CHAPTER 2 GROUNDTRUTH

As mentioned before, areas to be selected by satellite image analysis, where are eastern side of Long. 103° E, were surveyed on surface in the first phase survey (1994). In this second phase survey (1995), the selected areas, where are lain in the West Altan Tal Area between Long. 103° E and 96° 30′ E, were surveyed as groundtruth (refer to Fig. 1 & Fig. 10).

2.1 Abstract of Survey Area

2.1.1 Existing Gold deposits and gold Showings

At first, existing gold deposits and gold showings in the West Altan Tal Area showing high golden grade or having much ore reserves were selected, according to the analysis of existing data in first phase survey.

Secondary, after analyzing the existing data collected in second phase survey and discussing with Mongolian counterparts, 15 Gold depositsand gold Showings to be surveyed were picked up as shown in Fig. 10.

2.1.2 Satellite Image Anomaly

In first phase survey of this project, satellite image analysis was performed for the whole of the Altan Tal area, where is about 345,000km², to select the altered zones which were supposed to be affected by hydrothermal solution and gold mineralization.

For this purpose, non-relative stretch analysis on 33 scenes of TM images taken by Landsat satellite that covers the whole Altan tal area was performed based on multi-variable analysis using 3 bands (that is, 4,5 and 7 bands), and then supposed alteration areas which show the same tone of colours as the existing famous ore showings such as Ih-Shanhai and Shuten were selected in the east Altan tal area, where are eastern side of Long. 103° E., consequently 47 anomaly areas were selected, and furthermore 45 areas were picked out to be surveyed actually for the firstphase survey.

After groundtruth for these 45 areas, hydrothermal alteration was confirmed in 21 areas and 11 areas in 21 showed very eminent hydrothermal alteration. But in other areas, rock facies such as rhyolite, limestone and others were supposed to have affected on selection of alteration areas.

In the Second phase survey, alteration areas were selected in the west Altan Tal area by the same way as the previous year, and consequently 49 anomaly areas were done. Further selection on these 49 areas were done based on the first phase survey's result, topography, geological structure and others, and finally 21 anomaly areas were chosen with preferential order (refer to Appendix 1~10).

2.2 Purpose, Method and Contents of the Survey

2.2.1 Purpose and method

The purpose of survey for existing gold deposits and gold showingsis to survey generally them selected from existing data, to confirm their exact locations, to check geology and geological structure around them, to check their ore types, their scale and their alteration, and to take samples for chemical analysis and laboratory tests. It was also purposed to reconfirm the

chemical analysis, because it is said that there were some unreliable chemical data in existing data. Regarding the selected areas from satellite image analysis based on their tone of colours, it was purposed to surveyon surfsce, to confirm their locations and scale, to understand geology, geological structures, mineralization and alteration around them, and totake samples for for chemical analysis and laboratory tests.

Considering the results of the above mentioned survey, regional geology, regional geological structure and metallogenesis, it was finally purposed to estimate the potentiality of gold occurrence and then to indicate the hopeful areas for gold deposits.

2.2.2 Contents of the survey

The contens of groundtruth carried out in the Second phase survey are as follows;

(1) Survey areas: 36 (existing gold deposits and gold showings are 15, and satellite image anomaly are 21)
(2) Survey route in total: 161.5 km
(3) Samples taken in the field survey: 585 pieces
(4) Contents of laboratoey works: (refer to Appendix 11~14)
Chemical analysis: 344 pieces (each Au, Ag, Cu, Pb, Zn, As, Sb, Hg, Te = 9 elements)
X-ray deffraction examination: 100 pieces
Microscopic observation of thin section: 30 pieces
Microscopic observation of polished section: 10 pieces

2.3 Results of the Survey

Results of the groundtruth surveyed in the Second phase survey aredescribed in bdlow in order of survey route, regarding existing gold deposits and gold showings and anomaly areas by satellite image respectively (survey route is shown in Fig. 10).

2.3.1 Existing Gold Deposits and Gold Showings

Existing gold deposits and gold showings are basically numbered based on the first phase survey's analysis on collected data, but in several parts newly introduced gold showings from Mongolian side in Second phase survey have new numbers (attached ** mark). Therefore, some of gold ore showings have two kinds of numbers, such as old one and new one.

(1) MS-21 (refer to Fig. 11)

This area is located at Lat. 45° 55′ 14″ N and Long. 102° 24′ 40″ Ein Uvurhangai aimag, and also located at around 50km in NE direction from Bayanteeg sum in Uvurhangai aimag where the national road between Arvaiheer sum, the capital of Uvurhangai aimag and Bayanhongor sum, the capital of Bayanhongor aimag passes by. Topographically mountain ridges and river system around this area have a NW-SE trend.

The ore showings exist on a dry river which is running down gently south-eastward on a hilly region with relative heights of several meters~10m where general elevation is around 1,800m to 1,960m and exposures of granite are scattered.

According to the existing data, this area is belonged in the Bayanhongor metallogenic zone of north Mongolian metallogenic province in the Baikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located in Tuin~

Taatsyn gol mineralized zone that is at southeastern periphery of Hangai mountain areas in central Mongolia.

Geology around this area was composed of shale, green schist and coalbearing sandstone formed in Bendian age (?) of Proterozoic to lower Cambrian period, and composed of granitic rocks and quartz porphyry formed in Permian to Triassic period that intruded into older rocks. At marginal zones of granitic rocks, eminent silicification can be observed.

The mineral showings is consisted of shale, green schist, sandstone and eastern periphery of granitic rocks which ocupies like a circle of 0.5km diameter at northwestern side of the above mentioned rocks such as shale, green schist and sandstone. Geographically the ore showings distrubutes ranging around 1km in N–S direction and around 0.6km in E–W direction on valley.

In this Second phase survey, the survey was performed from the central part of granitic rocks to mineral showings on their surface, and quartz veins which develop at marginal zone of granitic rocks were specially investigated and were taken samples.

One sample was taken from the contact zone between granitic rock like dike (its strike; N45° E), green schist and sandstone (its strike; N50° W), and the other one was taken from quartz vein deloping in granite dike.

Chemical analysis of these 2 samples indecated no more than detecting limit on gold and silver, and less than detecting limit on other metallic elements. According to existing data, gold value of 3g/t was recorded (Togtokh et al., 1984), hopeful metallic minerals suggesting hydrothermal alteration or eminent quartz veins were not confirmed by chemical analysis and observation of outcrops. Therefore, the potentiality for gold occurrences in this area is estimated to be very low.

(2) MS–49 (refer to Fig. 12)

This place is located at Lat. 45° 37′ 38″ N and Long. 101° 59′ 30″ E in Uvurhangai aimag, and exists on hilly region with elevation of around 1,700m at eastern end of Shibeegyin mountains which is running in WNW–ESE direction at eastern side of Xhan Uul of Uvurhangai aimag.

According to the existing data, this area is belonged in the Bayanhongor metallogenic zone of north Mongolian metallogenic province in the Baikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located in Tuin~ Taatsyngol mineralized zone that is at south–eastern periphery of Hangai mountain areas in central Mongolia.

The ore showings is consisted of one quartz vein in granitic rocks formed in Middle~ Upper Cambrian, but the quartz vein shows 40m as its muximum width and continues around 140m in its strike side (that is, NE–SW direction). Though exploration works can not be confirmed, gold values of 0.3~5.0g/t were seen in the existing data.

Six samples were mainly taken from quartz vein and were chemically analized as shown in Fig. 12. Muximum value in chemical analysis for these 6 samples is gold value 0.7g/t from the sample which was taken at contact zone between the quartz vein and host rock, and which shows brecciated structureand existence of iron oxidized minerals. Any other specialities can not be detected in chemical analysis.

Existence of gold ore deposits is possibly estimated to be low, due to result of chemical analysis and to the restricted distribution of the quartz vein.

(3) MS−39 (144**; Khan Uul, refer to Fig. 13)

The center of ore showings is located at Lat. 45° 43′ 30″ N and Long. 101° 36′ 15″ E in Uvurhangai aimag, and is north−east around 7km from Bayanteeg sum and is south−west around 4km from Xhan Uul.

The ore showings distribute on hilly region with elevation of 1,800~2,100m followed from Xhan Uul. According to existing data, the centeral part of mineral showings extends 1,600m in east−west direction and 500m in N−S direction. The exploration works to be done here aregeological survey on 1 to 200,000 scaled map, 2 drill holes and more than ten trenches, but details are unknown.

According to the existing data, this area is belonged in the Bayanhongor metallogenic zone of north Mongolian metallogenic province in theBaikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located in Tuin~ Taatsyngol mineralized zone that is at southeastern periphery of Hangai mountain areas in central Mongolia.

Geology around here is characteristically composed of Bendian in Proterozoic to Cambrian sandstone, shale and greenschist, of Cambrian gabbroic rocks intruded into older rocks, and of Permian to Triassic granitic rocks (its extension; 0.5km × 1.5km).

Around many trenches, pits, and marks of drill holes found on hilly region, exposures were observed and samples were taken in this Second phase survey.

Geology around mineral showings is consisted of alternation of pelitic schist, green schist and calcareous schist. And schistosity here has ususlly east−west trend, but sometimes it is disturbed by micro foldings. In mineralized zone, quartz veins are recognized parallel to schistosity like as lens, but scale and continuity of each quartz veins are small, so biggest one of them shows only 1.5m in width and 5~10m in length. Furthermore, many faults and many dikes of granite porphyry are seen.

Hydrothermally altered and replaced zones are seen lenticularly and parallel to strike of schistisity in metamorphic rocks. Green schist and pelitic schist which are host rocks for ore showings appear partiallyto be phyllite and to be poor in their continuity, but include silicified and hydrothermally altered zones accompanying hematite, limonite and partially brecciated structure. Among every kinds of schist, thin beds of chert, dolomite and others are intercalated. Extension of these mineralized zones is coincident to schistosity of host rocks and is around in NW−SE direction.

Samples were taken from many trenches cross cutting mineralized zones, also taken mainly from quartz veins in silicified and hydrothermally altered zones whose existence were confirmed by surface survey. Totally 24 samples were taken, and their analysis shows that gold value variesfrom detecting limit to 0.074g/t, silver value is around detecting limit, copper and zinc contents sometimes exceed 100ppm and no valuable contents of metallic elements can not be detected. By X−ray diffraction analysis, any more minerals than quartz can not be clearly recognized.

According to existing data, gold value of 6g/t was recorded. Though samples were taken from typical mineralized zones, result of chemicalanalysis did not show so high gold value as the existing data and showedmuch lower gold value than initial expectation. They say that recently Mongolian Geological Survey surveyed along small rivers and they found commonly native gold

grains from soils on basement rocks. Therefore, in this area, gold ore deposits of residual type may be expected to exist in high possibility.

(4) MS-4 (refer to Fig. 14)

The center of the mineral showings is located at Lat. 45° 59′ 50″ N and Long. 101° 27′ 00″ E in Bayanhongor aimag and exists about 25km in SWS direction from Bayanhongor sum which is on hilly regionwith elevation of around 1,900m.

According to the existing data, this area is belonged in the Saran Uul district of the Khungui-Baidrag metallogenic zone of north Mongolian metallogenic province in the Baikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located at southeastern periphery of Hangai mountain areas in central Mongolia.

Geology around ore showings is composed of green schist, limestone, amphibolite~gabbro and gneissose granite of Leephey (?) system in Proterozoic, and the mineral showings are lenticular quartz veins in green schist, limestone and gneissose granite. These lenticular quartz veins extend 1.5km towards east-west direction intermittently, and show maximum width 50m and maximum length 130m. Appearance of quartz veins seems to be white and not to have mineralization, but at the points of sample numbers 7 and 8, limonite can be seen. Though gold value 0.2~4.0g/t were described in existing data, the result of chemical analysis of 6 samples taken mainly from quartz veins showed that most of gold contents areless than detecting limits and contents of other metallic elements are also low. X-ray diffraction analysis for samples from quartz veins clarified only existence of quartz and muscovite.

The existence of gold occurrences seems to be in low possibility, judging from the result of chemical analysis and the extended range of mineral showings.

(5) MS-31 (refer to Fig. 15)

This area is located at Lat. 45° 50′ 10″ N and Long. 101° 33′ 05″ E in Bayanhongor aimag and is about 35km in south-west direction from Bayanhongor sum. Mountain ridge and river system around this area show linear extension like as NW-SE direction, and hilly region with elevation of 1,900~2,000m and valley parts appear repeatedly. Thislinear topography develops along a fault thrusting to south-westwards.

According to the existing data, this area is belonged in the Saran Uul district of the Khungui-Baidrag metallogenic zone of north Mongolian metallogenic province in the Baikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located at southeastern periphery of Hangai mountain areas in central Mongolia.

Geology around mineral showings is composed of shale, phyllite, limestone, green schist, chert and amphibolite of middle Carboniferous, and of Permian granitic rocks which intruded into upper units. Shistosity of metamorphic rocks is directed almost north-west and south-eastwards. At some places where shale and schists were hydrothermally altered and replaced, quartz veins having limonite and hematite are deloping.

Permian granitic rocks which takes about 2km from mineral showings distribute in southwestern part of this area and their distributing range is circular with 0.5km diameter. Mineral showings develop along thevalley at northeastern periphery of Permian granitic rocks, and exist in quartz veins extending 1km long in NW-SE direction and 0.3km wide.

Five samples were taken from quartz veins developing in shale, phyllite and chert, and the result of chemical analysis shows that both gold and silver values are around detecting limits and

that contents of other usuful elements are less than detecting limits.

In existing data, rather high gold values such as 1.5~2.5g/t were described (Andreas et al., 1970, Boitenko et al., 1977), but mineralization in host rocks is weak in the whole area and chemical analysis at this time revealed very low gold contents. Therefore, the possibility ofgold occurrences here is estimated to be very low.

(6) MS-32 (refer to Fig. 15)

This area is located at Lat. 45° 50′ 29″ N and Long. 100° 33′ 59″ E in Bayanhongor aimag, is in SW direction about 35km from Bayanhongor sum and is in a eastern neighbourhood next from MS-31.

Mountain ridge and river system extend in northwest-southeast direction, and ridge parts with elevation of around 1,900~2,000m and valley parts appear repeatedly forming a linear and hilly topography, equally as MS-31.

According to the existing data, this area is belonged in the Saran Uul district of the Khungui-Baidrag metallogenic zone of north Mongolian metallogenic province in the Baikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located at southeastern periphery of Hangai mountain areas in central Mongolia.

Geology of this area is composed of lower Silurian to Carboniferous shale, phyllite, limestone, green schist, chert and amphibolite, and Permian granitic rocks which intruded into them. Shistosity of metamorphic rocks shows around northwest-southeast direction. Quartz veins with limonite and hematite develop at places where hydrothermal alteration andreplacement took place.

Permian granitic rocks which takes about 2km from mineral showings distribute in south-western part of this area and their distributing range is circular with 0.5km diameter. Mineral showings develop along thevalley at northeastern peripheryof Permian granitic rocks, and exist inquartz veins extending 1km long in NW-SW direction and 0.3km wide.

Three samples were taken at this time from quartz veins developing in shale, phyllite and chert. Result of chemical analysis for these 3 samples shows that both gold and silver contents are around detecting limits, and that contents of other metalic elements are also around detecting limits except muximum copper content of 59ppm.

The possibility of gold occurrences here can not be expected, because gold mineralization here is very weak and gold contents confirmed at this time are very low in spite of description in existing data saying gold value 1.1g/t (Andreas et al., 1970, Boitenko et al., 1977).

(7) MS-78** (neibour from 42; Saran Uul, refer to Fig. 16)

The center of this area which is hilly region with elevation of around 1,700m is located at Lat. 45° 46′ 00″ N and Long. 100° 36′ 30″ E in Bayanhongor aimag and is about 3km west from Saran Uul (its elevation; 1,882m) which is in SW direction from Bayanhongor sum.

According to the existing data, this area is belonged in the Saran Uul district of the Khungui-Baidrag metallogenic zone of north Mongolian metallogenic province in the Baikalian to early Caledonian fold belt of the northern megablock that is the main geotectonic unit of Mongolia and is located at the central part of Saran Uul district in south-eastern periphery of Hangai mountain areas in central Mongolia.

Geological components in this area are Carboniferous sedimentary rocks and Permian granitic rocks intruding into them. At the contact zone between them and-at granitic rocks

next to contact zone, mineralization mainly from copper are seen.

The mineral showings were discovered by geochemical exploration and are called porphyry copper type, according to the existing data. Bayanhongor Geology company whose headquarter is in Bayanhongor sum is summarizing their exploration works carried out recently on the mineral showings. Several long trenches which extend morethan 1km in total length towards N75° W and N15° E directions, and 4 drill holes at least were remained at the field site. From the remains of trenches and drill cores, chalcopyrite, pyrite, malachite and small quartz veins could be confirmed by naked eye. A quartz vein whose strike is N20° E and which was cut by a norternmost trench going in N75° W direction, extends more trhan 30m with 2m width and shows brecciated structure and limonite.

Totally 5 samples were taken at this time from quartz veins and granitic rocks, and the result of chemical analysis for samples from quartz veins shows values 0.5g/t on gold and 0.3% on copper. The value of 1.56% on copper was obtained from chemical analysis of sample taken at granitic rock accompanying impregnation of chalcopyrite. Considering generally, gold ore deposits of porphyry copper type can be confirmed to exist here.

(8) MS-160 (593**; Oortsog, refer to Fig. 17)

The center of this area is located at Lat. 44° 49′ 25″ N and Long. 100° 10′ 10″ E in Bayanhongor aimag and is about 20km in WNW direction from Bayangobi sum.

Mineralalized zone are distributed on the gentle north slope of the mountains trending WNW-ESE, with elevations of 1,700m.

According to the existing data, this area is belonged in the Bayangovi mineralized district of Bayanlig-Bayangovi metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The local geology is composed of Devonian green schists which areintercalated with sandstone, conglomelate and tuffs. Quartz vein zones occur in weakly metamorphosed sandstone conglomelate and tuffs, and extend about 2km in N55~55° W parallel to the schistosity. There are 6 shallow trenches cut the quartz vein zones. Individual quartz veins are discontinuas and less than a few centimeters wide. Limonite is observed in quartz veins and galena is sparsely recognized.

White mica (sericite) occurs in silicified metamorphics, indicating hydrothermal alteration effect.

In this survey, chemical analyses of 12 samples were carried out. the results of analysis show a maximum gold values of 0.2g/t from quartzvein and silicified zone. The other elements show low values except Zn (300ppm).

Available information reports average gold values of 1.5~15g/t, and gold reserveof P2 level are 660kg for this area. But analytical results of this survey could not prove the evaluation of previous information.

(9) MS-592** (170; Bayangovi-1, refer to Fig. 18)

The center of the survey area is located at Lat. 44° 44′ 20″ N and Long. 100° 19′ 1″ E, about 5km in WNW direction of Bayangobi Sum, Bayangobi Aimag.

Hills with elevations of 1,700m are distributed in this area, andshow parallel or echelon elongation. Mineralized zone are distributed onthe north slope of gentle ridge.

According to the existing data, this area is belonged in the Bayangovi mineralized district of Bayanlig–Bayangovi metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The local geology is composed of Devonian green schists which areintercalated with sandstone, conglomelate and tuffs. Sandstone and quartz vein bearing beresite are main constituents of the mineralization zone, form small hills with a few meters hight range in N50-70° W, parallel to bedding. Each small hills with a few meters wide, 100~200m long, showparallel~echelon distribution. Weathered greenschists and pelitic rocksoccupy topographically low part among those hills.

There are several trenches cut mineralized hills. Mineral showings of quartz veins occur in an area of 1km x 1km (over 1km along strike). Each quartz veins are several tens of centineters wide and show lens–shaped discontinuous form. Quartz vein show milky white or dusky brown in color, accompanied by limonite and pyrite. Altered sandstone, especially accompanied euhedral pyrite, is brown in color, and pyrite increase it'ssize near by the quartz vein. Alteration minerals such as chlorite, sericite and calcite are recognized by x–ray diffraction test.

Samples of the quartz vein and altered rosk were taken at this survey and chemical analysis of 14 of these are carried out. the results of analysis show a maximum gold value of 1.41g/t from quartz–siderite vein in pyrite bearing sandstone, followed by Au value of 0.103g/t from quartz vein in same zone. The others show low values.

Available information reports average gold values of 0.1~1.5g/t, and gold reserve of P3 level are 2500~3000kg for this quartz stockwork zone. There is little difference in maximum gold value compare this survey to previous existing report, but this survey proved that the extention of high gold zone are limited and therefore reserve of gold evaluated by previous report is questionable.

(10) MS–185 (590**, refer to Fig. 19)

The survey area is located at Lat. 44° 38'16"N and Long. 99° 53'57"E, about 70km south of the Bayangovi sum, Bayanhongor Aimag.

Hills with elevations of 1,700m~1,800m are widespread in the vicinity of the area. Mineralized zones are distributed in the mountains on the north side of a range oriented NW–SE.

According to the existing data, this area is belonged in the Bayangovi mineralized district of Bayanlig–Bayangovi metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The local geology is composed of Devonian mudstone, shale, and siliceous mudstone, and Govialtai Second–Stage granite which intrudes these.

So far the date of gold mineralization is unclear, but the host rocks are predominantly E–W striking argillaceous rocks and granite, in which stockwork quartz veins are developed.

Mineral showings occur in a 500m x 1,000m area, with a zone of quartz veins measuring about 5m x 100m, which show a NW–SE echelon distribution. The main ore minerals are limonite, hematite, and pyrite, with chalcopyrite and bornite sparsely recognized.

In this survey, samples of ore minerals which accompany the quartz veins were taken and chemical analysis of four of these were carried out. However, the results of analysis shows a maximum gold value of 0.018g/t, with other elements being below the analytical limits.

Available existing data reports gold values of 0.2~8.0g/t, but based on above mentioned analytical results of samples taken at representative locations in the survey area, gold mineralization is weak in this area and the potentiality of gold occurrences is low.

(11) MS-591** (209: Hoh Tolgoi, refer to Fig. 20)

This area is located at Lat. 44° 25'29"N and Long. 100° 47'41"E, about 40km southeast of Bayangovi, Bayanhongor Aimag.

According to the existing data, this area is belonged in the Bayangovi mineralized district of Bayanlig-Bayangovi metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The local geology is composed of Devonian sedimentary rocks and greenschist, altered pelitic schists, and the Devonian~Carboniferous granites which intrude these. According to available information, there are gold showings in this area that are believed to have been formed by Devonian~Carboniferous hydrothermal activity. The host rock is mainly greenschist striking E-W. Lens-shaped quartz veins are intercalated in the siliceous rocks. The predominant ore mineral is gold, but this is noteasily seen by the naked eye. In addition, pyrite, chalcopyrite, malachite, and galena are also recognized.

In this survey, quartz veins which developed in the Devonian sedimentary rocks and altered rocks were sampled and chemical analysis of eight of these samples were carried out. The results of the analysis showboth values of gold and silver are within analytical limits, but other elements were below the analytical limits.

Available analysis for the quartz veins report maximum grades forgold of 1.0g/t, and for silver of 30g/t, but based on analytical resultsof samples from representative locations in the survey area, gold mineralization in the host rocks in this area is weak and the potentiality forgold occurrences is believed to be low.

(12) MS-226 (refer to Fig. 21)

This area is located at Lat. 44° 08'20"N and Long. 100° 33'56"E, 50km south of the Bayangovi sum, Bayanhongor Aimag. Elevations in the vicinity of the survey area are from 1,400m~1,500m with scattered smallhills (relative height is several meters) in a south-flowing wadi surrounded on the north and east sides by small hills and lowlands.

According to the existing data, this area is belonged in the Bayangovi mineralized district of Bayanlig-Bayangovi metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The local geology consists entirely of Devonian~Carboniferous granites of the Second-Stage Altai complex. Mineral showings are found inthe scattered lenses of quartz veins in granite, which build small hill in the river bed. Quartz veins are arranged en echelon NE-SW, the largest of these being 5m wide and 35m long. Ore minerals associated with these veins are limonite, hematite, malachite, chalcopyrite, and pyrite.

In this survey, samples of the ore minerals accompanying the quartz veins were taken and

three of these were chemically analyzed. Thea analytical results show low values for gold and silver, with maximum values of 0.005g/t and 1.2g/t respectively. Values for copper and lead wererelatively high; with maximum values being 5,810ppm and 122ppm respectively.

Available existing data reports analytical grades of 3g/t of gold and silver (Zabotkin, et al., 1988), but the results of analysis for samples taken at representative locations in the study area show that, other than for copper, mineralization is weak, and it is believed that the potentiality for gold occurrences is low.

(13) MS-Hatan Suudal (572**)

The center of the survey area is located in southeast Govialtai Aimag, at about Lat. 42° 54'N and Long. 97° 43'E, at the east boundary of Umnugovi Aimag, and about 40km north of the border with China.

According to available existing data, this gold mineralization zone was discovered in 1986 by Y.N. Podkolzin in a survey known as the Mineral Resources Survey of Mongolia and is belonged in the Taliin Meltes-Hatan Suudal mineralized district of Tomortiin Nuruu metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The geology of the entire area is made up of sedimentary rocks known as the Middle Devonian Ekhiin Golin Group, and greenstones known asthe Upper Silurian~Lower Devonian Tomortiin Group. The Ekhiin Golin Group is composed of siliceous siltstone and sandstone, while the Tomortiin Group is composed of meta-sandstone alternating with greenstone, shale, conglomerate and limestone. These were intruded by Late Devonian~Early Carboniferous plagioclase granites. Rhyolite porphyry, andesite, microdiorite, and gabbroic dikes also occur here.

Upto date, ore mineral showings are known at three places in this area. Each of these ore showings was studied in this survey. The results for each ore showing, 1, 2, and 3 are given here.

* Ore Showing 1: (refer to Fig. 22-(1))

This ore mineral showing is located at Lat. 42° 53'58"N and Long. 97° 40'35"E, and is a zone of silicification and quartz veins at an elevation of about 1,500m on the south slopes of the E-W running Hatan Suudal Hills.

The geology is composed of Upper Silurian~Lower Devonian greenschist and pelitic schist which display E-W schistosity and contain a zone of quartz veins several tens of centimeters wide. In this area NW-SE basalt and andesite dikes can be seen which cut the metamorphic rocks, and E-W faults have formed which are parallel to the hills.

The ore mineral showing covers an area 1,350m long E-W and 350m wide. Within the ore showing, quartz veins several cm to 20cm wide haveformed on the south side. In the same way, there is strong silicification of metamorphic rocks along faults on the north side. Both of these form hills several meters high. In the quartz veins, small amounts of limonite, hematite, and pyrite were recognized.

Samples were taken from the quartz veins and strongly silicifiedmetamorphic rocks, and chemical analysis were conducted on fourteen of these. The analytical results showed low maximum values for gold and silver of 0.081g/t and 0.7g/t respectively. The maximum value for mercury was 140ppb, but values for other elements were from the detection limits to several

ppm. X-ray diffraction examination revealed albite and calcite.

* Ore Showing 2: (refer to Fig. 22-(2))

The largest mineralized zone in the Hatan Suudal Mineralized district is at its center, at Lat. 42° 53'40"N and Long. 97° 43'26"E, at an elevation of about 1,500m, along an E-W valley in the Hatan Suudal Hills.

The geology of the area consists of Upper Silurian~Lower Devonian basaltic volcanics, greenschist, meta-siltstone (beresite, as it is known in Mongolia), and the Devonian~Early Carboniferous granite, andesite, and microdiorite dikes which intrude them.

Gold mineral showings are mainly seen in scattered silicified zones and zones of quartz veins in the greenschist in valleys of the HatanSuudal Hills. The largest mineralized alteration zone in this district is 500m long E-W and 80m wide, with pyrite (1-15mm) intercalated with beresite. The beresite accompanied by pyrite is slightly oblique to the greenschist. Quartz veins developed in these rocks are arranged en echelon E-W or NE-SW. Ore minerals seen in the beresite and quartz veins aregold, limonite, hematite, pyrite, arsenopyrite, chalcopyrite, bornite, malachite, and azurite. Grains of native gold are visible in the quartz veins.

In this survey, ore minerals that accompany the quartz veins, aswell as the beresite host rock were sampled, with twenty-one of these samples being submitted to chemical analysis. The results of analysis forgold and silver were high, with maximum values of 43.5g/t and 19g/t respectively. However, that part of the quartz vein showing the highest gold values seems to be limited to the section accompanied by high amounts of sulfide minerals. The analytical results of channel sampling in a 1.0m~1.5m width in beresite intercalated with 5cm~20cm quartz veins yielded gold values of only 0.3~1.5ppm. Other than this, copper showed a maximum value of 2.48%. Quartz, albite, chlorite, and calcite were detected in x-ray diffraction examination. Also, microscopic observation allows the interpretation of beresite as sericitized and albitized andesiteor diorite dikes.

Available existing data (Podkolzin, et al., 1986) reports gold and silver grades of 156.8~158g/t and 167.8~172.8g/t respectively in the quartz veins, while in the beresite these grades are 11.7~12.6g/t and6.8~8.0g/t respectively. Based on the analytical results of samples believed to be representative of the whole area, gold and copper mineralization of the quartz veins is seen to be weak and the size and occurrenceof areas with high gold values were not as great as earlier had been expected. On the other hand, there was a low amount of gold in the greenschist and sandstone, with maximum values of 0.01ppm.

Gold mineralization is assumed to be a result of hydrothermal alteration and metasomatism which accompanied Devonian~Carboniferous igneous activity.

* Ore Showing 3: (refer to Fig. 22-(3))

This mineral showing is about 1.5km east of ore showing 2 in the center of the Hatan Suudal Mineralized Zone. The mineral showing is narrow and long, with an E-W orientation. The west end is at Lat. 42° 53'42"N and Long. 97° 44'38"E, and the east end is at Lat. 42° 53'42"N and Long. 97° 45'48"E. Elevations are around 1,500m and relatively flat in an E-W direction, but somewhat steep on the north side.

The mineralized ore showing is quartz vein zone with 60m~70m wide, which are developed in weakly altered Upper Silurian-Lower Devonian greenschist, sandstone, conglomerate, and tuff, can be traced roughly 2km E-W. There are 4~6 layers in the mineral

showing where zones of quartz veins dominate. These form several narrow, continuous ridges severalmeters high. But there is a lack of continuity in the quartz veins; frequently they are oblique to small sharp hills. Samples of nos. 67~71 were taken from the northernmost side, where quartz veins are relativelyclosely spaced, there being several quartz veins arranged horizontally over 5~6m. Chalcopyrite, pyrite, and malachite are visible to the nakedeye in part of the widest (60cm wide) of these veins. Iron sulfide minerals are not seen in quartz veins outside of this northern zone and, on the whole, mineralization is weak.

The results of chemical analysis of five samples taken from quartz veins showed only a gold value of 0.039g/t for the largest quartz vein zone on the north side, while values for all other quartz veins were below the detective limits. The possibility of a large-scale, high-gradegold occurrces at this ore showing is interpreted to be low.

(14) MS-Taliin Meltes (571**)

The survey area is located at the southern border of Govialtai Aimag, about 40km north of the border with China.

According to available existing data, this gold mineralization zone were discovered in 1986 by Y.N.Podkolzin in a survey known as the Mineral Resources Survey of Mongolia and is belonged in the Taliin Meltes-Hatan Suudal mineralized district of Tomortiin Nuruu metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of the southern megablock that is the main geotectonic unit of Mongolia.

The local geology is built up entirely of greenschist, sandstone, and silicified siltstone of the Devonian Ekhiin Golin Group, which is intruded by granites of the Late Devonian~Early Carboniferous Altai Complex, as well as rhyolite, andesite, basalt, and micropegmatite dikes. The Ekhiin Golin Group strikes N40° E and dips 70° ~90° with nearly vertical dips being prevalent.

Zones of quartz veins several meters high are scattered on the plains. These are distinguished as the Western District; a silicified zone, and 5km east of this, the Eastern District; a zone of quartz veins.

The center of the Western District is located at Lat. 42° 58'50"N and Long. 96° 34'20"E, in plains with elevations of 1,300m~1,400m. This area is located about 7km south-southeast of the Taliin Meltes springwater pond; the confluence of streams which flow out of the surrounding hills and mountains.

The quartz veins have selectively formed continuous 5m~30m widezones of altered sandstone, and beresite in Middle Devonian greenschist. These are distributed horizontally or en echelon over an area 3km long E-W and 1 km wide N-S, with WNW-ESE veins being dominant. Individual quartz veins are 5cm~50cm wide and 10m~100m long, and are accompanied by limonite, hematite, and pyrite. However, the concentration of quartz veins is somewhat sparse in comparison to the Hatan Suudal Mineralized Zone (refer to Fig. 23-(1)).

The center of the Eastern District is located at Lat. 42° 59'20"N and Long. 96° 37'30"E, about 6km east of the Taliin Meltes springwater pond.

The local geology consists of greenschist, sandstone, and silicified siltstone of the Middle Devonian Ekhiin Golin Group. Andesite dikes are also seen. Quartz veins form small hills in greenschist and sandstone in an area 5km long E-W and 2km wide N-S. The small hills are fromseveral meters to several tens of meters wide and from several tens of meters to 200

meters long. As shown in Fig. 23-(2), quartz veins in individual small hills form lenses less than one meter wide and lacking continuity. Quartz veins are mainly oriented NW-SE and WNW-ESE, but on the whole are continuous NW-SE. In addition to limonite and hematite, pyrite, chalcopyrite, and malachite are seen in individual quartz veins, but on the whole, mineralization is weak. Siderite was recognized by the browncolor of the host rock near quartz veins. In addition to andesite dikes,sandstone layers from several cm to one meter thick, and accompanied by pyrite are occasionally seen in the greenschist. These are oblique to the schistosity of the metamorphic rocks.

In this survey, samples of the alteration minerals accompanying the quartz veins and the host rock of the quartz veins (altered sandstone and beresite) were taken. The chemical analysis were carried out on 31 samples; 18 from the Western District and 13 from the Eastern District. Maximum gold and silver values were seen in the Eastern District, but the values were low; 0.155g/t of gold and 1.7g/t of silver. Copper and mercury values were somewhat high in the Eastern District; 578ppm and 780ppb respectively. The results of x-ray diffraction examination of samples from near the quartz veins showed albite, chlorite, sericite, and calcite. As interpreted microscopically, most of the beresitization of thegreenschist and sandstone is chloritization and sericitization from dolerite dikes.

As recorded in available existing data (Podkolzin, et al., 1986, Eastern District not surveyed), maximum grades for the quartz veins are 20g/t for both gold and silver, but analytical results for samples taken at this time to be representative of the whole area, show gold mineralization of the Taliin Meltes District to be generally weak. However, since there is a 3' southward shift between this survey are and the Western District of Podkolzin, 1986, it is possible that another gold mineralized zone occurs 5km south of here.

(15) MS--572** (Hadad gun hudag, refer to Fig. 24)

This survey area is located near the southeast border of Govialtai Aimag and the eastern border of Govialtai Aimag with Bayanhongor Aimag, at Lat. 44° 08'20"N and Long. 97° 49'23"E, about 280km south-southeast of Altai, the capital of Govialtai Aimag, and 330km southeast of Bayanhongor, the capital of Bayanhongor Aimag.

The mineral showings are in a region of flat hills with elevations of around 1,700m in the plains that run from southern to central Mongolia, and on the southern slopes of mountains which are passed for 12 to 13 km by the road that runs from Hadad gun hudag District. Discovery ofthis district dates back 100 years to the period of administration by the Ching dynasty of China.

According to existing data, this area is belonged in the Edrengiin mineralized district of Edrengiin Nuruu metallogenic zone of south Mongolian metallogenic province in the late Caledonian to variscan fold belt of thesouthern megablock that is the main geotectonic unit of Mongolia.

The local geology consists of propylitized andesitic volcanics, with scattered small quartz veins. Part of a completed prospect trench can be seen in what is believed to be the largest of the quartz veins. The trench is oriented N75° E, is about 100m long and is 2.5m deep at its deepest point. The quartz vein averages from 20~30cm wide, is 2.5m wide at its widest point: a mineralized alteration zone with visible chalcopyrite, pyrite, and malachite, accompanied by brecciation. There is somewhat weak sericitization at the contact between the quartz vein and