resistivity zone running north-south on the north side of that alteration zone is reported. In the airborne magnetic survey a magnetic anomaly and lineation in the vicinity of Gate Mountain was noted. Furthermore, gravity exploration data leads one to believe that the basement rock gets shallower in the southern part the farther south you go. Moreover, in wide-area gravity surveying Gate Mountain was a high-gravity anomaly area, and the trend was for the value to rise abruptly toward the southern end of the peninsula. Those circumstances are considered to be indicative of distribution of basement rock under the southern end of the peninsula. Since this region is comparatively large and has poor access, it was divided into five areas for implementation of the survey: the Tugas-Mt. Sujac area, the Sisigon-Matnog area, the Matnog-Culasi area, the Culasi-Manurabi areas and the Butang-Sua area.

(1) The Tugas-Mt. Sujac Area (Fig. II-3-16)

Location: About 30 km south of Irosin.

Accessibility: Travel by car is possible up to Pawa, located 4 km before Matnog on the road from Irosin to Matnog. The way from there to Tugas in the southwest direction is not negotiable by car. The alteration zone is reached by walking southward along the creek from west of Tugas.

Geology: From Pawa to Tugas is underlain by andesitic volcanic breccia. The rock crops out in the vicinity of Tugas is pyroxene andesite lava and homogeneous volcanic breccia.

Alteration: On a ridge about 300 m from Pawa there is a zone of white to yellowish brown argillic alteration (kaolinite (halloysite?) alteration). The wall rock is andesitic volcanic breccia. At the creek running in the north-south direction toward Mt. Sujac from Tugas there are silicified rock boulders. The alteration zone is observable as outcrops, with mostly silicification and smectite and kaolinite alteration. At parts with intense silicification there is pyrite dissemination, and natural sulfur is to be observed. Hydrothermal brecciation is also to be noted. Some of the kaolinite is considered to be supergene products.

Mineral showings: In analysis of the silicified rock the values for gold were all below 5 ppb, but one sample showed a copper anomaly value of 212 ppm.

Evaluation: Considering the assemblage of low-temperature alteration minerals, the alteration zone is one formed in the vicinity of the paleo-water table. That being the case, there is possibility of endowment of epithermal gold deposits (low-sulfidation type) deep underground in that vicinity.

Mining claim: MPSA status has been applied for.

(2) The Sisigon-Matnog Area (Fig. II-3-16)

Location: In the vicinity of 12° 35' to 12° 40' N, 124° 00' to 124° 05' E along the Matnog road from Matnog, Sorsogon Province, to where the Bulan road branches off.

Accessibility: It takes about 15 minutes by car from Irosin to where the Bulan road branches off to the Matnog road and about another 20 minutes from there to Matnog.

Geology: The geology of this area is comprised of two pyroxene andesite lava and pyroclastic rock, which represent the Older Volcanics of the Pre-Caldera Volcanics, and the Caldera Pumice overlaining it and consisting mainly of dacite to andesitic pumiceous tuff fragment.

Weak NE-SW lineaments and small-scale N-S and NE-SW faults are to be noted.

Alteration: From place to place along the Matnog road tuff breccia that has undergone argillic alteration crops out. There is infiltration limonite, but hardly any silicification. In the X-ray diffraction analysis smectite and clinoptilolite were detected in a sample from an altered rock outcrop (SM50), which are considered to be due to very slight hydrothermal alteration or weathering.

Between Gadgaron and Mannumlad along the Matnog road outcrops of yellowish white argillized (smectite altered) tuff breccia are to be seen, but no pyrite dissemination was noted. In a tuff breccia outcrop near Bolo red and white to yellowish white slight argillic alteration (kaolinite alteration) was noted. On a curve near Pange there was an outcrop of andesite lava considered to have undergone red to white argillic alteration (kaolinite alteration). Furthermore, in the vicinity of Busing on the road to Sta. Magdalena from Pawa on the Matnog road, too, pumiceous tuff breccia that had undergone white to yellowish white slight argillic alteration (kaolinite alteration) was noted. In X-ray diffraction analysis halloysite and goethite were noted in a sample (SM57) from the altered rock outcrop at the curve in the vicinity of Pange as an indication of low-temperature acidic alteration.

Along the road to Mount Sujac from Calpi on the Matnog road the alteration is accompanied

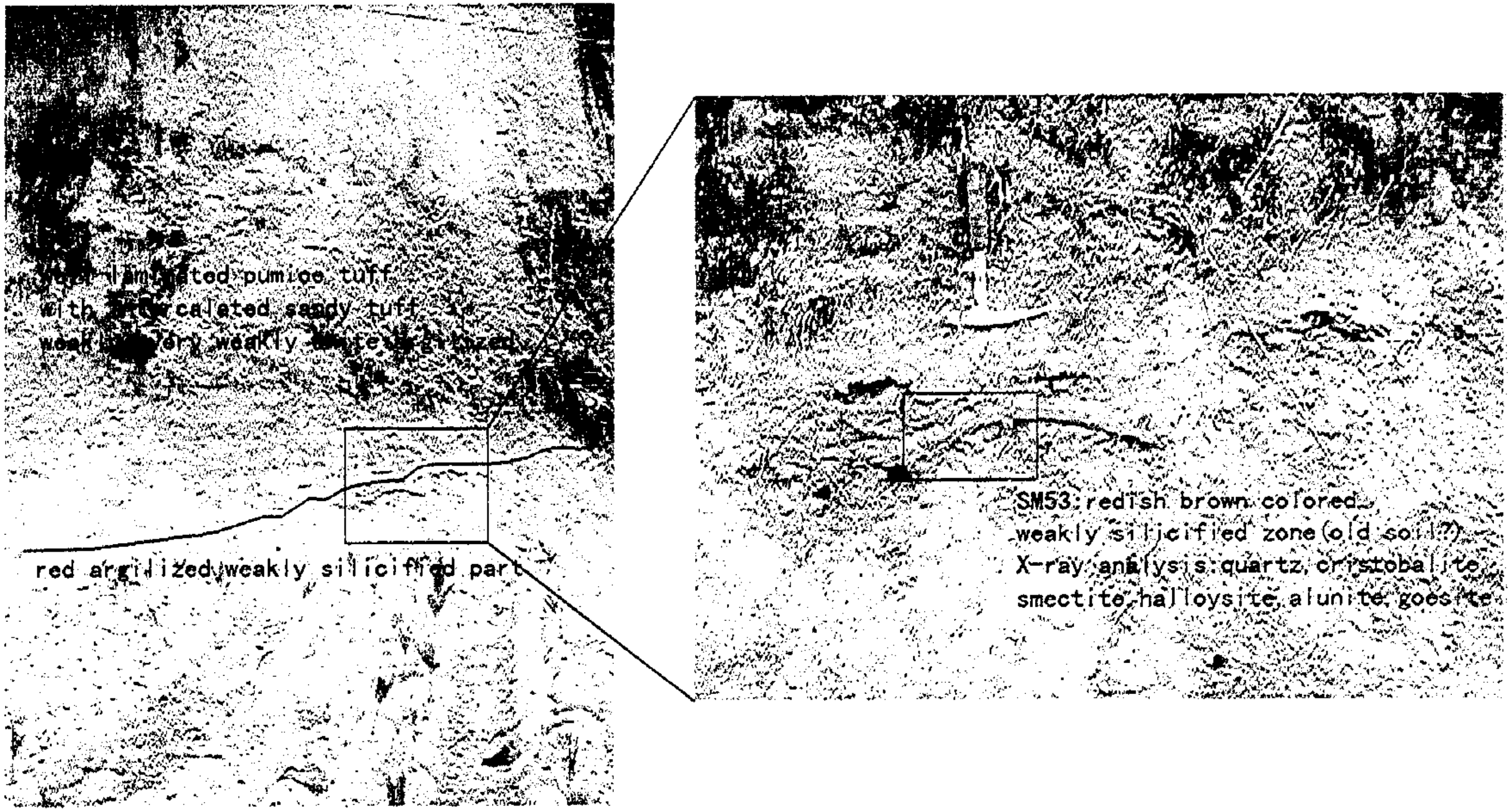


Fig. II-3-18 Outcrop of altered Older Volcanics under Caldera Pumice near Calpi along Matnog Road in Sisigon-Matnog area, eastern part of Gate Mountains

by silicification and tends to become somewhat more intense. Near Calpi a red argillized (kaolinite altered) and slight silicified tuff breccia outcrop is to be seen below the practically unaltered pumiceous sandy tuff, with a 3-5 cm silicified layer with mixture of oxidized iron in between. Furthermore, starting about 500 m upstream from there many floats of medium to intensely silicified and white to red argillized (kaolinite altered) rock are to be observed over a continuous stretch of about 1 km. In the X-ray diffraction analysis quartz, cristobalite, smectite, halloysite, alunite and goethite were detected in a sample (SM53) from the outcrop of red argillized and slightly silicified tuff breccia near Calpi, which is indicative of low-temperature acidic alteration, and quartz and alunite were detected in a float (SM55) of the altered rock about 500 m upstream of that as an indication of higher-temperature acidic alteration.

Resistivity data: There is an extensive area of low resistivity on the northwest side of the Matnog road, and at a depth of 500-800 m there is a wide-area low resistivity area extending in the northwest to southeast direction from Gabao to Mt. Sisigon to St. Magdalena.

Mineral showings: A gold high-concentration anomaly of 120 ppb Au was noted in an altered rock float along the road from Calpi to Mt. Sujac. A molybdenum anomaly value of 36 ppm was also detected in the same sample.

Mining claim: An exploration permit has been applied for a part of the area, but most of it is not covered.

Evaluation: The alteration is only slight along the Matnog road, but it becomes more intense along the road from Calpi to Mt. Sujac, and a gold high-concentration anomaly of 120 ppb having been noted in a float. That being the case, gold mineralization is expected on the south side (near Balocawe) of the road leading from Calpi to Mount Sujac.

(3) Matnog-Culasi Area (fig. II-3-16)

Location and Accessibility: It comprises the area facing on the sea from Matnog to Culasi.

Geology: Because of the poor situation as regards outcrops it was not possible to determine the overall geological composition, but it would appear that there is distribution of andesite below and lapilli tuff, air fall volcanic ash and accretionary lapilli above, covered by reef limestone.

Alteration: Silicified rock floats were noted, but only very rarely, in a few river beds. Most of the silicified rock was opaline with accompaniment by minute pyrite dissemination. The X-ray diffraction results showed smectite or alunite-tridymite.

Mineral showings: All there was in the way of mineral showings is the pyrite dissemination noted in silicified rock floats. The copper value for the silicified rock sample (KY40) with pyrite dissemination was 118 ppm.

Evaluation: Although there is no expectation of alteration zones in the survey area, it is surmised that the very shallow part of a steam-heated alteration zone crops put in the upstream part of the river were silicified rock floats were noted. Although there was no sign of gold mineralization, samples suggestive of copper mineralization were obtained.

Mining claim: No mining areas established there yet.

(4) Culasi-Manurabi (Fig. II-3-16)

Location: This area is situated along the coast of the southern end of Sorsogon.

Accessibility: It takes about 30 minutes by car from Irosin to Matnog. From there it is possible to hire a boat that takes you to the entrance to the creek.

Geology: As indicated in Fig.II-3-16, four creeks were surveyed in turn, starting from the west side. The survey of the creek on the east side of Manurabi was discontinued because no altered rock floats at all were found. The floats were black pyroxene andesite. In the creek between Manurabi and Mambjog, too, the floats were black andesite, and there was no altered rock. The Ginablan River was surveyed from Ginablan Bay. According to Delfin, F. G. et al. (1988) there is distribution of an alteration zone at the upper reaches of that creek. The cliffs on both sides downstream are formed by pyroxene andesitic volcanic breccia to lava. Tuff containing accretionary lapilli crops out in the river bed, with silica-diorite veins (width of 40 cm, N5°W) cutting the tuff. The floats are black pyroxene andesite, with no altered rock to be seen. From that it is surmised that there is no alternation zone at the upper reaches of the Ginablan River. Neither was there any altered rock in the Bonot Creek, where pyroxene andesitic volcanic breccia was distributed.

Alteration: None

Mineral showings: None

Evaluation: The alteration zone near Mt. Sujac mentioned in Delfin, F. G. et al. (1988) was not found. It is probably a matter of mistaken location. On the southeast side of the Gate Mountains there is no development of alteration zones and little possibility of deposit endowment.

Mining claim: Exploration permits have been applied for for some parts, but most of the area is not covered by any.

(5) Butang-Sua Area (Fig. II-3-17)

Location: In the vicinity of 12° 32' to 12° 36' N, 123° 56' to 124° 00' E between Butag and Sua along the southern coast of Sorsogon Province.

Accessibility: The place where the Bulan road branches off from the Matnog road is reached from Irosin by car in about 15 minutes, and the place where the road to Butag branches off the Bulan road is reached from there in about 10 minutes. From there it takes about 15 minutes to Butag.

The different survey points are reached from Butag by bunker boat. It takes 1 hour to Sua from Butag by that means of transportation.

Geology: The geology of the area is comprised of pyroxene andesite lave and pyroclastic rock representing the Older Volcanics of the Pre-Caldera Volcanics.

Lineaments are noted in the NW-SE direction and the ENE-WSW to E-W direction.

Alteration: Of the creeks running north from Sua, there are many altered rock floats at the one on the west side. They consist of chalcedony quartz, intensely silicified rock with pyrite dissemination or limonite penetration and medium to intensely silicified rock with white argillization due to kaolinite, which leads one to believe that there is an alteration zone accompanied by silicification upstream. In the X-ray diffraction analysis quartz, goethite and hematite were detected, which is reson for surmising the existence of medium- to high-temperature hydrothermal activity. At the creek that flows into Tagiran Point, too, floats of altered rock with medium to intense silicification and accompanied by pyrite dissemination and white (argillic) alteration are to be noted, although in smaller quantities, and on the basis of that it is surmised that the alteration from Gate Mountain continues nearly to the coast. In the X-ray diffraction analysis cristobalite and alunite were detected as an indication of low-temperature acidic alteration.

Furthermore, along the coast from Quezon to Aguinaldo were noted outcrops and floats of reddish brown altered rock with a very high limonite content and white altered rock accompanied by kaolinite alteration, both of which had undergone medium to intense silicification. In the X-ray diffraction analysis quartz, halloysite, alunite and goethite were detected in a sample (SM65) from such an altered rock outcrop, which is indicative of low-temperature acidic alteration.

Upstream of Marinab were found floats of altered rock with kaolinite alteration and slight silicification, and in the X-ray diffraction analysis quartz, kaolinite, alunite and goethite were detected in the sample thereof (SM66), which is indicative of medium- to rather high-temperature acidic alteration.

Mineral showings: Neither useful metal element high-concentration anomalies nor useful metal indicator elements high-concentration anomalies were noted in the chemical analysis of the altered rock.

Mining claim: Application has been made for MPSA status.

Evaluation: Most of the alteration is thought to be steam-heated shallow alteration, but it is surmised that there is widespread hydrothermal activity deep underground at Gate Mountain, and therefore there is a possibility that a large-scale hydrothermal deposit has been formed.

Evaluation of the Gate Mountains Region:

It was confirmed that a comparatively large alteration zone is distributed at the creek that extends southward toward Mt. Sujac starting from 1 km west of Tugas. Furthermore, it was confirmed that the float (SM55) found at the entrance to the creek extending in the east to east-northeast direction from Mt. Sujac was a float from silicified rock, and the gold and molybdenum contents of that silicified rock were 150 ppb Au and 36 ppm Mo. It is therefore presumed that there is a extensive alteration zone on the Mt. Sujac side of that creek. Silicified floats were also found at KY42 and KY43 between Matnog and Culasi. Those alteration zones and floats are distributed practically on a straight line running in the direction northwest-southeast. Furthermore, from the topography as well a fault along that line can be surmised (Fig. II-3-16). That direction is the same direction as that of the creek along the road from Sisigon to Matnog. From SAR images, too, a lineament that just about coincides with that place was extracted. On the other hand, it has become clear from the survey carried out from the south that it is highly probable that the alteration zone on the southwest slope of Mt. Sujac that had been surmised does not exist. That being the case, it is possible that hydrothermal activity in the area extending from the middle to the eastern part of the Gate Mountains region was controlled by the above-mentioned fracture in the northwest-southeast direction, and therefore it is considered to be necessary to undertake a survey along that fracture.

Along the southwest coast of the Gate Mountains region as well many floats of silicified rock and altered rock were noted. Although it is not clear yet by which fracture(s) the hydrothermal system that brought about such alterations was controlled, a lineament of the same direction as the above-mentioned fracture system has also been extracted in this region, and it is considered to be a promising candidate in that respect. It should be noted, however, that northeast-southwest lineaments crossing it at right angles and north-northeast to south-southwest lineaments have also be extracted.

Considering the mode of occurrence of the alteration zones and the mineral assemblage, most of the alteration zones in this region are thought to be steam-heated alteration. In some of them there is distribution of silicified rock with the somewhat high-temperature assemblage of quartz and alunite for which the gold and molybdenum grades are 150 ppb Au and 36 ppm Mo, and there is also distribution of silicified rock with comparatively high copper and phosphorus anomaly values. Considering such data it might be reasonable that there is expectation of occurrence of mineralization deep underground.

3.2.10 Siruma Peninsula Area (Fig. II-3-19)

Reason for selection: White clay is mined in this area(Cruz, J.R.D., 1956; Llave, G.A., 1971; Caleon, P.C., 1971), and since that means kaolin and illite, one can surmise a connection with hydrothermal deposits.

Location: It is situated at the west end of the Caramoan Peninsula.

Accessibility: No road is available from Naga to the area. Ricardo A. Banares, the owner of a white clay mine in the area was kind enough to take us there by a clay transporting vessel from in front of his house west of the town of Nagas. It took about 5 hours.

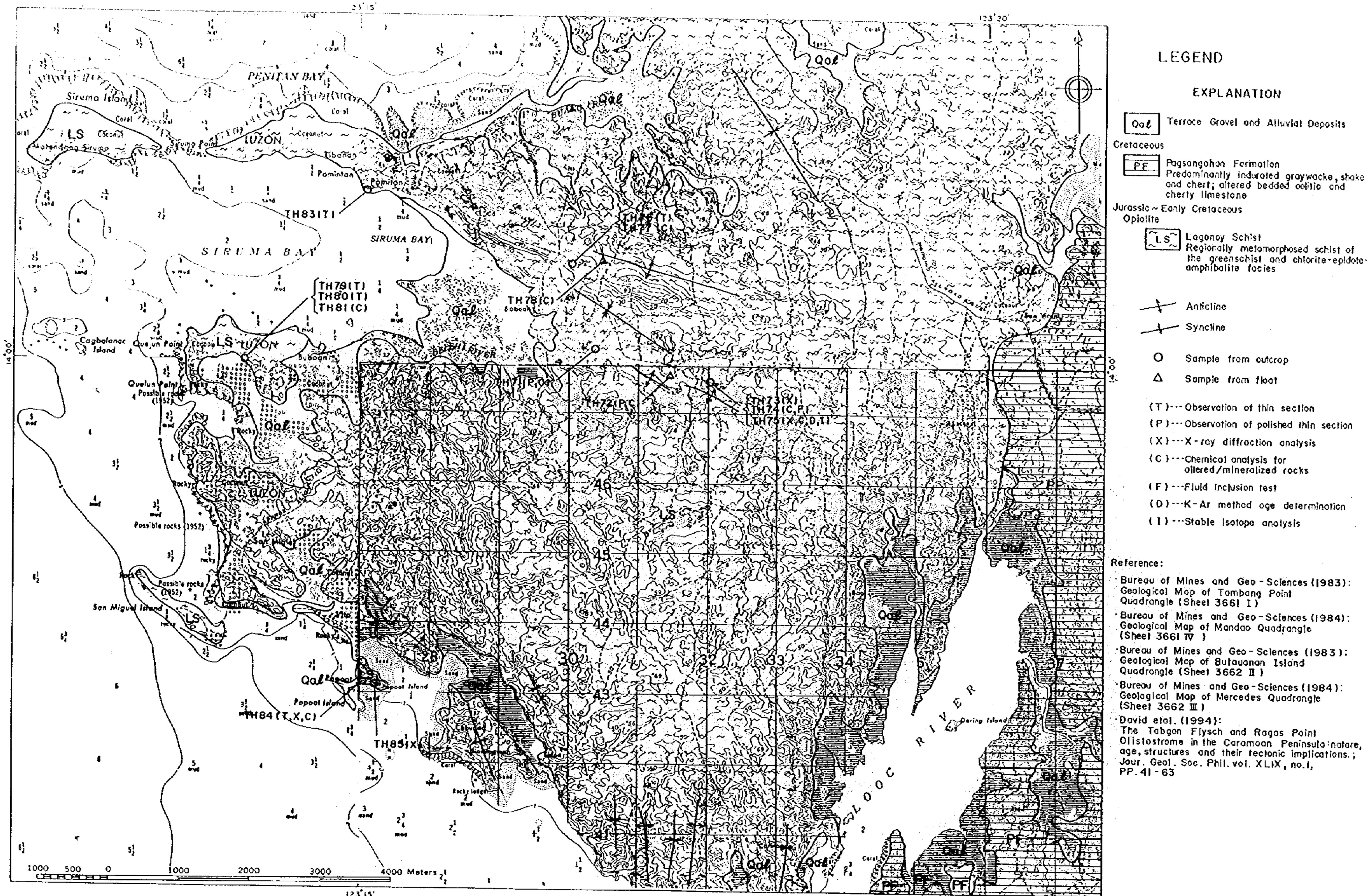


Fig.II-3-19 Geological map of the Siruma Peninsula Area and sample locations

Geology: There Mr. Ricardo guided us in our survey in the areas around the clay mine and a manganese mine. The wall rock of the white clay deposit is green schist to mica schist. According to David et al. (1946) they are considered to be members of the Lagonoy ophiolite. There are quartz veins in the green schist. According to Mr. Ricardo's explanation, local people extract gold by panning from remnants of quartz veins in the argillized zone. The quartz veins are just about parallel to the schistosity, and at the edge of the veins the alteration does not have a halo (Fig. II-3-20). Therefore the quartz veins are thought to have been formed in about the same period as the metamorphism, which means that the type of gold deposit is different from epithermal gold deposits. This schistosity is N65°W to N72°W while the topographic prominent in this area arranged parallel to that direction.

The wall rock of the manganese deposits at the southwest end of Siruma Bay is black to violet gray mica schist to wollastonitic schist. According to David et al. (1994) they are members of the Lagonoy ophiolite. There are a lot of quartz veins parallel to the schistosity, with accompaniment of manganese ore.

Alteration: The white clay deposit consists of sericite, kaolinite and smectite, resulting from argillization of the greenschist and mica schist. The average monthly production figure is 1,000 tons. The white clay deposit is distributed widely under the topsoil. Instead of argillization along cracks or veins, there is nearly uniform argillization everywhere. That mode of occurrence of clay is different from that of argillization zones seen in epithermal gold deposits. Leaving Siruma Bay, we surveyed another white clay mining site, that one on Popoot Island to the south and now abandoned. The source rock of the white clay is mica schist. At outcrops where the texture of the source rock still remains, one can see quartz veins parallel to the schistosity, and pyrite is observable in both the schist and the quartz veins. If the pyrite undergoes oxidation decomposition, forming an acidic solution, it would appear to be easy for it to react with the acidic solution and be replaced by kaolinite since there are no minerals in the schist with high capability to neutralize the acid solution. Therefore it is possible that the Siruma white clay deposit, too, was formed by the acidic fluid produced by oxidation decomposition of the pyrite disseminated in the schist.

Mineral showings: The gold content of the quartz veins in the white clay ore body is < 5 ppb Au, which is to low for assignment of any grade. Analysis of the quartz veins at the entrance of an old pit (shaft) on a ridge showed the value of 2,200 ppb Au as well as anomaly values for copper and cobalt of 565 ppm Cu and 51 ppm Co. The quartz veins are parallel to the schistosity of the greenschist and do not have alteration halo. One of the quartz veins in the greenschist (TH72) had

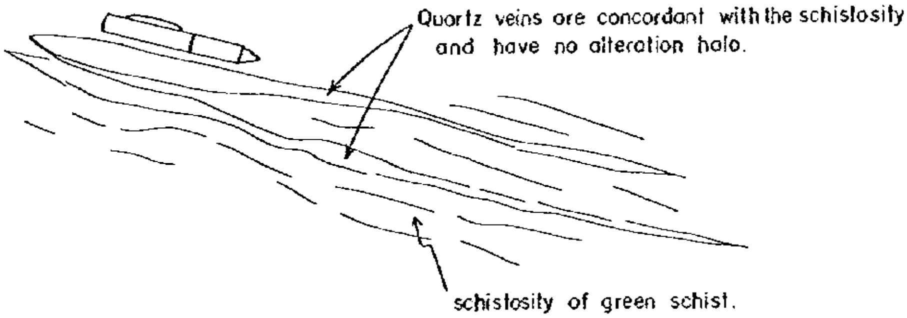


Fig.II-3-20 Occurrence of quartz veins in green schist in Siruma Peninsula Area.

the anomaly value of 160 ppm Cu.

At the manganese mine some green oxidized copper ore is to be observed, and that indicates copper mineralization, although very, very slight. One of the quartz veins in the mica schist of the manganese mine had a chromium anomaly value of 643 ppm Cr.

Evaluation: Considering the above observation findings, the white clay deposits of this area are not hydrothermal but rather are thought to have been produced by acidic alteration of supergenes resulting from oxidation of sulfides in mica schist and diorite schist. One cannot therefore not expect any epithermal gold deposits in this area. However, since gold panning is being carried out, there is the possibility of gold deposit endowment accompanied with the quartz veins (mesothermal veins?) in the schist. Furthermore, since existence of large amounts of sulfides that brought about the above-mentioned alteration of supergenes is surmised, existence of massive sulfide deposits, too, in the schist is possible.

Mining claim: A part of the area is covered by mining rights, and most of it is covered by application by TROPICAL EXPLORATION PHILS. INCORP. for FTAA status.

3.2.11 Tambang-Olas Area (Fig. II-3-21)

Reason for selection: Since many small-scale miners mine placer gold by panning in this area, its gold deposit potential is high.

Location: The area is located in the western part of the Caramoan Peninsula about 40 km northeast of Naga.

Accessibility: Tinambac can be reached from Naga by car in about 1 hour. It takes about another hour from Tinambac to Tambang because the road is unpaved and in very poor condition. A hired boat is needed from there. From Tambang to Olas it takes about 50 minutes that way. From Olas the boat goes up the Olas River, reaching the landing pier nearest to the survey area in about 30 minutes. After getting off the boat, it is necessary to walk for about 1 hour to reach the survey area.

Geology: According to David et al. (1994), the geology of the Caramoan Peninsula is divided into the Western Caramoan Structural Segment and the Eastern Caramoan Structural Segment by the Minas fault, this survey area being included in the Western Caramoan Structural

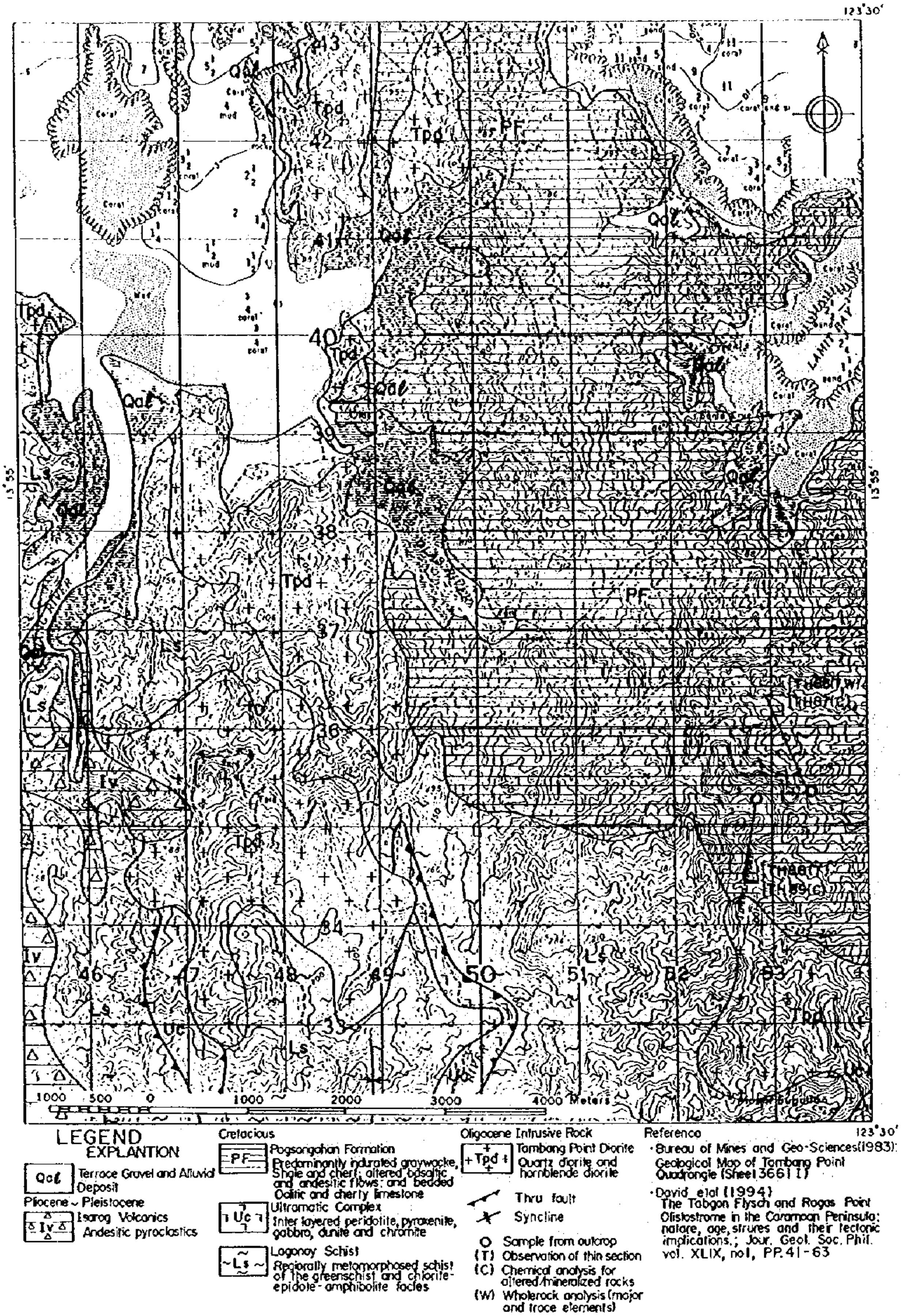


Fig.II-3-21 Geological map of the Tamban-Olas Area and sample locations

Segment. In the Western Caramoan Structural Segment there is distribution of the Lagonoy ophiolite, the late Cretaceous Pagsaghan formation and oligocene diorite intruding into them. This survey area is an area of distribution of the Lagonoy ophiolite.

Many of the floats to be seen in the dry parts of the river bed on the upper reaches of the Olas River are diorite. Few of them have developed schistosity. In correspondence with indication on the existing geological maps of distribution of plutonic rock in the vicinity of this area there are many diorite to granodiorite rock floats as well. Quartz floats are also to be seen. At the place where samples TH86 and TH87 were taken there is an outcrop of green rock. Instead of schistosity it has developed jointing and shear cracks. There is epidote alteration along the cracks, and pyrite is also to be observed. Quartz veins enter along the shear cracks, without any alteration halo at the edges of the veins.

Alteration: The only alteration to be observed is epidote alteration and pyrite dissemination in the shear zones of the green rock. There are no zones of argillic or other alteration.

Mineral showings: The values obtained in analysis of the quartz veins in the shear zones of the green rock were 10 ppb Au, 311 ppm Cu and 301 ppm Cr. In the area gold grains are gathered from the river sediment by panning, and there is an old pit where gold veins per se used to be dug (at the place where samples TH88 and TH89 were collected). At the abandoned pit there are remnants of calcite veins in the form of mine dump, and the local people say that there used to be occurrence of gold associated with the galena in the quartz and calcite veins. The values obtained in analysis of a calcite vein (TH89) containing bands of quartz with a width of several millimeters are 10 ppb Au and 1,465 ppm Mn. The direction of the old pit is N20°E, and the slope is 62° to the west. The wall rock is greenschist. It is thought that this metalliferous vein type of gold deposit is the result of reconcentration, at the time of intrusion of granodiorite, of the gold concentrated in the quartz veins formed in the greenschist at the time of metamorphism.

Evaluation: The gold mineralization in this area consists of quartz veins (mesothermal veins?) in the schist and alluvial deposits resulting from them. Furthermore, in view of nearby distribution of diorite there is possibility of existence of metalliferous veins accompanying it (e.g. TH89). Another possibility is that the gold in the quartz veins in the schist was reconcentrated by intrusion of diorite to form new metalliferous veins. Since the geological setting is the same as that of the Paracale area of Camarines Norte, high potential regarding the same type of gold mineralization is surmised.

Mining claim: Mining rights have been applied for a part of the area, and most of the area is covered by several applications for FTAA status.

3.2.12 Western Goa Area (Fig. II-3-22)

Reason for selection: Mr. Arnel, a geological technician of BMG Region V informed us of existence in the area of quartz veins in a several meters wide at the foot of Mt. Isarog. Therefore there were expectations regarding the possibility of epithermal gold deposits.

Location and Accessibility: The area is situated 4 km northwest of the central part of Goa. Access to it is relatively good since the road, although unpaved, is used by local people in their everyday lives.

Geology: There is continuous outcropping of mica schist along the tributary of the Lagonoy River.

Alteration: Argillic alteration zone with a width of 30 cm accompanied by minute pyrite is observed appears to fill fault fissures. This includes quartz vein characterized by swelling and contraction at the center. The results of X-ray diffraction analysis indicate a mineral assemblage of quartz-kaolin > sericite > siderite. However, it is possible that the sericite is a rock forming mineral of the wall rock. No other alteration was noted.

Mineral showings: Thick white massive quartz veins crop out in the schist. Pyrite dissemination is to be observed in some of the quartz veins. In the analysis values of 60 ppb Au for the pyrite dissemination part of such quartz vein (KY60a), 395 ppm Cu (KY67a) for the argillic alteration zone with a width of 30 cm and 284 ppm Cu (KY67c) for the nearby schist wall rock were obtained.

Evaluation: From the characteristics of the veins and the nature of the wall rock it is considered that the quartz veins of this area are quartz veins accompanying schist as in the Tambang-Olas area. The results of the limited analysis of samples indicate gold mineralization in the quartz veins and copper mineralization in the argillic alteration zone. Regarding gold mineralization, the mode of occurrence gives grounds for expectation of mesothermal origin, but low grade is surmise. Deposit potential will have to be evaluated on condition of separation by mechanical or chemical weathering and occurrence of secondary enrichment.

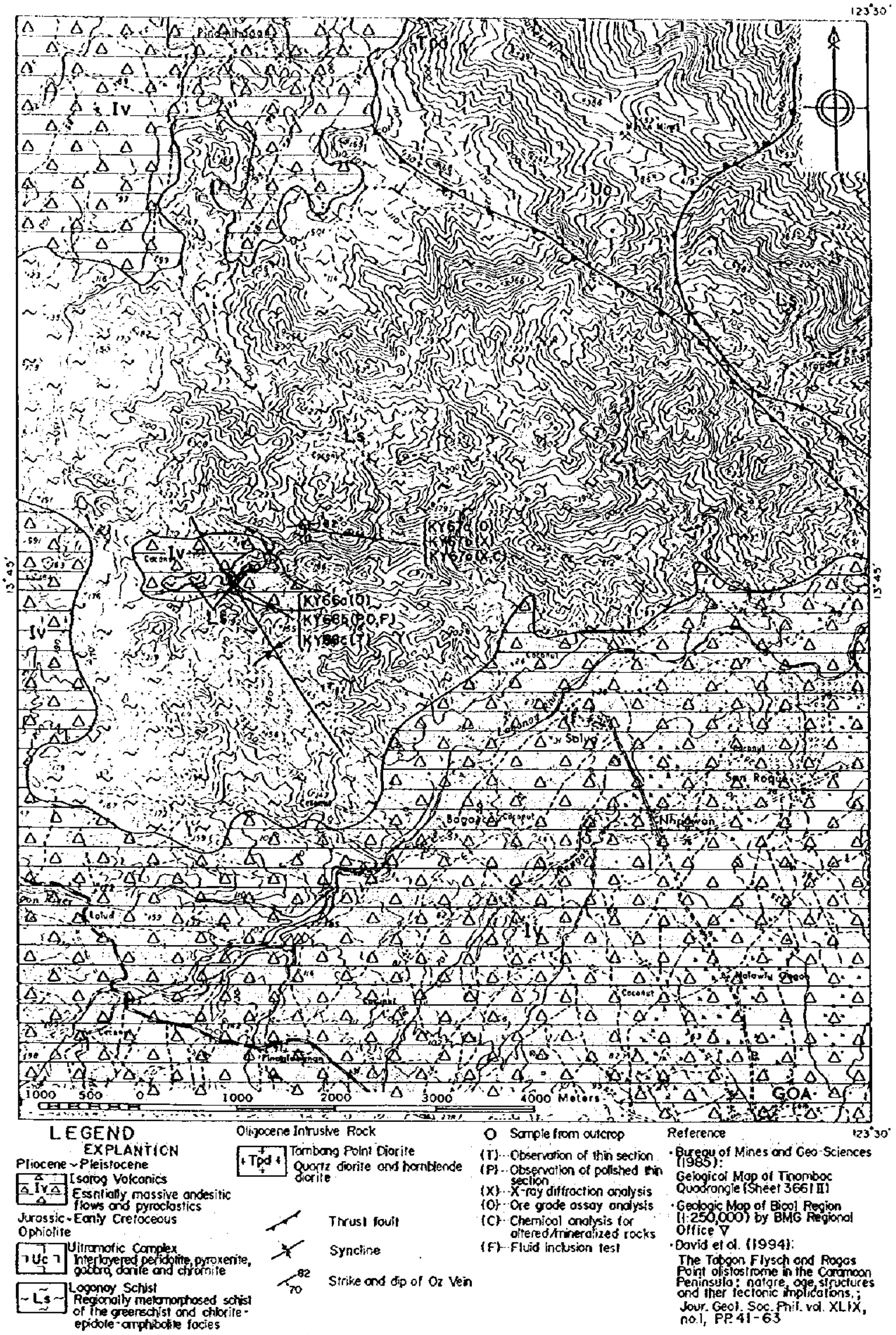


Fig.II-3-22 Geological map of the Western Goa Area and sample locations

Mining claim: No mining areas have been established.

3.2.13 Western Pasacao Area (Figure II-3-23)

Reason for selection: This area is known as prospect for copper and gold mineralization. From the diorite stock and limestone distributed in this area, the presence of Carlin-type or porphyry-type deposits is conceivable. In addition, from the regional airborne magnetism, magnetic anomalies are observed 5 km SW, 5 km ENE and 7 km WSW of Pascau, tending to spread NW to SE.

Location: Alongside the seaside located SE of Camarines Sur State, 20 km NW of Pasacau, in the vicinity of 13°31'-13°38' N, 122°51'-122°57'E.

Accessibility: It takes 45 minutes from Naga, Camarines Sur State, to Pasacau and one hour from Pasacau to Wagas Point by driving a car. Copper mineralization is present at Bidlayo and Dalupaon located along the seaside leading from Pasacau to Wagas Point.

Geology: The layer structure is formed from the bottom, as follows:

- Ragay volcanic rocks in phenocryst rich andesite from Oligocene,
- Bicol layers in conglomerate, sandstone, calcareous sandstone and brecciated calcareous lens from Miocene,
- Talisays layers in limestone from late Miocene, and siltstone and sandstone from Pliocene, and
- Panganiran diorite, or hornblende andesite, where the diorite replaced the most part of the volcanic rocks.

Among the lineaments, those with high continuity trending NW to SE and those comparatively short trending NE to SW are superbe.

Alterarion: In Bidlayo where copper mineralization is present, fine-grained and medium-grained phenocryst rich andesite contained in the country rocks has been chloritized or epidotized and slightly pyritized with silicification. In a place 2 km east of Wagas, many boulders from the country rocks subjected to the alteration to silicified rocks, silica veins and propylite in reddish brown chalcedonic condition caused by partial penetration of limonite. According to the result of X-ray diffraction, a large amount of quartz, calcite and dolomite was detected from the samples of altered rocks collected 2 km east of Wagas together with a small amount of smectite. These

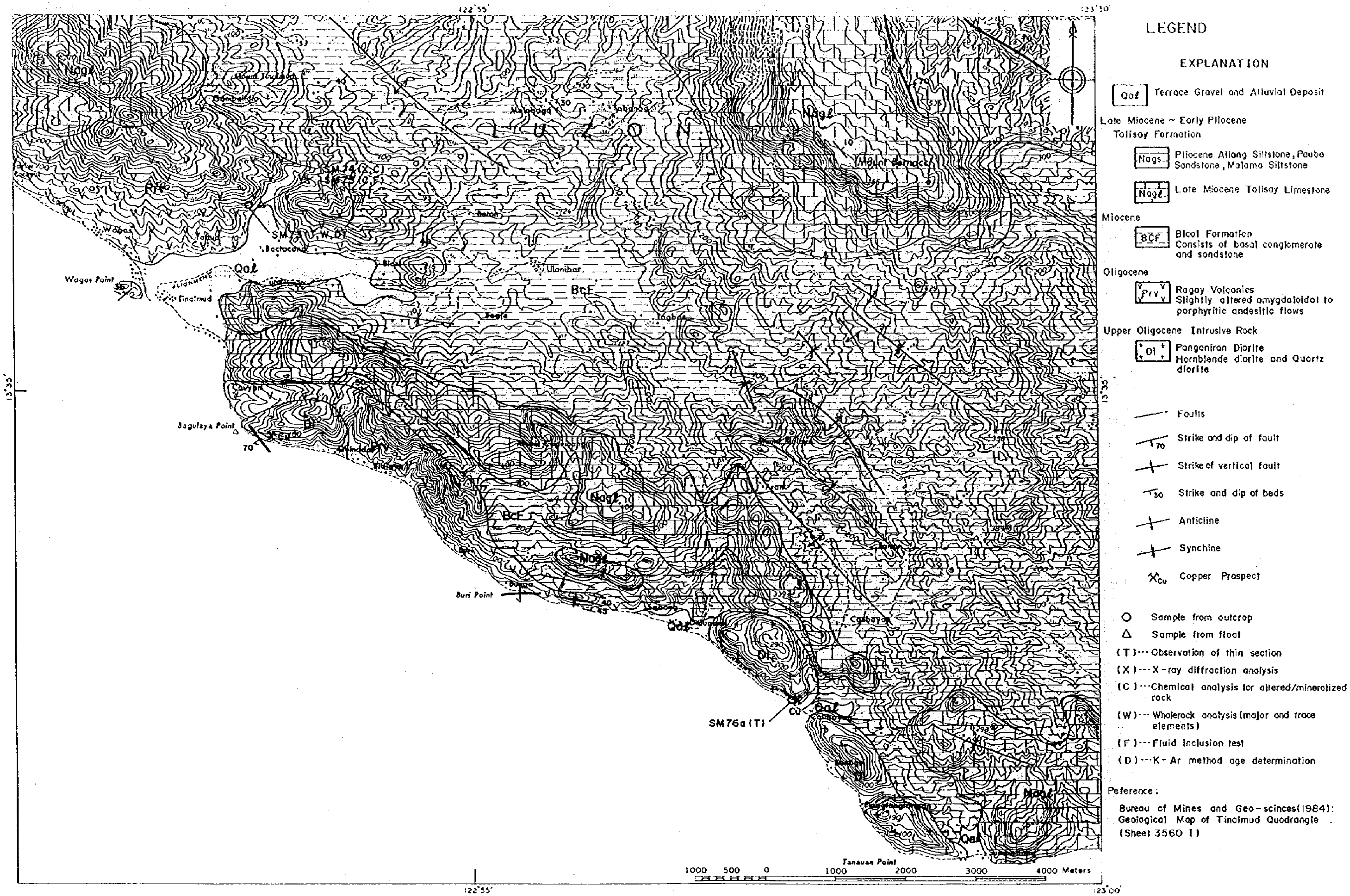


Fig.II-3-23 Geological map of the Western Pasacao Area and sample locations samples show hydrothermal alteration caused by neutral to alkalic solution.

Mineral showings: During the period of the geological survey performed this time, silicified rocks were taken from a place 2 km east of Wagas and the chemical analysis was made. From the results, any anomaly due to highly concentrated useful metal elements and metal indicating elements was not observed. However, according to an existing literature (Castaneda, 1972: CS43), fine-grained chalcopyrite, chalcocite and malachite penetrated into altered phenocryst rich andesite were observed together with fine-grained pyrite. From the results of analyzing the sample ores collected from Dalupaon, the copper content showed 0.47%. The above said mineralization is limited in the shear zones trending NW to SE.

Mining claim: Application has been made for MPSA and FTAA status.

Evaluation: In this area, copper mineralization brought by the diorite intruding into pyroclastic rocks was observed, and porphyry-type deposits is conceivable. The exposure is limited, moreover ore grade and magnitude of mineralization are low. It is limited in the direction NW to SE. Thus, the survey of the areas surrounding the lineaments and fractures is considered necessary.

If the diorite intruded later than that of limestone sedimentation, the presence of Carlin-type gold deposits is expected. In addition, the presence of skarn deposits that have replaced the limestone is aslo expected.

3.2.14 Eastern Pasacao Area (Figure II-3-24)

Reason for selection: Although existing mineralization is unknown, the geological setting is similar to that of Western Pasacao area.

Location and Accessibility: The survey area is located east of Pasacao along the seaside where the settlement Manit is positioned at the center. It is difficult to make an access to this area by land from Pasacao. Thus, boats were chartered for implementing this survey.

Geology: The geology of this area examined on the outcrops consists of crystaline schist and basalt sheets, andesite or basalt lava, pyroclastic rocks and coraline limestone. For the relations between the crystalline schist and andesite or basalt rocks, it seems the latter covers the former with unconformity. The limestone overlaining them with unconformity looks vesicular free from

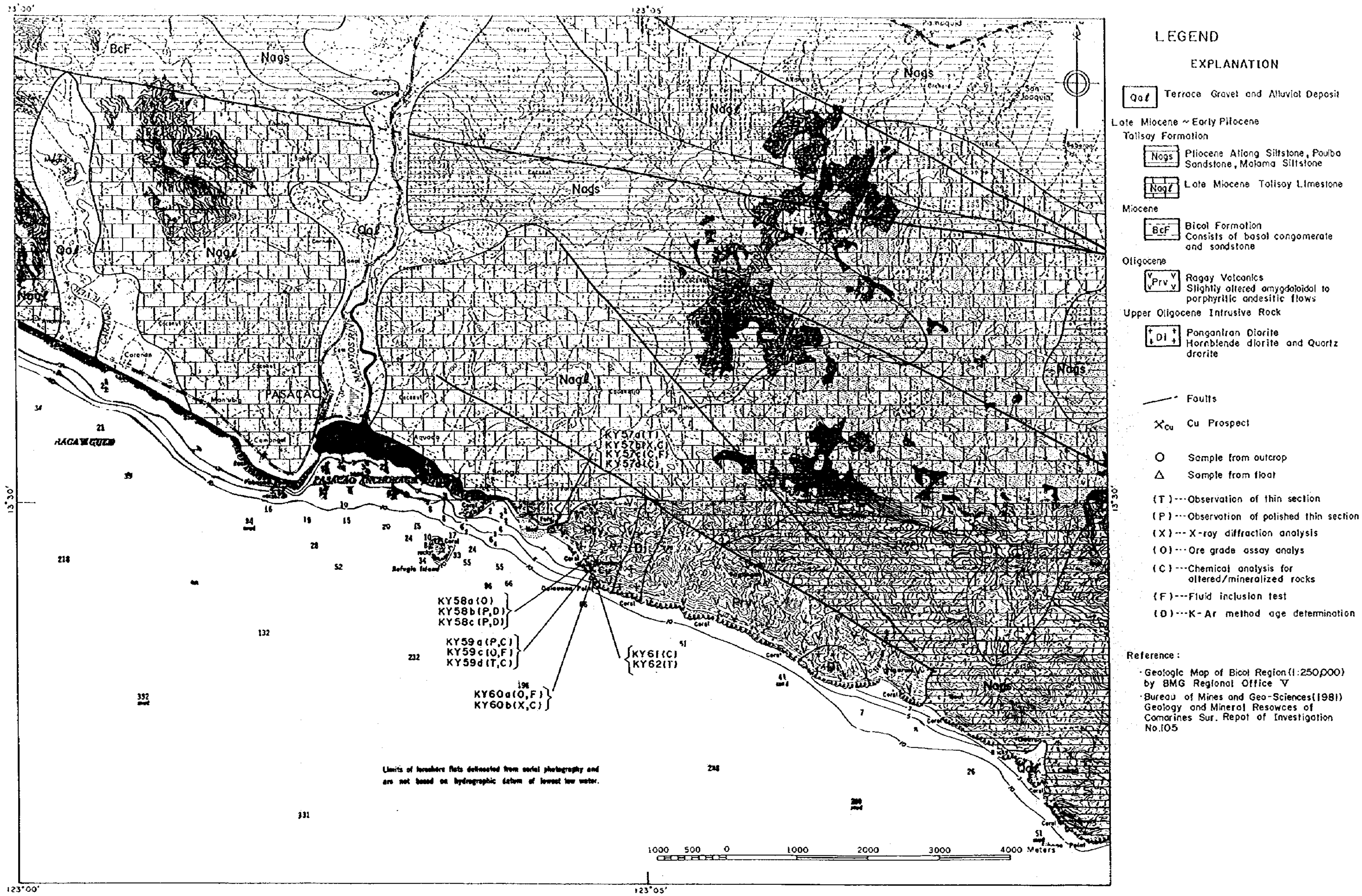


Fig.II-3-24 Geological map of the Eastern Pasacao Area and sample locations diagenesis, giving impressions as a sediment nearly from the Recent.

Diorite with a diameter of several meters fully covering the coast was observed as boulders. However, the relations between this diorite and the geological features observed on the outcrops are unknown.

Alteration: The andesite or basaltic volcanic rocks distributed along the coast has been damaged by strong weathering particularly in the portions supposed to be subjected to alteration. It is difficult to clarify the characteristics of the alteration. In the diorite with quartz veinlets accompanied by copper oxide minerals, the alteration due to silicification is remarkable, but that due to potash substances is unobserved.

Mineral showings: The diorite with developed quartz veinlets also contains copper oxide minerals and limonite. In the andesite, calcite veins develop but quartz veins do seldom. In addition, in the crystalline schist, remarkable dissemination of pyrite was observed in the areas with pyrite distribution and on the side near basal distribution. Hot springs gushing out along the faults were observed though in a small scale.

The altered rocks and silicified rocks showed the following analytical values: 10-35 ppb Au, 180-180 ppm As Other than these, Co, Cr, Ni and Mg also showed extreme high concentration, suggesting the source rocks form basic rocks or ultrabasic rocks. Some of the crystalline schist (KY61) disseminated by pyrite showed the following components: 80 ppb Au, 138 ppm As, 897 ppm Cr, 8.47% Mg, 834 ppm Ni

For the quartz veins (KY57) in andesite, the fine quartz veins (KY59) developing in silicified rocks continuing swelling and shrinkage and the quartz veins (KY60) densely developing in the diorite with copper oxide minerals, the fluid inclusion homogenization temperature was measured. As a result, each average temperature was as follows: 200.3°C (ranging 173-234°C), 234.1°C (ranging 208-251°C), 187.0°C (ranging 161-202°C) Each salinity was as follows: 0.18-0.53%, 0.88-1.40%, 2.74-3.87%

Evaluation: In copper mineralization caused by the group of fine quartz veins observed in the diorite, potash alteration is not observed along the veins. Consequently, it is inconceivable the mineralization is caused by the porphyry copper, and, most probably, caused by that related to the formation of plutonic rocks. Quartz veins grow in andesite. There are some correlations between the distribution of basalt and the crystalline schist in the areas disseminated by pyrite. For these reasons, the hydrothermal behavior in the activities of volcanic rocks will be also a matter of our concern.

Mining claim: The application has been made to FTAA.

3.2.15 Iriga-Baao Area (Figure II-3-25)

Reason for selection: Although any metallic mineralization has not been reported in this area, slightly old volcanic rocks may have been distributed at the foot of the volcanos newly created by Mt. Iriga. From the results of lineament analysis, the lineaments trending NW to SE are crossing with those trending NE to SW. Thus, the presence of alteration zones due to the hydrothermal behavior is conceivable.

Location and Accessibility: The objective survey area is a hilly country located west of Mt. Iriga.

Geology: Apparent lower unit consists of basaltic two-pyroxene andesite lava and upper one consists of biotite bearing rhyolite or dacite lava dome, basaltic fall out volcanish ash, pumice tuff and volcanic mud-flow sediment Geological features in this area is characterized by the volcanic succession brought by bimodal volcanic activities.

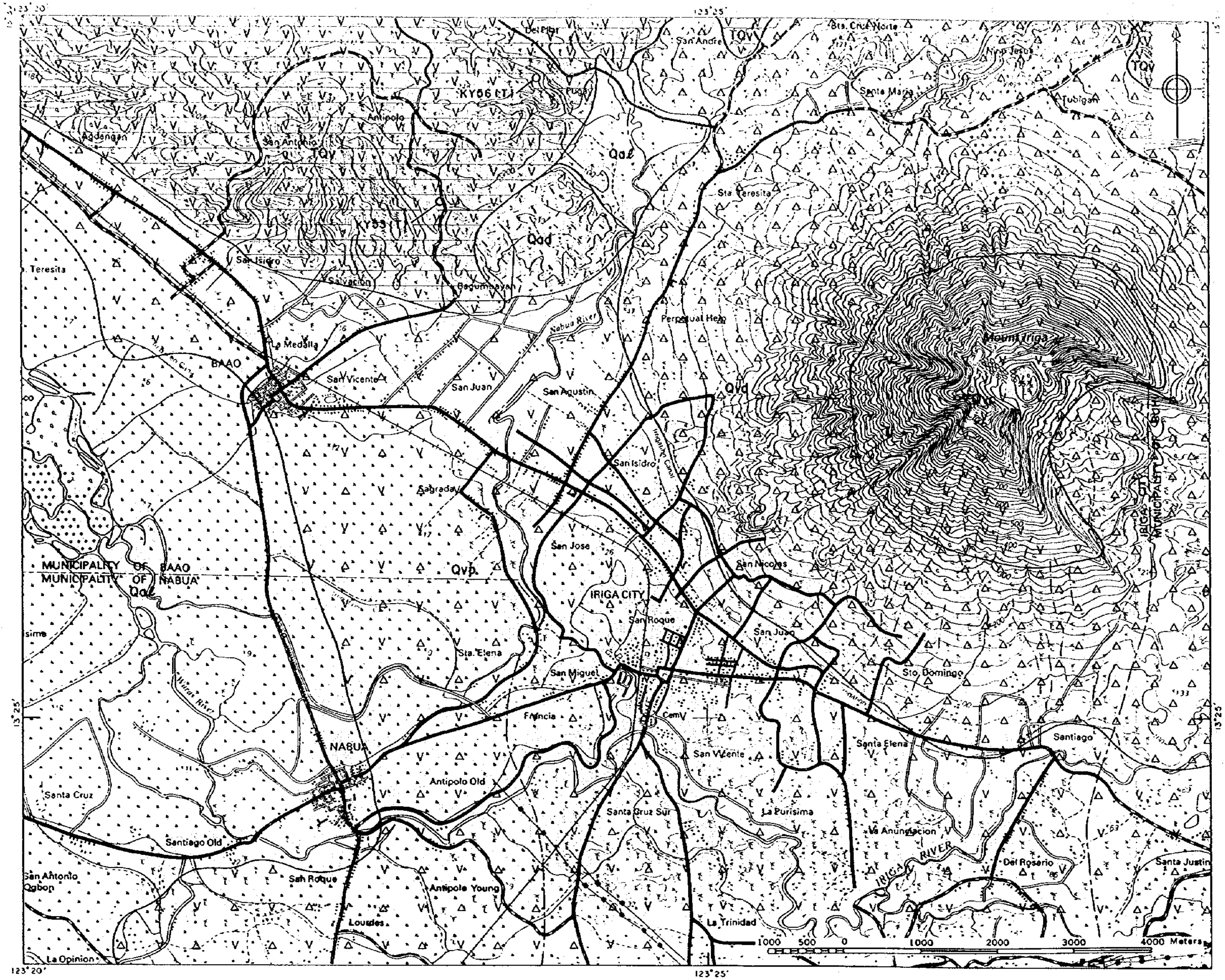
Alteration: No alteration is observed.

Mineral showings: No mineralization was observed in this area except perlite that has been produced from the dacite lava dome.

Evaluation: Many lineaments were extracted and sorted as promising areas where several systems were crossing each other, but neither alteration nor minerlization was observed. This area is supposed to be a volcanic body or product formed as older one than Mt. Iriga proper judging from its more advanced degree of erosion and dissection compared to those of Mt. Iriga.

For this reason, the lineaments were emphasized and extracted in comparison with those in the surrondings, most probably.

Mining claim: No mine claim has been approved.



LEGEND

EXPLANATION

Qal	Terrace Gravel and Alluvial Deposits.

Quaternary

Qvc	Iriga Volcanic Cone mainly andesitic lava flows.
Qvd	Iriga Volcanic Rocks andesitc volcanic deposits of Mt Iriga, occuring lavas pyroclastics around Iriga Cone
Qvp	Quaternary wide spread pyroclastic agglomerate, volcanic breccia and tuff
Qad	Acidic Volcanic rock glassy, invariably with biotite containing perlite layers.

Pliocene ~ Early Pleistocene

TQv	Porphyritic massive andesitic lava flow intercalated with agglomerate.

O Sample from outcrop

(T) ··· Observation of thin section

Peference:

- R.B. Jagolino et al: The Bagunbayan Perlite Deposit, Baao, Camrines Sun. (Bureau of Mines Unpublished Report)
- Geologic Map of Bicol Region (1 : 250,000) by BMG Regional Office V.

Fig.II-3-25 Geological map of the Iriga-Baao Area and sample locations

3.2.16 Buhi-Western Mt. Malinao Area (Fig. II-3-26)

Reasons for selection: This area is located NE of Mt. Malinao. Compared to Mt. Malinao, the topographical dissertion has been more promoted, and the volcanic rocks from older Oligocene have been distributed. East of Mt. Malinao, there is Tiwi geothermal field in operation at present. As said above, low sulfidation-type mineralization is observed in the depths of this geothermal system. Base on this fact, the existence of hydrothermal systems older than those in the field is conceivable. From the lineament analysis, those trending NW to SE are crossing those trending NE to SW. Judging from this fact, the existence of alteration zones brought by hydrothermal activities is also conceivable.

Location: This area is located east of Lake Buhi, Albay State, in the vicinity of 13°25'-13°32' N, 123°31'-123°35' E.

Accessibility: It takes one hour to go from Nago to Iriga using a car on the national roads. The car will reach Buhi within half an hour more. When you take a boat from Buhi, you will arrive at the entrance of Cayohoson Creek by boat within another half an hour.

Geology: The area is underlain by pyroxine-andesite lava and pyroclastic rocks. The basement system of volcanic system is unknown.

A large number of NW-SE lineaments has developed northeast of Mt. Malinao. Some magnetic anomalies were observed in the airborne magnetic survey covering north of Mt. Malinao

Alteration: Numerous silicified boulders, particularly quartz veins, are remarkable in Santa Cruz River running along the eastern side of Lake Buhi. There observed are vesicular quarts in reddish brown with limonite intruding inside, chalcedonic quartz disseminated by pyrite, white rocks with intense to medium silicification and highly silicified rocks in white color with red to brown limonite intruding inside. Other than those in Santa Cruz River and Cayohoson Creek catching the settlements in Santa Cruz inside, no remarkable altered rock boulders are observed. Thus, it is estimated the alteration has expanded upstream the both rivers.

According to the result of X-ray diffraction analysis, tridymite, kaolinite and alunite have been detected from the boulders altered by argillization, showing the acidic alteration occurred at a low temperature in the shallows. Quartz and pyrite have been also detected in silicified portions.

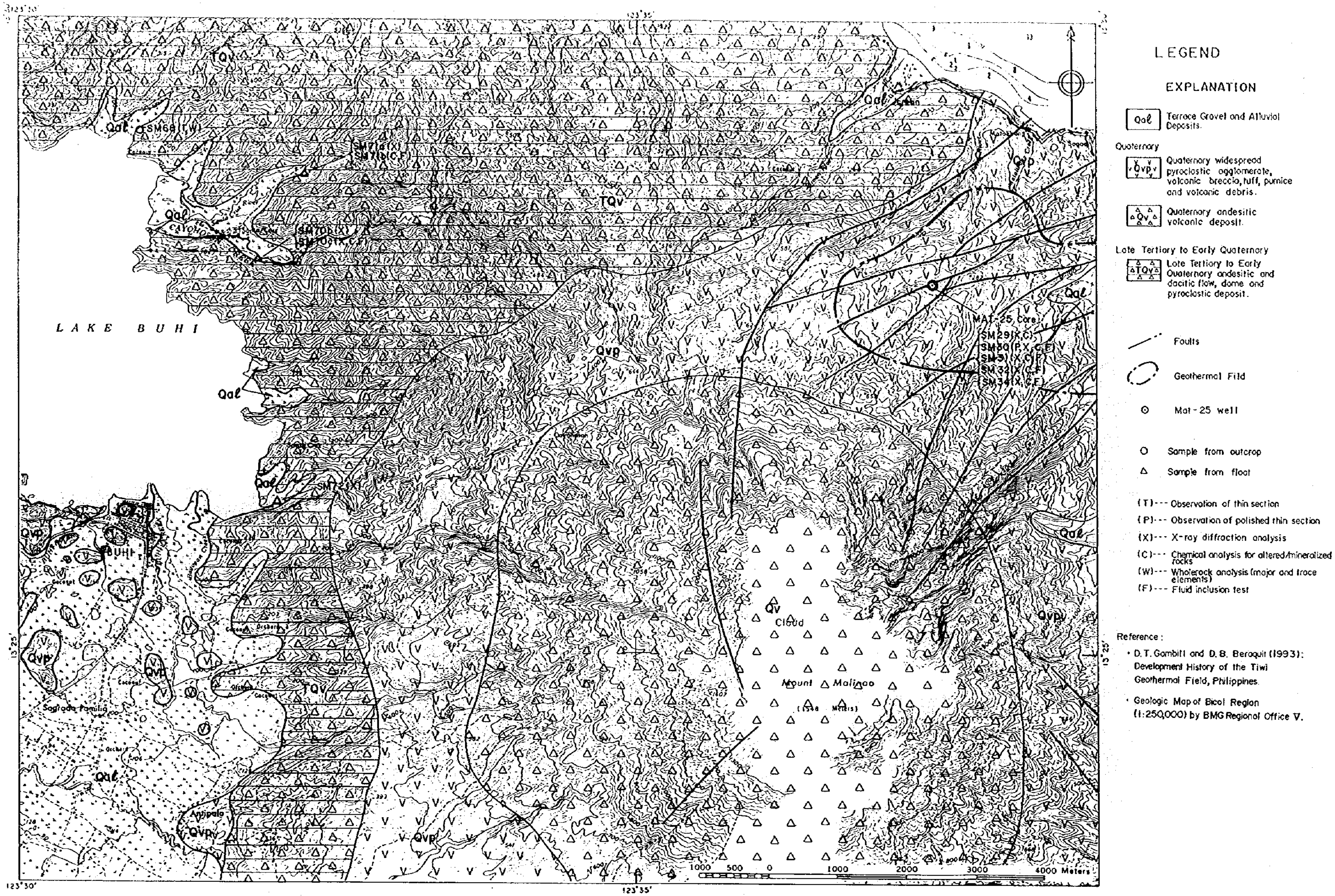


Fig.II-3-26 Geological map of the Buhi-Western Mt. Malinao Area and sample locations

For the fluid inclusion homogenization temperature , the samples of the boulders collected from the quartz veins in Santa Cruz River (SM71b) showed high temperatures ranging 288 to 334°C (average 309.9°C) while the salinity was low ranging 0.00-0.71 weight %, suggesting the considerable influence of the meteoric water.

Mineral showings: None

Evaluation: From the result of chemical analysis applied to the floats, no anomaly was found in the concentration of Au, Ag and base metals. However, it is assumed that the altered zones have spread east on Lake Buhi.

Mining claim: Blank

Evaluation of areas from Tiwi to Mt. Malinao: In the depths located east of Mt. Malinao, low sulfidation-type mineralization was observed. However, the formation of valuable mineral deposits is inconceivable due to insufficience in the depth and the hydrothermal activities in operation at present. Although no mineralization is observed west of Mt. Malinao, the existence of alteration zones has been confirmed, and the period of hydrothermal activities is considered older than those in the eastern areas. Thus, the potential of mineral deposits formed in the depths is thought to be high.

3.2.17 Balatan Area (Figure II-3-27)

Reason for selection: This area is known as the places for copper mineralization. Judging from the diorite stock and limestone distributed in this area, recharge storage in skarn deposits, Carlin-type deposits and porphyry-type deposits is conceivable. Lineaments have developed in the systems trending NW to SE crossing those trending NE to SW. This area was divided into two areas, located north and south, for the survey purpose.

(1) Balatan North area

Location: Area in Balatan and upto 7 km northwest of Balatan along the seaside located southwest of Camarines Sur State, in the vicinity of 13 ° 19'-13° 23' N, 123° 12'-123° 16' E.

Accessibility: It takes about one hour to go from Naga, Camarines Sur State, to Baao by car running on the national roads. It takes about 30 minutes to go from Baao to Balatan by car

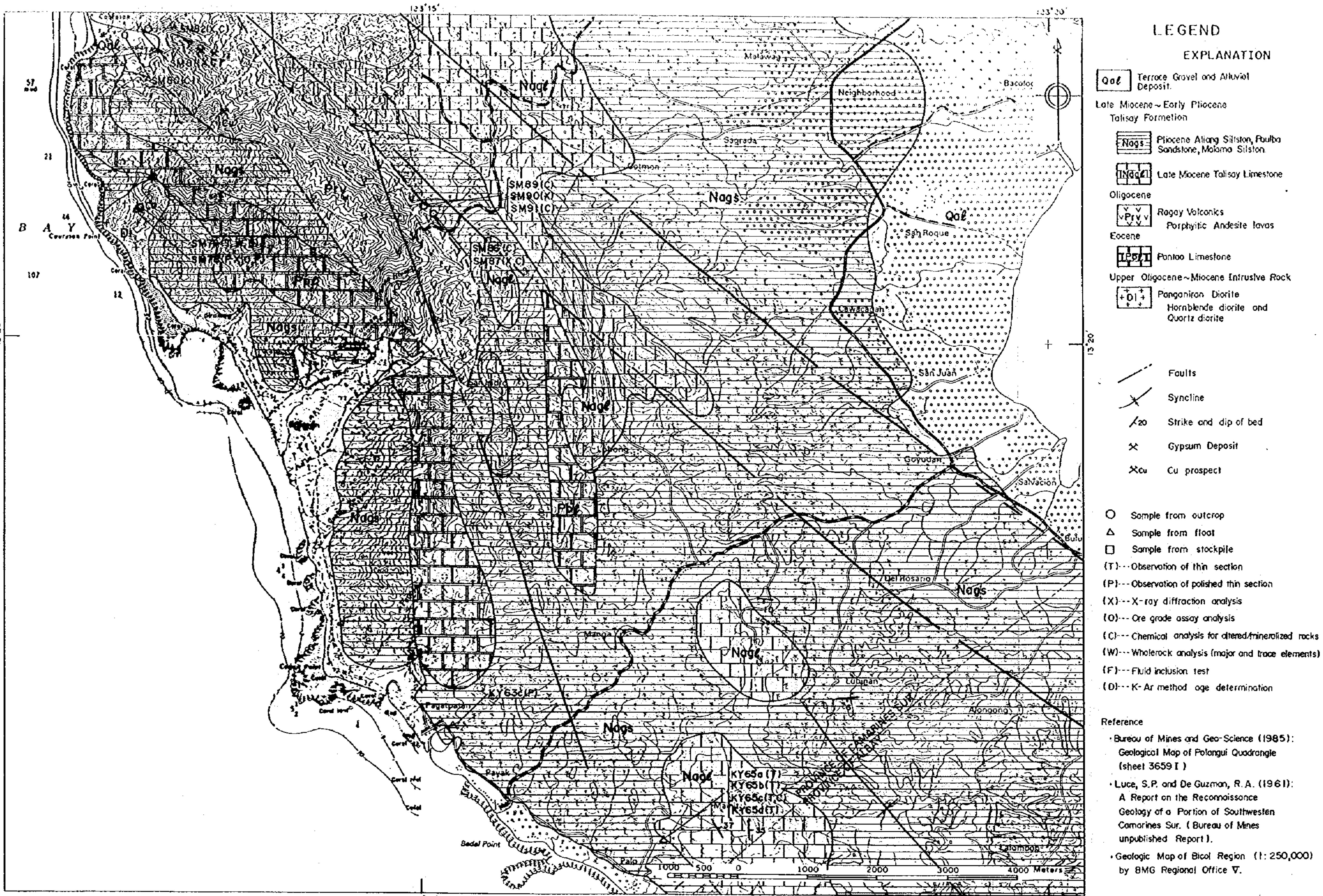


Fig.II-3-27 Geological map of the Balatan Area and sample locations running on paved roads. A banker boat spends about 40 minutes to go from Balatan to Caorasan.

Geology: The geology in this area consists of Siramag limestone from the first period of Miocene, Siramag andesite and diolite from the middle to late period of Miocene and Pasacau clastics from the late period of Miocene to Pliocene. Siramag andesite occurs as the lenses made of fine to medium-grainedlife clastics showing a dark-brown color. Siramag andesite is of andesite porphyry subject to the structural control trending northwest, providing highly brecciated and cateclastic zones. Siramag andesite contains plagioclase, pyroxene and amhibole as the rock forming minerals, and epidote, chlorite, sphene, etc. as the accessory minerals. The diorite is medium to coarse-grained quarts diorite containing amphibole, black mica, quartz, plagioclase and potassium feldspar. Pasacao clastics consists of gray calcium-shale, sandstone and limestone.

As the lineaments, those of NW-SE systems have extremely developed. Among large structures, Caorasan fault passing through the hill country in Balatan shows this trend. These structures also control the direction of gypsum deposits and andesite porphyry.

Alteration: In Camangahan creek located 2 km NNW of Siramag where copper mineralization is present, quartz veins with the maximum size of 20 cm are observed in the diorite. Copper minerals including pyrite, limonite and chalcopyrite have been disseminated, but any alteration including arigillization is not observed. On the other hand, there are many gypsum and copper (chalcopyrite) deposits in this area. These are distributed in the direction trending NW to SE under structural control. In Caorasan creek downstream, Siramag andesite has been silicified to a medium extent with white argillization. Some portions show reddish brown color caused by the intrusion of limonite. Siramag andesite has been altered green with the appearance of epidote. These alterations are widely observed around the gypsum deposits located upstream. These gypsum deposits are present as fine-grained or massive gypsum lenses in white fibrous form, accompanied by the portions where fine-grained pyrite is belted in tight formation (Figure II-3-28). Gypsum deposits are in close formation from Cananbanan creek to Sapang creek located near Cananbanan. These deposits were born inside Siramag andesite, accompanied by alteration zones where pyrite is in close formation, or those agrillizated in dark gray to black color with enriched pyrite, silicified chalcedonic portions and those with developed quartz veins. The portions with remaining country rocks have been altered green and partially accompanied by medium to intense silicification (Figure II-3-29).

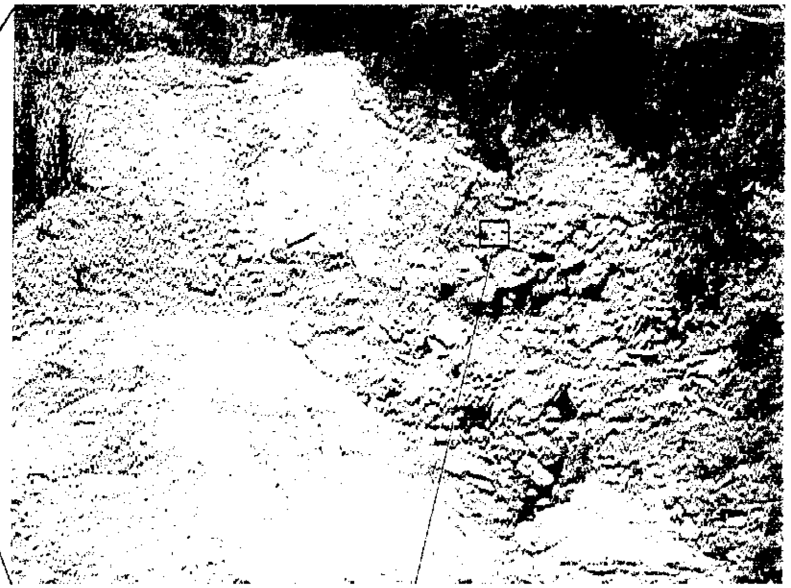
According to the result of X-ray diffraction, a large amount of calcite and a small amount of quartz were detected from the samples of the rocks (SM81) altered to epidote, sampled from

Gypsum ore stockpile

Gypsum ore and altered volcanic rock with dark-grey pyrite band

Fig. II-3-28 Gypsum ore stockpile in Caorasan, northen Balaten

Open-cut of Gypsum ore deposit



Outcrop of Gypsum ore deposit and altered host rock

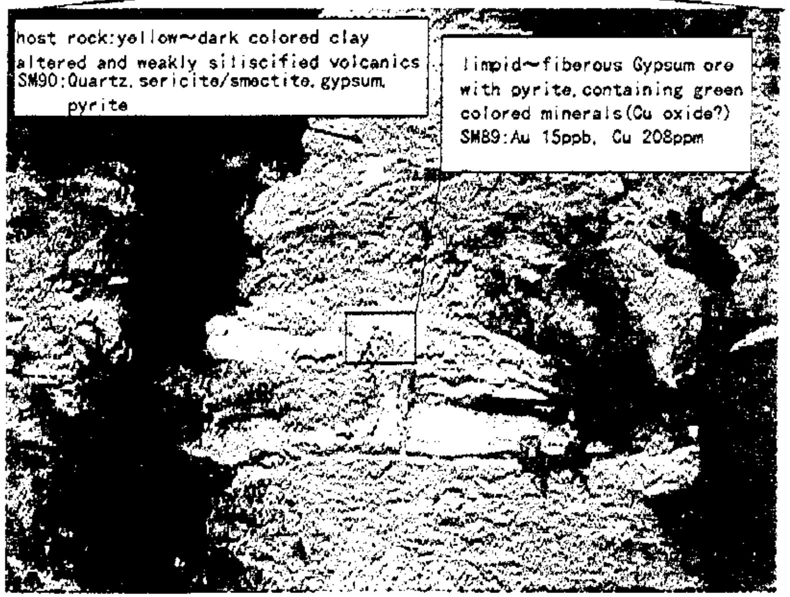


Fig. II-3-29 Gypsum ore deposit near Cabanbanan, Northern Balatan

Siramag andesite observed downstream Carorasan creek. From the samples (SM82) where Siramag andesite has been silicified to a medium extent and argillized white, mixed-layer minerals of quartz and chlorite together with laumontite were detected. From the altered country rocks collected from the gypsum deposits located near Cabanbanan, quarts and mixed-layer minerals of sericite smectite (SM87), and quartz, mixed-layer minerals of sericite and smectite, gypsum and pyrite (SM90) were detected, respectively. It is considered that the both alterations were caused by neutral to alkaline hydrothermal activities at medium to slightly low temperatures. According to the result of measuring fluid inclusion homogenization temperature and sault concentration, the samples of the quarts veins (SM78) collected from Camangahan creek, located 2 km NNW of Siramag where copper mineralization is present, were used. These samples showed both low values, 103-142°C for the former and 0.00-0.35 weight % for the latter, suggesting intense effect of the meteoric water.

Mineral showings: In Camangahan creek located 2 km NNW of Siramag, quartz veins in irregular form of lenses with the maximum size ranging 4-20 cm were observed in the diorite and altered andesite. In the veins and surrounding country rocks, disseminated chalcopyrite, bornite and the intrusion of malachite were observed. The result of ore analysis using the samples collected from Camangahan creek was as follows: Au 210 ppb, Cu 0.40% According to Reyes,F.T. (1970:CS30), a tunnel with a length of about 40 m has been excavated in the direction of N40 ° W, 50 ° NE. From the soil samples collected near this area, 800 ppm was obtained as the concentration of the copper analyzed. From the result of chemical analysis using the gypsum ores collected from the deposits in Cananbanan creek located near Cananbanan, the concentration of Au and Cu was comparatively high, reaching 15 ppb and 208 ppb, respectively.

According to Reyes, F.T. (1970:CS30), copper mineralization accompanied by quartz veins developed in the directions different from those of the andesite porphyry with remarkably developed cracks subjected to the alteration to propylite was observed at the sources of Caorasan creek, where malachite has been disseminated. The result of chemical analysis using the ore samples obtained through this mineralization showed the copper concentration reaching 0.83%. The result of analyzing the copper included in the sand collected from Mangit creek located near Cananbanan showed comparatively high values ranging 200 to 300 ppm.

Evaluation: In this area where the diorite intruded, thread-lace dissemination of copper ores brought by the quartz veins was observed in the diorite and altered andesite. Also in the gypsum and pyrite deposits controlled by the structures trending NW to SE distributed in the places positioned at large heights, anomaly due to high Cu and Au concentration was observed. Judging from the distributions and the condition of these geochemical anomalies, the formation of porphyry-type deposits is conceivable. In the future, it will be necessary to carry out detailed survey near the gypsum deposits as well as around the lineaments trending NW to SE and the fractures. In addition, the presence of Carlin-type gold deposits is possible when the period of diorite intrusion is later than the period of limestone sedimentation. The presence of skarn-type deposits that replaced the limestone is also expected.

Mining claim: MPSA and FTAA:

(2) Balatan south area

Location and Accessibility: The foot of the hills along the seaside from Balatan to Palo located southwest was surveyed. The position 1 km this side of Palo is accessible by car. It takes one and half hour to go from Naga city to this survey area by car.

Geology: There are widespread alluvial sediments alongside the coast located downstream the river, making the outcropping difficult. Most of the floats are coraline limestone, and andesite, basalt and diorite are observed in some cases. It is possible to examine the reef limestone crops out in upstream. The primary sedimentary structure is comparatively clear and vesicular, suggesting the sediment is comparatively young.

Alteration: Among the floats, there are basaltic volcanic rocks that have been very rarely disseminated by pyrite. In addition, the presence of the volcanic rocks altered by propylitization was observed.

Mineral showing: The survey did not reach the extent of clarifying the mineralization.

Evaluation: Within the limited scope of survey implementation, it was impossible to clarify the alteration or mineralization due to, for example, alluvial sediments. The presence of copper mineralization located upstream the Palo River has been reported and the execution of rolling was expected but ended without collection. Thus, satisfactory information to make reasonable evaluation was unobtainable.

Mining claim: FTAA has been applied.