CHAPTER 5 GEOCHEMICAL SURVEY

5-1 Objective

Geochemical survey including soil geochemical and rock geochemical were carried out concomitant with geological survey and it aimed to detect zones with gold anomaly within the surveyed area.

5-2 Survey area

The geochemical survey and geological survey were carried out in the same area. The area for geological and geochemical surveys in the zone B was extended toward the northeastern part due to indications of gold mineralization extending to this area. The location map of the samples is shown on Fig. II-5-1.

5-3 Survey Methods

5-3-1 Sampling

A total of 1,926 soil samples were taken using a semi-grid distribution at the depth of B-horizon. For the location of sampling sites aerial photography and topographic maps were used and confirmed by using GPS. The spacing of the samples was designed so that 4 to 5 soil samples can be taken every square kilometer. At the survey area, the B-horizon started at the depth of few decimeters, and approximately 2 Kg samples were taken from each sampling site. The results of the survey are shown in Appendix 5.

5-3-2 Sample preparations

Preparation of soil sample was carried out at the DINAMIGE laboratory. The samples were sent to the analysis after being dried, sieved under 80 meshes and milled under 150 meshes.

5-3-3 Chemical analysis

Chemical analysis was carried out for the 34 following elements; Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Co, Cu, Ga, Fe, La, Pb, Mg, Mn, Hg, Mo, Ni, P, K, Sc, Ag, Na, Sr, S, Tl, Ti, W, U, V, Zn and Au. The methodology employed for gold analysis was Fire assay-AA and for the others elements were employed ICP, AA and XRF.

The chemical analysis was carried out at the Lakefield Geosol Laboratory in Brasil. The result of the analysis is shown in Appendix 6.

5-4 Interpretation method

The results from geochemical samples were statistically analyzed. Based on statistical processing, computerized distribution maps were drawn for every elements. The correlation matrices among the elements were also calculated and the Exploratory Data Analysis (EDA) method was applied to define the threshold values (anomalous values) for each element. Factor analysis studies were also utilized for the processing of geochemical data, but no correlation between gold and others analyzed elements were found.

5-5 Interpretation results

5-5-1 Results of statistical data treatment

Two statistical data treatment were carried out, one using all data from the 5 areas and other treatment was performed for each one of the 5 survey areas. 11 elements (Sb, Hg, U, Ag, B, Be, Bi, Cd, Sn, Ti and W) indicated values less than the detection limit for most of the samples. Correlation coefficients were calculated in order to clarify the relation among elements. The results of these correlation and the EDA treatment results are shown on Appendix 7.

The maximum analytical values for gold in each survey zone, was as follows; Zone A (Au146ppb), Zone B (Au138ppb), Zone C (Au88ppb), Zone D (Au138ppb), Zone E (Au79ppb).

5-5-2 Results of Single elements analysis

Based on the results of statistical data treatment, the threshold values were determined by cumulative frequency and EDA methods. Cumulative frequencies for Au, As, Co, Cr, Cu, Mo, Ni, V and Zn were made. The cumulative frequency for Au is shown in Fig. II-5-2 and for As is shown in fig. II-5-3, while the cumulative frequency for others elements is shown in Appendix 7.

5-5-3 Results of Multi elements analysis

Factor analysis was examined by multi element analysis. Relationships between elements and factors were extracted by the factor analysis and as a result, Appendix 7 shows that a very weak correlation between Au and (As, S and P) was observed.

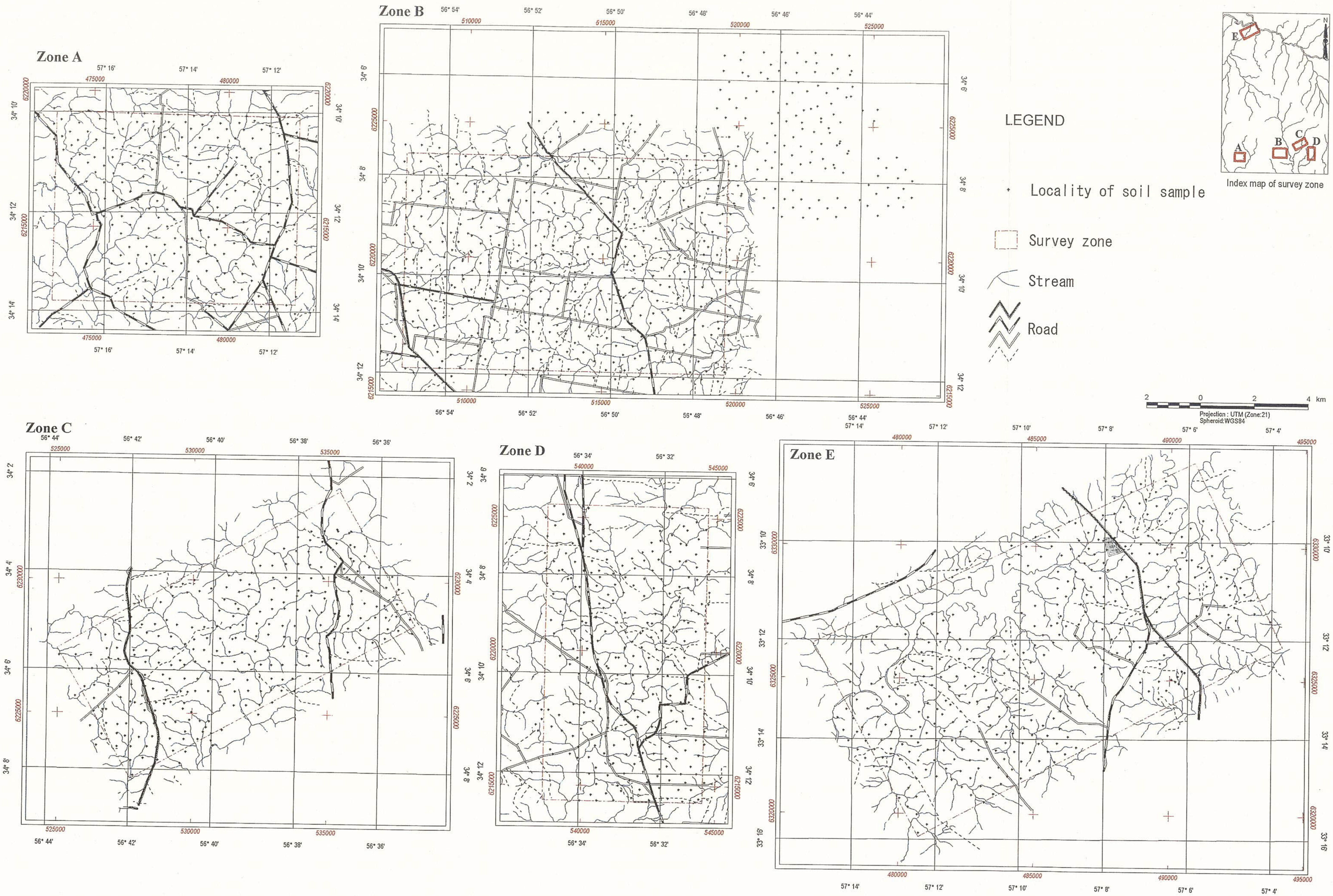


Fig. II-5-1 Location map of soil samples

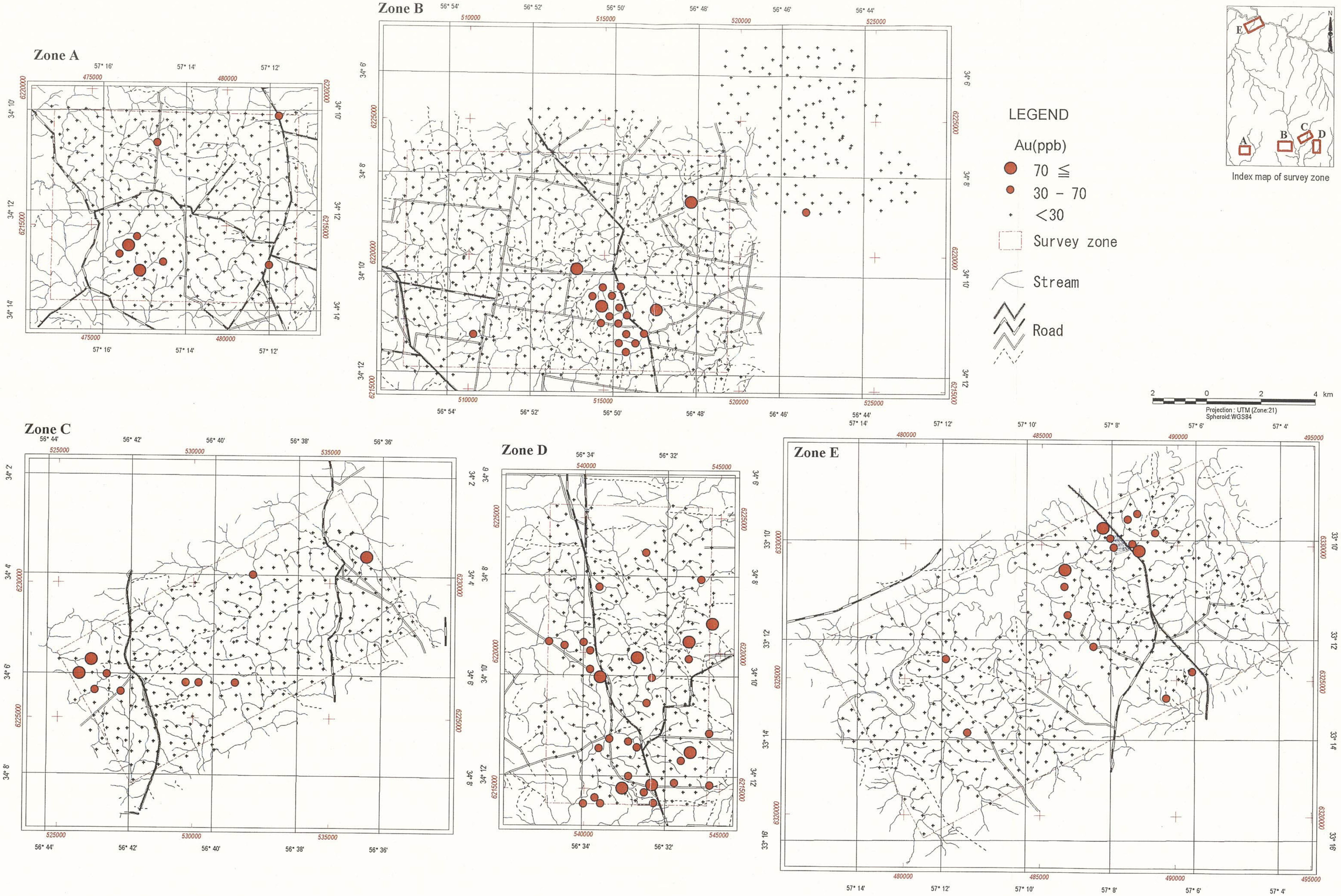


Fig. II-5-2 Distribution map of Au anomalies of soil samples

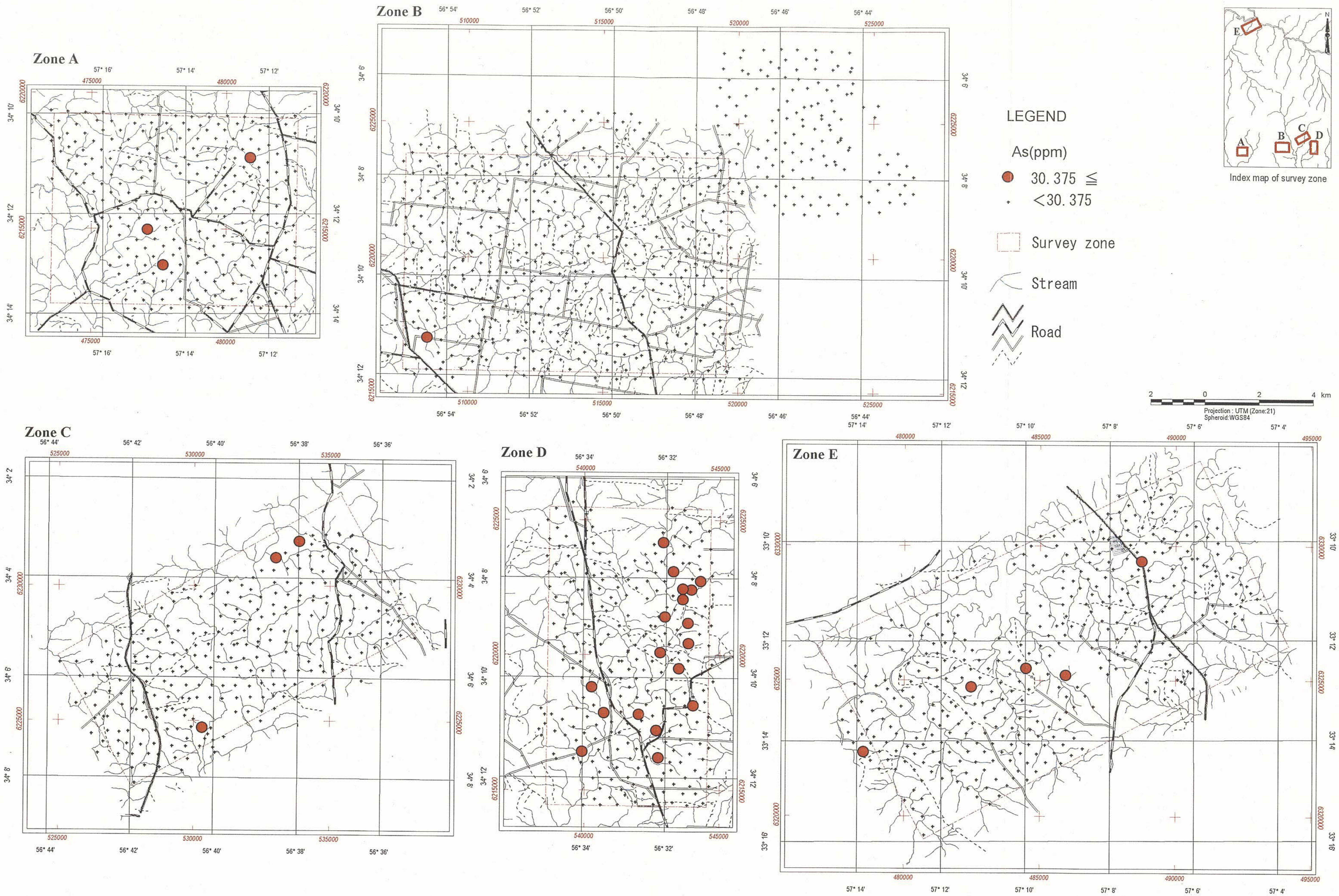


Fig. II-5-3 Distribution map of As anomalies of soil samples

CHAPTER 6 GEOLOGICAL SURVEY

6-1 Coverage and Purpose

The geological survey was carried out within San Jose area and Arroyo Grande area in order to understand the geological features and structure of the project area as well as to interpret the soil geochemical and rock geochemical anomalies.

During Phase II, the geological survey surveyed 5 zones from Zone A to Zone E, with a total coverage area of 400 Km^2, as shown in the Fig.II-6-1.

6-2 Methodology

For each surveyed zone, photography were taken from interesting geological sites, ore sampling and geological description were performed at the geologically interesting section of each zone. The survey covered most outcrops and rock. Geological sketch not only of mineral showings but also at geologically important outcrops were also carried out. An amplified map at 1:50,000 scale topographical map and aerial photograph at 1:40,000 scales were used for the field survey. A route map was prepared based on the topographical map, aerial photography and GPS. The locations of the main outcrops, sampling points, and also geological information such as strike and dip of schistosity and veins were plotted on the map.

6-3 Result of geological survey in each zone

6-3-1 Zone A

The Zone A is located at the western edge of the San Jose area, at 50Km west from San Jose de Mayo city and to the North of Nueva Helvecia city, as shown in Fig. II-1-1. The surveyed area has a rectangular shape elongated to E-W and measuring 9Km by 7 Km, with a total area of 63 Km^2.

6-3-1-1 Geology and Geological structure

(1) Geology

Geological map of the Zone is shown in Fig. II-1-2.

The geology of the zone A is composed of San Jose belt (pCCsjo), ancient granitic unit (pCCG) and younger granite intrusions (pCC).

The older unit named San Jose greenstone is composed of meta-volcanic and meta-sedimentary sequence and it is widely distributed in the zone A. Meta-volcanic rocks is present at the central and northern part and the meta-sedimentary rocks are present at the southern part of the surveyed area. Ancient granite outcrops at the northern edge of the area while younger granite is distributed at the western side. Thin section of meta-volcanic rock (AR2028) showed as main constituents minerals, chlorite, quartz, amphibole, plagioclase and actinolite.

The meta-sediments of the southern part show an approximate E-W exposition and mainly composed of psammitic schist, pelitic schist, quartz-schist and chorite schist. Part of the pelitic schist presents black to dark gray color and locally presenting weak pyrite dissemination.

The meta-sediment of the central western part is mostly composed of carbonate rock and intruded by younger granite at the western edge of the survey area. The carbonate rock has light gray to brownish color and it presents locally an E-W direction faults.

Intrusive rock of the Zone A is composed of ancient granite and younger granite.

Ancient granite outcrops at the northern part and it is separated from greenstone unit by E-W direction fault. The rock has a whitish color and fine to medium size texture. Thin section (sample number AR2029) showed mostly quartz, feldspar, plagioclase, muscovite and biotite.

Younger granite that outcrops at the northwestern part of the Zone A intrudes the San Jose greenstone and the ancient granite. It presents mostly quartz, K-feldspar, biotite and amphibole. Thin section of the sample AR2033 showed minerals as quartz, K-feldspar, plagioclase and biotite and accessory minerals as amplibole, augite and zircon. Younger granite intrudes the greenstone unit in the form of dikes at the southern part of zone A. The granitic dikes are in form of lenses at the boundary between meta-volcanic at north and meta-sediment at the south part of zone A. It has dark gray color and locally shows milonitic texture. Thin section results of sample AR2015 mainly showed quartz, biotite, K-feldspar and plagioclase and minor alteration minerals as sericite, epidote and chlorite.

(2) Geological structure

The distribution of the geological units is strongly controlled by the E-W direction tectonic structures as faults. At the northern part of the zone A, a fault along E-W direction controls the boundaries between ancient granite and greenstone unit. This same fault extends toward east, crosses the northern portion of the Mahoma gold mine in zone B and go through the southern part of the zone C.

In the San Jose greenstone unit, the boundary between meta-sediment and meta-volcanic is controlled by structure of E-W (locally N70W) direction and presenting schistosity and foliation. At the geological boundary are present many granitic dikes and mylonite with N70E to N80E direction. The meta-sediment of the southern part shows E-W (locally N80W) schistosity that is concordant with the granite dike. Locally it presents tectonic deformation with direction concordant with a dike within greenstone unit. The dip of overall geological structure is from vertical to a maximum inclination of 80 degrees.

The geophysical survey results indicated that the granite of the northwestern part has a low magnetism with order of less than 0 nT. At the central part of the granitic intrusion it was confirmed value of order below –100nT. The radiometric results showed high K anomaly.

The San Jose greenstone unit showed magnetism higher than 0 nT, with places above the values of 100 nT.

6-3-1-2 Quartz veins zone

Two large zone with outcrop of quartz veins were confirmed in the zone A, named A-a and A-b. Quartz vein thickness was in the order of centimeters to decimeters with a maximum thickness of about 2,5 meter. The quartz vein presents in general the form of lens and sometimes it is tabular. In general it is concordant with the schistosity and sometimes it becomes discordant. The quartz vein is commonly milky and semi-transparent and locally blackish and opaque.

(1) Quartz vein zone A-a

The quartz veins zone is located at northern part of the survey area and the meta-volcanic (meta-basalt) San Jose unit hosts it. Pelitic schist is observed locally as host rock. The general direction of the quartz veins is N-S or NNW-SSE. The host rock shows silicic alteration.

The sketch A-1 (Fig. II-6-3) and the sketch A-2 and A-3 (Fig. II-6-4) were made within A-a zone. Trenches of 1m to 3m wide and depth of 1 to 2m were seen excavated along a length of 50m. The trenches were excavated during the Mahoma gold mine operations. There is no outcrop of the host rock, but there are 3 to 4 parallel quartz veins filling soil and in this location the total width of quartz veins is 1 to 2m. Quartz veins samples (AQ2042, AQ2043, AQ2044, AQ2045, AQ2138 and AQ2139) were taken in the trench and the maximum Au value was 176ppm. Samples numbers AQ2138 and AQ2044 showed value of As above 110ppm. Samples AQ2042 and AQ2044 showed Ag above 10ppm. Host rock samples (AR2023, AR2024 and AR2073) showed gold analytical results below 5 ppb level.

The characteristic color of the quartz veins were grayish brown, due to thin fractures filled by sulphide or by oxidized minerals. The gold rich quartz veins were black to milky and opaque, locally was sacharoidal. Native gold of 0.5 to 1.0mm sizes are seen in the oxidized portion of the quartz veins.

Polished section samples (AQ2042 and AQ2044) detected pyrite and limonite.

The sketch number 2, on Fig.II-6-4 shows a whitish quartz vein with blackish spots and a width of 70cm. The three samples taken from the same sulphide rich quartz vein showed Au129ppm, Au39.7ppm and Au0.17ppm. The fluid inclusion results of the quartz vein showed a homogenization temperature of 163°C (sample AQ2138) and 196°C (sample AQ2139).

Results of fluid inclusion tests made in quartz veins from sketch site A3 presented homogenization temperature of 235.7°C for blackish quartz vein and temperatures between 190 to 210°C for whitish quartz vein.

About 1.4 Km to the northwest of the surveyed trench 3 more quartz veins samples were collected and their analysis showed Au0.09ppm, Au0.26ppm and Au0.09ppm. Polished sections of the samples presented pyrite, goethite and limonite. X-ray results confirmed the presence of goethite.

At other site, about 1.2 Km to the southeast from the same trench, there was confirmed quartz vein with width of 40cm within meta-basalt. The schistosity in the meta-basalt is N20W and the analysis showed Au0.12ppm.

(2) Quartz vein zone A-b

This quartz veins zone is located at southern part of the survey area and the meta-sediment (meta-pelitic and meta-psammitic) San Jose unit hosts it. The general direction of the quartz veins is E-W and it is commonly white or blackish color with low pyrite content.

At the eastern part of this zone, 20cm wide quartz vein fills the schistosity of the psammitic schist with E-W direction. At the site indicated by the A-4 sketch site (Fig. II-6-5), it was confirmed a quartz vein along N80W direction with 20cm width filling schist. The quartz vein is whitish at the central part and black color along the border. The blackish portion of the vein showed Au1.2ppm (AQ2076) and sample of host rock showed results below 5ppb. The sample AQ2150, AQ2151, AQ2152, AQ2153 and AQ2154 presented no gold value, and the fluid inclusion showed a homogenization temperature between 155°C and 165°C and salinity between 5 and 10%.

6-3-2 Zone B

The Zone B is located at the central part of the San Jose area, at 30Km north from San Jose de Mayo city and 80Km to northwest of Montevideo capital. The zone area has a rectangular shape elongated to E-W and measuring 12Km by 8 Km, with a total area of 96 Km^2.

The closed Mahoma gold mine is located at the central part of the zone B.

6-3-2-1 Geology and Geological structure

(1) Geology

Geological map of the Zone is shown in Fig. II-1-7.

The geology of the Zone B is composed by, Complex basement (pCCcb), San Jose belt (pCCsjo), ancient granitic unit (pCCG) and younger granite (pCC).

The Complex basement and the San Jose belt is separated by an E-W fault zone and present spots with concentration of quartz, K-feldspar, plagioclase and biotite. The rocks show alteration as epidote and chlorite.

The older unit named San Jose greenstone unit is composed of meta-volcanic and meta-sedimentary sequence and it is widely distributed in the zone B. Meta-volcanic rock is present from northwest to northern part and show minerals as quartz, plagioclase, K-feldspar and weak dissemination of pyrite. Ancient granite outcrops at the central part of the area.

The meta-sediment shows an approximate E-W direction and psammitic schist, pelitic schist and alteration minerals as chlorite, epidote, smectite and muscovite. In the entire area it is frequent the presence of meta-basalt and locally it is found rounded gravels. Locally it is observed alternations of meta-volcanic and meta-sedimentary rocks. At the northeast and northwestern portion of the Zone B, the crystalline schist is parallel to the regional schistosity.

Thin section results of the psammitic schist showed the presence of quartz, K-feldspar, muscovite, calcite, jailosite and opaque.

Triassic and Quaternary units cover the above units.

Ancient granite and younger granite stocks and dikes compose the intrusive rocks of the Zone B. Ancient granodiorite outcrops at central and northeastern part of the Zone B as dikes along ENE-WSW direction. Silicification is frequently seen at the proximity of the fault zone, which is milonitized in the central part. The fault zone along NE-SW direction has milonite in the central part.

The dolerite and whitish color granitic dikes are intruded along E-W direction at the southern part of the Zone B.

(2) Geological structure

The distribution of the ancient granodiorite is strongly controlled by E-W or NE-SW directions tectonic structures. At the central part of the zone B, shear zones with E-W and NE-SW directions are present. Shear zones trending ENE-WSW were detected in two locations at the central part with parallel disposition. The northern shear zone was numbered B-I and the southern shear zone was numbered B-II. Shear zones with approximate E-W direction were detected at the central part (named B-III) and at southern part (named B-IV) of the Zone B. It was confirmed that the ENE-WSW shear zones cut the E-W direction shear zone.

The B-I shear zone was confirmed within granodiorite outcrop with subvertical N60E direction. B-II shear zone were not identified in field but aerial photography and remote sensing delineated it. B-III shear zone controls the Mahoma gold mine and it controls the southern border of an ancient granite intrusion. B-IV shear zone is present at southwestern part of the

Zone B controlling the outcrop of the San Jose greenstone unit.

The geophysical survey results indicated that overall granitic intrusion has low magnetism. The same low magnetism was observed in the San Jose greenstone unit of the zone B.

6-3-2-2 Quartz veins zone

Four large quartz veins outcrop zone were confirmed in the Zone B, named from B-a to B-d and most part of them were related to shear zone. In general, the quartz vein presents lenticular or tabular form and in general concordant to schistosity, although some of them are discordant. The quartz vein is in general milky and semi-transparent but locally blackish and opaque vein is also observed.

(1) Quartz vein zone B-a

This quartz veins zone is located at the eastern part of the Zone B and comprises an area of 2 Km^2. The quartz veins outcrops with the following format: stock work type, vein type and lens type.

Stockwork type has the largest area covered by quartz fragments of around 80m diameter with many stock work veins. The vein is milky and semi-transparent with black quartz at the border of the vein.

Vein type has approximately 100m length with quartz veins fragments scattered within an area of 20m in width. The big size in the width of the veins is probably due to weathering.

At the eastern part of the Zone B, quartz veins fragments are scattered in an area of 15m by 80m. The vein is in general transparent, but locally it is blackish and semi-transparent. The gold content of the vein was Au0.4ppm. In the south part of the Zone B, quartz veins fragments zone of 7m by 20m showed a variety of them from transparent to semi-transparent and blackish. Gold content of milky quartz vein was Au0.83ppm and the blackish vein was Au0.77ppm. The quartz vein sketch (B-1) is shown in Fig. II-6-8.

(2) Quartz vein zone B-b

It is located in the western edge of the Zone B within an area of 0.5Km by 1.0Km in size. It was confirmed quartz lens and quartz veins. The confirmed 3 veins measured approximately 20m in lengths and 1m in width. The vein is transparent in general and the analytical results showed Au0.03ppm.

(3) Quartz vein zone B-c

It is located in the north part of the Zone B within the area of B-I shear zone and measuring 0.5Km by 2Km. The outcrops of the quartz veins fragments measure approximately 15m by

40m and the direction of the vein follows the shear zone of ENE-WSW direction. The vein is in general transparent with very low gold contents.

(4) Quartz vein zone B-d

This zone is located in the central part of Zone B and measures approximately 0.5Km by 1Km. The approximate size of the quartz vein fragments outcrop is 20m by 50m and 5m by 25m. The vein is from transparent to semi-transparent. The quartz veins show an approximately parallel direction to the shear zone B-III. Gold content of these veins are also very low.

Fluid inclusion data from zones B-a and B-b showed respectively homogenization temperature of 209.2℃ and 171.6℃ and salinity of 8.1% and 2.6%. Three samples taken from zones B-c and B-d showed respectively, homogenization temperatures of 183.3℃, 307.6℃ and 233.1℃ and salinity of 21.5%, 19.0% and 13.1%.

6-3-3 Zone C

The Zone C is located about 30Km to the northeastern of the San Jose city with a total area of 60 Km^2.

6-3-3-1 Geology and Geological structure

(1) Geology

Geological map of the Zone is shown in Fig. II-1-9.

The geology of the Zone C is composed of San Jose belt (pCCsjo), Paso Severino belt, ancient granitic unit (pCCG) and basic intrusions.

Meta-sedimentary origin green schist mostly composes the San Jose and Paso Severino units. The San Jose unit outcrops at the southern part and the Paso Severino unit at the northern part of the Zone C. The ancient granite intrusion outcrops at western and eastern part and the dolerite (dd) is observed at the eastern part of the Zone C.

The older unit named San Jose greenstone unit is composed of meta-volcanic and meta-sedimentary sequence and it is widely distributed in the Zone C. Meta-volcanic rocks are present at the southwestern part, while meta-sedimentary rocks are present at the southeastern part of the surveyed area.

Various rocks such as meta-sandstone and a variety of schist and gneissic rock compose the meta-sedimentary sequence. The biotite gneiss shows grayish green and dark grey color and it is generally folded. Thin section results showed quartz, biotite, plagioclase, muscovite, sericite and chlorite. The schistosity presents in general an E-W direction.

The meta-volcanic show a greenish color. Thin section results (sample BR2046) showed quartz, muscovite, chlorite but less biotite and epidote. The schistosity has a general E-W direction.

Another older unit named Paso Severino unit is composed of green schist and locally presenting meta-sediments. The meta-sediments outcrop at northeast part and the meta-volcanic outcrop at central part of the Zone C that is represented by the meta-sandstone. Meta-sandstone is gray to brown color, mica rich and with many quartz veins filling it. Meta-volcanic of the Paso Severino unit is composed of green to dark green color schist. It presents mostly quartz, chlorite, actinolite and epidote.

Ancient granite is divided in granodiorite and granite. Granite is grayish and medium to coarse grain, presenting phenocryst of quartz, K-feldspar, plagioclase and biotite. It is intruded in the San Jose unit showing an elongation to southwest and separated by an E-W fault. Granodiorite outcrops at western part of the Zone C along an E-W disposition. The rock has a greenish gray color of medium size texture. Thin section and X-ray (sample number BR2010) analysis showed mostly, quartz, feldspar, plagioclase and amphibole. Alteration minerals as quartz, muscovite, chlorite and calcite are present.

Dolerite is dark gray color and it intrudes the San Jose unit and ancient granite at the northeastern part of the Zone C. The dike shows a NE-SW trend similar to the general direction of the San Jose greenstone unit. The dolerite shows amphibole, epidote and magnetite.

(2) Geological structure

Five shear zones/faults that were numbered from C-I to C-V are present in the Zone C. The faults C-I and C-II are present in the central part along a NW-SE disposition. They were also interpreted by remote sensing showing a regional continuity within San Jose greenstone belt. C-III fault is located at the eastern part along the same NW-SE direction and presenting silicification at the vicinities of the fault zones C-IV and C-V.

6-3-3-2 Quartz veins zone

Three large quartz veins outcrop-zones were confirmed in the Zone C, named C-a, C-b and C-c. In general the quartz vein is transparent, but locally it is milky and semi-transparent or blackish and opaque.

(1) Quartz vein zone C-a (Carreta Quemada area)

This quartz veins zone is located at the eastern part of the survey area, within Paso Severino belts, along NW-SE direction. The most important quartz vein within the zone is shown on sketch C-1 in the Fig.II-6-10. The larger quartz vein presents a width of 5m and a length of 600m filling meta-sedimentary rocks. The vein is milky to blackish with sacharoidal texture and locally rich in pyrite. Six samples taken from this vein showed maximum value of Au0.03ppm. Another vein is located to the west and showing milky to blackish color. Gold content resulted in Au5.51ppm.

(2) Quartz vein zone C-b

This quartz vein zone is located within Paso Severino unit and present silicic alteration at the vicinities of the quartz vein. At the proximity of the C-IV fault, a quartz vein show NE-SW direction that is concordant with the fault direction. Others quartz veins at the proximity of the C-IV fault zone show E-W direction. The sketch C-2 indicated in Fig.II-6-11 shows milky to semi-transparent quartz veins gold anomalies of Au1.19ppm, Au0.39ppm and Au0.42ppm.

(3) Quartz vein zone C-c

The zone C-c is located at west of the Zone C with many quartz veins in the proximity of the fault C-III. The quartz veins fill meta-sediment of the San Jose greenstone unit. Thin milky and semi-transparent quartz vein with width of 10cm and length of more than 10m presented a gold content of Au0.22ppm.

6-3-4 Zone D

The Zone D is located about 30Km east from San Jose city, with a total area of 66 Km^2.

6-3-4-1 Geology and Geological structure

(1) Geology

Geological map of the Zone is shown in Fig. II-1-12.

The geology of the Zone D consists of San Jose belt (pCCsjo), Paso Severino belt (pCCps) and ancient granitic unit (pCCG).

The older units named San Jose and Paso Severino greenstone unit are composed of meta-volcanic and meta-sedimentary sequence that are widely distributed in the Zone D. Meta-volcanic rocks is present at the central part and meta-sedimentary rocks are present at the northern part and at the eastern edge of the zone D.

The meta-sediment shows black to dark gray phyllite and meta-sandstone that strikes to NW-SE and NE-SW. At the proximity of the ancient granite it is strongly silicified and showing alteration minerals such as K-feldspar, epidote and chlorite. At the fault zone and at the sites bordering the Arroyo Grande River and its branches it shows pyrite dissemination and very weak dissemination of chalcopyrite. Outcrops of meta-volcanic are present at the central part of the zone D and it is composed of greenish color meta-basalt. Outcrops of meta-volcanic are seen along NW or NE direction. Both, meta-sediment and meta-volcanic units show alterations of silicic, epidotic and chloritic at the vicinities of ancient granite or NE-SW trending fault zones.

Intrusive rock of the Zone D consists of ancient granite, dolerite dike (dd) and gabbro dike (gb). Ancient granite outcrops at central east and central western part trending NW-SE. It is composed of medium to coarse texture biotite granite, muscovite granite, granodiorite, diorite and quartz diorite. Meta-dolerite outcrop as dikes with a trend along N60E direction at the western part of the Zone D. Gabbro dikes outcrops at the northern part within Paso Severino unit along an approximate N-S direction.

(2) Geological structure

Two large fault zones, one at the central part with E-W trending (D-I) and the other at central southern part with NE-SW trend (D-II) are present in Zone D. The D-II fault controls the boundary between San Jose greenstone unit and ancient granite. The sketch D-1 (Fig. II-6-13) shows detail of gold bearing quartz vein filling contact zone of two faults.

6-3-4-2 Quartz veins zone

Two large quartz veins outcrop zone were confirmed in the Zone D, named D-a and D-b. The quartz vein is in general milky and semi-transparent and locally it is blackish and opaque.

(1) Quartz vein zone D-a

This quartz vein zone presents a N-S elongated form and covering the central northern part of the Zone D. Quartz vein is in general semi-transparent and of small size, presenting locally pyrite and rarely chalcopyrite. The San Jose unit host rock is strongly altered by silicification and chloritization. Results from X-ray analysis showed quartz, chlorite and goethite alteration.

Gold bearing quartz vein, which presented a gold content of Au171ppb, is shown in the Fig.II-5-13 as sketch number D-1.

(2) Quartz vein zone D-b

This quartz vein zone is located at the western part of the survey area within ancient granite. The quartz is in general semi-transparent. The Fig.II-6-14 shows the sketch D-2 that seems to represent the quartz vein of this zone.

6-3-5 Zone E

The Zone E is located in the Arroyo Grande belt area about 150Km north of San Jose city and with a total area of 120 Km^2.

6-3-5-1 Geology and Geological structure

(1) Geology

Geological map of the Zone is shown in Fig. II-1-15.

The geology of the Zone E is composed of the following units: Complejo Basal (pCCcb), Arroyo Grande belt (pCCag), ancient granitic unit (pCCG), younger granite intrusions (pCC), dolerite dike (dd) and gabbro (gb). Triassic sediments cover the above units.

The older unit, named Complejo Basal (pCCcb), outcrops at the southwestern part of the Zone E. It is a mylonitized biotite granite and presents large crystals of quartz, K-feldspar, plagioclase and biotite. Fault defines the boundary between complejo Basal and the Arroyo Grande belt.

Metamorphic rock of sedimentary origin and volcanic origin, which composes the Arroyo Grande greenstone unit, is widely distributed in the Zone E. Meta-basalt, meta-rhyolite and amphibolite compose the rocks of volcanic origin.

The most common meta-sedimentary rocks are quartz-schist, phylllite, gneiss, green-schist, meta-sandstone and mica-schist. Dark grey color meta-sandstone outcrops at the eastern side of the Zone E. Strong silicification and chlorite alteration is observed at the proximity of the younger granite. Meta-sandstone, mica-schist and muscovite schist are observed at western part of the Zone E. Thin section results indicated quartz, biotite, muscovite and sericite and it was interpreted as quartz arenite. X-ray analysis indicated quartz, muscovite and limonite.

Meta-volcanic of Arroyo Grande greenstone unit are composed of meta-basalt, meta-rhyolite and amphibolite. Dark gray to dark green color meta-basalt outcrops along a NW-SE direction. Alteration such as strong silicification, epidotization and choritization were observed.

Intrusive rock of the Zone E consists of ancient granite, younger granite, dolerite and gabbro.

Ancient granite outcrops at northern part and it is separated from greenstone unit by E-W direction fault. The ancient granite is composed by a variety of texture and mineralogy, but in general it presents gray color, medium to coarse size texture porphyry granodiorite, locally biotite granite, muscovite granite, diorite and quartz diorite. Thin section showed mostly, quartz, feldspar, plagioclase, chlorite, magnetite and biotite.

Younger granite that outcrops at the northern part of the Zone E intrudes the Arroyo Grande greenstone unit. Thin section results of the sample AR2048 showed mainly sericite and chlorite with cataclastic texture. Dolerite dikes are intruded along E-W direction at the central and northeast of the Zone E. The dolerite of the central part intrudes in the Arroyo Grande unit but the dolerite of the northeast part intrudes in the younger granite. Results of the thin section analysis in sample DR2043 indicated mainly plagioclase and augite and secondary minerals as magnetite and chlorite

(2) Geological structure

At the northern part of the Zone E, a fault (E-I) with E-W direction controls the boundaries between ancient granite and the Arroyo Grande greenstone unit. At the vicinity of this fault, 2 quartz veins are seen along NW-SE and E-W directions. A fault along NW-SE direction (E-II) is present at northwestern part of the Zone E and it separates the younger granite from the Arroyo Grande unit.

6-3-5-2 Quartz veins zone

Six large quartz veins outcrop zones were confirmed in the Zone E, named E-a, E-b, E-c, E-d, E-e and E-f. Most of the quartz veins zones were gold barren.

At the E-b quartz veins zone, sketch E-1 (Fig.II-6-16) showed a milky semi-transparent quartz vein with local black spots. Analytical results showed no gold content for the milky semi-transparent section, but the blackish section of the quartz veins presented gold values of 2ppm. Fluid inclusion tests showed a homogenization temperature of 170℃ and salinity of 30%. At the northern part of the zone E-b, quartz veins of 2m width and length of 50m are shown in the sketch E-2 (Fig. II-6-17). The veins trends N70W with a 50° dip to north. 11 samples were taken from the above vein, and the results of 9 of them showed gold contents between Au0.012ppm and Au0.34ppm. At the southern part of the zone E-b, a milky semi-transparent quartz vein with blackish section showed gold content of Au0.50ppm and Au3.21ppm.

At the E-d quartz veins zone, a N80W direction quartz vein filling younger granite showed Au9.32ppm and Au2.74ppm.

At the E-e quartz veins zone, within an area of 1.5Km^2, were taken samples from the host rock for fluid inclusion tests and X-ray analysis. X-ray analysis of these samples indicated silicification, weak sericite and weak chlorite alterations. Fluid inclusion samples (DR2093) indicated an homogenization temperature of 193.4℃ and salinity of 2.4%.

At the E-f quartz veins zone, within an area of 2Km^2, were taken samples for fluid inclusion tests and samples of quartz veins for chemical analysis. The quartz veins fill the boundary between Arroyo Grande unit and ancient granite. The host rock shows silicification and weak sericite and chlorite alterations. Fluid inclusion test of the quartz vein indicated an homogenization temperature of 192.4℃ and salinity of 9.0%. The gold content of the quartz vein was Au4.42ppm.

6-4 Compilation of the geological survey

The geology of the 5 surveyed zones consists of the following units: Complejo Basal (pCCcb), San Jose belt (pCCsjo), Arroyo Grande belt (pCCag), ancient granite (pCCG), younger granite (pCC), dolerite dike (dd) and gabbro (gb) and Triassic sediments. The regional geology presents an E-W trend that is the same direction of the greenstone units in the surveyed area. The surveyed areas are controlled by faults and linear structures as indicated by the aerial geophysical lineaments along ENE-WSW direction. Shear zones along WNW-ESE direction cross the ENE-WSW structures.

A total of 17 zones with concentration of quartz veins were surveyed and its results showed that the quartz veins are mainly transparent to semi-transparent, milky and few of them are blackish. Analytical results showed that gold mineralization exists in the quartz veins, but it is heterogeneous. Gold mineralizations are present either in small veins or only within the blackish spots within quartz veins. The compilation of the five zones is shown in the Table II-6-1.

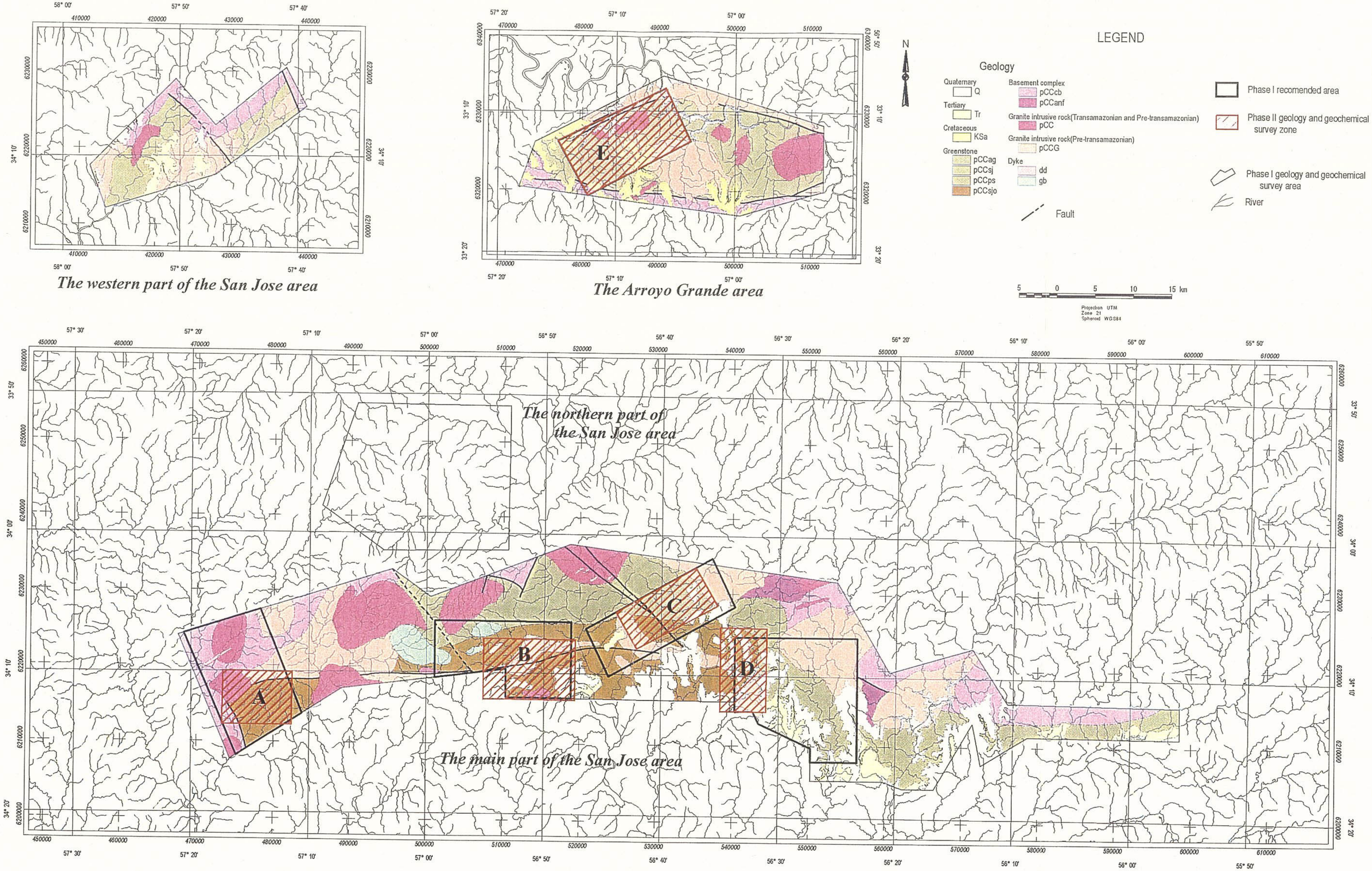


Fig. II-6-1 Extraction map of the Phase II survey areas

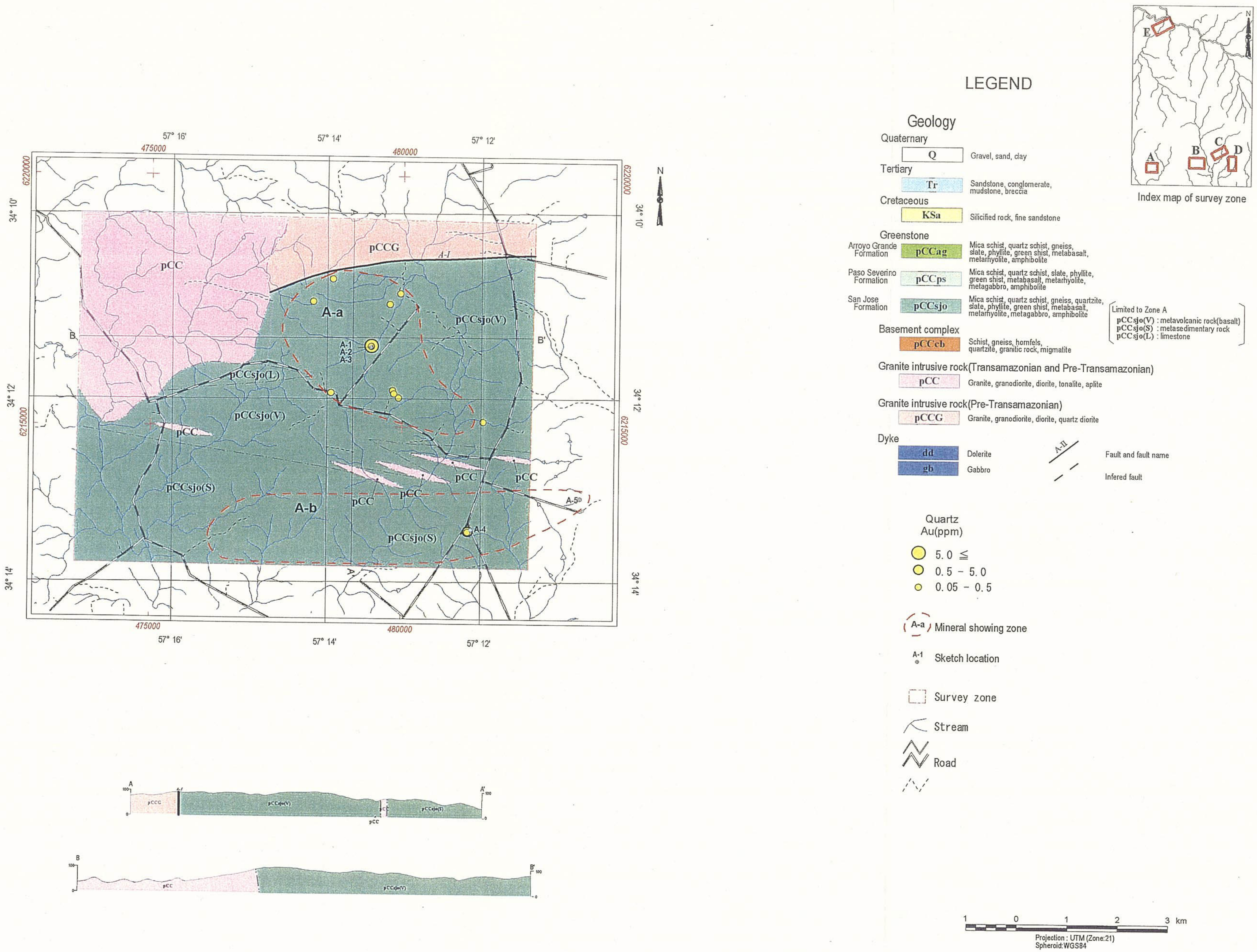


Fig. II-6-2 Geological map of Zone A

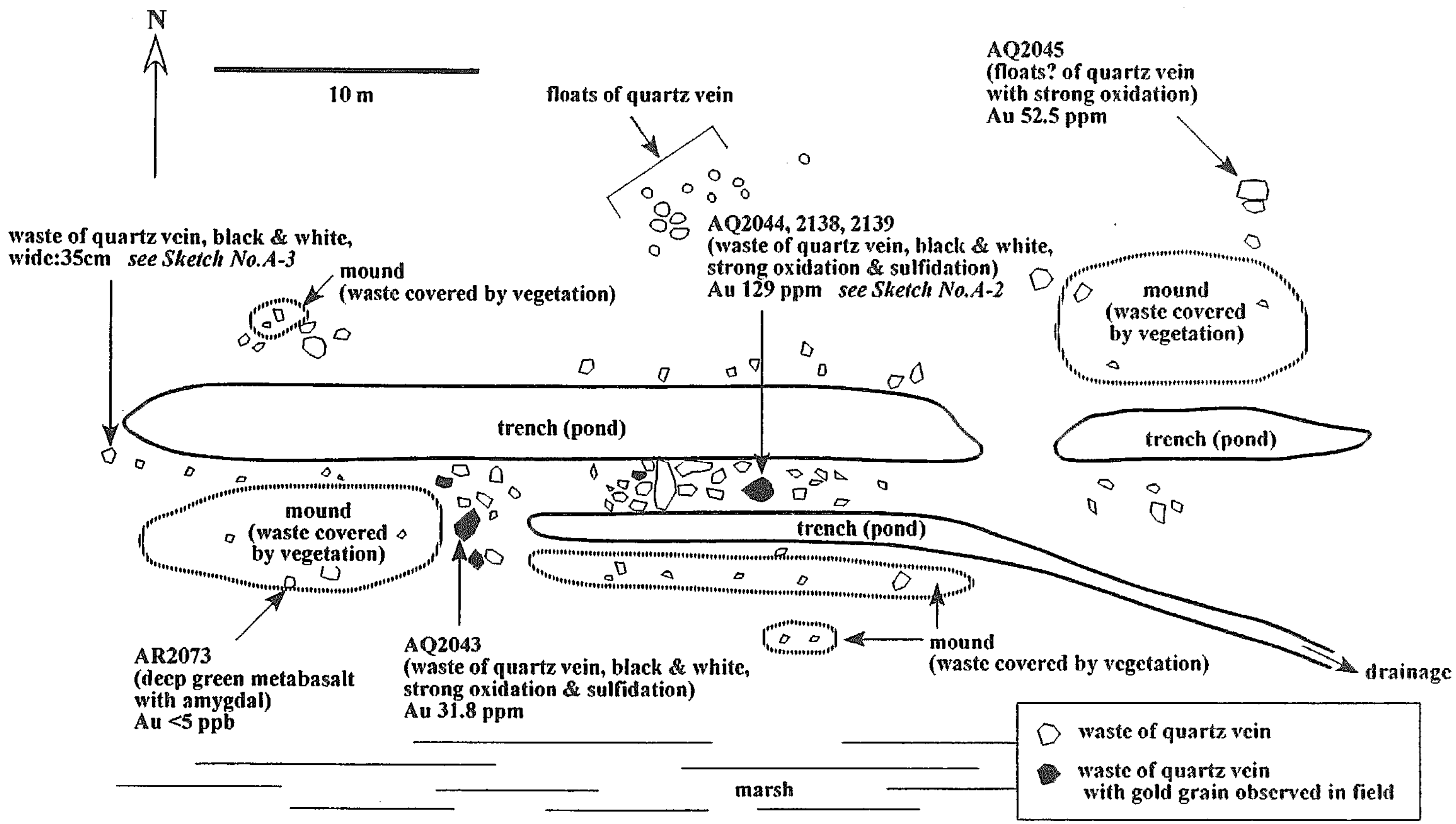
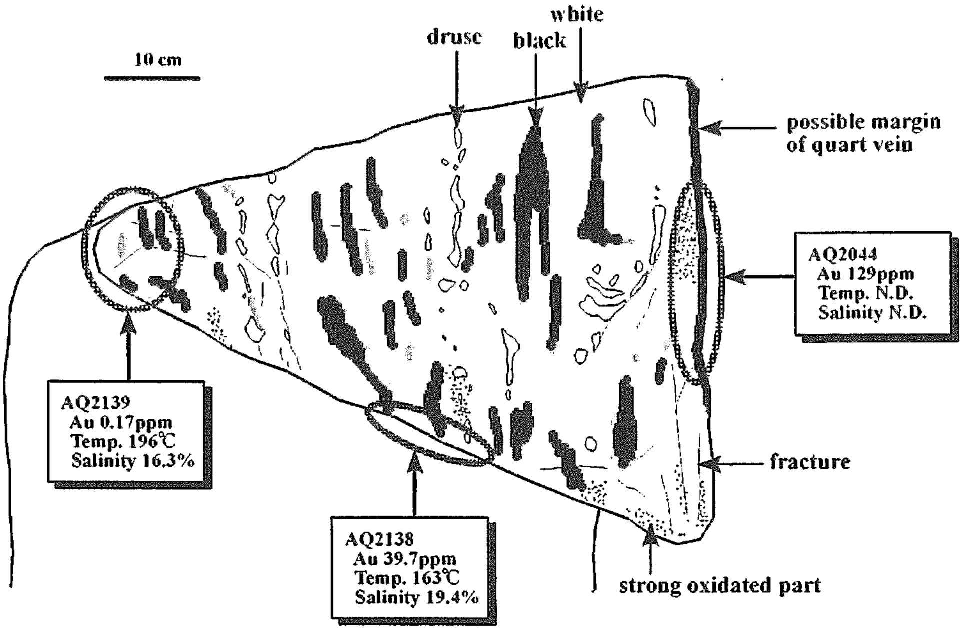
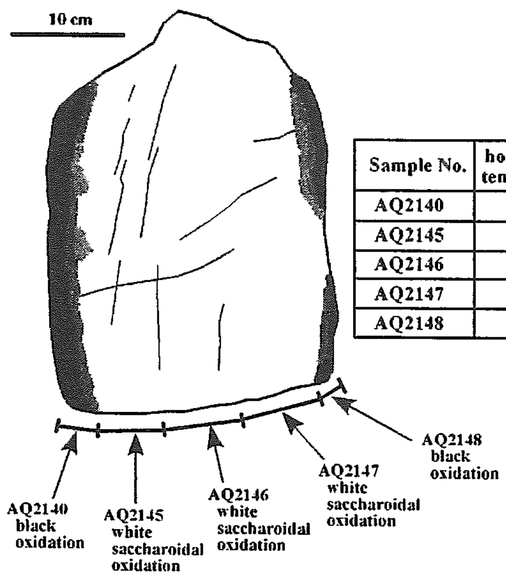


Fig. II-6-3 Sketch of trench (Location A-1)



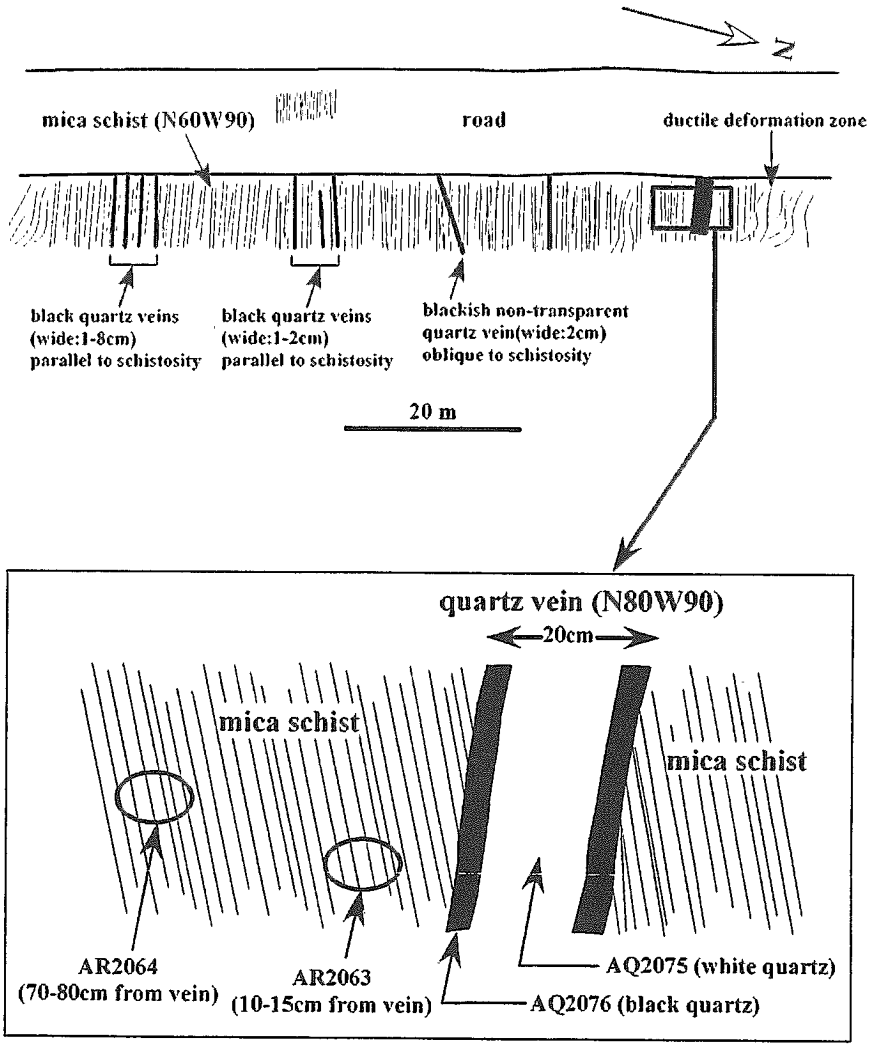
(A) quartz vein with gold grain (non-transparent white and black color, partly saccharoidal) (Sketch No. A-2)



Sample No.	homogenization temperature (℃)	salinity (%) (NaCl eq.)	type of fluid inclusion
AQ2140	235.7	9.7	H_2O
AQ2145	190.1	30.8	H_2O-Halite
AQ2146	192.8	8.4	H_2O
AQ2147	210.1	7.7	H_2O
AQ2148	N.D.	N.D.	N.D.

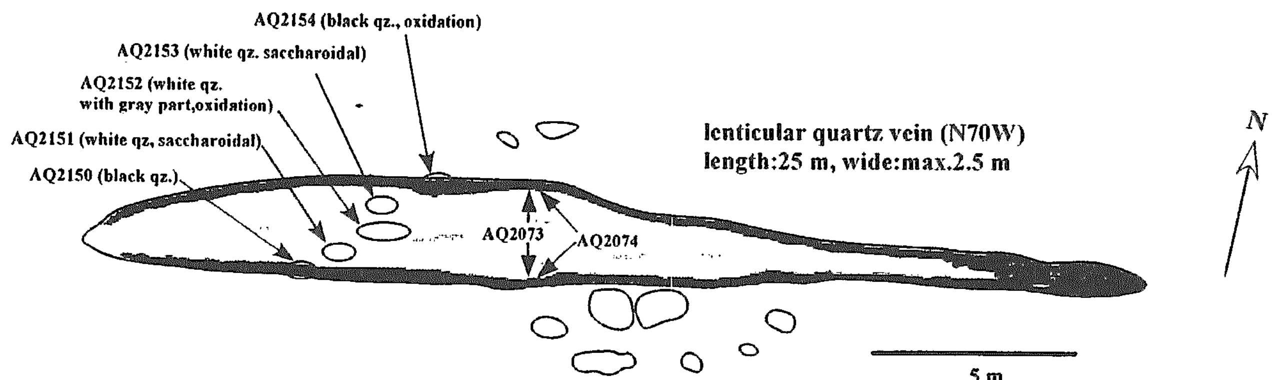
(B) quartz vein (wide 35cm, non-transparent white and black color, partly saccharoidal) (Sketch No.A-3)

Fig. II-6-4 Sketch of waste rock around trench (Location A-2 and A-3)



Sample No.	Au (ppb)	As (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)
AQ2075	<5	<1	3	<5	15
AQ2076	1227	<1	4	<5	16
AR2063	<5	29	12	<5	104
AR2064	<5	14	24	<5	88

Fig. II-6-5 Sketch of quartz vein (Location A-4)



Sample No.	homogenization temperature (℃)	salinity (%) (NaCl eq.)
AQ2150	N.D.	N.D.
AQ2151	155.7	5.0
AQ2152	162.0	9.5
AQ2153	164.6	10.5
AQ2154	156.1	10.2

Sample No.	Au (ppb)	As (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)
AQ2073(white, central)	<5	<1	4	<5	18
AQ2074(black, margin)	<5	<1	2	<5	14

Fig. Ⅱ-6-6 Sketch of quartz vein (Location A-5)

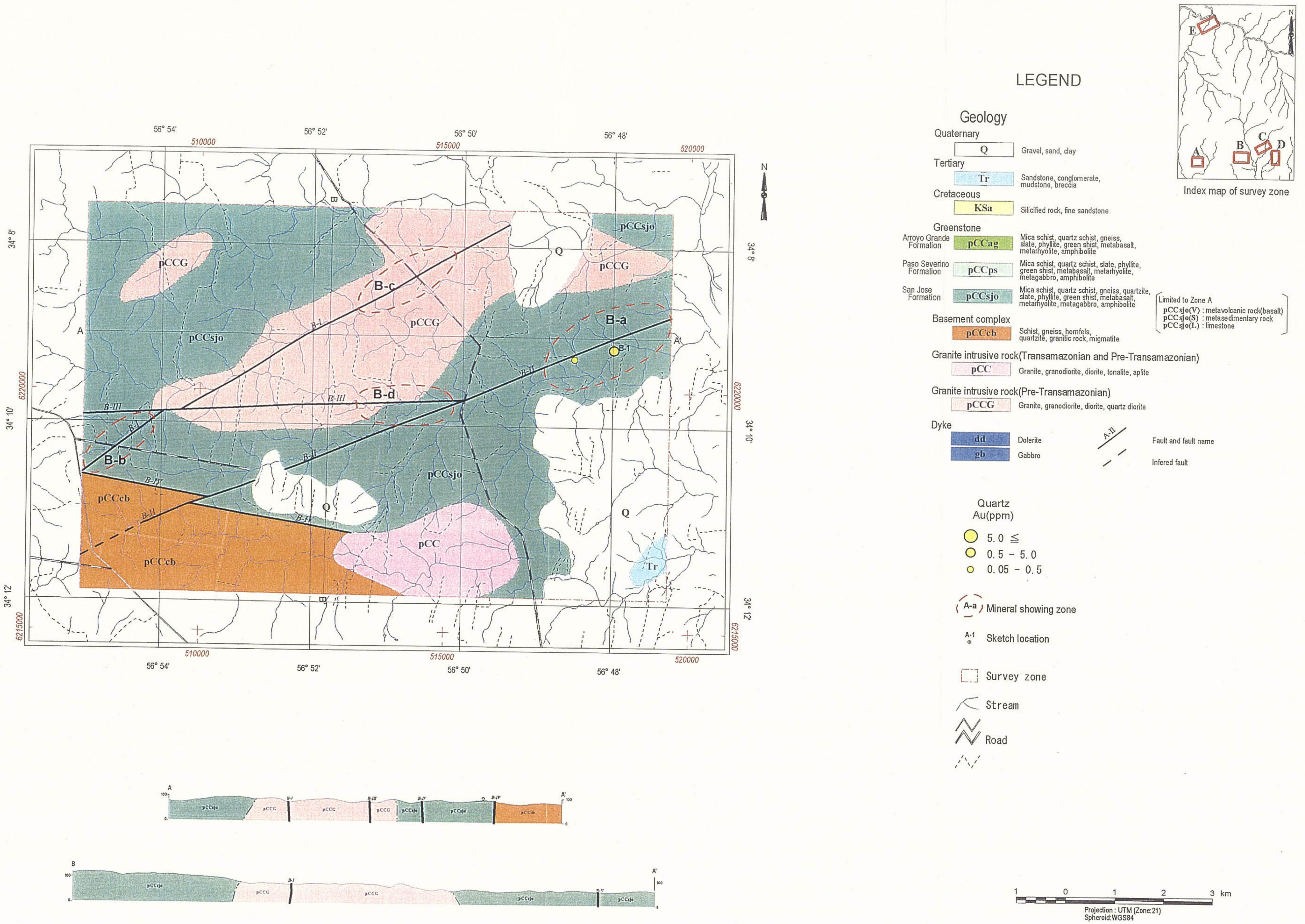


Fig. II-6-7 Geological map of Zone B

Zone B

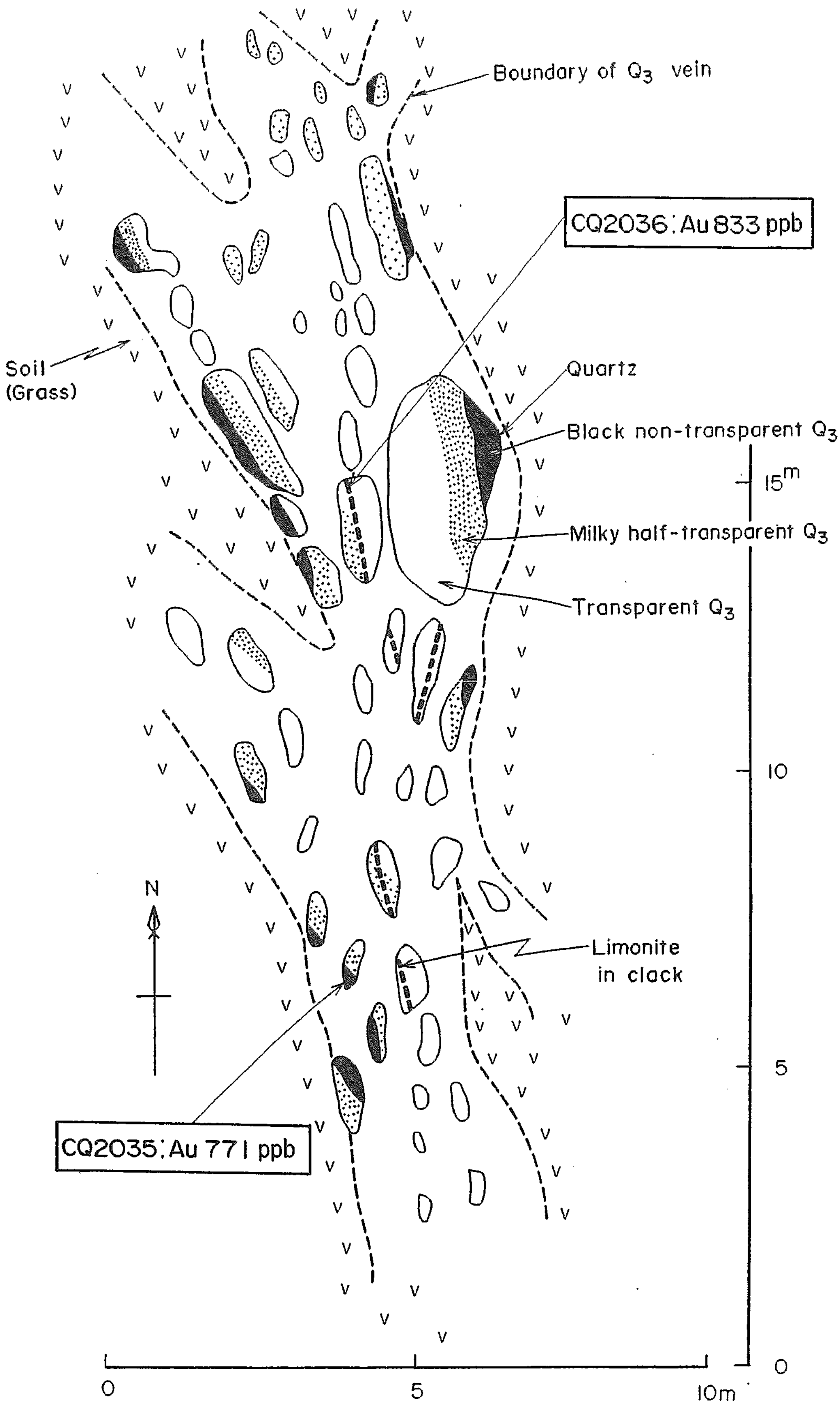


Fig. II-6-8 Sketch of quartz vein (Location B-1)

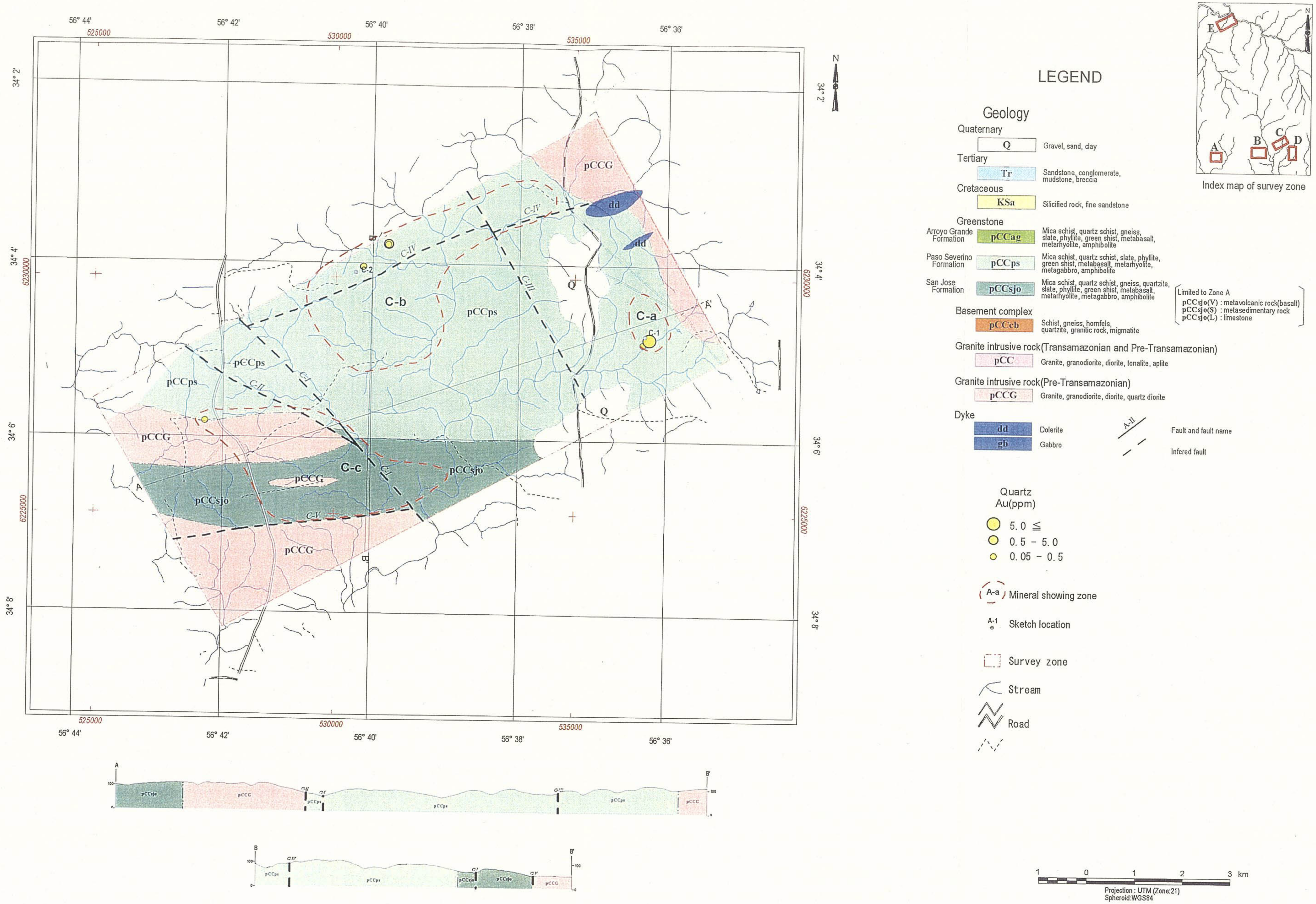
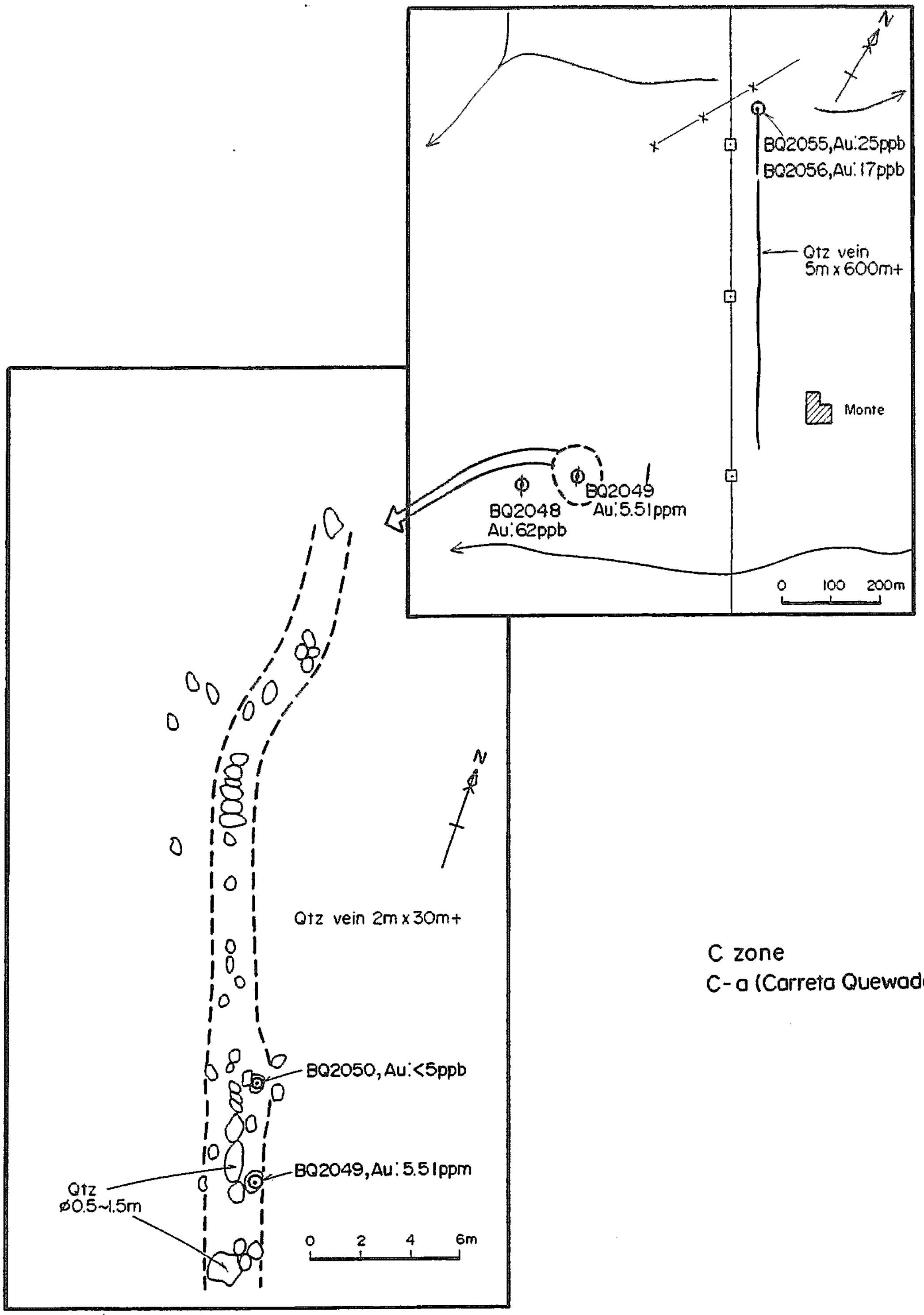


Fig. II-6-9 Geological map of Zone C



C zone
C-a (Carreta Quewada)

Fig. II-6-10 Sketch of quartz vein (Location C-1)

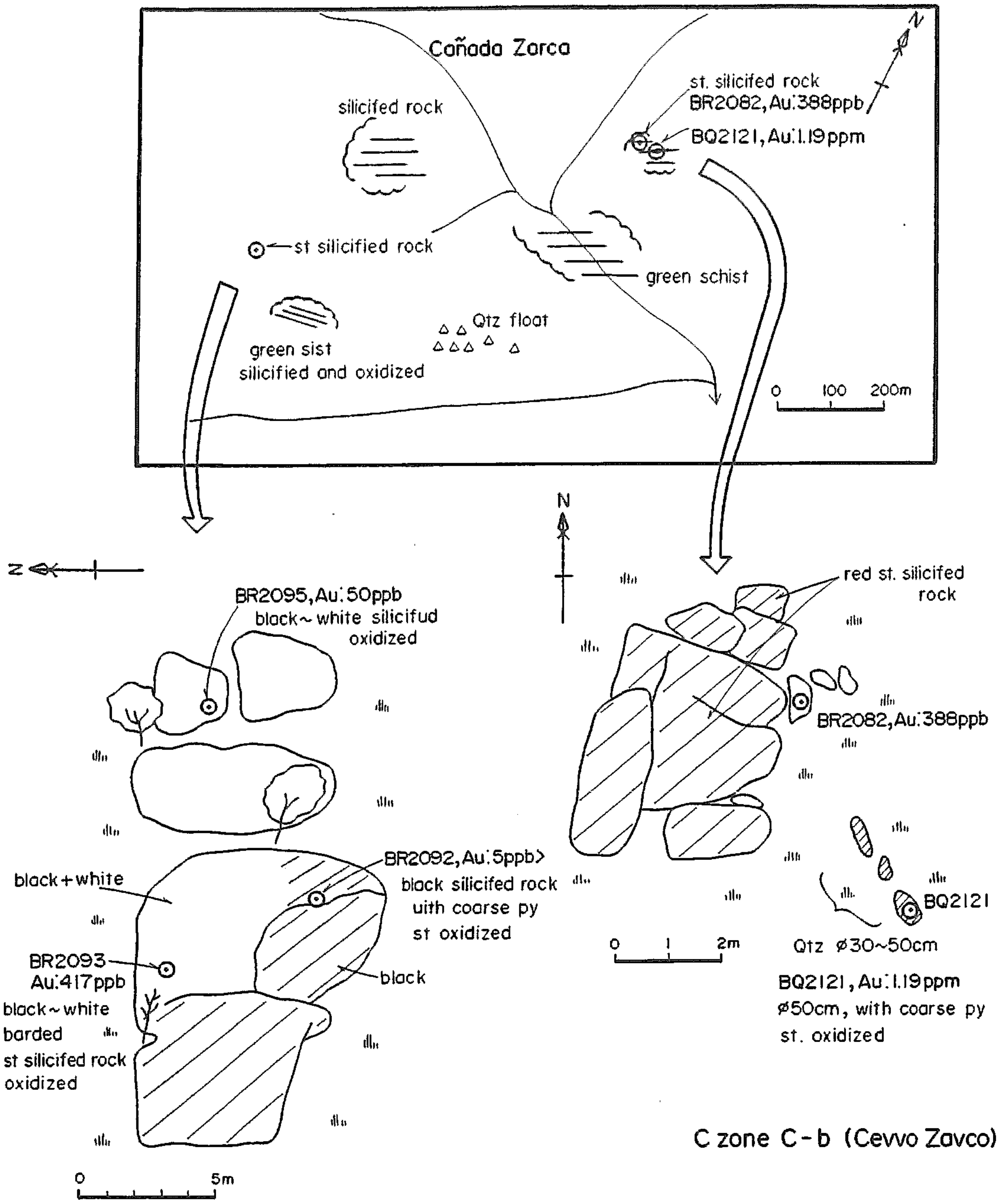


Fig. II-6-11 Sketch of quartz vein (Location C-2)

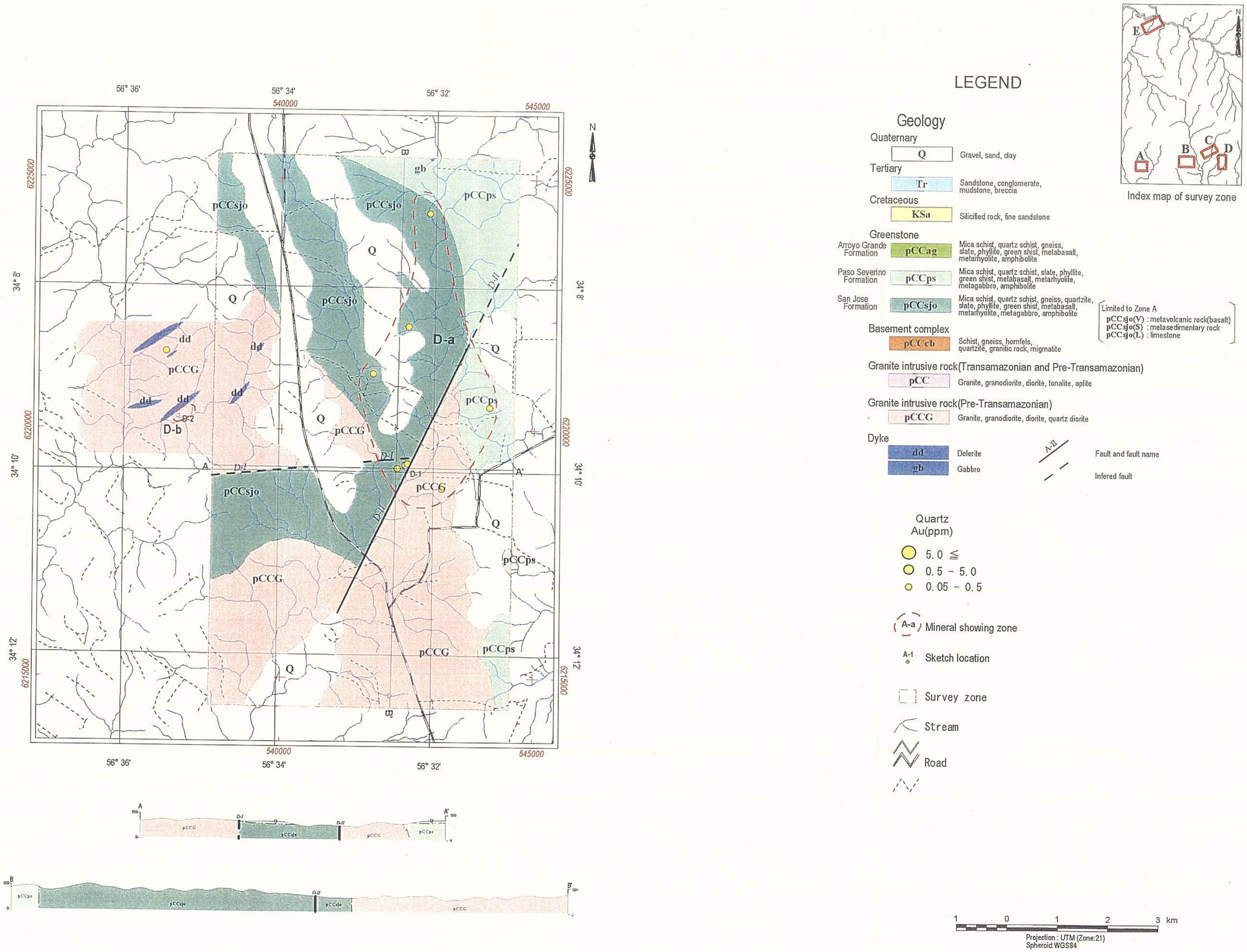
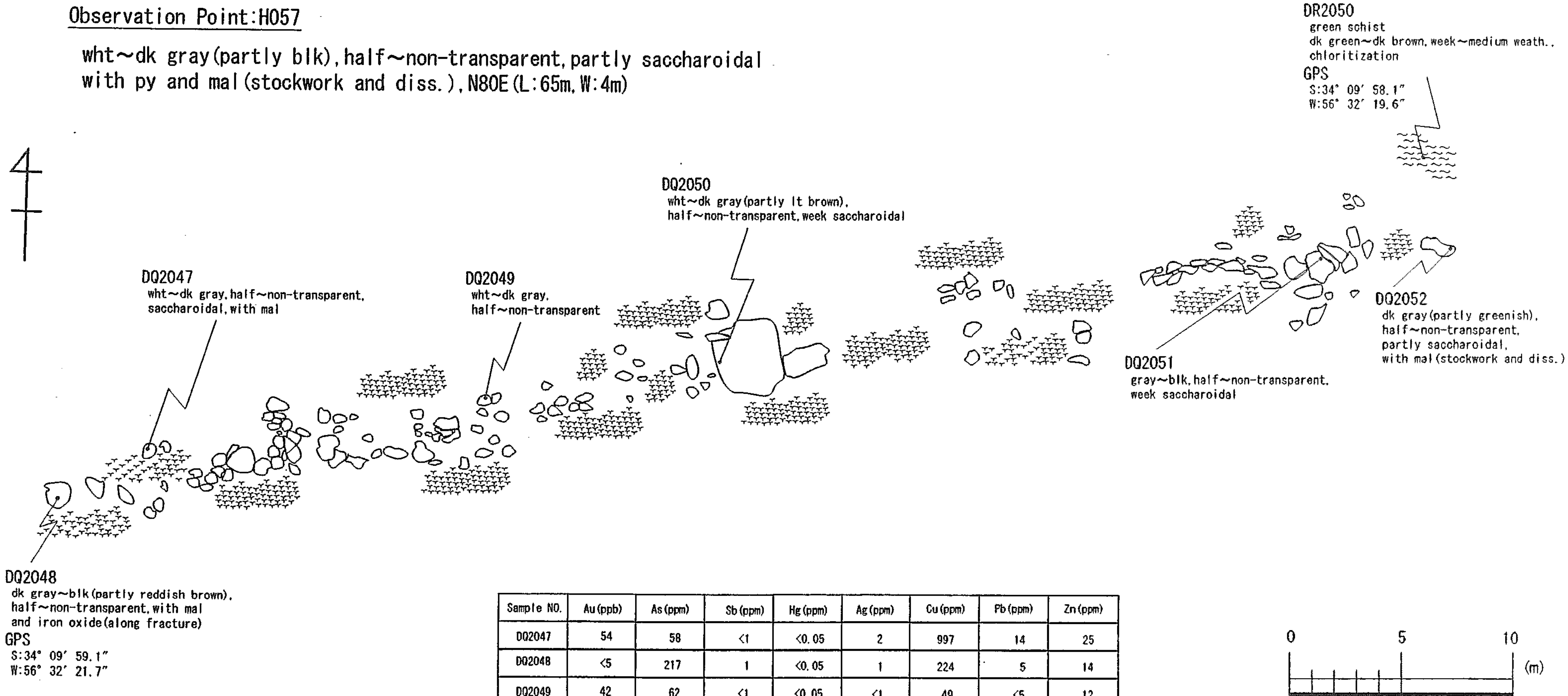


Fig. II-6-12 Geological map of Zone D

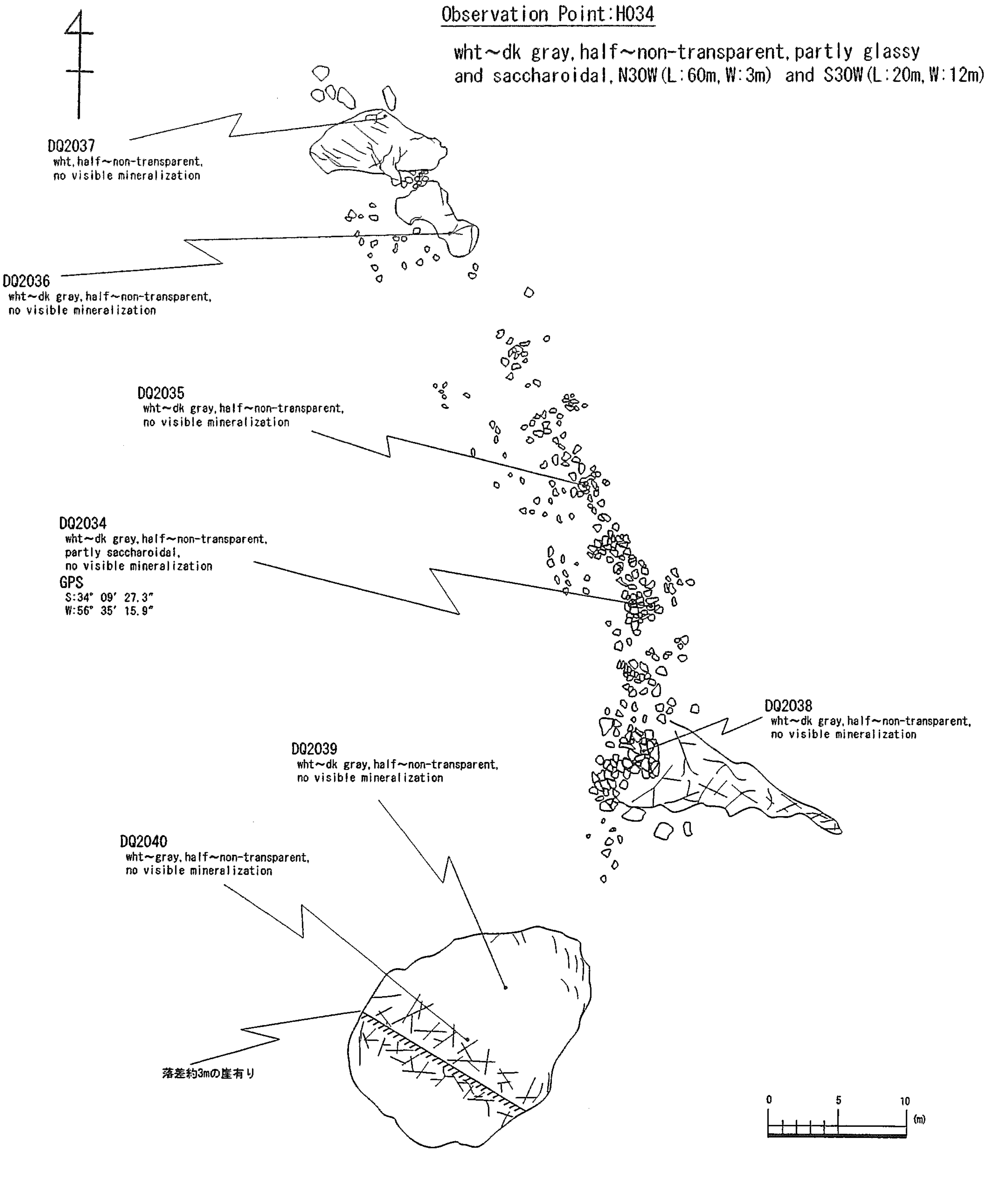
Observation Point:H057

wht~dk gray(partly blk), half~non-transparent, partly saccharoidal with py and mal(stockwork and diss.), N80E(L:65m, W:4m)



Sample NO.	Au(ppb)	As(ppm)	Sb(ppm)	Hg(ppm)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)
DQ2047	54	58	<1	<0.05	2	997	14	25
DQ2048	<5	217	1	<0.05	1	224	5	14
DQ2049	42	62	<1	<0.05	<1	49	<5	12
DQ2050	<5	<1	<1	<0.05	<1	7	<5	10
DQ2051	71	1526	27	<0.05	<1	1525	<5	44
DQ2052	171	10953	147	<0.05	1	1.7%	6	72
DR2050	<5	3485	1	<0.05	<1	580	<5	81

Fig. II-6-13 Sketch of quartz vein (Location D-1)



Sample NO.	Au (ppb)	As (ppm)	Sb (ppm)	Hg (ppm)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)
DQ2034	<5	<1	<1	<0.05	<1	2	<5	12
DQ2035	<5	<1	<1	<0.05	<1	3	<5	11
DQ2036	<5	<1	<1	<0.05	<1	3	<5	11
DQ2037	<5	<1	<1	<0.05	<1	3	<5	10
DQ2038	<5	<1	<1	<0.05	<1	3	<5	15
DQ2039	<5	<1	<1	<0.05	<1	3	<5	13
DQ2040	<5	<1	<1	<0.05	<1	3	<5	13

Fig. II-6-14 Sketch of quartz vein (Location D-2)

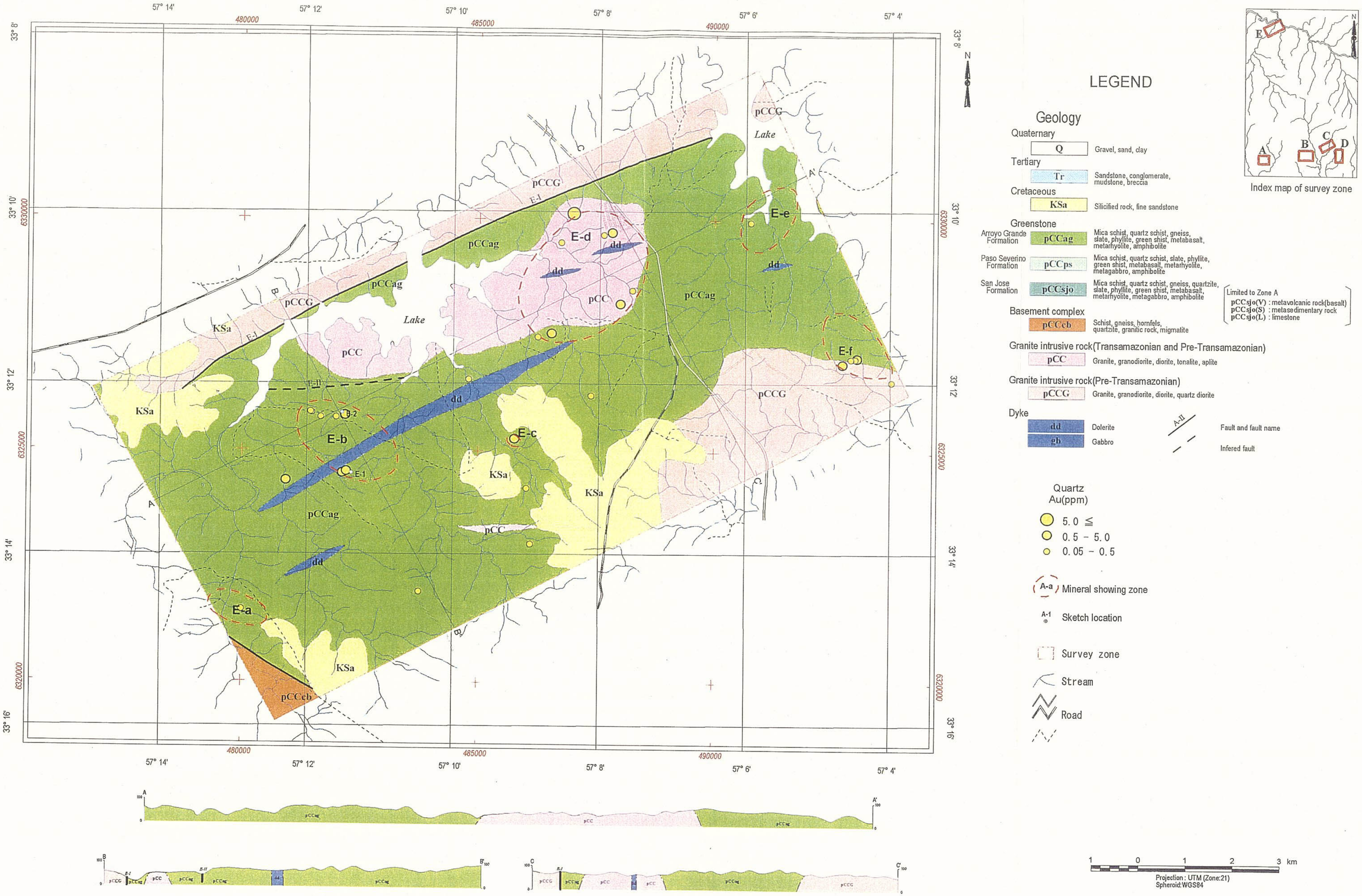
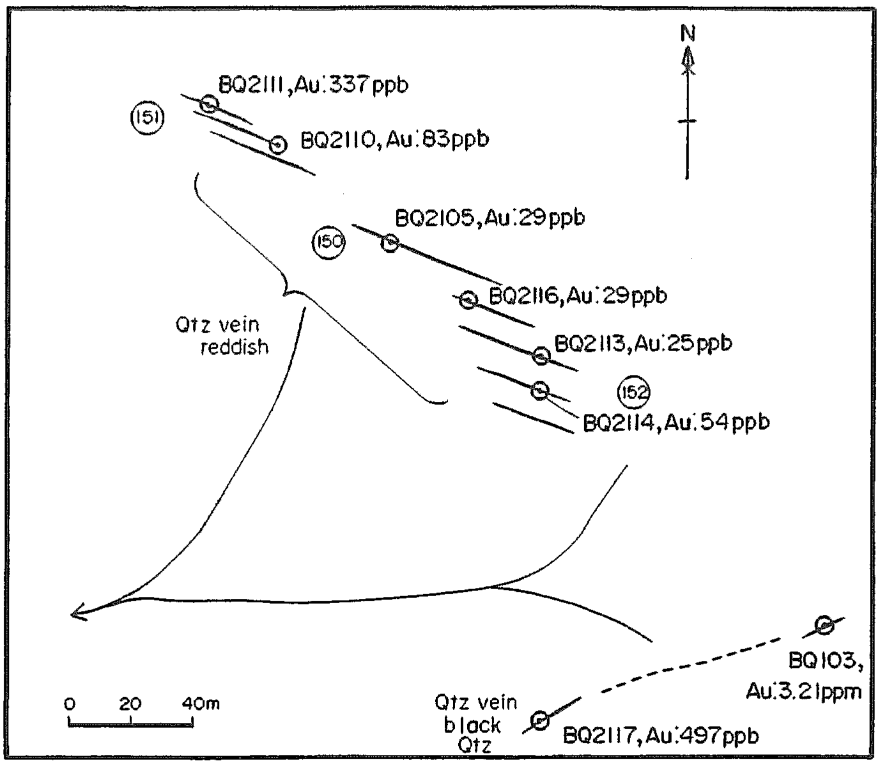


Fig. II-6-15 Geological map of Zone E



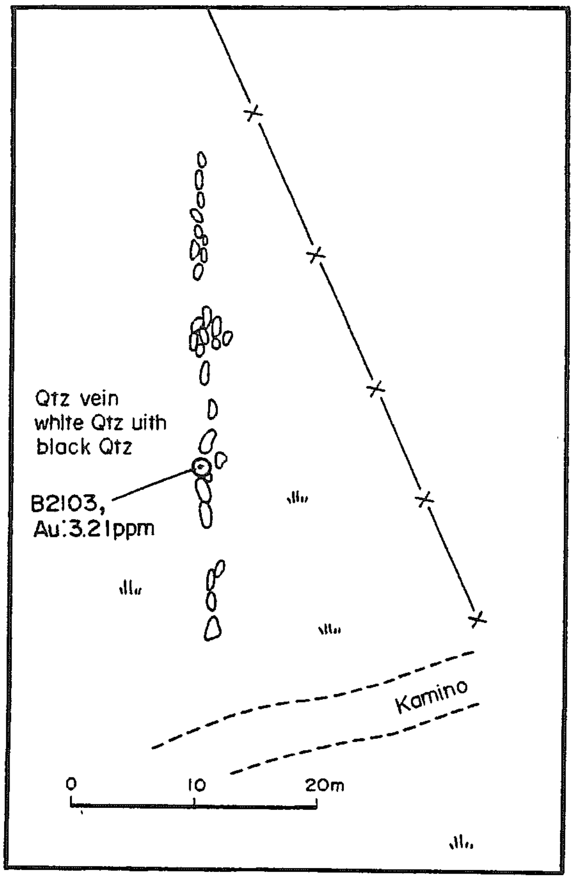
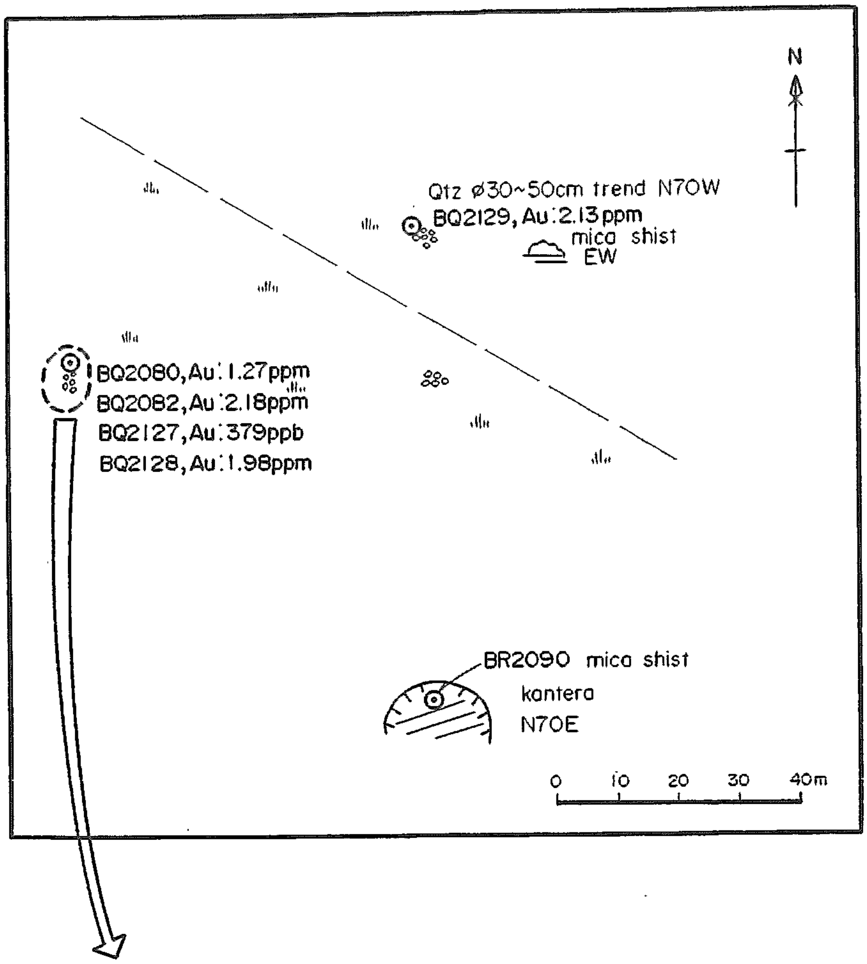


Fig. II-6-16 Sketch of quartz vein (Location E-1)

E zone

Arroyodel Medio



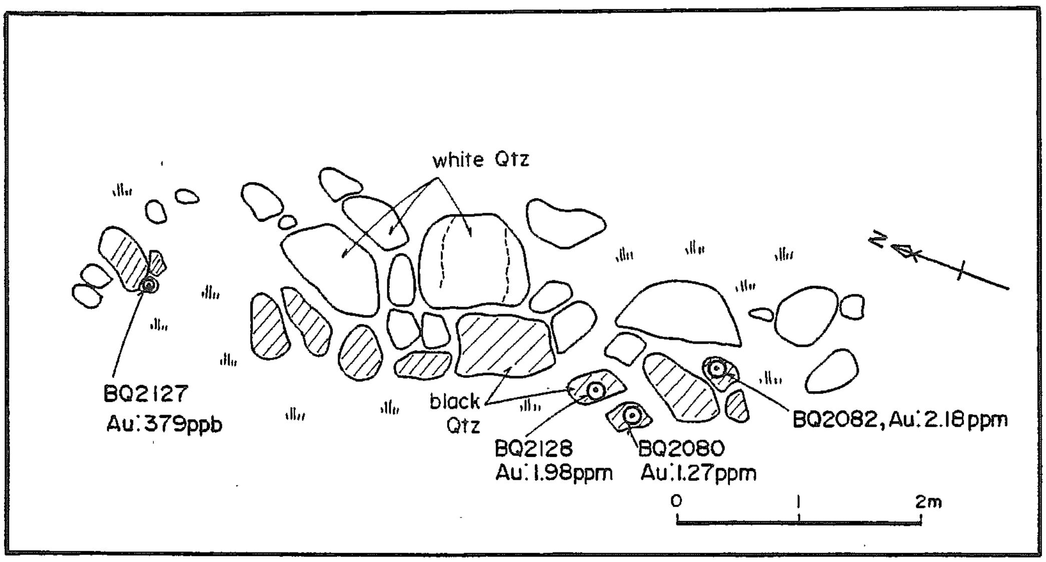


Fig. II-6-17 Sketch of quartz vein (Location E-2)

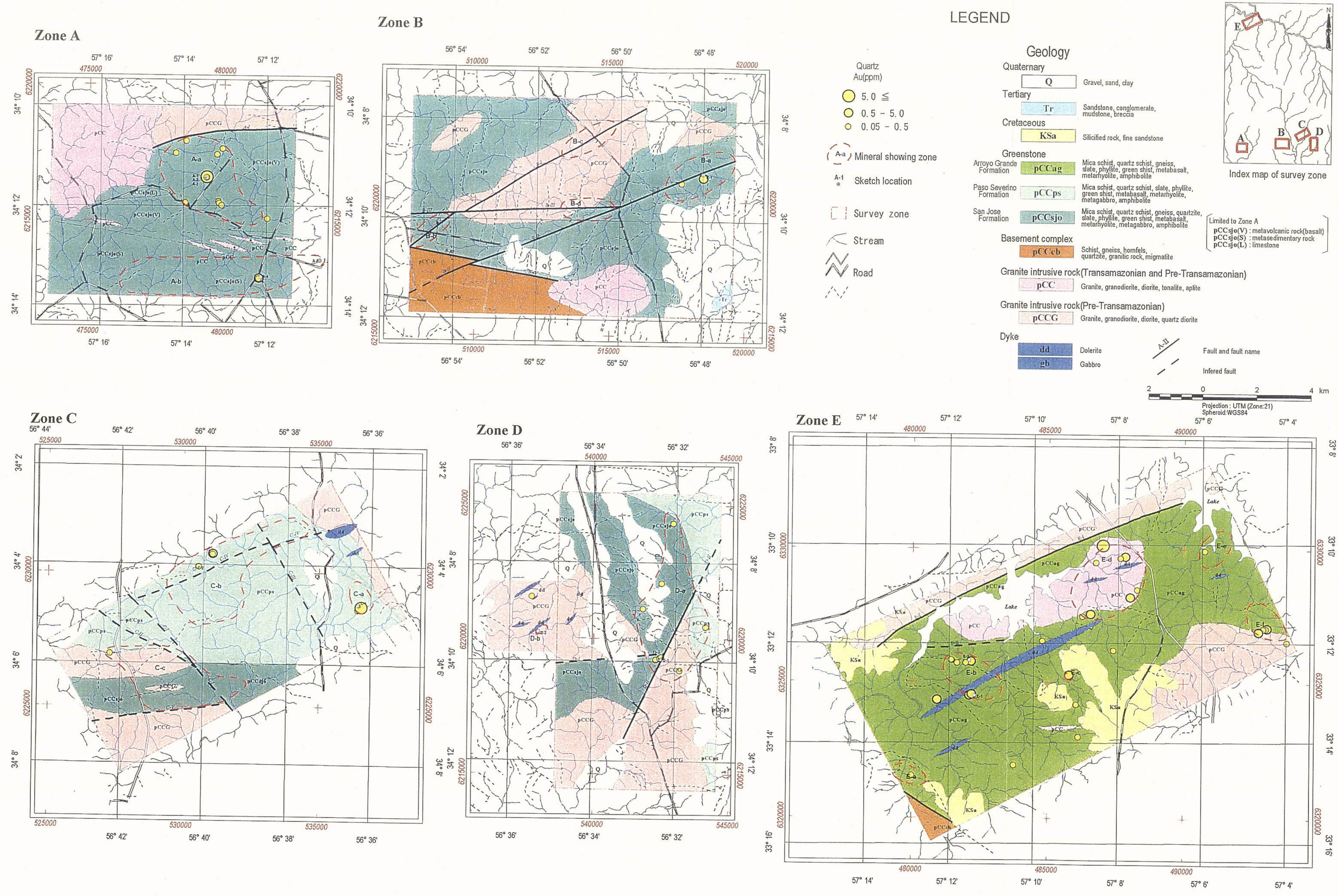


Fig. II-6-18 Composite map of results of geological survey

Tab. II-6-1 (1) Situation and evaluation of quartz veins zones in geological survey

Zone	Quartz Veins Zone	Location in Zone	Width	Host Rocks	Geological Situation	Main Quartz Veins (Mineralization)	Quartz types of Vein*1 A	Quartz types of Vein*1 B	Quartz types of Vein*1 C	Results of Assay*2 A	Results of Assay*2 B	Results of Assay*2 C	Quartz sample No. with Au A	Quartz sample No. with Au B	Quartz sample No. with Au C	Note (Sulphide mineralisation and etc.)	Evaluation*3
Zone A	A−a	North	4km×2.5km	pCCsjo Metabasalt	Among fracture zone	wide1·2m3·4veins strike:N-S	△	◎		×	176、129、52.5			AQ2042、AQ2044、Q2045		Strong sulfidation and oxidation. Host rock undergo silicifiction.	◎
	A−b	South	7km×1.5km	pCCsjo Metasediment	Among Fracture zone?	wide20cm strike:N80W	△	○	◎		×	1.23		AQ2076	AQ2075	Few sulfidation and oxidation.	○
Zone B	B−a	East		pCCsjo Clystaline schist	Along Fault B−II	①50m×80m>	◎	○	△	×	×	×				Stock-like	◎
						②20m×100m>	◎	○		×	×						
						③15m×80m>	◎	○	△	×	×	0.4			CQ2058		
						④ 7m×20m>	◎	◎	△	×	0.83	0.77		CQ2036	CQ2035	Partly limonitization	
	B−b	West		pCCsjo Clystaline schist	Along Fault B−I	① 4m×12m>	◎	◎		×	0.03			CQ2012			△
						② 5m×10m>	◎			×							
						③ 4m×15m>	◎			×							
	B−c	North	0.5km × 2km = 1km^2	pCCG Granodiolite	Along Fault B−I	①15m×40m>	◎			×							△
						② 4m×20m>	◎			×							
	B−d	Center	1km×2km =2km^2	pCCG Granodiolite	Along Fault B−III	①20m×50m>	◎	◎		×	×						△
						② 5m×25m>	◎	◎		×	×						
Zone C	C−a	East		pCCps	Along the Foult C−I	① 5m×600m		◎	△		0.03	×		BQ2055		Polish	○
						② 5m×30m>		◎			5.51			BQ2049		Strongly oxidized	
	C−b	North	0.5km × 1km = 0.5km^2	pCCps	Along the Foult C−IV	①20m×30m		◎	△		×	×				Oxidized	○
						②0.5m×4m		◎			1.19			BQ2121		Reddish, Oxidation, Py	
						③30m×50m		◎			0.025			BQ2019		Oxidized	
	C−c	South East	2km×5km =8km^2	PCCsjo, pCCG	Along the Foult C−V, pCCG	①0.1m×10m		◎			0.22			BQ2001			△
						②10m×20m			◎			×					
						③10m×50m			◎			×				Limonitization	
						④0.5m×10m		◎			×					Py, Limonitizaton	

*1 Quartz types of Vein A: Transparent Quartz, B: Milky Half-transparent quartz, C: Black Non-transparent quartz. Amount ◎ : Large, ○: Small, △: Very Small

*2 Au Results of Assay: ppm, ×: <5ppb

*3 Evaluation ◎ : Very Good, ○ : Good, △ : Not so Good

Tab. II-6-1 (2) Situation and evaluation of quartz veins zones in geological survey

Zone	Quartz Veins Zone	Location in Zone	Width	Host Rocks	Geological Situation	Main Quartz Veins (Mineralization)	Quartz types of Vein*1			Results of Assay*2			Quartz sample No. with Au			Note (Sulphide mineralisation and etc.)	Evaluation*3
							A	B	C	A	B	C	A	B	C		
Zone D	D−a	Center-North	3km × 5km = 7km²	pCCsjo Green schist	Along the Arroyo Quemada	①4m×65m>	○	◎	△	×	0.17	0.07		DQ2052	DQ2051	Partly malachite, diss, stockwork	△
						②3m×20m>		◎			0.04			DQ2059		Partly pyrite	
						③3m×10m>		◎			0.04			DQ2061		Partly pyrite and malachite	
	D−b	West	0.2km × 0.5km =0.1km²	pCCG Granodiorite	Along the dd	① 2m×20m>	◎	◎		×	×						△
						② 2m×20m>	◎	◎		×	×						
						③ 3m×60m>	◎	◎		×	×						
						④ 12m×20m>	◎	◎		×	×						
Zone E	E−a	Southwest	0.6km×1.5km	pCCag		①2m×20m		◎			×			BQ2091		Strongly Oxidation, Pyrite	△
						②2m×10m		◎			0.10			BQ092		Oxidation	
						③2m×40m		◎			0.03			BQ098		Oxidation	
	E−b	Central West	2.5km×1.5km	pCCag		①2m×10m		△	◎		×	2.18 1.98		BQ213	BQ2082 BQ2128	Strongly Oxidation	◎
						②2m×10m		◎			2.13			BQ2129		Strongly Oxidation	
						③3m×20m		◎			3.21			BQ2103		Oxidation	
						④2m×30~50m×8		◎			0.34			AQ2080		Oxidation, reddish colored	
	E−c	Center	0.5km×0.2km	PCCag		wide:10-15cm strike:N60W	◎		△	4.29			AQ2080				△
	E−d	Central North	3km×2.5km	pCC pCCag		wide:1m	△	◎			9.32				AQ2119	Oxidation	◎
						wide:a few 10cm?	△	◎			2.74				AQ2093	Oxidation	
	E−e	Northeast	1.5km×1km	PCCag		①3m×7m	◎	△			0.03			DQ2090		Partly malachite and fracture with limonite	○
						②3m×5m	◎	△			0.43			DQ2093		Partly malachite and fracture with limonite	
						③2m×7m	◎	△			0.05			DQ2096		Fractures with limonite	
						④1m×3m	△	◎			0.03			DQ2098		Fractures with limonite	
	E−f	Southeast	1km×2km	pCCag		①1.5m×7m	◎			4.42			DQ2132			Partly malachite	○
						②1.5m×30m	○	◎		×	0.10			DQ2134		Fractures with limonite	
						③1.5m×20m	△	◎		×	0.09			DQ2136		Partly limonite	
						④3m×40m		◎			0.75			DQ2137		Fractures with limonite	

*1 Quartz types of Vein A: Transparent Quartz, B: Milky Half-transparent quartz, C: Black Non-transparent quartz. Amount ◎ : Large, ○: Small, △: Very Small

*2 Au Results of Assay: ppm, ×: <5ppb

*3 Evaluation ◎ : Very Good, ○ : Good, △ : Not so Good