containing halite crystals. Homogenization temperature ranges from 230 to 250ºC, and salinity varies from 32 to 34 wt% NaCl eq. (Appendix I in the Interim Report). The data support the formation of tourmaline under the condition of high temperature.

In the carbonate rocks in the southeast, malachite is found in veinlets and lenticular aggregate composed of quartz and calcite. Mineralization of grade of 25 g/t Au and 2.95% Cu (THH010) is found here. In the second factor of the factor matrix by a principal component analysis, Bi, Cu, Pb, Sb, Se, Sn, and Te are extracted as elements showing strong positive correlation with Au (Appendix I in the Interim Report).

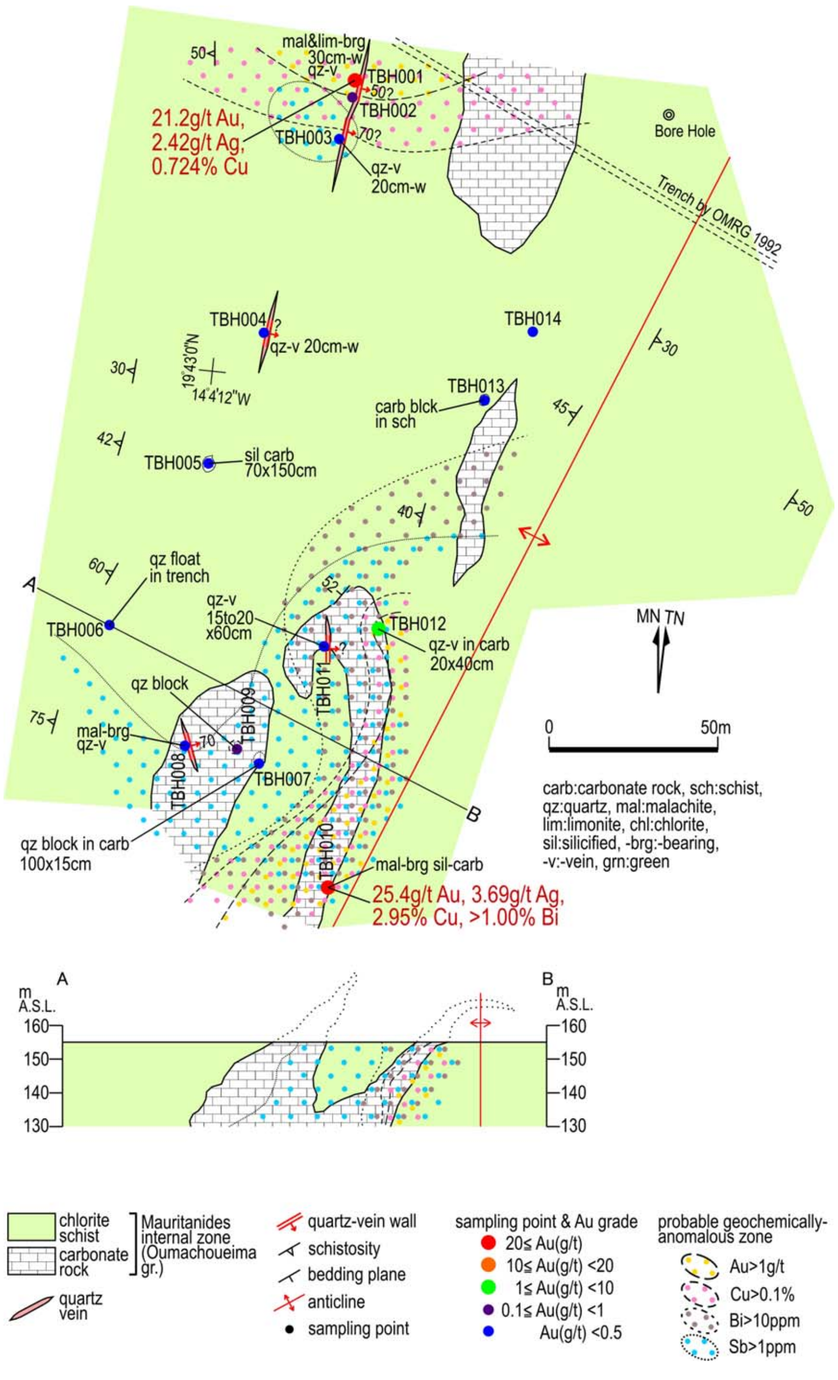


Fig. 4.2.10 Geological map and geochemical anomaly of the Tabrinkout prospect

Geochemical anomaly map (Fig.10.2.10) represents gold, copper, bismuth and antimony anomalies (>1 g/t Au, > 0.1 % Cu, >10 ppm Bi, >1 ppm Sb). Anomalies of copper, bismuth and antimony are overlapped on carbonate rocks. Gold anomalies over 20 g/t are recognized at two samples: one is from a malachite-bearing quartz vein and the other from a silicified carbonate rock accompanied by malachite. The carbonate rock in the southeast of the sector is located within 50m from the anticlinal NNE-SSW directed axis. Since open cracks formed near the axis of anticline are developed, mineralization would have come up to the surface through the cracks.

Although the Tabrinkout region has been studied as tungsten occurrence, tungsten minerals as scheelite and wolframite have not been found on the surface survey in the present study. Moreover, maximum value of tungsten assay in this geochemical survey was 30.3 ppm. A few tungsten minerals recorded in the past investigation were observed under the microscope in the samples collected from boring cores (BRGM, 1975). However, according to the "Mineral Plan", tungsten from placer deposit was recorded to have produced at the amount of 9.4 tons with assay of 30 to 35 % WO_3.

In the Tabrinkout prospect, elements showing strong positive correlation with Au are Bi, Cu, Pb, Sb, Se, Sn, and Te by the principal analysis. These elements bear a striking analogy to an assemblage of elements (Ag, Bi, Cu, Pb, Sb, Se, Sn, and Te) revealing a strong positive correlation with Au in the Guelb Moghrein deposit. This indicates that the mineralization of both districts have been formed under similar circumstances and mechanism. This is also revealed by fluid inclusion study in quartz vein, so that fluid inclusions in quartz veins in both the Tabrinkout prospect and the Guelb Moghrein deposit are composed of polyphase inclusions containing halite crystal and gaseous inclusions, and that homogenization temperatures and salinities in both districts represent almost the same range. It is suggested that mineralization of both districts have passed under the high temperature and high salinity. Therefore, it is highly probable that mineral deposit such as the Guelb Moghrein gold-bearing copper deposit could lie under the carbonate rocks in the Tabrinkout prospect.

(7) Kadiar

The Kadiar Cu-Au prospect is located about 550 km southeast of Nouakchott, and it takes approximately 11 hours from Nouakchott to Kadiar by vehicle. The prospect contains chlorite-sericite schist, meta-basic volcanics and serpentinite. In the lens-shaped or lumpy siliceous gossan sandwiched between these rock bodies, disseminations of malachite have been found. The siliceous gossan extends directing NNW-SSE parallel to schistosity, showing average striking of N31° W and dipping of 50° southwest. A N-S Limonitization extends to several km. Major gossan forms a small, 10-30m high hill, with approximately 60m width from east to west and 500m length from south to north (Fig. 4.2.11)

The siliceous gossan could have been formed by replacement of carbonate rock in the schist (BRGM, 1975), copper mineralization chiefly composed of malachite is also recognized along fissures in the siliceous gossan (Fig. 4.2.12). Oxidation zone within 20m below the surface contains 1% Cu, and the mineralization containing 1% of Cu have been confirmed at more than 60m depth of sulfide zone, and the drillings have caught assay of 0.5-1.3 g/t Au (OMRG, 1995).

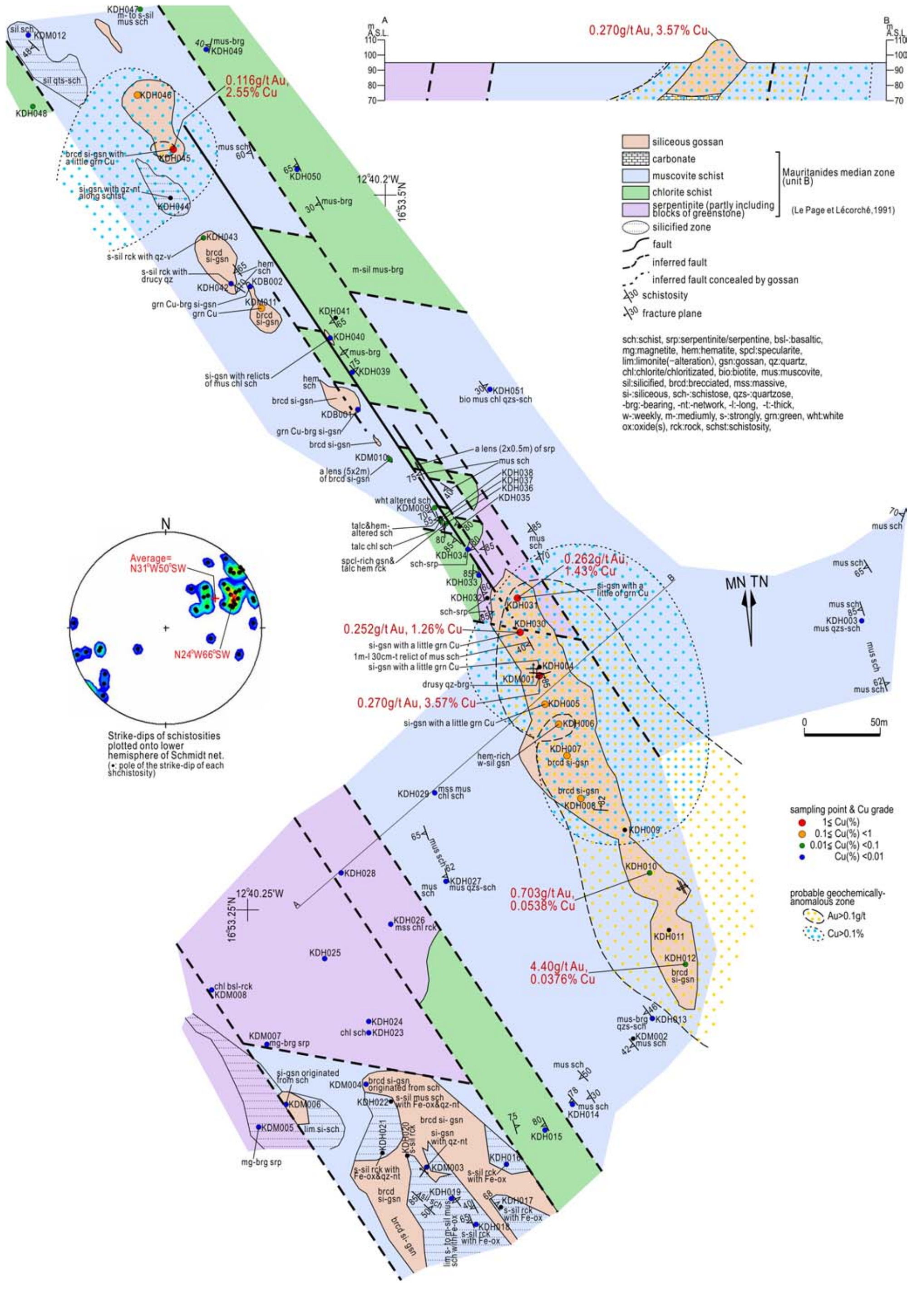


Fig. 4.2.11 Geological map of the Kadiar prospect

The maximum assay of 3.6% of Cu and 4.4 g/t of Au is conformed in siliceous gossan accompanied with malachite (Appendix I-2.8). Under the microscope, malachite, chrysocolla and goethite are found as ore minerals (Appendix I-2.5).

Fluid inclusion in the quartz vein cutting the siliceous gossan ranges from 4 to 10 micrometer and is dominant in liquid inclusions. Homogenization temperature is divided into two groups: one ranges from 140 to 170ºC, and the other between 270 and 370 ºC, but centers at 150-160 ºC. Salinity is low varying from 0.4 to 11 wt% NaCl eq. (Appendix I-2.3).

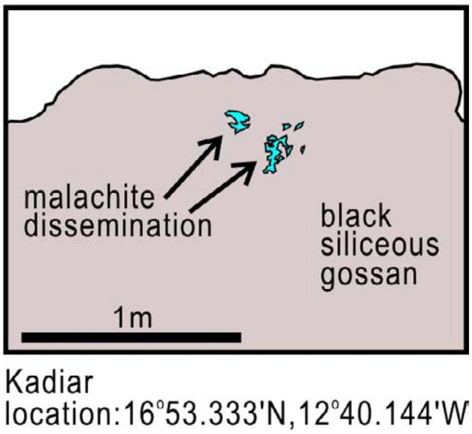


Fig. 4.2.12 Malachite dissemination in Kadiar prospect

(8) Indice 78

The Indice 78 prospect is located in about 35km south-southeast of the Kadiar prospect. The prospect consists of gold-bearing quartz veins and malachite lens in chlorite schist and chloritic andesite in the Mauritanides. Bodies of chloritic andesite crop out in ranging between 5m x 10m and 100m x 200m+ but they direct NNW-SSE. Schistosity of chlorite schist strikes N5-20° W and dips 25-40° west (Fig. 4.2.13).

Quartz veins strike N5-20° W and dip 25-70 west. The veins are 4-10m wide and extend 40-60m long. Large six veins form an echelon arrangement. According to the analysis of the Schmidt net, an average vein reveals a N11° W strike and a 44° dip to southwest. Quartz veins enlarge in the chlorite schist. Quartz in the veins is in form of white and fine sugar-like grain. Copper and gold mineralization in the region trends NNW-SSE (Fig. 4.2 13), this direction corresponding to the schistosity of chlorite schist.

The quartz vein is composed of secondary copper oxides of malachite, chalcopyrite, chalcocite and native gold (Appendix I-2.3). In chlorite schist and chloritic andesite, copper mineralization composed of small malachite lies widely in veinlet and dissemination. The maximum assay of 9.7% Cu and 19.3 g/t Au is confirmed in malachite-chalcocite quartz vein in the southern part (Appendix I-2.5).

Fluid inclusion in quartz in the quartz vein ranges from 4 to 25 micrometer and comprises liquid and polyphase inclusions. Homogenization temperature of the liquid inclusions concentrates at 200-350℃, and salinity reveals 6-22 wt% NaCl eq.; while polyphase inclusions are respectively characterized by 120-170℃, and 27-30wt% NaCl eq. (Appendix I in the Interim Report). This suggests that the highly saline fluid is related to copper and gold mineralization.

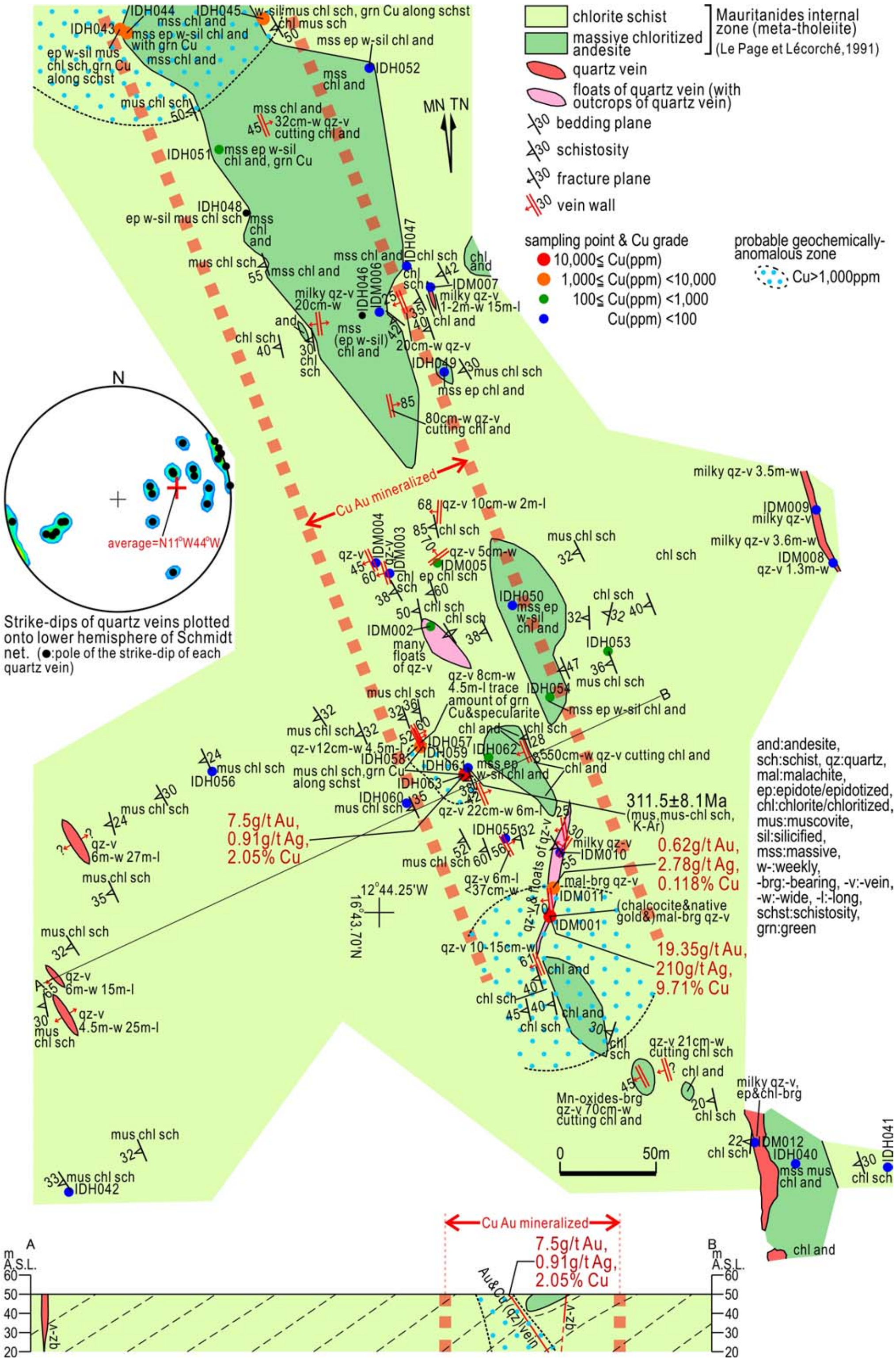


Fig. 4.2.13 Geological and geochemical map of the Indice 78

(9) Oudelemguil

The Oudelemguil copper deposit is located about 600 km southeast of Nouakchott, and it takes 10 hours from Nouakchott to Oudelemguil via M'Bout town by vehicle. The deposit consists of silver-bearing malachite veins in the picritic basalt of the Mauritanides (Fig. 4.2.14).

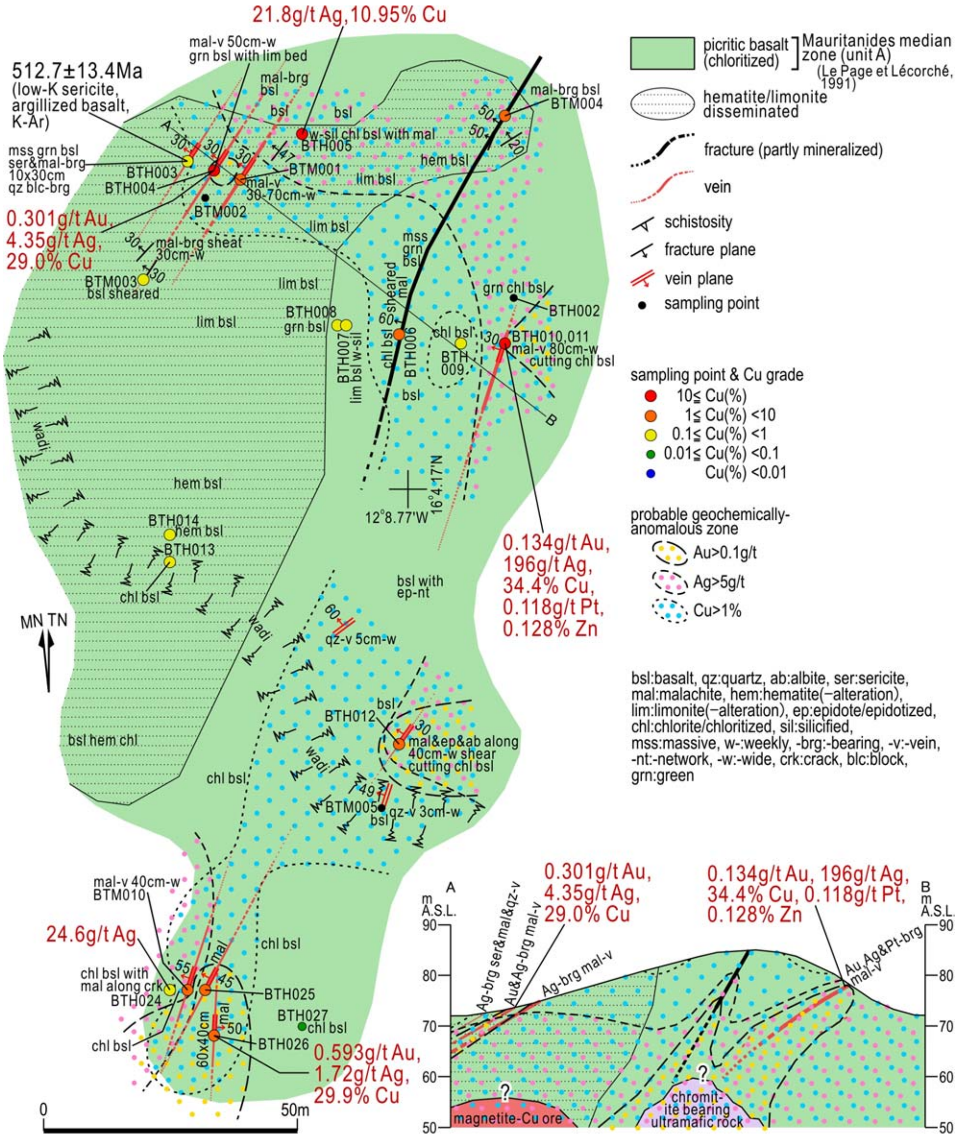


Fig. 4.2.14 Geological and geochemical map of the Oudelemguil deposit (Principal sector)

The surveyed area comprises the Principal sector in the north and the Ragel sector, a very small area of 5m x 10m, located in about 1 km south from the former one. In the Principal sector, the basalt forms a hill of 15m height, 200m wide north-south and 100m wide east-west (Fig. 4.2.14). The western part of the hill is altered by hematitization and limonitization.

Five veins are confirmed parallel to each other, which show N25-40° E strike and 30-55° dip to northwest. The veins are 0.4-0.8m thick, with the maximal extension of 300m. The present survey conforms to the maximum assay of 34.4% for Cu, 0.59 g/t for Au and 196 g/t for Ag (Appendix I-2.5). Platinum assay of 0.1 ppm is confirmed in malachite vein associated with gold and silver mineralization. An example of outcrop with malachite mineralization is shown in Fig. 4.2.15.

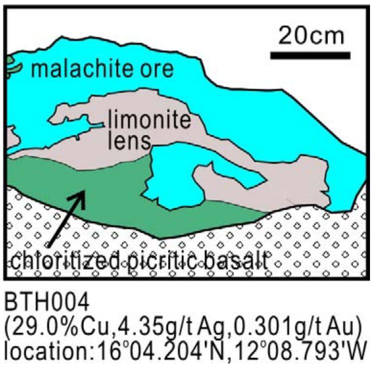


Fig. 4.2.15 Mineralized outcrop of Oudelemguil deposit

Under the microscope of malachite vein, ore minerals consist of malachite, crysocolla, covelline, chalcocite, bismuthinite, hematite and goethite (appendix I-2.3). Gangue minerals are composed of chlorite, epidote and a small amount of quartz.

Fluid inclusion in quartz in the malachite vein is 4-15 micrometer in size, and is composed of liquid, gaseous and polyphase inclusions. Homogenization temperature of liquid inclusions is 120-130℃ and salinity shows 8-14wt% NaCl eq. (Appendix I in the Interim Report).

Dating has been implemented using sericite sample from argillaceous basalt in the northwest of the Principal sector in Oudelemeguil (Fig. 4.2.14). The sericite sample has shown dissolution of potassium. K-Ar dating shows 512.7±13.4Ma (Appendix I-2.6). It is possible that the K-Ar dating of potassium-dissolved sericite showed about 30% older age than the true closure age (Higashihara et al., 2004). Based on this suggestion, the closure age of sericite must be 390Ma, and it corresponds to the terminal stage, 400-300Ma, of metamorphism of the Mauritanides. Since the sericite produced by mineralization has been under the greenschist facies since it was formed, confirmation of the formation stage may not be possible.

(10) Diaguili

Diaguili prospect is located about 840km southeast of Nouakchott and about 30km south-southwest of Selibaby. It takes about 16 hours from Nouakchott to Diaguili. The prospect forms a line of three about 10m high hills. The hills are directed NE-SW with about 1km extension. The region consists of quartzite, conglomerate, muscovite schist and black schist (Fig. 4.2.16). Schists lie between the southern and central hills. The southern hill mainly consists of quartzite, and the northern hill is composed of conglomerate, while the central hill comprises quartzite and conglomerate. The latter often has a schistose texture of a NE-SW strike and a 45-85° dip to northwest.

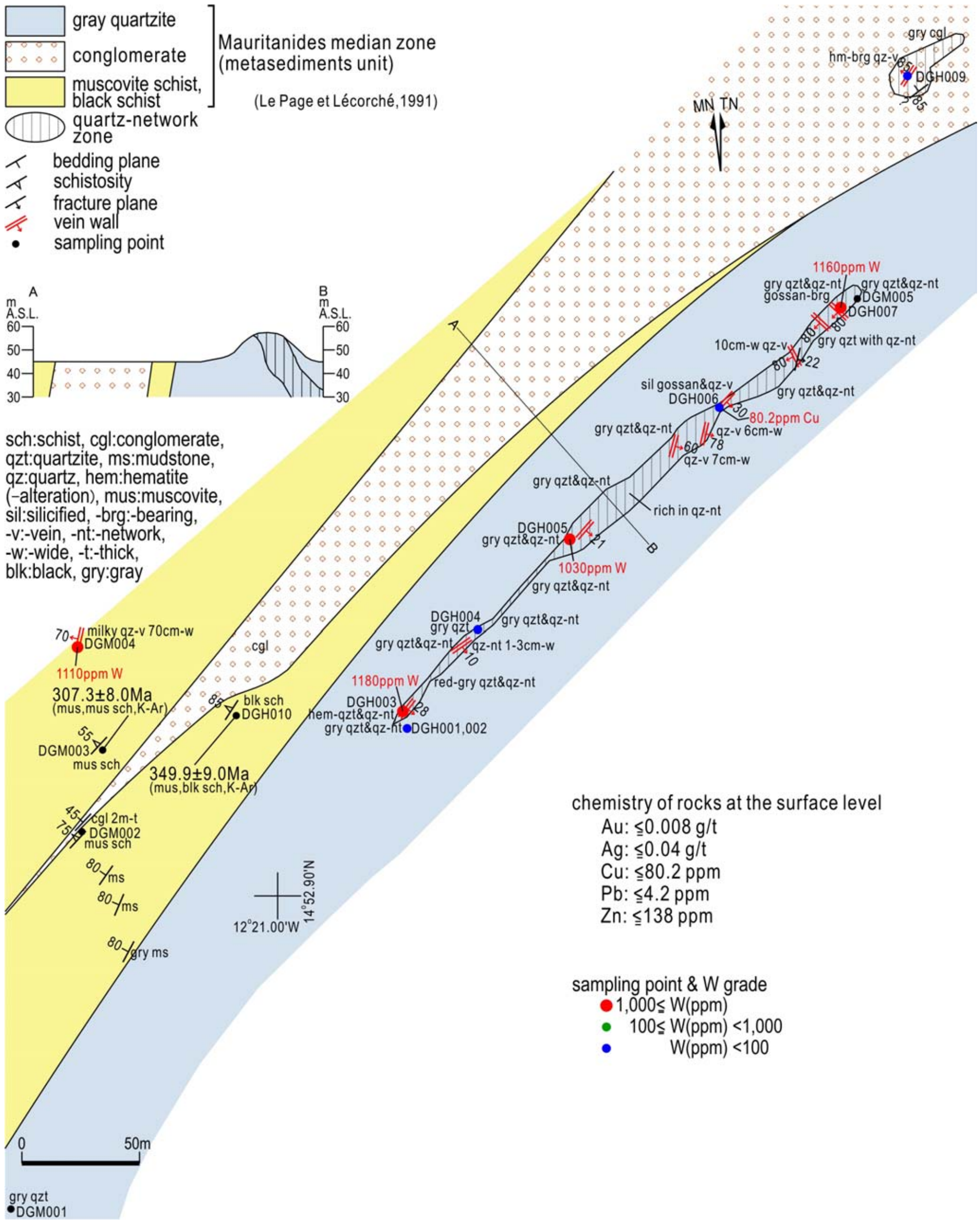


Fig. 4.2.16 Geological and geochemical map of Diaguili prospect

Quartz network and quartz veins mainly develop in quartzite, and rarely in schists and schistose conglomerate. The quartz vein is, in average, 10 cm thick, with maximal thickness of 70cm. Quartz veins have both NE and NW strikes. The present survey has found specularite in the quartz vein, but has not confirmed copper mineralization. By chemical analysis of the quartz vein, gold assay is less than detection limit (0.001 g/t) and copper assay is 80 ppm in maximum, while there are four samples over 1,000 ppm for tungsten (Appendix I-2.5).

BRGM has conducted a geological survey and drilling work in this region in 1975. The survey has confirmed the maximal grade of 12.7 % for Cu by a cannel sampling in the central hill. Malachite and crysocolla are mainly observed at the outcrop, and pyrite, chalcopyrite, bornite and chalcocite are found in the primary zone (BRGM, 1975). Since the present investigation has not confirmed existence of copper minerals in the Diaguili prospect, it is difficult to be regarded as a copper prospect.

(11) Guidimaka

Chromite deposits in Guidimaka are divided into two regions: one is a region about 8-12 km east of the Selibaby city, the other scatters about 4-8 km east of the Diaguili village (BRGM, 1975). The present survey has been conducted on three deposits located in the east of the Diaguili village.

The Guidimaka deposit is located about 3km southeast of the Diaguili prospect. There are eight podiform-type chromite ore bodies that are 10-40m long, and up to 15m thick in the serpentinite in the Mauritanides. The grade of Cr_2O_3, at 22-33%, is not high. This survey confirmed the existence of PGE mineralization that indicates a Pt grade of 0.07-0.1ppm. This is the first report of the existence of platinum group elements in Mauritania. Mineralization of this deposit is characterized in 4.3.

(12) Jreida-Lemsid

Jreida-Lemsid is an area along the Atlantic Ocean from 15km north to 100km north of Nouakchott. This survey has been conducted in the Tanit-Lemsid sector in the central part of the area. The Tanit-Lemsid sector is located about 60-70km north of Nouakchott. It takes about 1 hour from Nouakchott to Tanit. Coastal sand and dune sediment of Quaternary are widely spread in the area.

The dune extends from Tanit to Lemsid over a distance of 8 km, and a width of 250m in the south, 1,200m in the central site and 800m in the north. It lies parallel to the present beach. Not all the dunes show existence of mineralization (BRGM, 1975). Allon (1959) showed a first estimation of 1,900,000 m^3 at 3% TiO_2, distributed over an area 3 km long by 500 m wide, i.e. 160,000 tons of ilmenite (BRGM, 1975).

In this survey, totally 8 pit holes, about 5m deep have been drilled in the coastal sand and dune: 4 pits at Tanit forming a square at each apex with the interval of 500m, and 4 pit holes at Lemsid. For assay, sand has been collected by each meter basically, however the interval of collection points varied according to the sandy facies characteristics. After collecting the sand, panning was conducted to separate heavy minerals which provided to assay.

Based on the observation of pits, terrigenous reddish brown-colored sandy formation is dominant in black heavy minerals compared with white oceanic sandy formation containing fragments of shells (Appendix I in the Interim Report). In the pit holes generally, concentrations of 2.8-5.1% TiO_2, of ilmenite which is several cm thick exist just beneath the surface, but there is no concentration layer as large as to measure in meters (see geological column, Appendix I-2.14), except the pit hole

LMD4 at Lemsid. In this pit, grades of TiO_2 vary between 2.7% and 6.0% from the surface to the 5m depth. Their weighted average grade is 4.5% TiO_2. Under the microscope, heavy minerals are mainly composed of ilmenite, and quartz, zircon, a little amount of hematite, vesuvianite, monazite, rutile and corundum (AppendixI-2.).

The 13 deposits and prospects described above, are summarized in Table 4.2.2.

Table 4.2.2 Summary of geological survey at each deposit/prospect

	Deposit/prospect	Metal	Result
4	Koedia Idjill	Fe	● Deposit is Superior-type BIFs in Itabirite (banded ferruginous quartzite) of Late Proterozoic. ● Ore body is composed of lumpy and lamellae, fine-grained hematite. Fe grade ranges from 67 to 68%.
5	Tiris	Fe	● Deposit consists of coarse-grained magnetite orebody in meta-ferruginous quartzite, leptynite and amphibolite of Archean. Fe grade is 35-42%. ● Folding develops in metamorphic rocks. ● Deposit seems to be formed from clastic sediments by metamorphism.
8	Sfariat	Fe	● The area consists of gneiss, limestone, granites of Archean. ● The tectonic zone comprises faults. The rocks are strongly sheared.
11	Tasiast	Au	● It consists of hydrothermal gold deposit in magnetite-BIF in greenstone of Archean. Age of gold mineralization is Proterozoic. ● Sericite-chlorite schist, amphibolite and BIF are subjected by muscovite alteration, and then muscovite is altered into kaolinite and dickite. ● Amphibolite schist is dominant in magnetite and coarse-grained garnet often occurs. ● Veinlet and lens of pyrrhotite occur in chlorite schist in BIF, and gold exists with pyrrhotite. ● BIF near the surface is subjected by alteration of hematite, limonite, nontronite and kaolinite by supergene enrichment, and is accompanied by quartz veinlet. BIF with high grade of gold is subjected by strong nontronite alteration.
	Tijirit	Au	● Distribution of basic rocks (basalt, gabbro) and carbonates. Fracture zone is dominant in N10-20˚E direction. ● It is composed of gold-bearing quartz vein deposit formed by the hydrothermal fluid ascending along the sheared zone. ● The quartz veins, composed of a N10-20˚E strike and a N20˚W strike tunning diagonally, form an echelon arrangement, with a maximum length of 200m. ● Mineralized parts of quartz vein are subjected by hematitization and limonitization, and occur malachite and native gold.
14	Tabrinkout	Au, Cu	● Distribution of chlorite schist and carbonate rocks in the Mauritanides. ● Malachite disseminates in carbonate rocks and gold-bearing malachite quartz vein cuts in schist. ● Due to analogies of principal analysis of chemical analytical value and homogenization temperature and salinity of the fluid inclusion study, there is possibility that Guelb Moghrein –type deposit would be laid.
17	Guelb Moghrein	Cu, Au	● It consists of hydrothermal copper and gold deposit (IOCG?) which has replaced a magnetite-bearing magnesian ferruginous carbonate in green schist in the Mauritades and

			occurs as layer and lens. ● Sulfide minerals of chalcopyrite and pyrrhotite occur in dissemination and veinlets around magnetite grains in carbonate lens, and form veinlets in the vicinity between carbonates and chlorite schist. ● At the surface, oxidation zone is formed by supergene enrichment, and malachite disseminates in magnetite-bearing carbonates. Copper grades in primary sulfide zone and oxidation zone are 0.4% and 2.7%, respectively. ● High saline fluid has ascent along sheared zone in magnetite-bearing carbonates and produced hydrothermal alteration and deposition of copper and gold.
18	Kadiar	Cu, Au	● It is composed of copper and gold bearing siliceous gossan body which replaces massive and lens-formed carbonate rock intercalated in chlorite schist and serpentinite. Gossan trends N-S which is parallel to schistosity. ● Mineralization at the surface is dissemination along the fissure. Secondary copper minerals are mainly composed of malachite.
19	Indice 78	Cu, Au	● It consists of quartz veins and malachite lens which is formed in chlorite schist and chloritic andesite. ● The copper-bearing quartz veins have thickness of 4-10m and length of 40-60m. Malachite, chalcopyrite, chalcocite and native gold are confirmed there.
20	Oudelemguil	Cu	● It is composed of malachite veins in picritic basalt which is limonitized and weakly silicified. The veins strike N25-40°E and dip 30° to 55° northwest, with thickness of 0.4-0.8m and the maximum length of 300m. ● Geomagnetic anomaly is confirmed by this geological survey.
22	Diaguili	Cu	● It consists of quartz network and quartz veins in quartzite. The veins are directed NE and NW. ● Hematite is confirmed in the quartz vein, but no copper mineralization is found.
23	Guidimaka	Cr	● It consists of massive chromite deposit in serpentinite. Eight podiform-type ore bodies exist which are 10-40m long and, up to 15m thick.. ● Main mineral of chromite consists of magnesiochromite, and Cr2O3 grade is low ranging 22-33%. ● This survey confirmed the existence of PGE that indicate a Pt grade of 0.07-0.1ppm. ● Sulfide minerals of PGM are confirmed by EPMA.
26	Jreida-Lemsid	Ti	● Terrigenous reddish brown sandy formation is dominant in ilmenite. ● Concentrations of several cm thick ilmenite exist just beneath the surface.

4.3 Major deposits and characteristics of their mineralization

Of the 13 deposits and prospects described above, the following is a report of mineralization of 6 major deposits: the Koedia-Idjill and Tiris deposits which has been exploited and significant for Mauritanian economy, the Tasiast and Guelb Moghrein deposits to be developed, and the Tijirit and Guidimaka deposits to be promoted.

(1) Koedia-Idjill

(a) F'Derik, Seyala, Rouessa and Tazadit deposits

Periphery of the F'Derik, Seyala, Rouessa and Tazadit deposits located in 5 to 30 km south of the Zouerate city forms a peneplain at approximately 300 m asl, which is composed of the Tiris group of the Archean. The deposits are situated in the Koedia-Idjill mountain range elevated at 500 to 600 m though the highest peak being 915 m high, which is shaped by the nappes of the Idjill group of the probable Proterozoic.

F'Derik, Seyala, Rouessa and Tazadit deposits are iron deposits composed of hematite, and exist in the Tazadit unit which is one of the nappes of the Idjill group (Fig.4.2.5). The itabirite formation composed of banded hematite-bearing quartzite is predominant in this unit. The formation is accompanied by schist and nonferrous quartzite. The itabirite formation with thickness ranging from 300 to 2,000 m comprises siliceous phyllite, siliceous itabirite (60 m thick and 35-45 % Fe) and hematite-bearing itabirite (150 m thick and 63-64 % Fe) from the lower layer (BRGM, 1975). The itabirite formation generally strikes east to west and develops repetitive isoclinal folds, dipping south in moderate to steep angles. Ore bodies at the ore deposits are 700m x 500m in a maximum scale, and show in harmony structure with layers in the Tazadit unit. The ore body is a lenticular concentrate grading 65% of Fe of scaly hematite with goethite and is a massive pocket-shaped hematite body grading 68% of Fe in the itabirite formation. In iron ore there is a 1-2mm thick banded structure composed of fine hematite and quartz. The high grade iron ore with more than 67% Fe reveals distinctively pale blue. Under the microscope, it can be observed that hematite replaces primary magnetite (Appendix I-2.3).

K-Ar dating of muscovite in weakly weathered muscovite schist from Guelb Hamariat located in 4 km northeast of the Rouessa deposit, shows 2407±67.7Ma (Appendix I-2.12). However, potassium dissolution is recognized in this sample. The age is the same as for muscovite and biotite showing 1754±38Ma and 1850±50Ma gained by Bronner (1992). It corresponds to the last stage of Superior-type BIF formation.

(b) M'Haoudat deposit

The M'Haoudat deposit is an iron deposit composed of hematite and is located in 55 km northeast of the Zouerate city in the M'Haoudat unit being one of the nappes of the Idjill group (Bronner et al., 1992). The M'Haoudat unit consists of ferruginous quartzite, non-ferruginous quartzite and schist (BRGM, 1975). The ferruginous quartzite strikes NW-SE and steeply dips northeast, extending within an area of 15 km in length and 0.2 in width. The non-ferruginous quartzite and schist lie with the ferruginous quartzite. Their structure is harmonized. The iron ore body is lenticular and pocket concentrates grading over 60 % Fe of foliated and massive hematite in the ferruginous quartzite. The ore body is 1200m long and 100m wide.

Under the microscope, it is revealed that the banded texture is composed of quartz lamina and hematite lamina and that hematite replaces magnetite (Appendix I-2.3).

Rb-Sr model dating of whole rock from metabasalt of the Tazadit unit which comprises this deposit, shows 2363Ma-2255Ma (Appendix I-2.6). It corresponds to the Huronian period of the Proterozoic.

[Remote sensing analysis]

LANDSAT image of the Zouerate area including the Koedia-Idjill and Tiris iron formation, and ASTER images of the Koedia-Idjill region are shown in Fig 4.3.1. The assessment for image analysis is as follows:

- It is difficult to extract the iron deposits in the Koedia-Idjill and Tiris by using LANDSAT images, but ASTER images are distinct and clearer than LANDSAT.
- In the Koedia-Idjill region, ASTER HIS image (left bottom in Fig 4.3.1) reflects geographical features compared to ASTER false color image.
- ASTER band ration image is shown on right bottom picture in Fig. 4.3.1, where RGB is applied in the ratio of 4/8, 4/9 and 1/3. These band ratios are selected when the 4/8 reflects calcite and mica, the 4/9 reflects clay minerals and the 1/3 reflects iron oxides. The entire area of mountain range of the Koedia-Idjill displays blue iron oxides, but it is difficult to extract only itabirite layer of the Tazadit unit where the iron formation lies. Since the Koedia-Idjill mountain range is formed by the Idjill group, and ferruginous quartzite is located at a high altitude in the mountains, and their talus covers in the entire area including foothills, the band rationing images extract spectrum of iron oxides intensively.

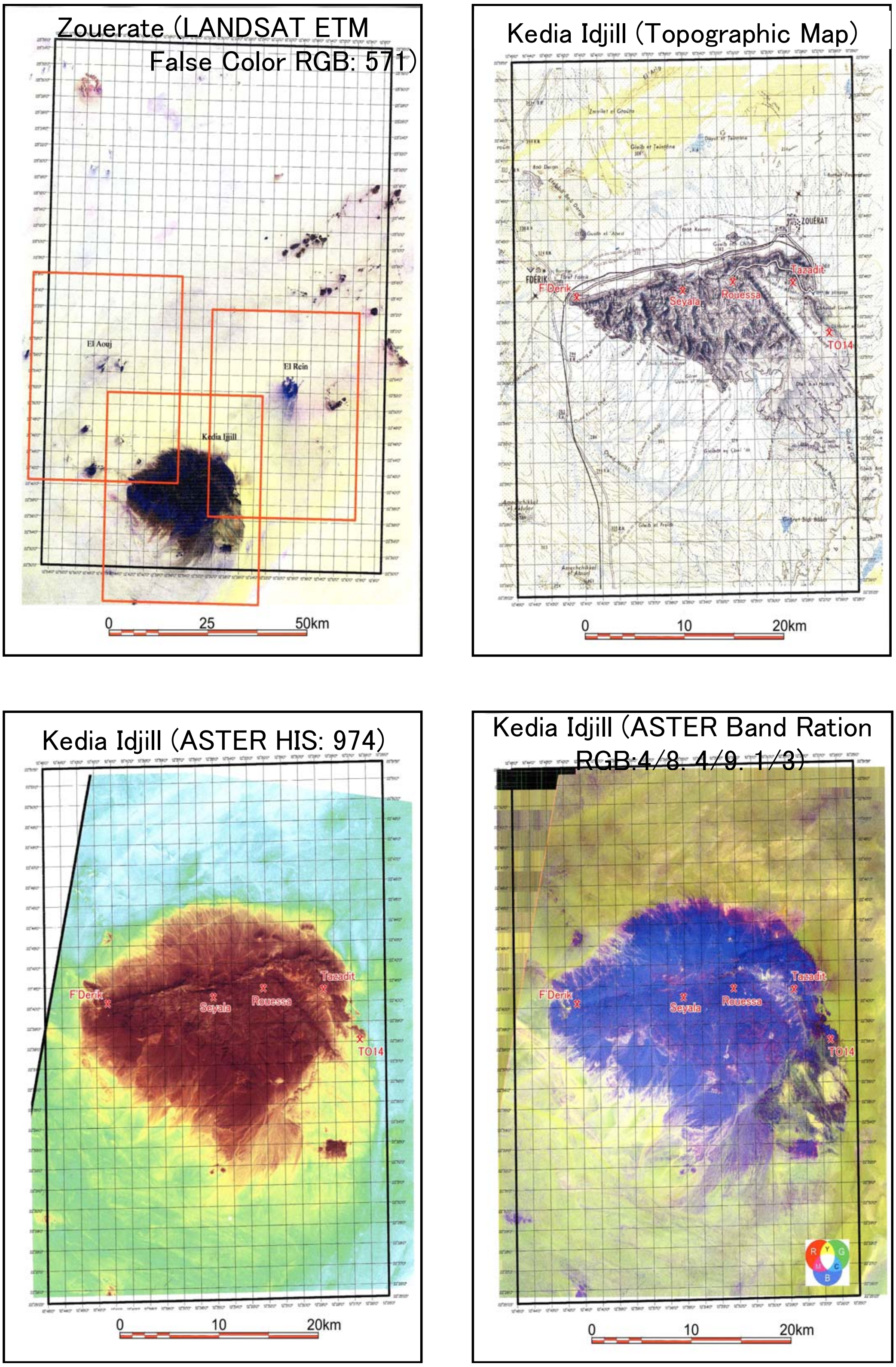


Fig. 4.3.1 Satellite images LANDSAT of the Zouerate area and ASTER of the Koedia-Idjill

(2) Tiris

The Tiris iron formation is composed of El Rhein, El Aouj and Atomai deposits which is located about 25km northeast, 40km northwest and 40km west of the Zouerate city, respectively (see Fig. 4.2.5).

(a) El Rhein deposit

The deposit is magnetite deposit and is located 25 km northeast of the Zouerate city. The district around the deposit consists of meta-ferruginous quartzite, meta-nonferrous quartzite, gneiss, leptynite and amphibolite of the Tiris group. The meta-ferruginous quartzite crops out like a tableland forming land of 100 to 200m in height, 5 to 10 km in extension and 2 to 3 km in width. The ore body is the concentration of coarse-grained magnetite in leptynite. The thickness of the ore body is about 100m, while the N-S extension is 1.2km. Average grade is 37 % Fe. The ore body represents a complicated folding structure with the fold axis trending N-S, showing an intrafolial folding. Three foldings reveals complex structure within the scope of 1.5 km in north-south and 1 km in east-west.

The ore is coarse grain and lumpy. It mainly consists of magnetite and quartz with a little amount of hematite and goethite (Appendix I-2.3).K-Ar dating of potassium feldspar and whole rock of the leptynite collected from this deposit indicate the same value of 1480±40Ma (Riphean of Proterozoic). It suggests the final age of metamorphism (Appendix I-2.6).

(b) El Aouj (Central) deposit

The deposit is a magnetite deposit and is located 40 km northwest of the Zouerate city. The area around the deposit consists of meta-ferruginous quartzite, meta-white quartzite, leptynite and amphibolite of the Tiris group. The deposit is coarse-grained magnetite deposit of which host rocks are meta-ferruginous quartzite and partly leptynite. Magnetite-bearing quartzite reveals anticline structure having a NE-SW directed fold axis, and extends at 4 km in north-south and 1 km in east-west.

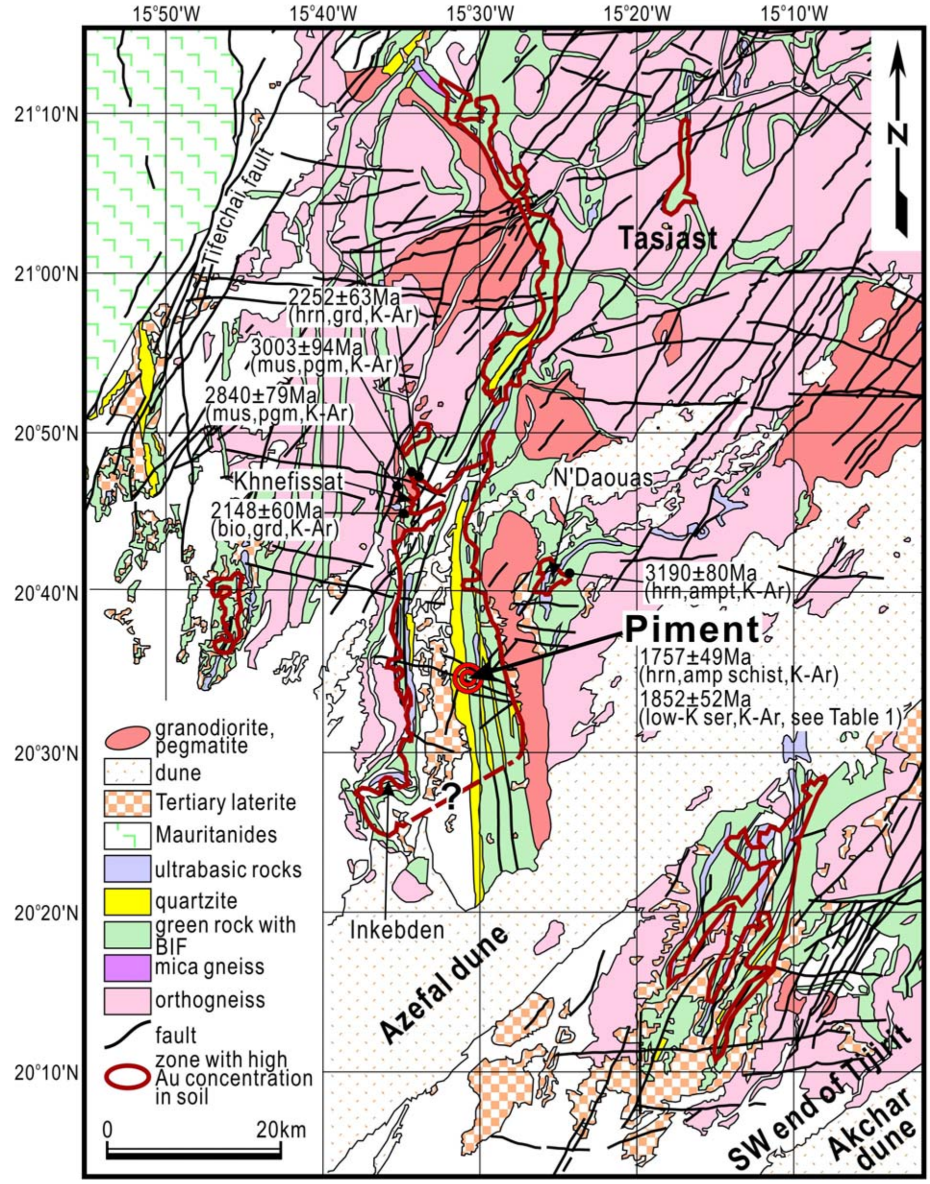
(c) Atomai deposit

The deposit is also magnetite deposit and is located in 35 km west of the Zouerate city. The district around the deposit hosts meta-ferruginous quartzite, meta-white quartzite and leptynite of the Tiris group, with a partial intrusion of aplite. The deposit is coarse-grained magnetite in meta-ferruginous quartzite. Magnetite-bearing quartzite commonly strikes E-W and steeply dips north. It crops out within an area of total length of 8 km and 0.5 km width.

(3) Tasiast

(a) Geology

The Tasiast area consists of Archean group, comprising a granite-gneiss zone and a greenstone belt. The granite-gneiss zone consists of tonalite-granodiorite series, migmatitic gneiss, granodioritic migmatite and small-scaled intruded pegmatite. The greenstone belt is composed of greenstone of peridotite, serpentinite and amphibolite, and quartzite and mafic schist (Fig. 4.3.2). Distribution of the greenstone is limited to 5km in width and 80km in length. It extends N-S to NNE-SSW direction and includes magnetite-bearing BIF. The schistosity of the rock in the greenstone and lamellae of magnetite-bearing BIF confirm with the general direction of the greenstone belt, with the dip being 60-80° toward the east or west.



(modified Artignan et al., 2000)

Fig. 4.3.2 Regional geological map of the Tasiast area

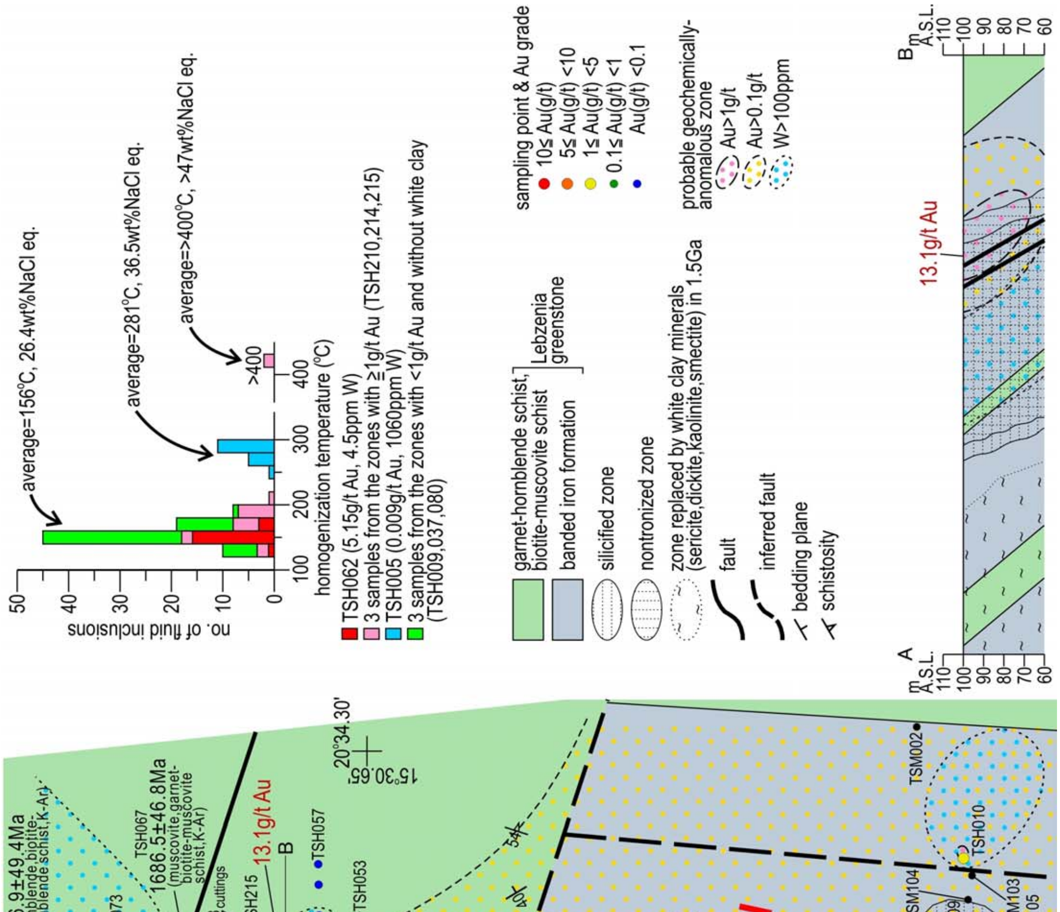


Fig. 4.3.3 Geological map and geochemical anomalies in the Tasiast Piment area

(b) Deposit

Formation of the gold deposits in this area is associated to hydrothermal alteration of sericite and kaolinite in magnetite-bearing BIF with the greenstone belt (Fig.4.3.3). The hydrothermal alteration covers an area of 200m from east to west and about 1km from north to south. The gold mineralization presents various types of occurrences: gold-bearing quartz vein (3.3-0.5cm in thickness), gold-bearing quartz network and dissemination. At present, the high gold mineralization is found in the sector called Piment.

This sector consists of the rocks composing the above described greenstone belt, and chlorite-muscovite schist. In an area of about 30km from north to south and about 5km from east to west in the schist, the magnetite-bearing BIF harmoniously covers the schist. The magnetite-bearing BIF comprises 2 or 3 layers with the width of each being about 400m. Magnetite-bearing BIF consists of magnetite, hematite, goethite and quartz with less than 0.5 mm in grain size, and shows distinct banded structure composed of iron oxides and quartz of 0.5cm to 1cm in size.

Magnetite-bearing BIF and chlorite schist in the Piment sector are exposed to strong hydrothermal alteration. The alteration is especially strong near the gold mineralization. Alteration of silicification, nontronitization, and white argillization (dickite, sericite, smectite and kaolin) is concentrated in the area extending 200m from east to west and 1km from north to south at least (Fig4.3.4 and 4.3.5). Numerous quartz veinlets less than 1cm thick develop, AT the intensely altered BIF.

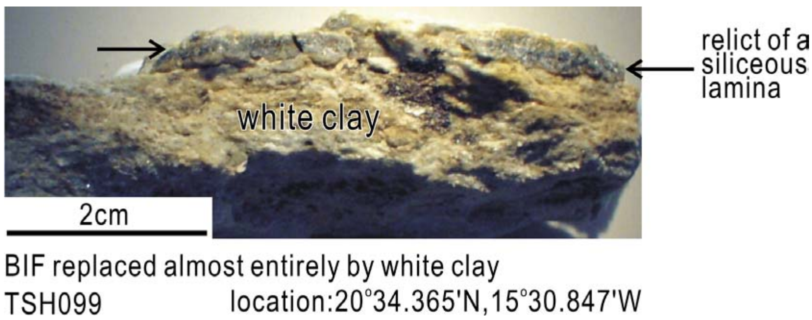


Fig. 4.3.4 White argillized iron formation

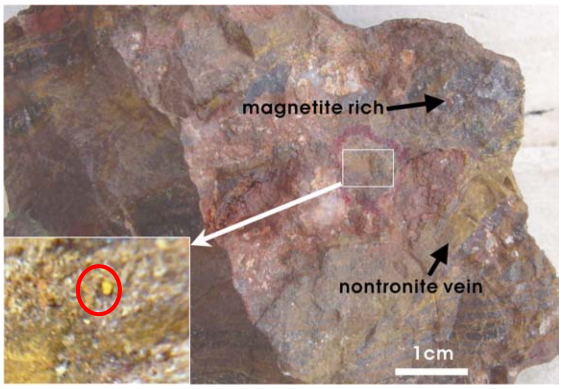


Fig. 4.3.5 Native gold (left bottom: enlarged) and yellow nontronite vein cutting magnetite-rich BIF

Turbulent sedimentary structure including fractures and breccias probably caused submarine sliding, is observed in the BIF cropped at the peak of the Piment sector. This is suggested that there was submarine activity by which unconsolidated to consolidated materials of sediments were transported and broken.

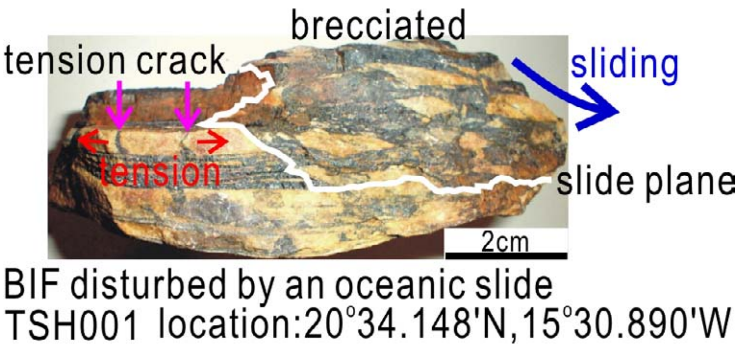


Fig. 4.3.6 Turbulent sedimentary structure caused submarine sliding (?)

The gold mineralization occurs in two parallel trends. The eastern branch is continuous over a 4.5km strike length, and the western branch is continuous over 2km strike length. The east branch comprises one major shoot, referred to as the "Piment Central" zone and three smaller shoots, the Piment Center Extension, Piment Nord and Piment Sud zones. The mineralization dips to the east of 45-70° and the shoots plunge at about 30° southerly. The mineralization widths vary between 5 and 30m with a 20 to 25m width common in the strongly mineralized areas. The rocks are oxidized to a depth of about 40m. The western branch contains low grade mineralization only (Rio Narcea Gold Mines, 2005).

In the drilling cores, porphyroblast of garnet with 1 to 10mm in diameter is often found in amphibole schist (Fig. 4.3.7). Lamina of magnetite 2 to 3mm in width and magnetite layer composed of magnetite and quartz also occur in the schist. In chlorite and amphibole schists, and magnetite layer, pyrrhotite occurs in disseminated and veinlet forms. The pyrrhotite is often accompanied by native gold observed by the naked eye. The mineralized zones in the cores are illustrated in Fig. 4.3.8.

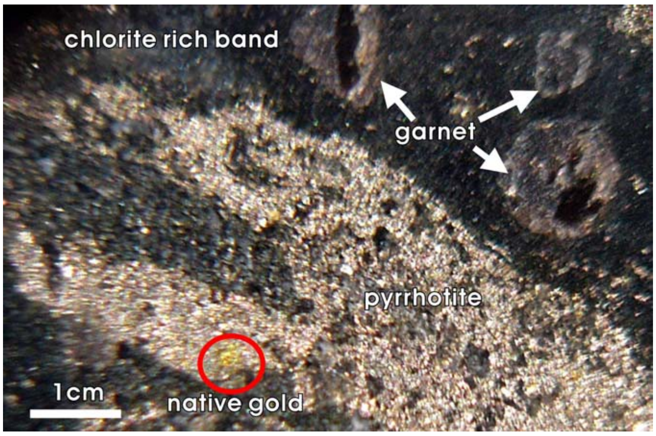
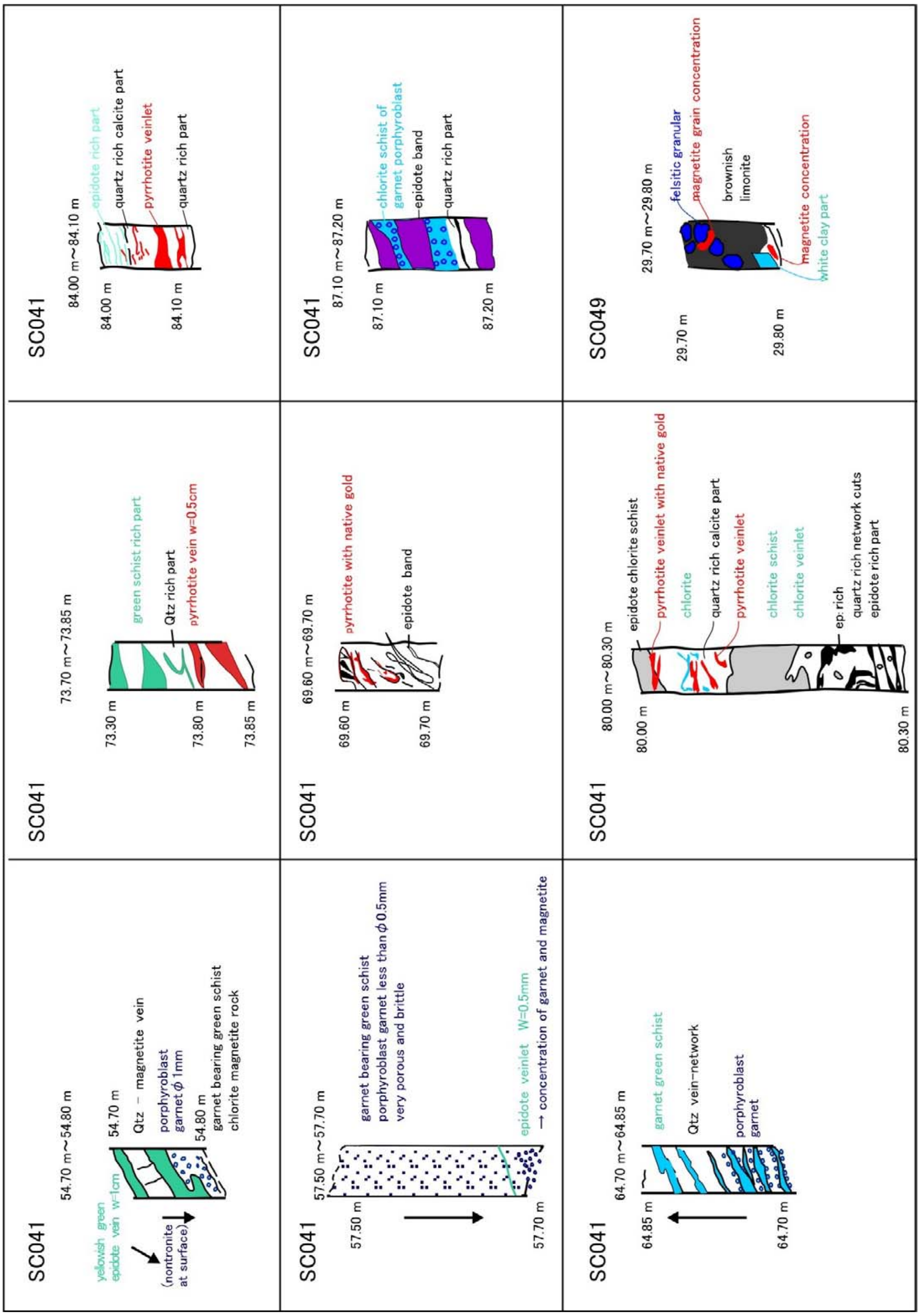


Fig. 4.3.7 Pyrrhotite and native gold with porphyroblast of garnet in chlorite-amphibole band



Location of SC041: Y=13345, X=2412

SC049: Y=13995, X=2380

Fig. 4.3.8 Occurrence of mineralized zone in the cores in the Tasiast Piment