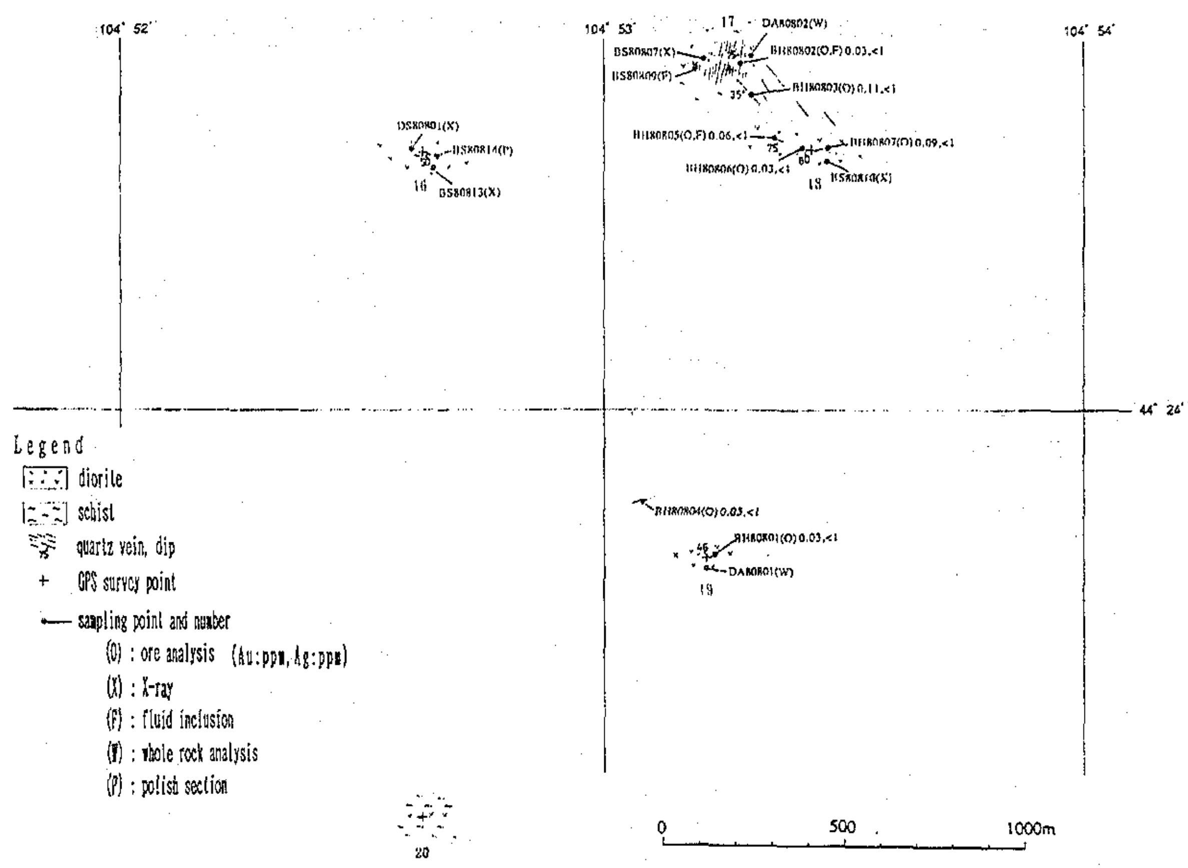


Fig. II-1-12 Geologic map of ore-showings No. 16~20 (Bayan Bor Nuruu)

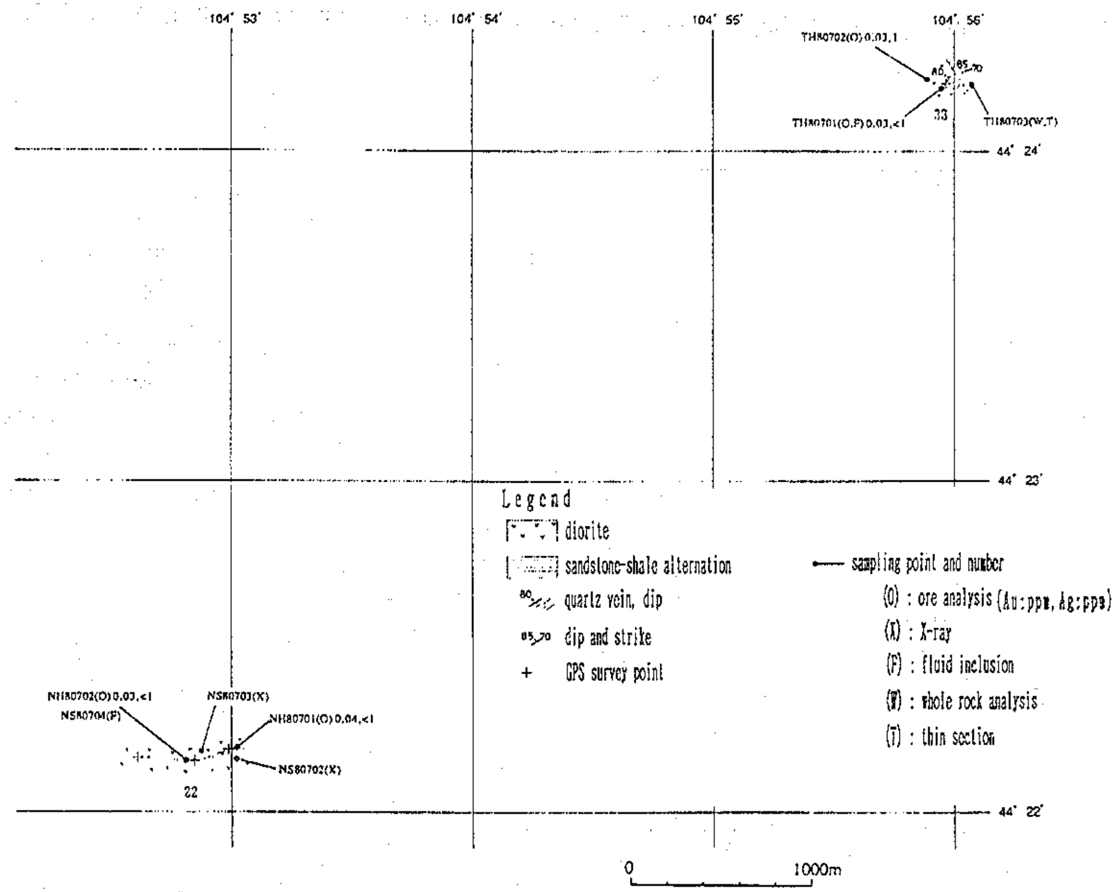


Fig. II-1-13 Geologic map of ore-showings No. 22, No. 33 (Treshinii)

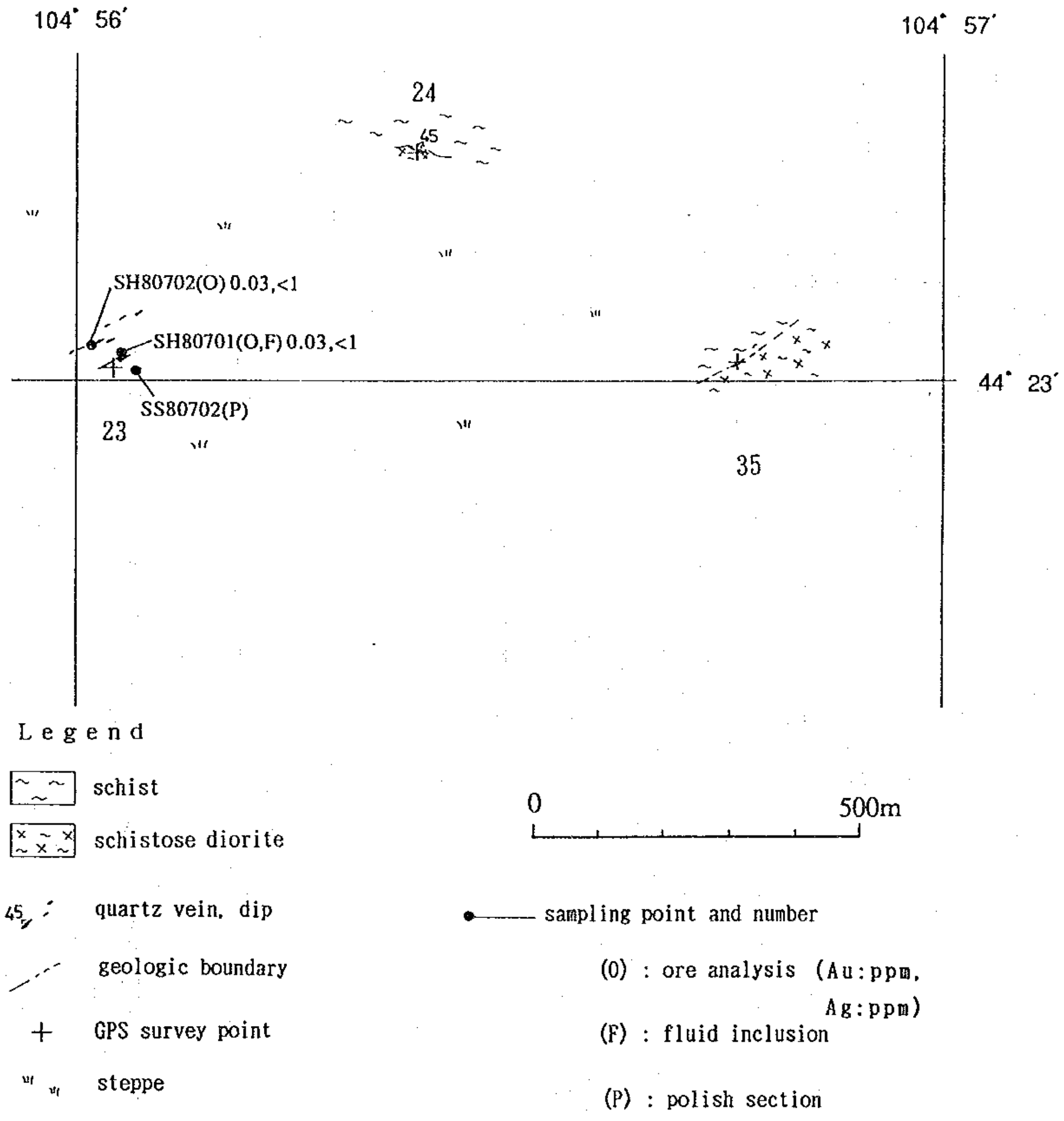


Fig. II-1-14 Goologic map of ore-showings No. 23, No. 24 and No. 35

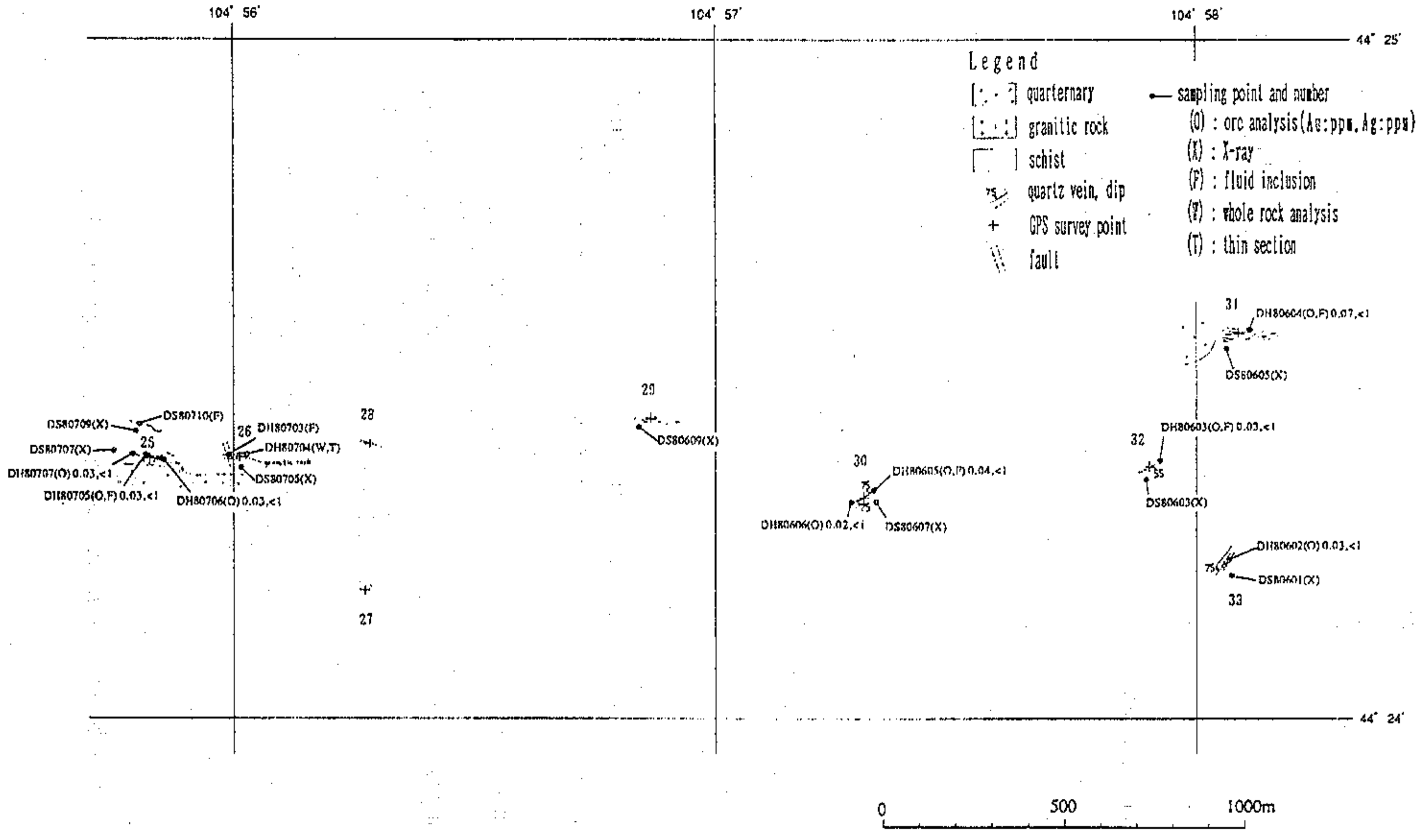


Fig. II-1-15 Geologic map of ore-showings No. 25～33 (Reperney)

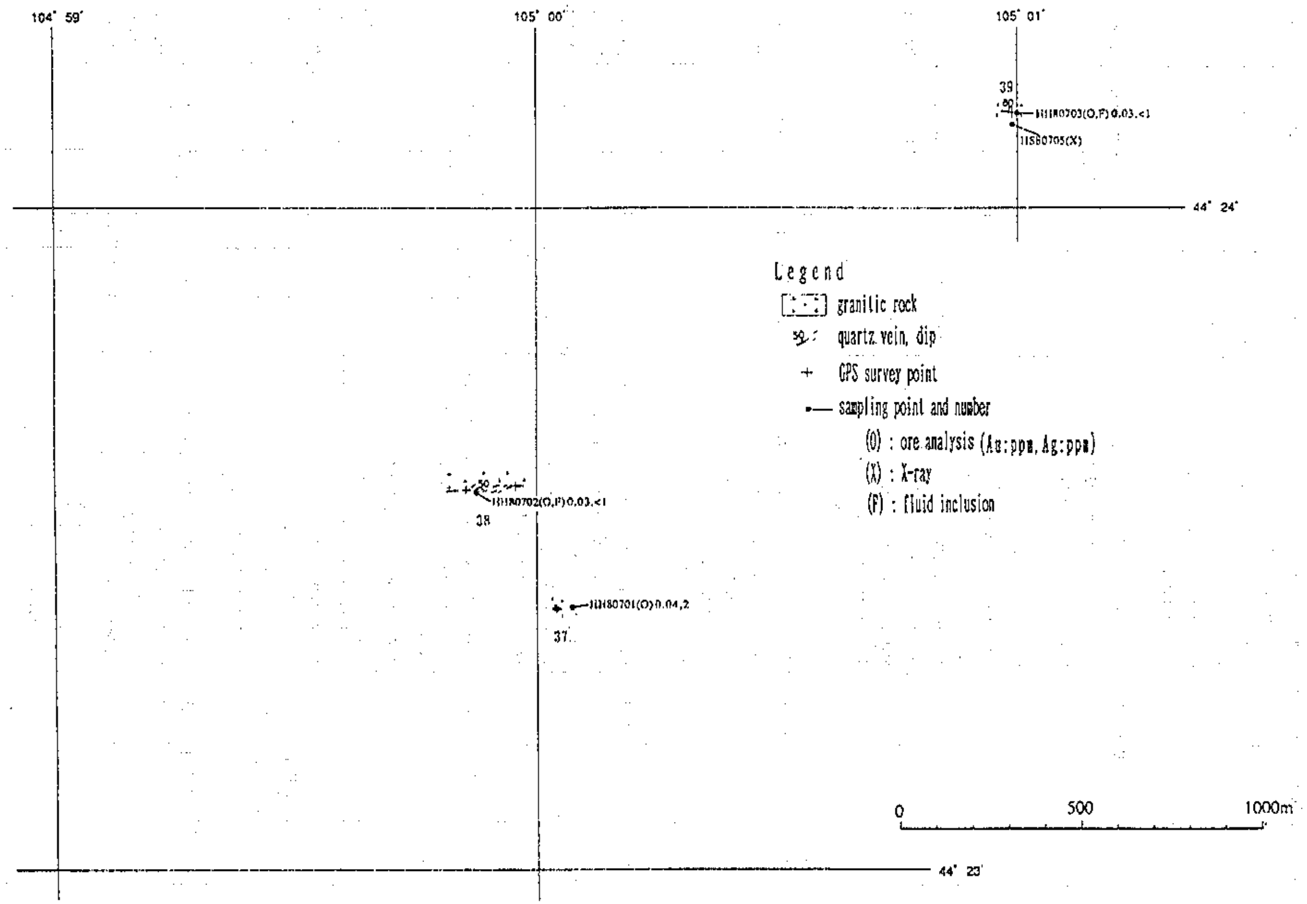


Fig. Ⅱ-1-16 Geologic map of ore-showings No. 37～39 (Haraat Shand)

Table Ⅱ-1-5 Ore-showings in the Dugshih area(1)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Ag(g/t)	pcs	Filling Temp ℃	Alteration type	Remarks
16		Au	Qz-v	104°52'38"	44°24'22"	Five quartz veins are seen in the area of 30m×80m. vein size Max. 0.6 m×25m Milky white quartz contains small amount of pyrite, pyrrhotite and chalcopyrite.	micro diorite	0.03 ~ 0.09	0.4	2	-	(Qz-chl)	Strike: N50°W-N80°W, dip: 50°-75°S
17	Bayan Bor Nuruu	Au	Qz-v	104°53'16"	44°24'29"	quartz vein swarm vein size Max. 0.4 m×120 m vein zone: EW 120 m×NS 140m milky white mono quartz 23~25 veins / section average width: 0.15 m	diorite	0.03	0.4	2	120~320 Av. 203	Qz-ser-chl-pl	Strike: N30°-50°E, dip: 50°-80°W
18	Bayan Bor Nuruu (eastern extension)	Au	Qz-v	104°53'26"	44°24'23"	More than ten milky mono-quartz veins are seen in the area of EW 500m×NS 200m. Maximum size of a vein is 0.7 m wide × 80 m long.	diorite, schist	0.06	0.6	1	-	Qz-chl-cal-pl	Strike: N50°-80°W, dip: 75°-80°SW
19		Au	Qz-v	104°53'13"	44°23'47"	Three quartz veins are distributed in the area of 30m×40m. Milky white vein quartz is disseminated by small amount of pyrite.	diorite	0.03	0.6	1	-	(Qz-chl)	Strike: N80°E, dip: 46°N
20		Au	Qz-v	104°52'40"	44°23'24"	quartz vein swarm formed at the contact of diorite and psammitic schist vein size: Max. 0.7 m×15 m vein zone: EW 60m×NS 30 m	diorite and schist	0.03	0.4	1	-	(Qz-chl)	Strike: N80°W, dip: 90°? Three vein zones are recognized.
21		Au	Qz-v	104°52'04"	44°22'35"	milky white chalcedonic quartz vein at the contact of diorite and schist vein size: Max. 0.3 m×4.5 m	diorite and schist	-	-	-	-	(Qz-chl)	Strike: N75°W, dip: 30°S
22	Ulanu Nuur (eastern extension)	Au	Qz-v	104°52'12" ~ 104°52'46"	44°22'12" ~ 44°22'21"	More than ten milky white quartz veins are seen in the area of EW 800m×NS 100m. Maximum size of a vein is 1.5 m wide × 100m long.	micro diorite andesite	0.03 ~ 0.04	0.4 ~ 0.6	2	-	Qz-chl-pl	Strike: N70°-80°E, dip: 10°-75°S epi-chl alt. no sulfide
23	Sultin Rudag (eastern extension)	Au	Qz-v	104°56'03"	44°23'01"	More than five milky white quartz veins are seen in the area of EW 200m×NS 200m. Maximum size of a vein is 2 m wide × 30 m long. This area is completely covered by alluvial deposits.	not obvious	0.03	0.4	2	129~289 Av. 165	?	Strike: N70°E, EW, dip: steep pyrite and goethite are visible
24		Au	Qz-v	104°56'23"	44°23'11"	milky white chalcedonic quartz veins in the diorite rock body vein size: Max. 0.3 m×10m vein zone: Max. 10m×30m	diorite	-	-	-	-	Qz-chl	Strike: N70°W, dip: 45°N

Table Ⅱ-1- 5 Ore-showings in the Dugshih area(2)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Coodinate Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Assay Ag(g/t)	Assay pcs	Filling Temp ℃	Alteration type	Remarks
25	Reperny	Au	Qz-v	104°55′50″	44°24′23″	quartz vein swarm formed at the contact of diorite and psammitic schist vein size: Max. 4.2 m×88m vein zone: EW 140 m×NS 100m	diorite and schist	0.03	0.4	3	139~354 Av. 249	Qz-ser-cal pl	Strike: N85°W, dip: 35°-60°N There are two vein zones and four trenches applied to them.
26		Au	Qz-v	104°56′01″	44°24′23″	milky white chalcedonic quartz veins scattered in the diorite rock body vein size: Max. 1.8 m×15m vein zone: Max. 50m×150 m More than twelve small veins are seen in two vein zones.	diorite					Qz-Ser	Strike: N70°-85E°, dip: 75°-80°N
27		Au	Qz-v	104°56′16″	44°24′12″	Six semi-transparent mono-quartz veins are sporadically seen in pelitic mica schist. vein size: Max. 0.5 m×3 m vein zone: Max. 30m×40m	diorite	—	—	—	—	(Qz-Ser)	Strike: N10°W, dip: ?
28		Au	Qz-v	104°56′17″	44°24′24″	milky white chalcedonic quartz vein zone in sericite schist vein size: Max. 0.3 m×5 m vein zone: Max. 3 m×65m about ten small quartz veins	sericite schist	—	—	—	—	(Qz-Ser)	Strike: N70°W, dip: ?
29		Au	Qz-v	104°56′52″	44°24′26″	quartz vein swarm formed in the pelitic schist vein size: Max. 0.3 m×5 m vein zone: Max. 25m×150 m	pelitic schist	—	—	—	—	Qz-chl-pl	Strike: N77°W, dip: 85°N
30		Au	Qz-v	104°57′13″	44°24′19″	milky white chalcedonic mono-quartz vein in the diorite rock body vein size: Max. 1.8 m×80m	diorite	0.02 ~ 0.04	0.4 ~ 0.6	2	142~204 Av.174	Qz-ser-cal	combination of two veins N55°E,75-90°N ×N70°E, 75°S
31		Au	Qz-v	104°58′05″	44°24′34″	parallel quartz veins in psammitic schist vein size: Max. 0.5 m×80m vein zone: Max. 50m×200 m Wesern end of the zone is covered by colluvial deposit. average vein ratio≦ 10 %	diorite	0.07	0.4	1	162~343 Av.252	Qz-ser-chl-pl	Strike: N80°W, dip: 75°-90°S
32		Au	Qz-v	104°57′54″	44°24′22″	milky white chalcedonic quartz vein zone in sericite schist vein size: Max. 0.1 m×10m vein zone: Max. 3 m×60m	sericite schist, diorite	0.03	0.6	1	101~301 Av. 182	Qz-chl-pl	Strike: N80°E, dip: 45S, Strike: N55°E, dip: 55S
33		Au	Qz-v	104°58′03″	44°24′14″	four parallel quartz veins in diorite rock body vein size: Max. 3 m×80 m vein zone: Max. 50m×80 m milky white mono quartz	diorite	0.03	0.4	1	130~292 Av. 196	Qz-Ser-chl-cal-pl	Strike: N45°E, dip: 75°NW

Table Ⅱ-1- 5 Ore-showings in the Dugshih area(3)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate		Characteristics and Size	Host Rock	Assay			Filling Temp ℃	Alteration type	Remarks
				Longitude	Latitude			Au(g/t)	Ag(g/t)	pcs			
34	Treshinil	Au	Qz-v	104°55′59″	44°24′12″	ten to eleven parallel quartz veins in the diorite rock body milky white mono-quartz vein size: Max. 0.6 m×30m vein zone: Max. 50m×30m	diorite	0.03	0.6 ~ 1.3	2	151~329 Av. 238	Qz-pl	Strike: N20°E. dip: 60°~80°W
35		Au	Qz-v	104°56′41″	44°23′01″	three quartz veins along the boundary between diorite and psammitic schist vein size: Max. 0.3 m×10m vein zone: Max. 40m	diorite	–	–	–	–	(Qz-ser)	Strike: N63°E. dip: 35°N
36		Au	Qz-v	104°57′14″	44°23′10″	Three quartz veins are seen in the area of 20m×70m. vein size Max. 0.6 m×20m Milky white mono quartz	micro diorite	–	–	–		(epi-chl)	strike: N75°E. dip: 90°
37	Baraat Shand	Au	Qz-v	105°00′02″	44°23′24″	quartz vein swarm vein size Max. 0.5m×30m vein zone: EW 20m×NS 30 m milky white mono quartz 10 veins / section average width: 0.2 m	diorite	0.04	1.5	1	–	(Qz-ser)	strike: N25°W. dip: 75°SW
38		Au	Qz-v	104°59′55″	44°23′35″	Five parallel milky mono-quartz veins are seen in the area of EW 100m× NS 20m. Maximum size of a vein is 3 m wide × 40 m long.	diorite (schistose)	0.03	0.4	1	154~325 Av. 243	(Qz-ser)	strike: N70°~85°E. dip: 45°~85°NW
39		Au	Qz-v	105°00′59″	44°24′08″	milky white mono quartz vein zone vein size Max. 1m×35m vein zone:NS 100m× EW 1000m	diorite (schistose)	0.03	0.4	1	149~392 Av. 251	Qz-cal	strike: N80°W. dip: 80°N
40	Dersen Us Hudag	Au	Qz-v	104°46′51″	44°30′46″	milky white mono quartz veins vein size Max. 5m×150 m vein zone:NS 100m× EW 1000m	schist (pelitic)	0.03	< 0.3 ~ 2.5	2	110~262 Av. 199	ser-chl	strike: N60°W. dip: 60°NE~90° Mn Oxide bering
41		Au	Qz-v, sil-r, alt clay	104°46′16″	44°30′30″	white clay zone with pyrite-rich silicified rock and fragments of milky white chalcedonic vein quartz size of alteration zone: EW ≧100 m× NS ≧300 m	schist	0.03 ~ 0.04	< 0.3 ~ 2.7	4	–	Qz-ka-ser	Strike: N15°W, dip: 90°? Hot spring type
42	Ayagch	Au	Qz-v	105°03′23″	44°32′50″	milky white chalcedonic quartz vein with silicified rock single vein. mono-quartz vein size: Max. 8 m×300 m average width 1 ~2 m	syenite	0.03	0.4	1	139~319 Av. 212	–	Strike: N70°W, dip: 90°?

formation of the northwestern part of the area and the latter, massive silicified rocks, occur in the eastern rim of the uplifted Paleozoic block in the northwestern part of the area associated with extensive white argillization and pyritization alteration.

Quartz veins are grouped into two; E–W system containing most of the quartz veins of the area (Repernii, Haraat Shand and others) and N–S system of parallel veins such as Bayan Bor Nuruu and Treshinii. These quartz veins are extensively distributed but, judging from economical point of view, a size of each quartz vein is small and concentration of veins are scarce. Alteration zone of white argillization and pyritization accompanied with a massive silicified rock is quite extensive with a size of more than 150 m width and extension of more than 400 m in N15°W direction.

Homogenization temperature of fluid inclusion of quartz veins is more than 200°C and some specimen showed boiling phenomena of ore forming fluid.

Alteration is characterized by chlorite–sericite facies.

Assay values of 32 samples are rather low grade; gold 0.11 g/t and less, silver 3 g/t and less.

The results of the survey are summarized in the Table II–1–5.

1-3-5 Onh area

1. Geology (Ref. Fig. II–1–17)

The area is located in the north of CMTL. Geology of the area is composed of, in ascending order, Siluro–Devonian (S–D), Devonian (D_1a, D_1b, D_1g) and Cretaceous (K). Paleozoic formations occupy the central part of the area forming an E–W elongated uplifted block.

Siluro–Devonian (S–D) is composed of dark green colored andesitic volcanic products. The formation crops ont as a small body in the northern rim of the uplifted block.

Devonian (D_1a) crops out in the central part of the area constituting an axial part of the uplifted block. The formation is composed of phyllite ~ crystalline schists derived from alternated sandstone, siltstone and mudstone. The formation is folded with its axis of E–W ~ N70°E.

Devonian (D_1b) is overlying Dia and distributed in the central part of the area surrounding D_1a. The formation is composed of phyllite ~ crystalline schists derived from alternated sandstone, siltstone and mudstone, and limestone.

Devonian (D_1g) crops out in the western part of the area and is medium ~ coarse–*grained as dikes with elongation of E–W direction.*

Cretaceous (K) is composed of weakly solidified conglomerate, sandstone and mudstone. The formation is deposited abutting on Paleozoic uplifted block and is widely distributed both in southern and northern parts of the area forming flat topography.

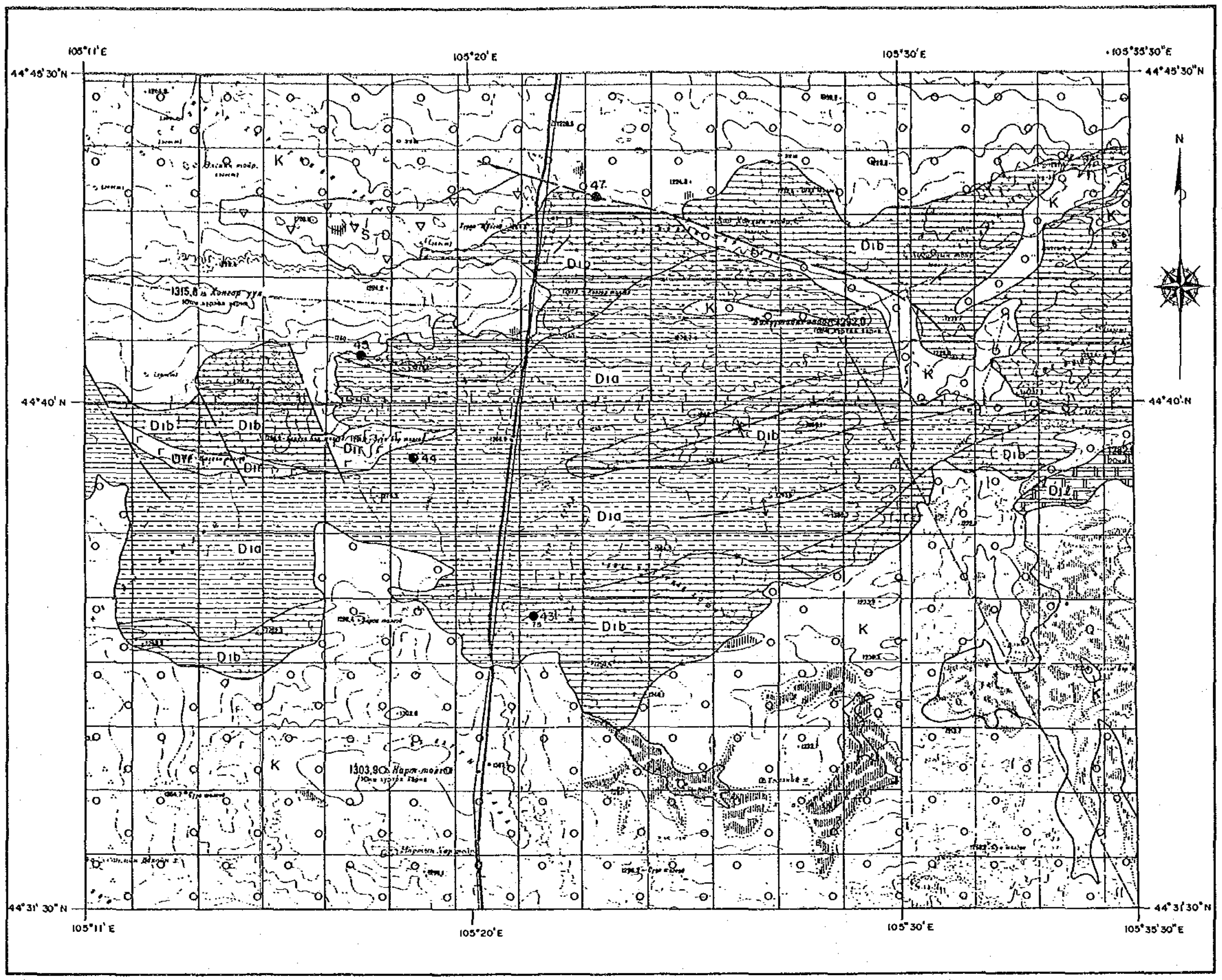
2. Ore deposits and mineral indications

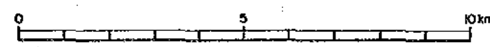
Mineral indications are mainly quartz veins and their distribution is limited within the uplifted Paleozoic formations in the central part of the area. Vein system is divided into two groups; E–W system such as Onh and North Onh and N30°–60°E system found as small scale veins in the northern part of the area. Whole the veins except North Onh are small size and concentration of veins are sporadic.

Homogenization temperature of fluid inclusion of quartz veins varies from below 200°C at west to 220° ~ 340°C at east of the area.

As wall rock alteration, quartz–sericite facies predominates.

Chemical analysis of 13 ore samples show gold value of 0.04 g/t and below and silver 2 g/t and below.

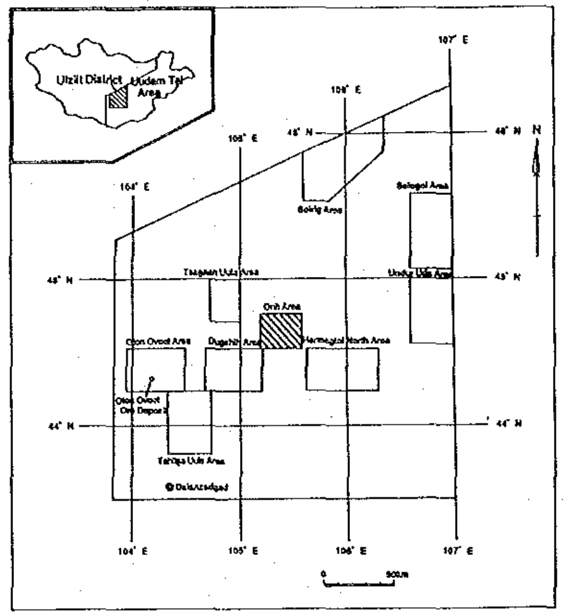




PL. II－1－6

MINERAL EXPLORATION
IN
THE UUDAM TAL AREA, MONGOLIA (PHASE II)

Geologic Map of the Onh Area



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JANUARY 1993

LEGEND

Geologic Age	Geologic Unit	Symbol	Rock Types
Quaternary	Q		sand, gravel, loam
Tertiary	Tv		olivine basalt
Cretaceous	K		sandstone, siltstone, conglomerate, limestone, coal
Jurassic-Cretaceous	J-K		conglomerate, siltstone, sandstone
	J-Kv		basalt, trachybasalt-trachyandesite, trachyte
Jurassic	J		conglomerate, siltstone, sandstone
	Jv		trachyte-dacite, trachyrhyolite
Permian	P		*trachyte, andesite, trachyandesite, dacite, tuff*
Carboniferous-Permian	C-P		basalt, trachyandesite, andesite, tuff, conglomerate
Carboniferous	C		sandstone, siltstone, conglomerate, mudstone
Devonian-Carboniferous	D-C		tuffaceous conglomerate, sandstone, siltstone
Devonian	*D2ℓ*		*limestone*
	D2		basalt, trachybasalt, andesite, dacite, rhyolite, tuff
	D1ℓ		limestone
	D1b		sandstone, shale, siltstone
	D1a		shale, siltstone, sandstone

Geologic Age	Geologic Unit	Symbol	Rock Types
Silurian-Devonian	S-Dℓ		limestone
	S-D		dacite, rhyolite, andesite, tuff, phyllite, shale
Silurian	S		sandstone, siltstone, shale, phyllite
Undifferentiated Paleozoic	PZ		sandstone, siltstone, clayey shale
Ripheian	Rℓ		recrystallized limestone
	R2		quartzite, phyllite, siltstone, sandstone, amphibolite
	R1-2		shale, amphibolite, quartzite, phyllite, gneiss
Intrusive Rocks	e		granodiorite porphyry
	d		*diorite, microdiorite, diorite porphyry*
	Pg		granite, granosyenite
	Pr		rhyolite, quartz porphyry
	C-Pg		granite, granodiorite, granosyenite, diorite
	D2g		granite, granodiorite
	D2d		diorite, gabbro
	D1r		rhyolite, dacite

● ore showing

Symbol	Meaning
	unit name and boundary
	strike and dip directon
	anticline
	syncline
	fault
	inferred fault
	thrust fault

Fig. II-1-17 Geologic map of the Onh area

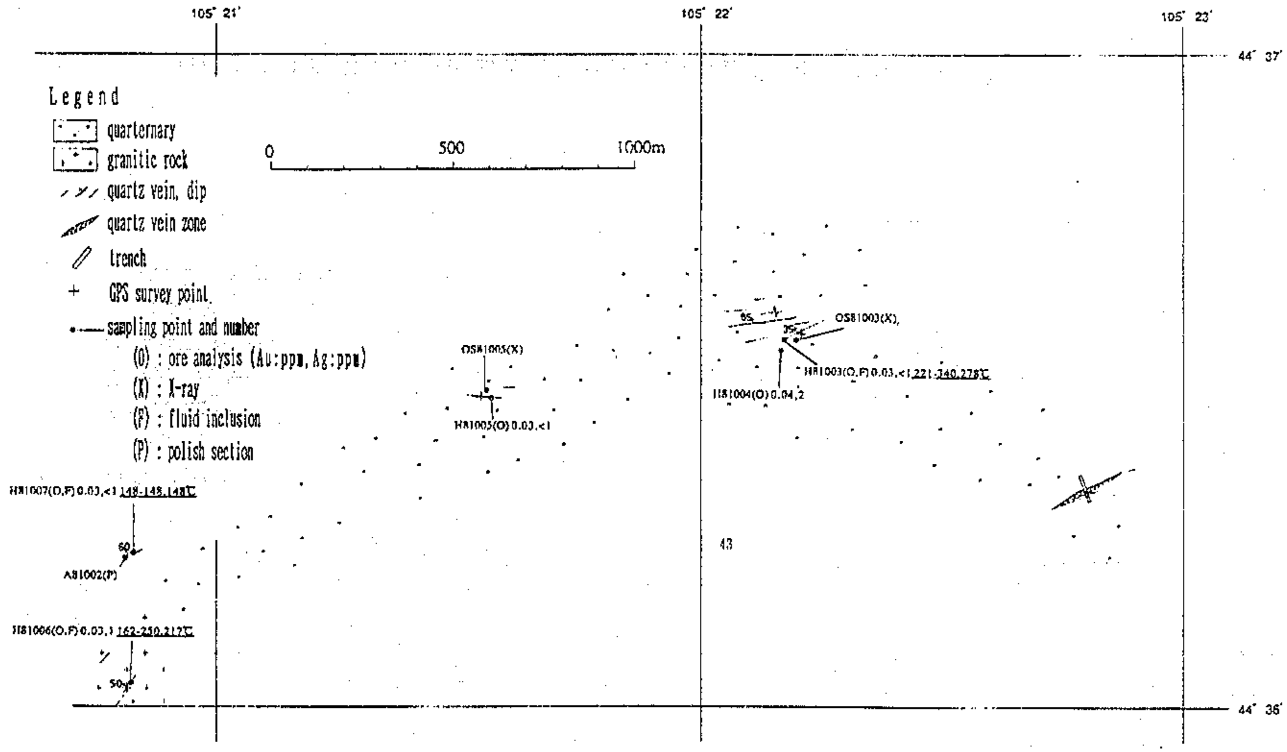


Fig. II-1-18 Geologic map of ore-showing No. 43 (Onh)

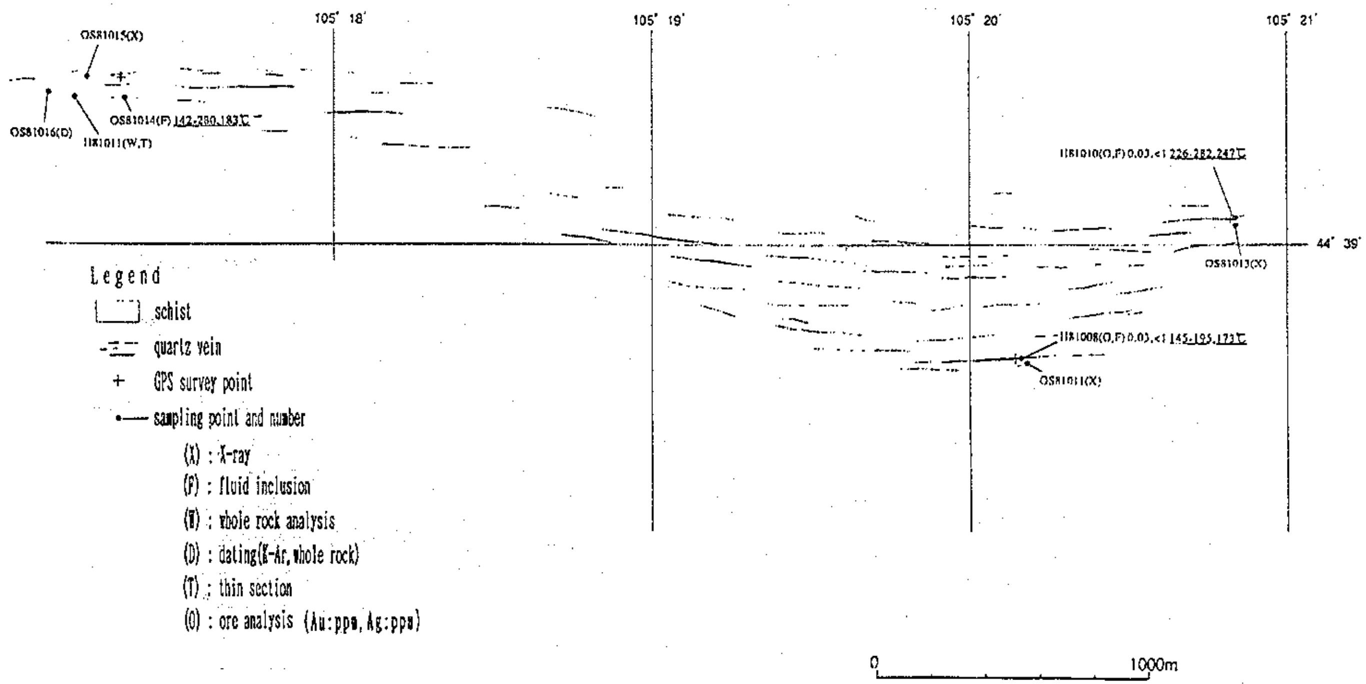


Fig. II-1-19 Geologic map of ore-showing No. 44 (North Onh)

Table Ⅱ-1- 6 Ore-showings in the Onh area

No.	Name of deposit	Mineral	Type of Deposit	Coodinate		Characteristics and Size	Host Rock	Assay			Filling Temp ℃	Alteration type	Remarks
				Longitude	Latitude			Au(g/t)	Ag(g/t)	pcs			
43	Onh	Au	Qz-v	105°22′12″ ~ 105°20′50″	44°36′32″ ~ 44°36′14″	Many quartz veins are scattered in the area of 3,000 m × 1,000 m. vein size Max. 1m wide, 50 ~ 200 m long This area is mostly covered by colluvial deposit and dune sand	schist(S_2 - D_1), granite rhyolite and gabbro	0.03 ~ 0.04	< 0.3 ~ 1.7	7	148~340 Av. 244	Qz-ser-cal-pl	strike: N60°~80°E. dip: 35°NW~90°
44	North Onh	Au	Qz-v	105°20′08″ ~ 105°17′13″	44°38′45″ ~ 44°39′23″	parallel quartz vein swarm vein size Max. 2.0m×150 m vein zone: EW 3,500 m×NS 500 m milky white mono quartz veins run every 10~20m intervals	schist(S_2 - D_1)	0.03	< 0.3 ~ 0.6	3	142~282 Av. 212	Qz-ser-cal-pl	strike: E-W. dip: steeply dipping to the north or south
45		Au	Qz-v	105°17′26″	44°40′46″	parallel quartz veins quartz veins are seen in the area of EW 800m× NS 100 m. Maximum size of a vein is 4 m wide × 80 m long.	gry ser sch (S_2 -D_1)	0.03	< 0.3	1	182~305 Av. 257	Qz-ser-chl-pl	strike: N70°W dip: 85°S
46		Au	Qz-v	105°18′12″	44°41′03″	milky white mono quartz vein (amethyst bearing) vein size Max. 0.5 m×8 m	schist (S_2 - D_1)	0.03	0.4	1	–	–	strike: N70°E. dip: 90°
47		Au	Qz-v.	105°22′55″	44°43′24″	milky white chalcedonic quartz veins aligned along the border line between tal and hilly zone vein size Max. 1m×2 m vein zone 100 m long	trachy-andesite (J ,)	0.03	< 0.3	1	–	Qz-talc	strike: N70°W. dip: vertical

The results are summarized in the Table II-1-6.

1-3-6 Soirig area

1. Geology (Ref. Fig. II-1-20)

The area is located in the northern part of CMTL with distribution of igneous rocks of Late Paleozoic to Mesozoic age, especially rich in Mesozoic volcanics. Geology of the area is composed of, in ascending order, Middle-Upper Carboniferous (C_{2-3}), Permian (P_{1-2}), Upper Permian (P_2), Triassic-Jurassic ($T-J_{1-2}$), Jurassic (J_2), Lower Cretaceous (K_1) and Upper Cretaceous (K_2).

Middle-Upper Carboniferous (C_{2-3}) is composed of crystalline schists derived from sandstone, siltstone and mudstone and it crops out as a small exposure in the northeastern part of the area.

Permian (P_{1-2}) spreads widely from centeral to southern part of the area and is composed of bluish grey crystalline derived from sandstone and siltstone.

Upper Permian (P_2) is distributed in the centeral and eastern parts of the area and is made of alkali granite.

Triassic-Jurassic ($T-J_{1-2}$) is composed of granite, granodiorite and diorite and shows as small exposures in the southwestern and northwestern parts of the area.

Jurassic (J_2) is distributed near Ongan Tsagaan Tolgoi in the southern part of the area and is made of dark grey colored andesite.

Lower Cretaceous (K_1) crops out filling a tectonic basin extending NE-SW in the northwestern part of the area and the northeastern tip of the area. The formation is composed of weakly consolidated sandstone, shale and siltstone which form flatlying beds with intercalation of coal seams.

Upper Cretaceous (K_2) is exposed as a small distribution in the southeastern part of the area and is composed of weakly consolidated sandstone, shale and siltstone forming flatlying beds.

2. Ore deposits and mineral indications

Mineral indications are quartz veins and massive silicified rocks in the country rocks of granite, granodiorite and diorite of Permian to Jurassic ages and andesites of Jurassic age.

One of the characteristics of the mineralization is the scarcity of sulfide minerals.

Quartz veins of N60° ~ 80°E system predominate both in numbers and sizes. The biggest quartz vein is found at Zalaa Unl and the biggest massive silicified rock is at Munh Tsagaan Tolgoi. Quartz-sericite facies predominates as an alteration product.

Analysis of 20 samples gaves the highest gold value of 0.12 g/t at North Munh Tsagaan Tolgoi.

Homogenization temperature of fluid inclusion showed the highest 205°C at Munh Tiagaan Tolgoi and the rest of temperature were in the range of 120° ~ 190°C.

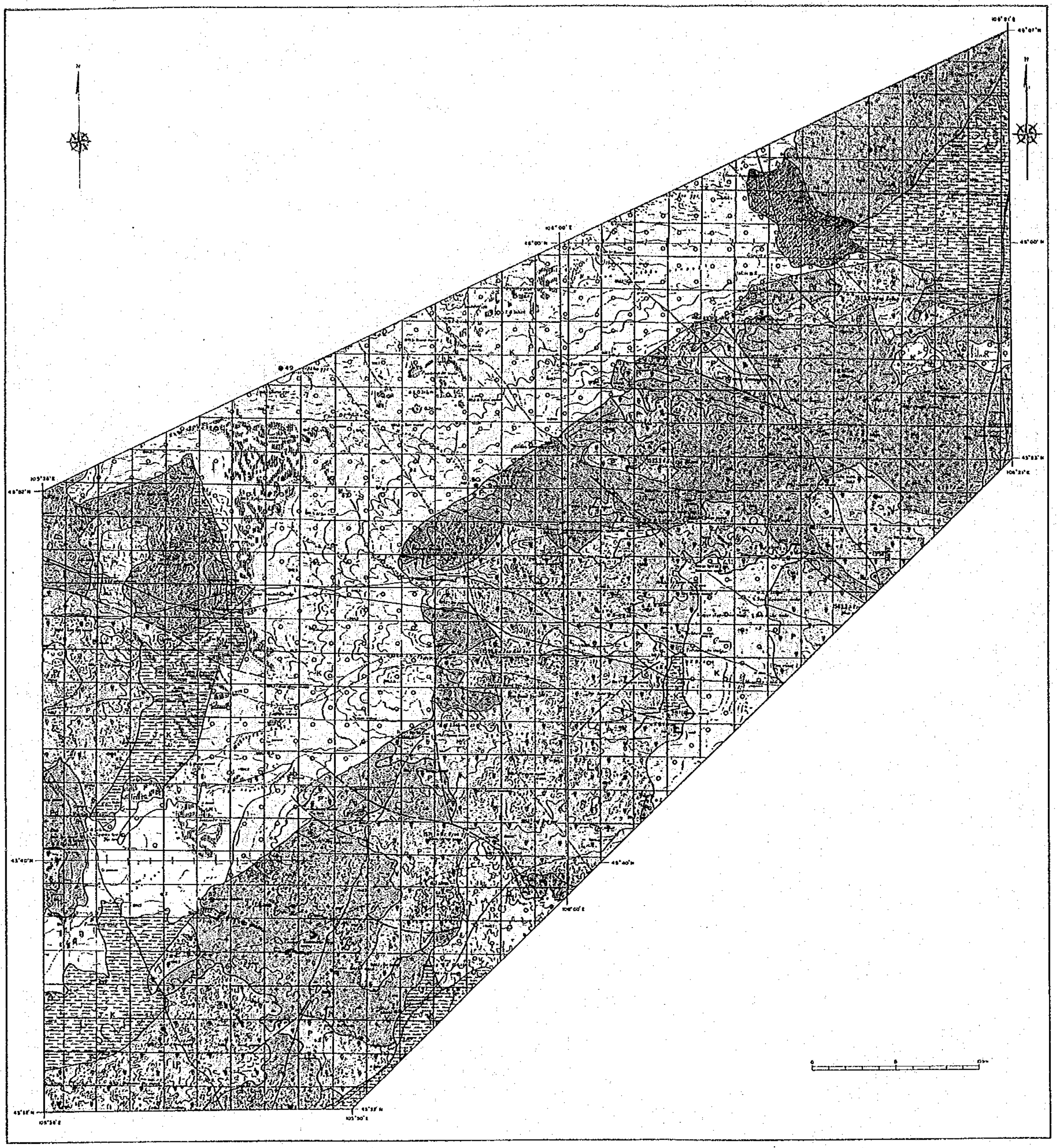
The survey results are shown in the Table II-1-7.

1-3-7 Sologoi area

1. Geology (Ref. Fig. II-1-25)

The area is located in the north of CMTL and rich in igneous rocks of Late Paleozoic to Mesozoic age.

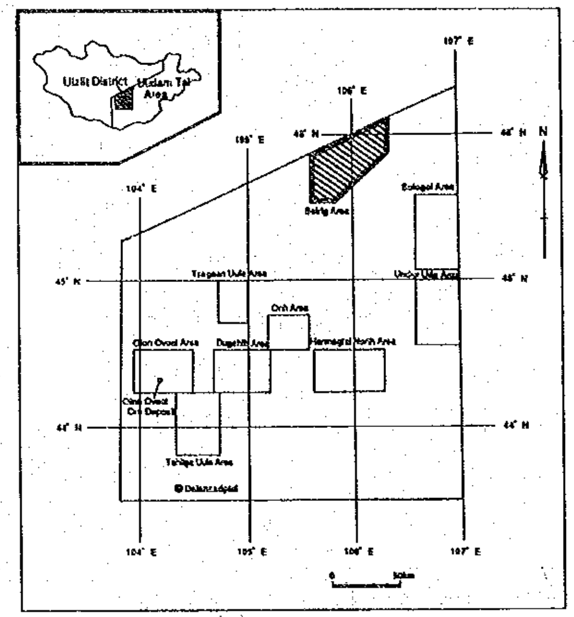
Geology is composed of, in ascending order, Vendian-Lower Cambrian ($V-Є_1$), Lower Paleozoic (PZ_1), Middle-Upper Carboniferous (C_{2-3}), Permian (P_1, P_{1-2}), Upper Permian-



PL. II－1－7

MINERAL EXPLORATION
IN
THE UUDAM TAL AREA, MONGOLIA (PHASE II)

Geologic Map of the Soirig Area



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JANUARY 1993

LEGEND

Geologic Age	Geologic Unit	Symbol	Rock Types
Quaternary	Q		sand, gravel, loam
Tertiary	Tv		olivine basalt
Cretaceous	K		sandstone, siltstone, conglomerate, limestone, coal
Jurassic-Cretaceous	J-K		conglomerate, siltstone, sandstone
	J-Kv		basalt, trachybasalt-trachyandesite, trachyte
Jurassic	J		conglomerate, siltstone, sandstone
	Jv		trachyte-dacite, trachyrhyolite
Permian	P		trachyte, andesite, trachyandesite, dacite, tuff
Carboniferous-Permian	C-P		basalt, trachyandesite, andesite, tuff, conglomerate
Carboniferous	C		sandstone, siltstone, conglomerate, mudstone
Devonian-Carboniferous	D-C		tuffaceous conglomerate, sandstone, siltstone
Devonian	D2l		limestone
	D2		basalt, trachybasalt, andesite, dacite, rhyolite, tuff
	D1l		limestone
	D1b		sandstone, shale, siltstone
	D1a		shale, siltstone, sandstone
Silurian-Devonian	S-Dl		limestone
	S-D		dacite, rhyolite, andesite, tuff, phyllite, shale
Silurian	S		sandstone, siltstone, shale, phyllite
Undifferentiated Paleozoic	PZ		sandstone, siltstone, clayey shale
Ripheian	Rl		recrystallized limestone
	R2		quartzite, phyllite, siltstone, sandstone, amphibolite
	R1-2		shale, amphibolite, quartzite, phyllite, gneiss
Intrusive Rocks	e		granodiorite porphyry
	d		diorite, microdiorite, diorite porphyry
	Pγ		granite, granosyenite
	Pr		rhyolite, quartz porphyry
	C-Pγ		granite, granodiorite, granosyenite, diorite
	D2γ		granite, granodiorite
	D2d		diorite, gabbro
	D1r		rhyolite, dacite

● ore showing

	unit name and boundary
	strike and dip direction
	anticline
	syncline
	fault
	inferred fault
	thrust fault

Fig. II-1-20 Geologic map of the Soirig area

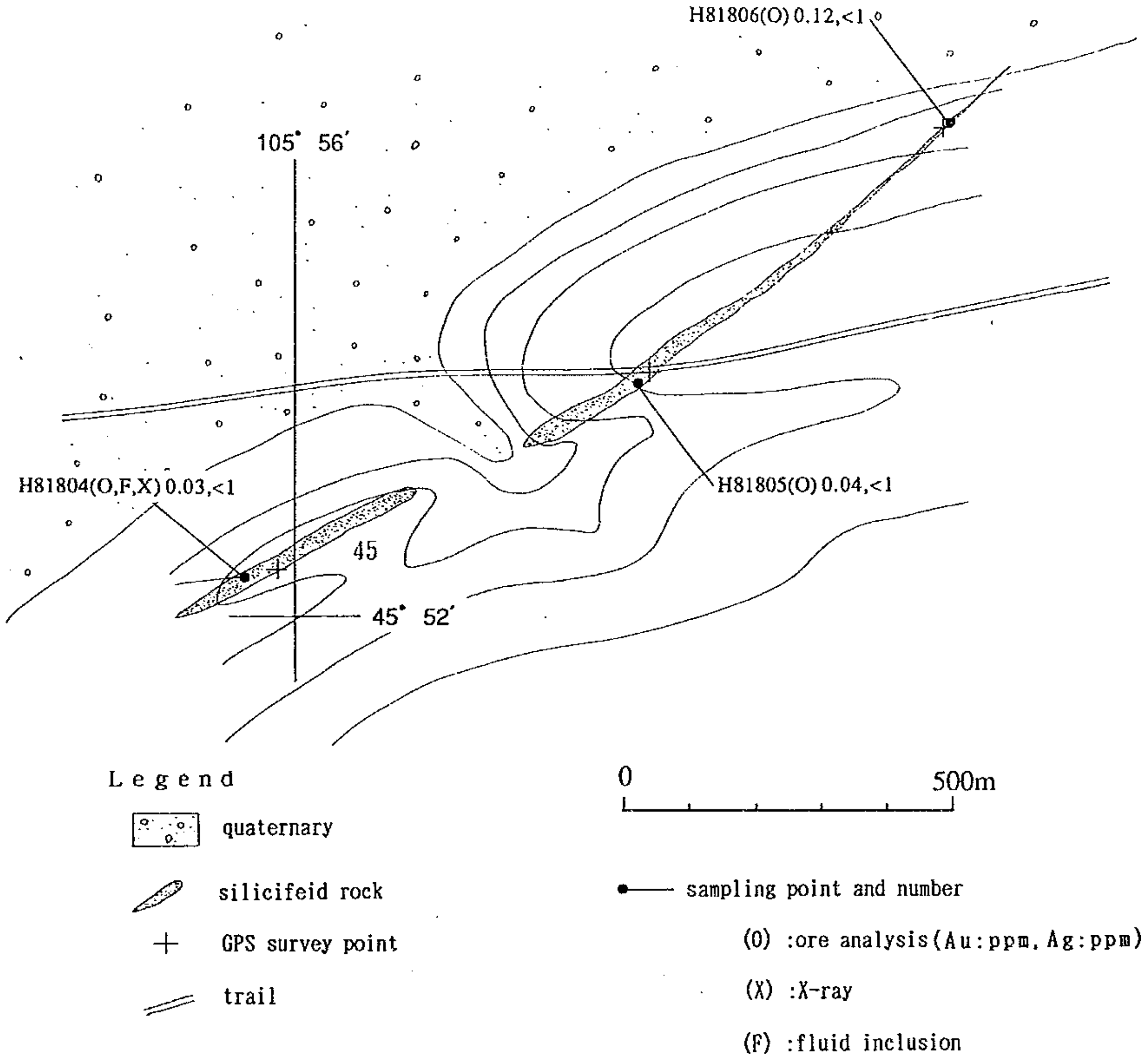


Fig. Ⅱ-1-21 Geologic map of ore-showing No. 50 (North Tsagaan Tolgoi)

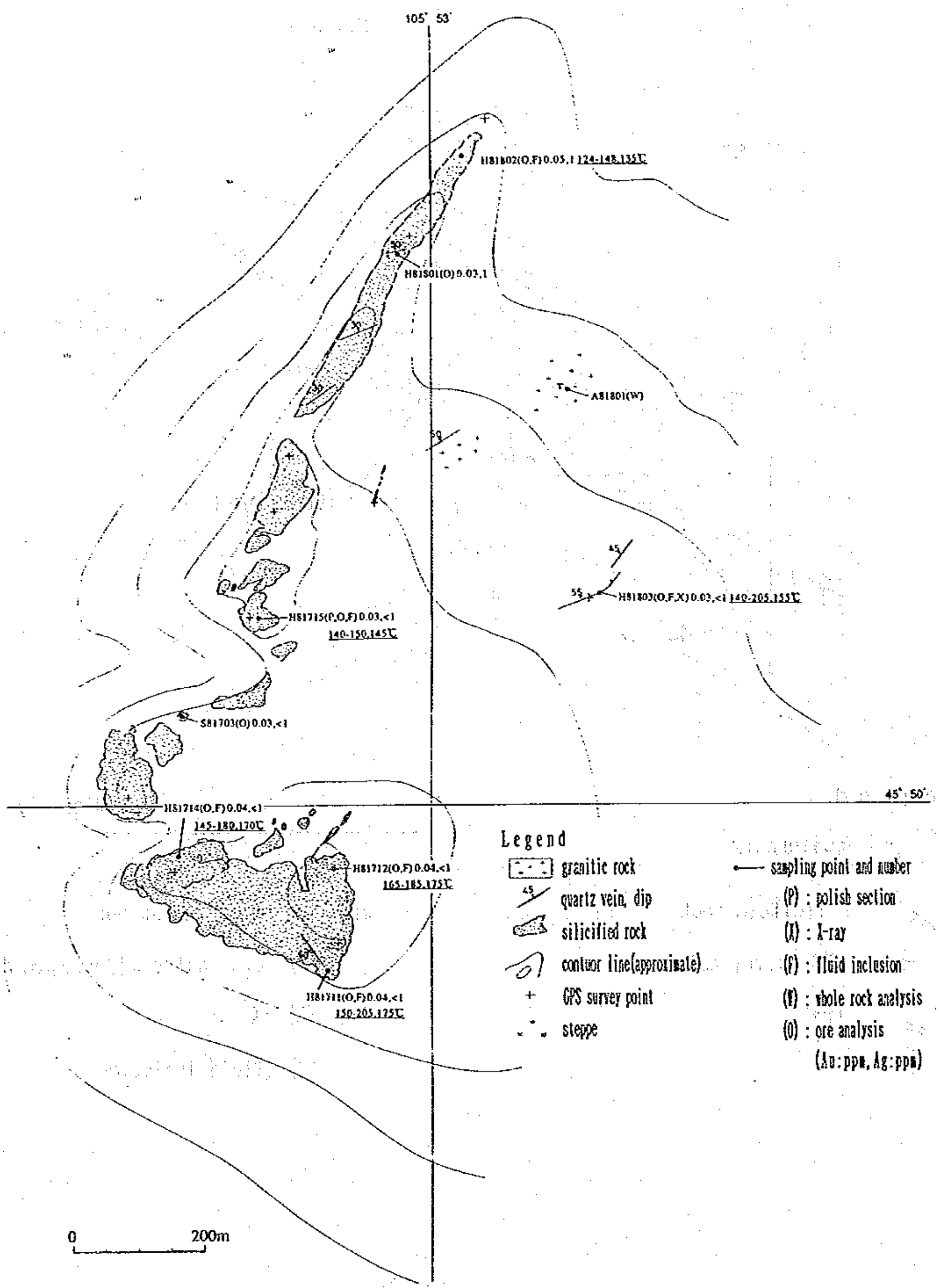


Fig. Ⅱ-1-22 Geologic map of ore-showing No.51 (Munh Tsagaan Tolgoi)

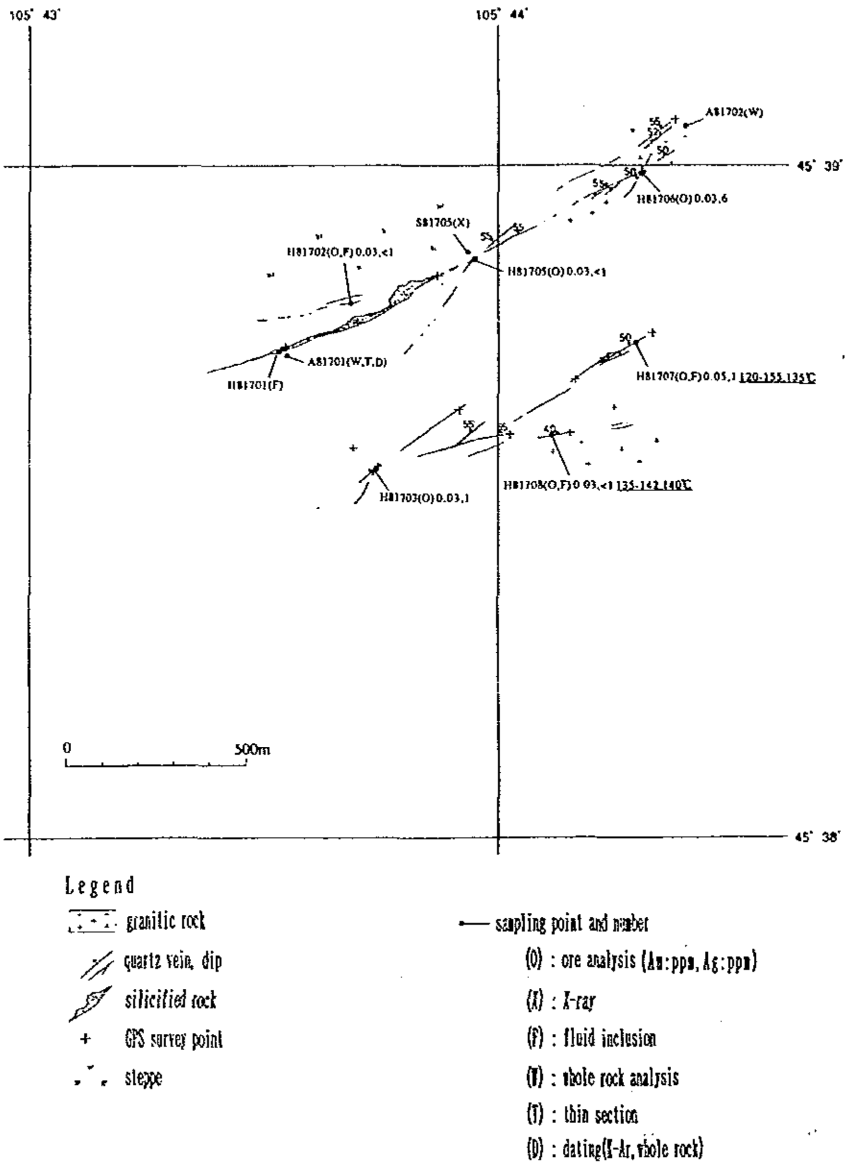


Fig. Ⅱ-1-23 Geologic map of ore-showing No. 52 (Zalaa Uul)

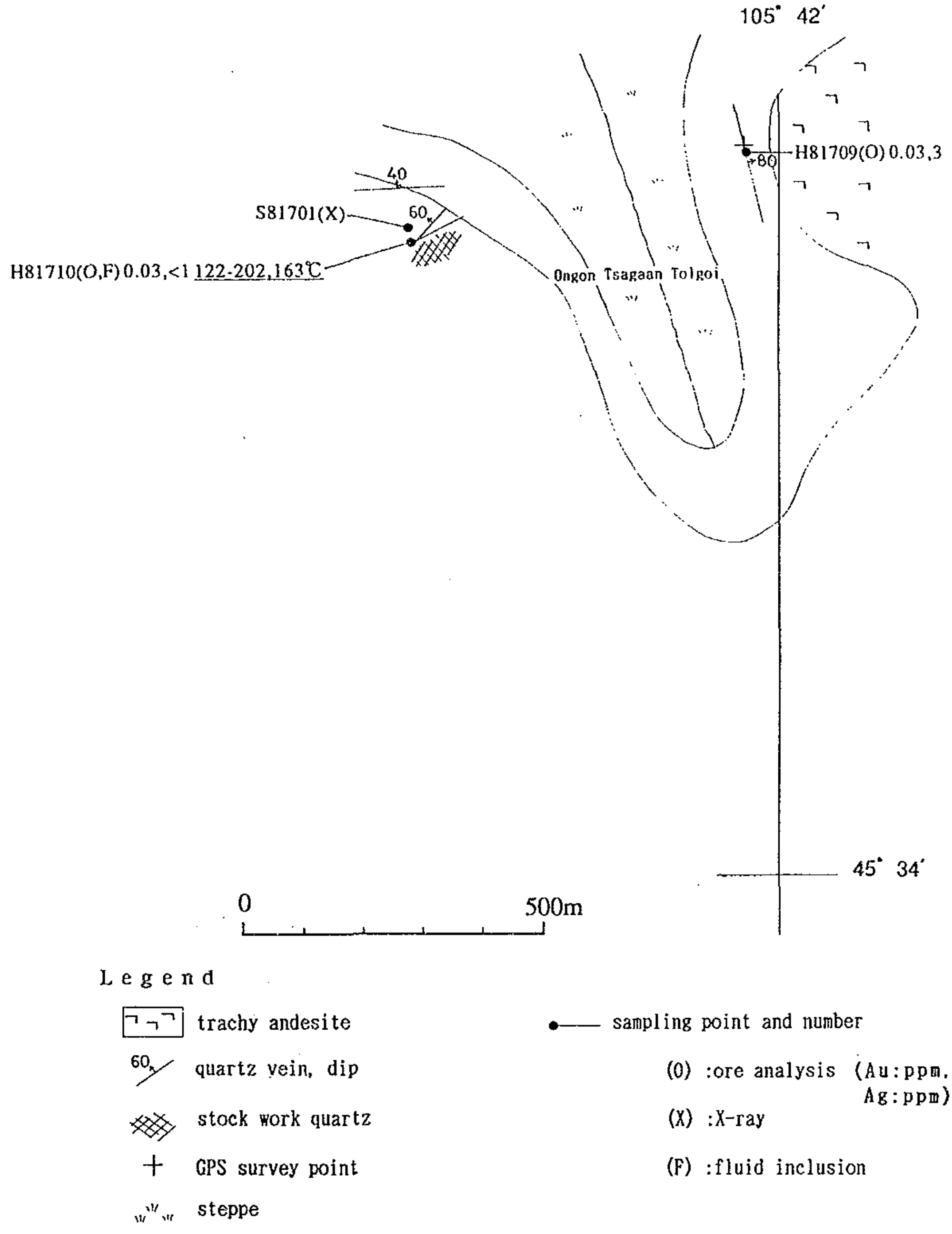


Fig. II-1-24 Geologic map of ore-showin No. 53 (Ongon Tsagaan Tolgoi)

Table II-1- 7 Ore-showings in the Soirig area

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Coodinate Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Assay Ag(g/t)	Assay pcs	Filling Temp ℃	Alteration type	Remarks
48		Cu	Skarn	105° 19' 18" ~ 105° 19' 29"	45° 43' 46" ~ 45° 44' 01"	magnetite-epidote-garnet skarn green copper bearing there are two ore showings ①four ore bodies, Max. 20 m× 50m, alignes N70 °E direction zone: 650 m× 80 m Cu<0.3% ②two ore bodies, Max. 20m× 20m, alignes N-S direction zone: 50m× 20 m Cu<0.3%	alkali-granite	–	–	–	–	epidote-garnet	strike: N70° E, N-S dip: ?
49		Au	Qz-v silicified zone	105° 47' 16"	45° 56' 00"	Four milky white quartz veins align N 65° W direction with silicified zone. Maximum size of a vein is 2 m wide × 15 m long. vein zone: 50 m long	gneissose-granite	–	–	–	–	(Qz-ser)	strike: N65° W dip: 65° SW
50	North Munh Tsagaan Tolgoi	Au	Qz-v	105° 55' 59" ~ 105° 56' 25"	45° 52' 02" ~ 45° 52' 12"	single quartz vein with silicified rock, mono-quartz Maximum size of the vein is 20m wide × 1,500m long.	granite	0.03 ~ 0.12	0.4 ~ 0.6	3	–	Qz-ser	strike: N50° E-N72° E dip: steeply to N?
51	Munh Tsagaan Tolgoi	Au	Qz-v	105° 52' 47"	45° 49' 53"	massive siliccified rock and milky white mono-quartz veins Max. size 400 m×1300m	granite	0.03 ~ 0.05	0.4 ~ 1.3	9	124~205 Av. 153	Qz-ser-K-fel	strike: N30° E-N70° E dip: 30 °-50 NW
52	Zalaa Uul	Au	Qz-v.	105° 43' 41" ~ 105° 44' 22"	45° 38' 35" ~ 45° 39' 04"	milky white quartz vein and massive silicified rock vein size Max. 20 m×1500m vein zone: 700m×1500m mono-quartz vein with hydro-fracturing	granite	0.03 ~ 0.05	0.6 ~ 5.7	6	119~202	Qz-ser-chl K-fel-pl	strike: N60° E-N85° E dip: 40° -55° N
53	Ongon Tsagaan Tolgoi	Au	Qz-v.	105° 41' 57" ~ 105° 41' 32"	45° 34' 49" ~ 45° 34' 34"	three milky white quartz veins and stockwork of quartz veinlets, partly silicified vein size Max. 2m×120 m vein zone: 300m×700 m mono-quartz vein with small amount of pyrite	trachy-andesite	0.03	0.6 ~ 2.7	2	122~202 Av. 163	Qz-Ser	strike: N10° W, N4 5° E, E-W dip: 80° E, 40° N, 60° NW
54		SiO_2	pegmatite	106° 14' 29"	46° 03' 03"	pegmatite quartz vein(milky white mono-quartz vein size: 1.5m×20m	granite	–	–	–	–	(K-feld)	strike: N80° E dip: 90° ?
55		SiO_2	pegmatite	106° 39' 41"	45° 55' 36"	massive pegmatite quartz size: 50m ×150m, 50m ×80m	granite	–	–	–	–	(K-feld)	elliptic shape area: 200m×200m
56		china clay	china clay	106° 55' 16"	45° 44' 19"	china clay deposit in lithoiditic welded tuff size: 50m ×100m class×3-4	lithoiditic welded tuff	–	–	–	–	(Qz-ser)	elliptic shape area: 400m×400m

Lower Triassic (P_2–T_1) and Cretaceous (K_1, K_2).

Vendian–Lower Cambrian (V–$Є_1$) is composed of gneiss and crystalline limestone and crops out in the northeastern to southwestern part of the area.

Lower Paleozoic (PZ_1) is composed of granodiorite and granite which intruded V–$Є_1$ and crops out widely in the central part of the area.

Middle–Upper Carboniferous is composed of granodiorite and granite which intruded the underlying formations and shows a small exposure in the central part of the area.

Permian crops out in the northern part of the area and is composed of trachyandesite, andesite and volcaniclastic rocks of the former two.

Upper Permian–Lower Triassic is composed of dark grey colored trachybasalt, trachyandesite and other volcanic rocks as small exposures in the southwestern part of the area.

Cretaceous (K_1, K_2) is composed of weakly consolidated sandstone, shale and siltstone which form flat–lying beds and K_1 crops out at the northeastern corner and K_2 in the southeastern part of the area.

2. Ore deposits and mineral indications

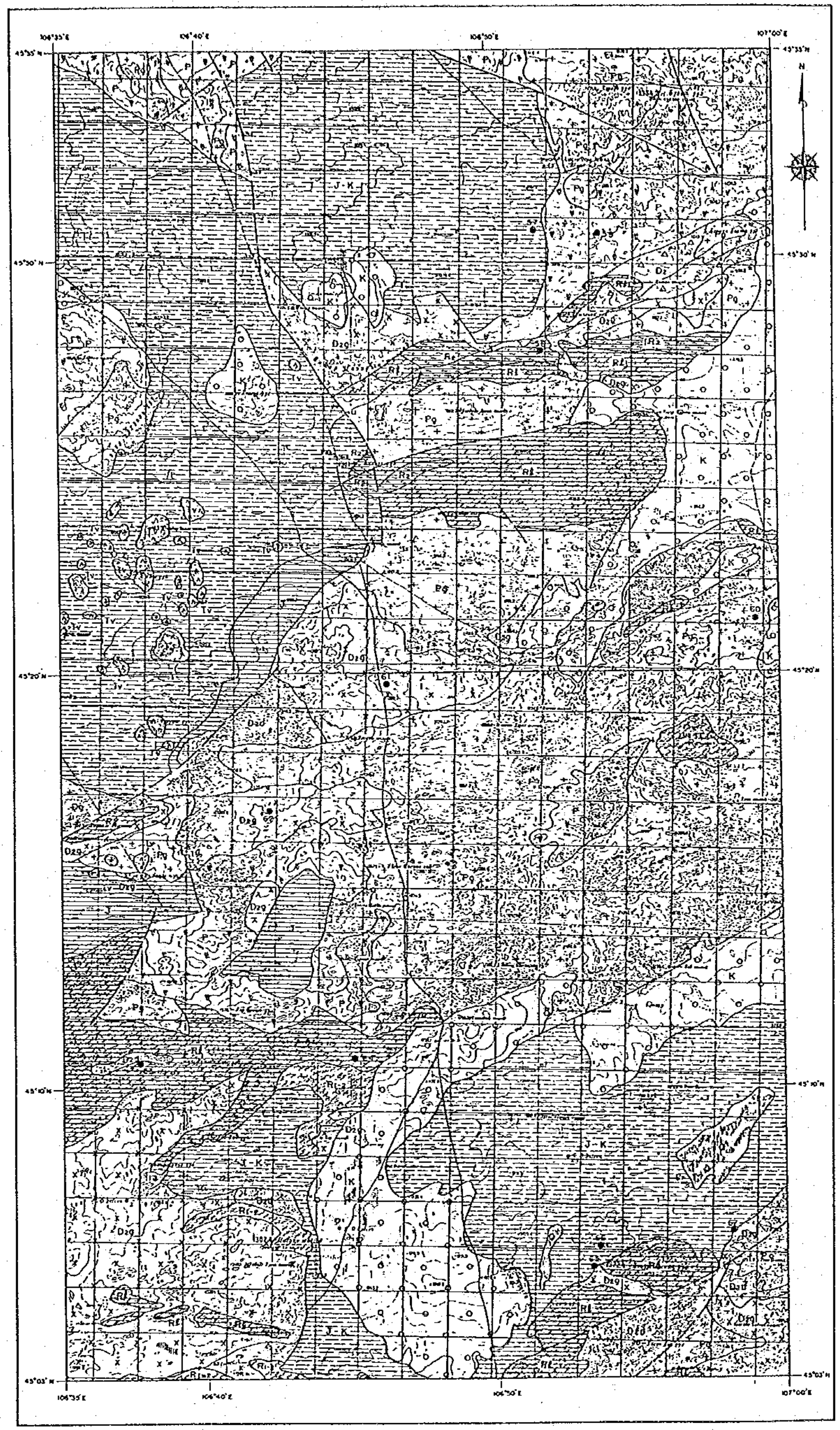
Mineralization occurred as form of quartz veins in the country rocks of Cambrian to Cretaceous age and massive silicified rocks in the country rock of Cretaceous (K_2). Both quartz veins and massive silicified rocks are big in size but lacking sulfide mineralization. As vein system of quartz veins predominates the direction of N60°–80°E. A massive silicified rock of Hetsuu Tsagaan Tolgoi in the southern part of the area is accompanied by siliceous and calcareous sinters indicating hot spring activity on the surface of the silicified rock.

As to alteration quartz–sericite facies predominates.

Homogenization temperature of fluid inclusion showed the highest 260°C at Futul Us and temperature ranges from 120° to 200°C for the most of the specimens.

Chemical analysis of 55 samples revealed the highest gold value of 0.46 g/t and silver 21.6 g/t at Morit

Survey results are shown in the Table II–1–8.



LEGEND

Geologic Age	Geologic Unit	Symbol	Rock Types
Quaternary	Q		sand, gravel, loam
Tertiary	Tv		olivine basalt
Cretaceous	K		sandstone, siltstone, conglomerate, limestone, coal
Jurassic-Cretaceous	J-K		conglomerate, siltstone, sandstone
	J-Kv		basalt, trachybasalt-trachyandesite, trachyte
Jurassic	J		conglomerate, siltstone, sandstone
	Jv		trachyte-dacite, trachyrhyolite
Permian	P		trachyte, andesite, trachyandesite, dacite, tuff
Carboniferous-Permian	C-P		basalt, trachyandesite, andesite, tuff, conglomerate
Carboniferous	C		sandstone, siltstone, conglomerate, mudstone
Devonian-Carboniferous	D-C		tuffaceous conglomerate, sandstone, siltstone
Devonian	D2ℓ		limestone
	D2		basalt, trachybasalt, andesite, dacite, rhyolite, tuff
	D1ℓ		limestone
	D1b		sandstone, shale, siltstone
	D1a		shale, siltstone, sandstone
Silurian-Devonian	S-Dℓ		limestone
	S-D		dacite, rhyolite, andesite, tuff, phyllite, shale
Silurian	S		sandstone, siltstone, shale, phyllite
Undifferentiated Paleozoic	PZ		sandstone, siltstone, clayey shale
Ripheian	Rℓ		recrystallized limestone
	R2		quartzite, phyllite, siltstone, sandstone, amphibolite
	R1-2		shale, amphibolite, quartzite, phyllite, gneiss
Intrusive Rocks	e		granodiorite porphyry
	d		diorite, microdiorite, diorite porphyry
	Pg		granite, granosyenite
	Pr		rhyolite, quartz porphyry
	C-Pg		granite, granodiorite, granosyenite, diorite
	D2g		granite, granodiorite
	D2d		diorite, gabbro
	D1r		rhyolite, dacite

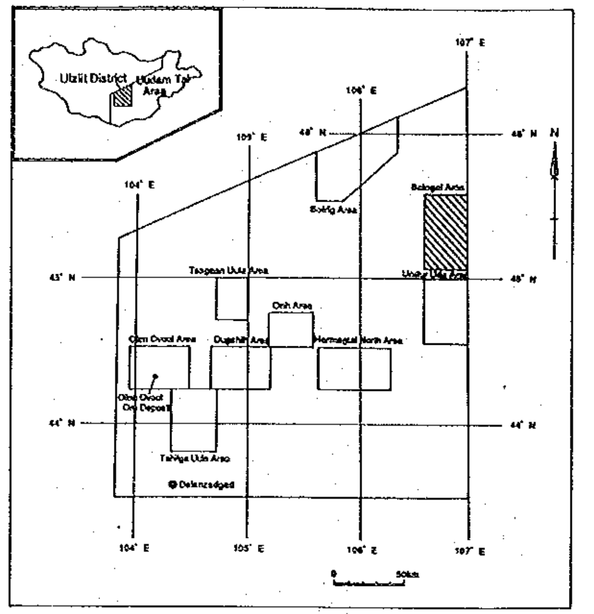
● ore showing

Symbol	Explanation
K	unit name and boundary
	strike and dip directon
	anticline
	syncline
	fault
	inferred fault
	thrust fault

PL. II－1－9

MINERAL EXPLORATION
IN
THE UUDAM TAL AREA, MONGOLIA (PHASE II)

Geologic Map of the Sologoi Area



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METAL MINING AGENCY OF JAPAN
JANUARY 1993

Fig. II-1-25 Geologic map of the Sologoi area

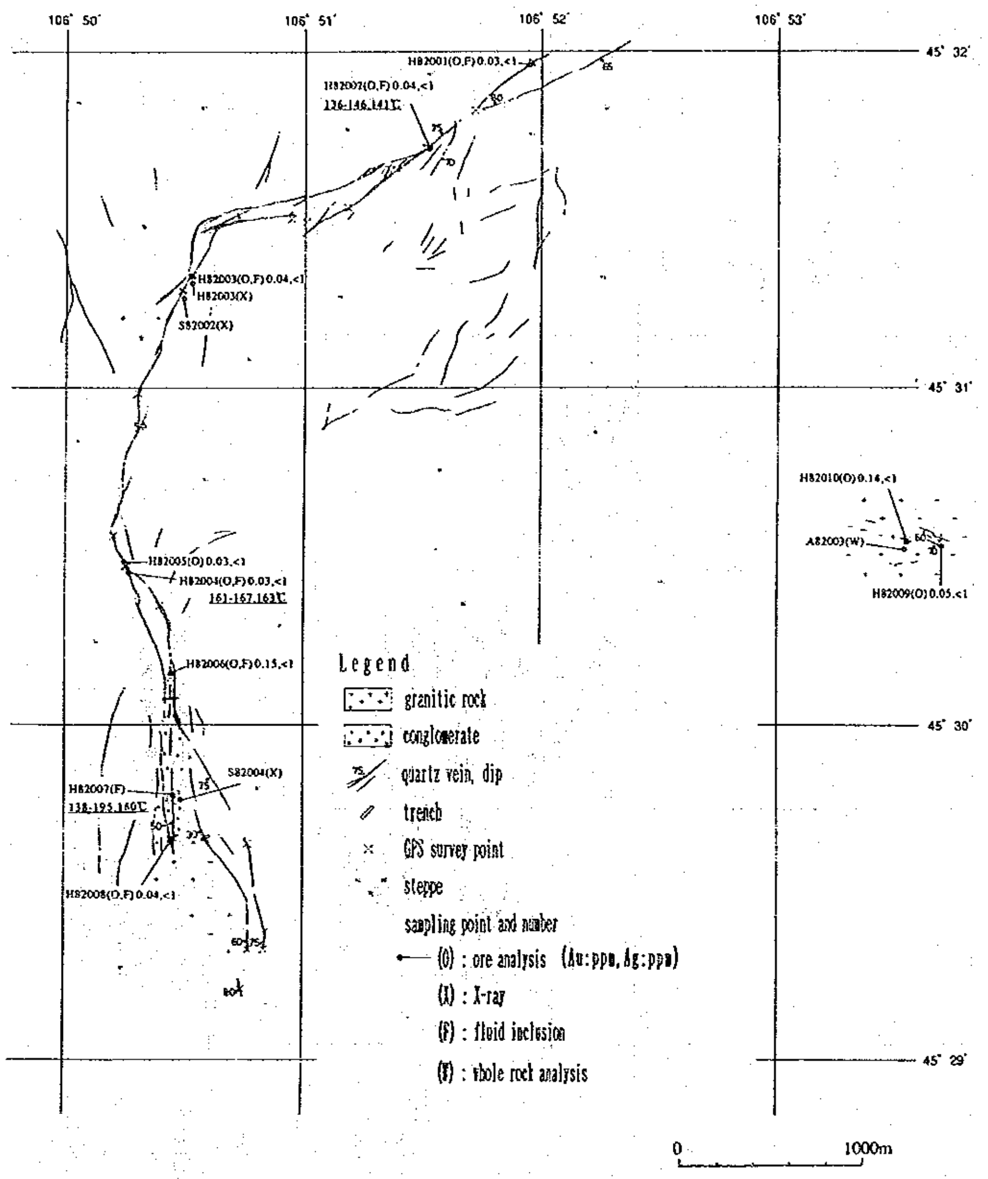


Fig. II-1-26 Geologic map of ore-showing No. 57 (Dersen Us Hudag)

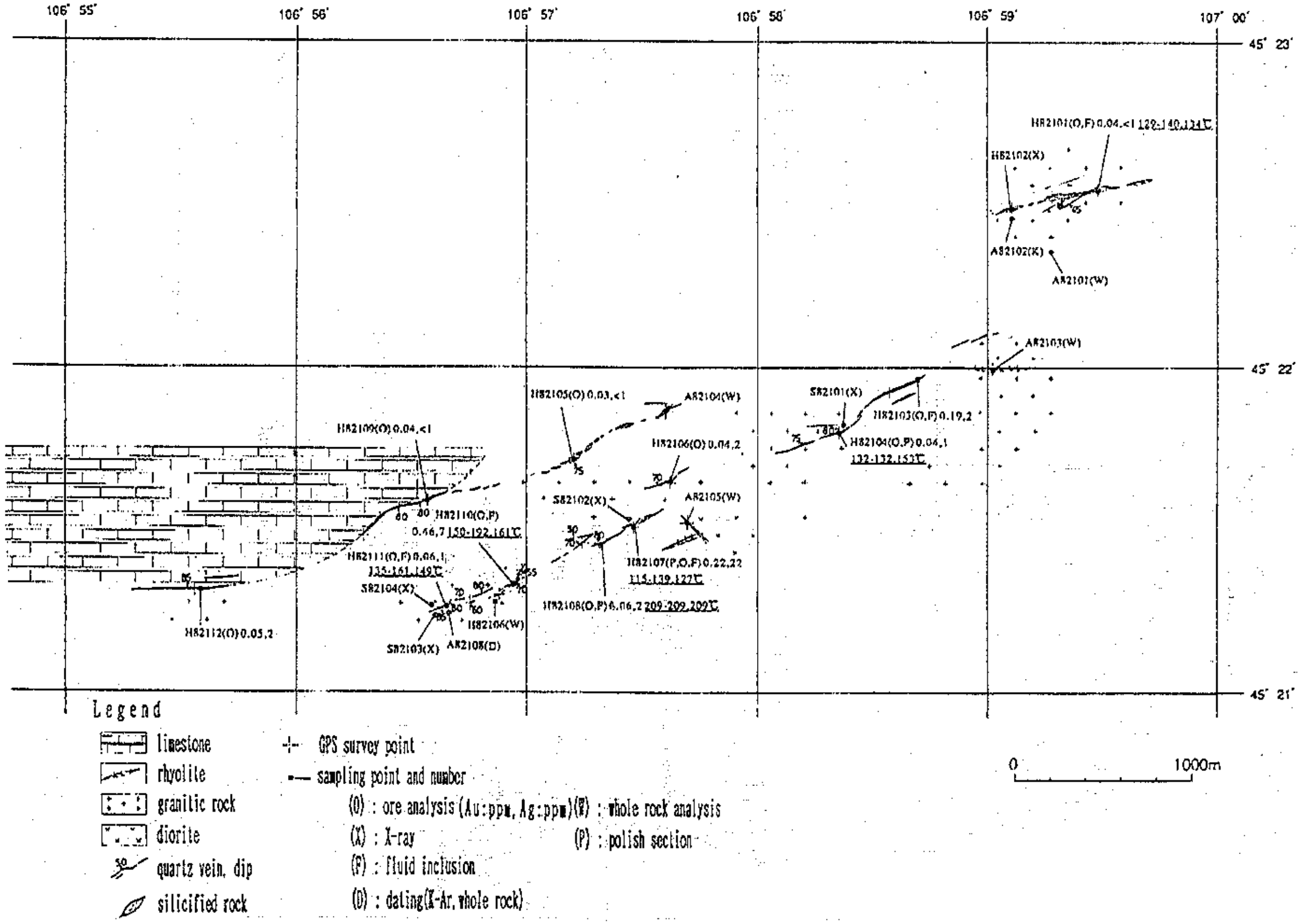


Fig. II-1-27 Geologic map of ore-showing No. 60 (Morit)

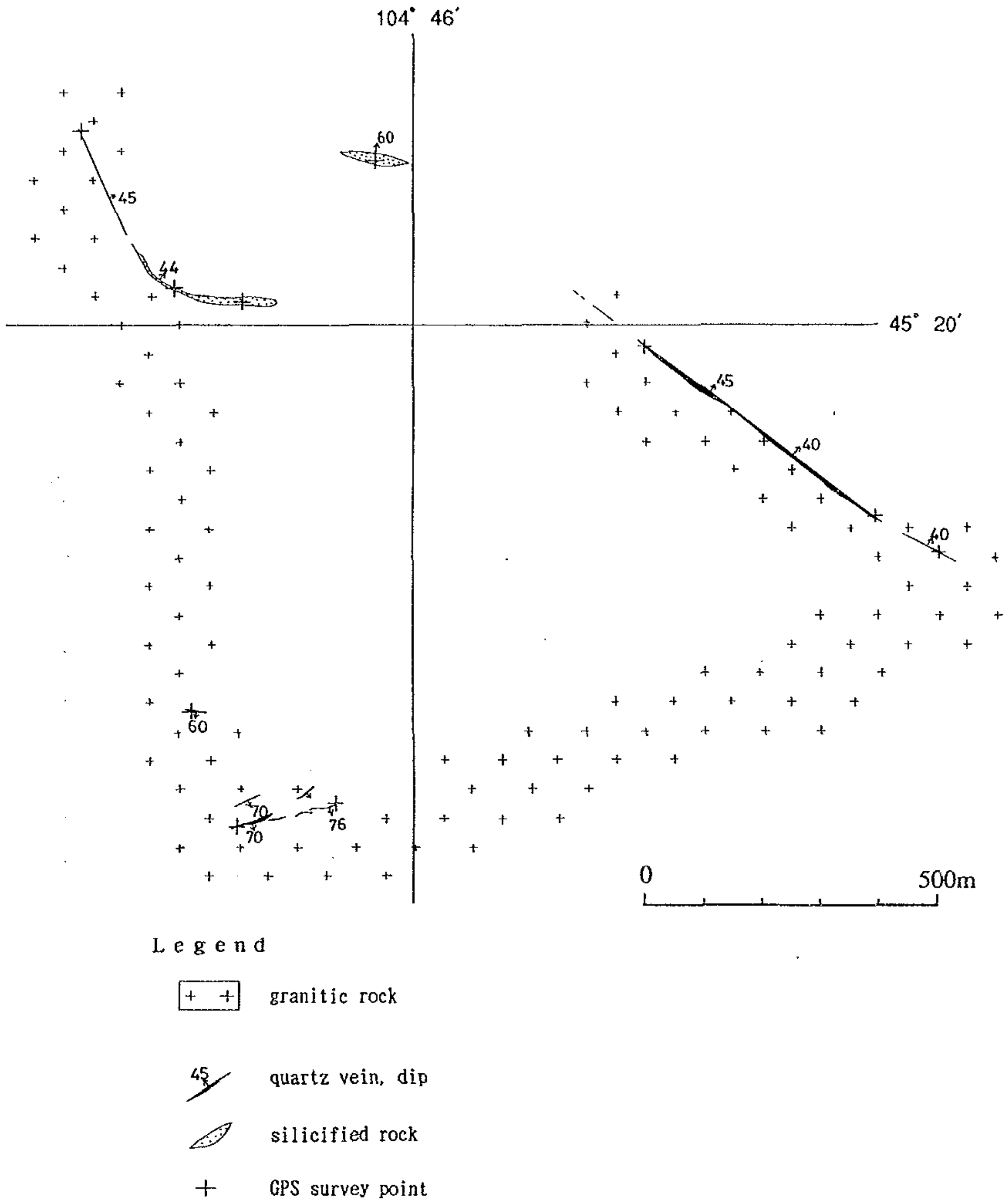


Fig. Ⅱ-1-28 Geologic map of ore-showing No. 61

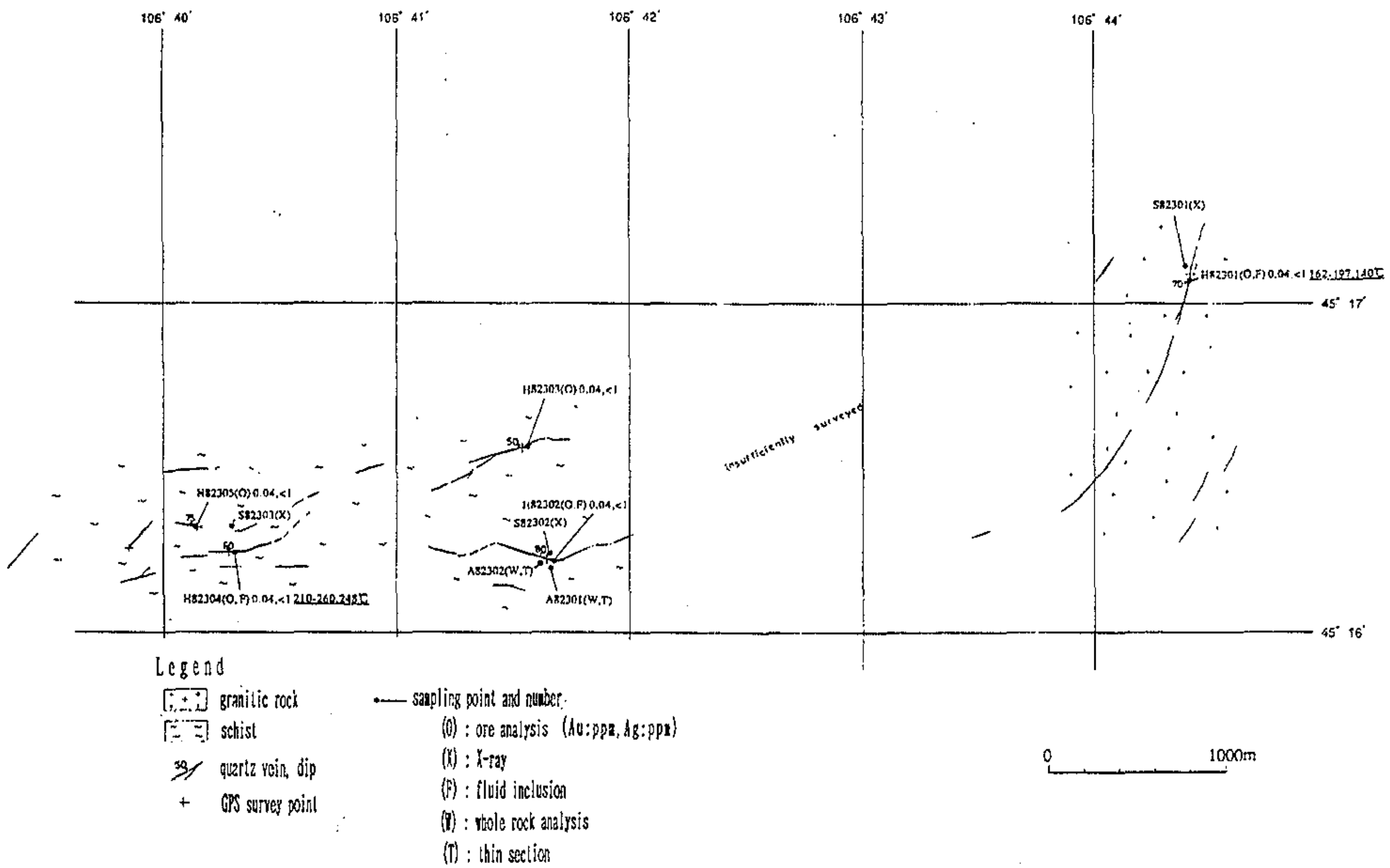


Fig. II-1-29 Geologic map of ore-showing No. 62 (Futul Us)

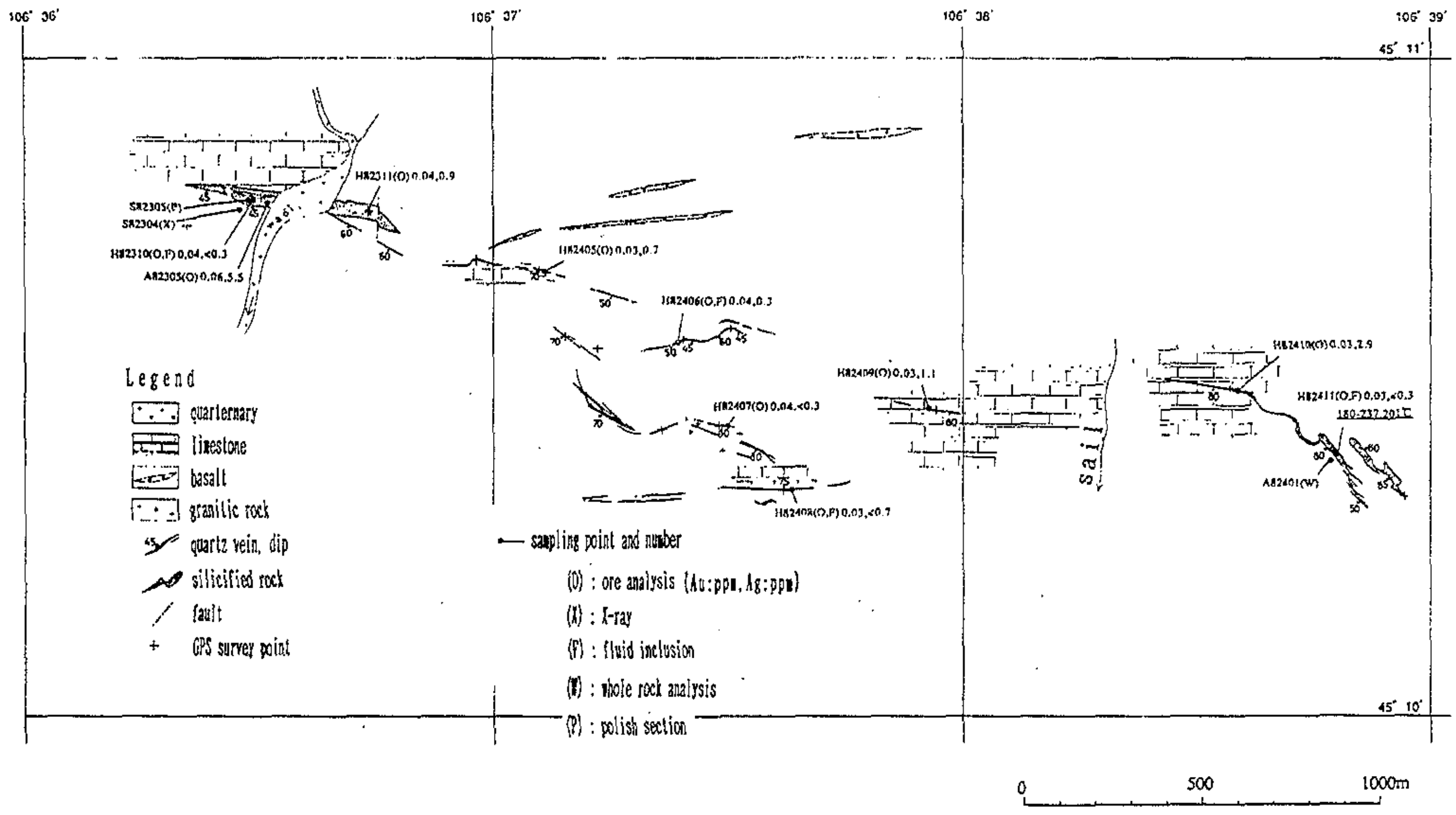


Fig. II-1-30 Geologic map of ore-showing No. 63 (Ulziit Ovoo)

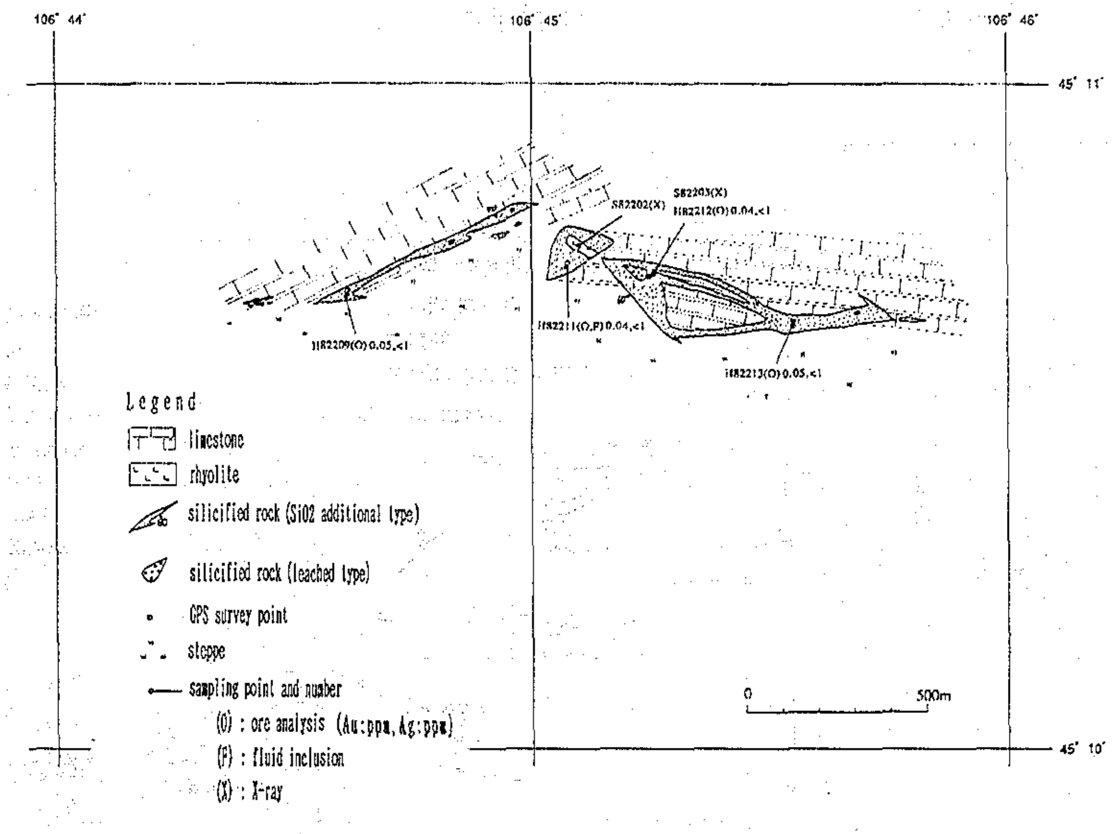


Fig. II-1-31 Geologic map of ore-showing No. 64 (Sologoi Bayan)

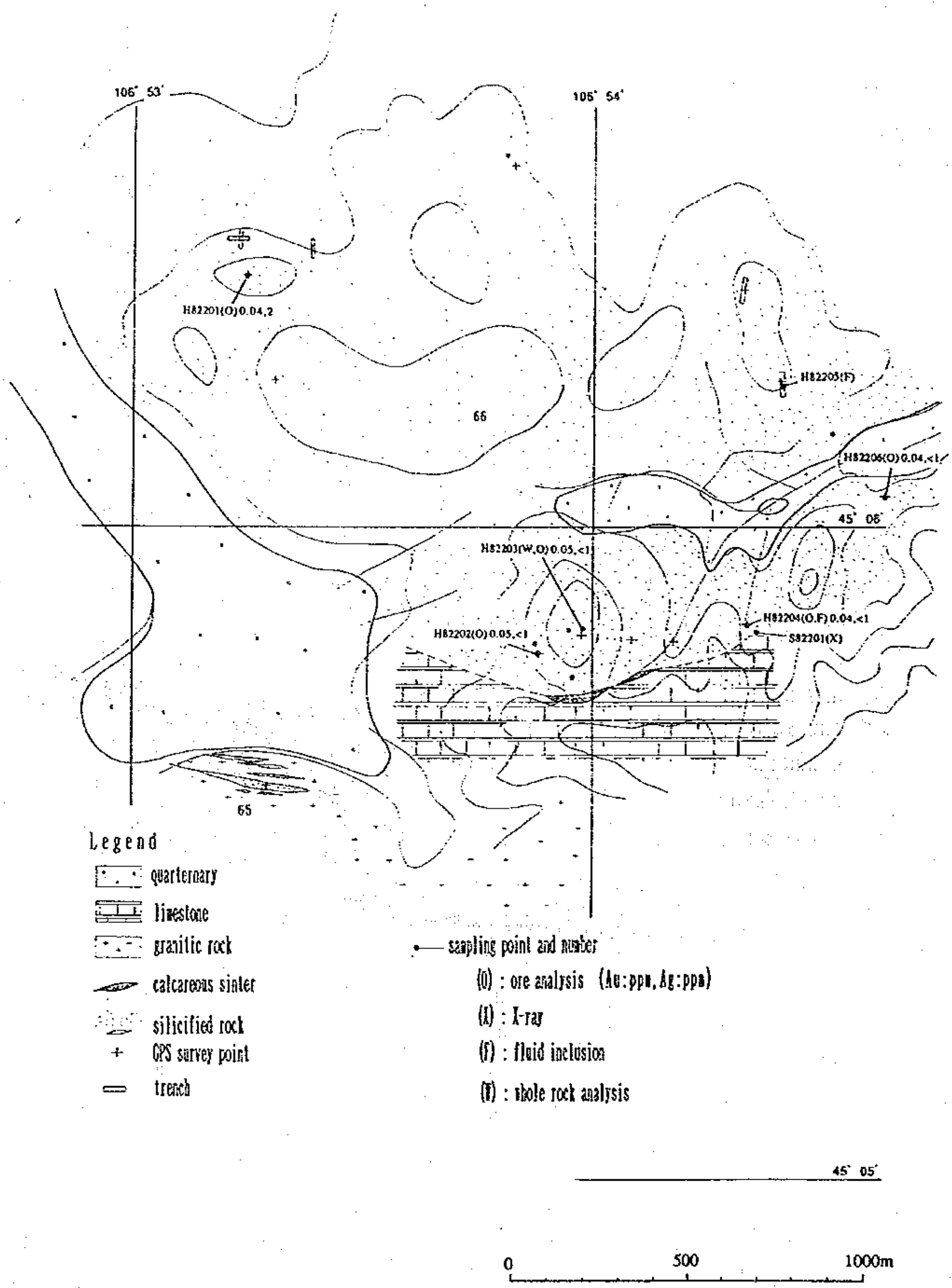


Fig. II-1-32 Geologic map of ore-showing No. 65 and No. 66 (Hetsuu Tsagaan Tolgoi)

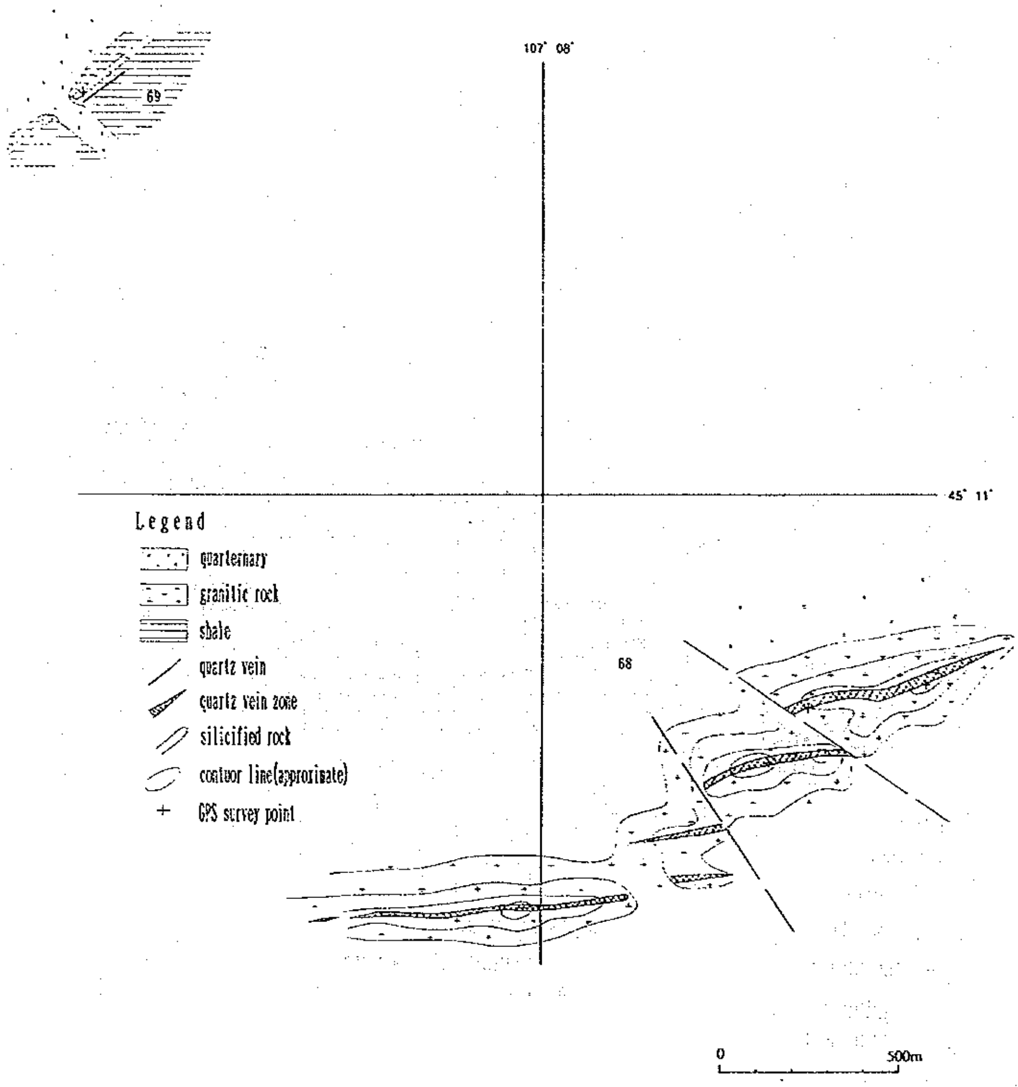


Fig. Ⅱ-1-33 Geologic map of ore-showings No. 68 and 69

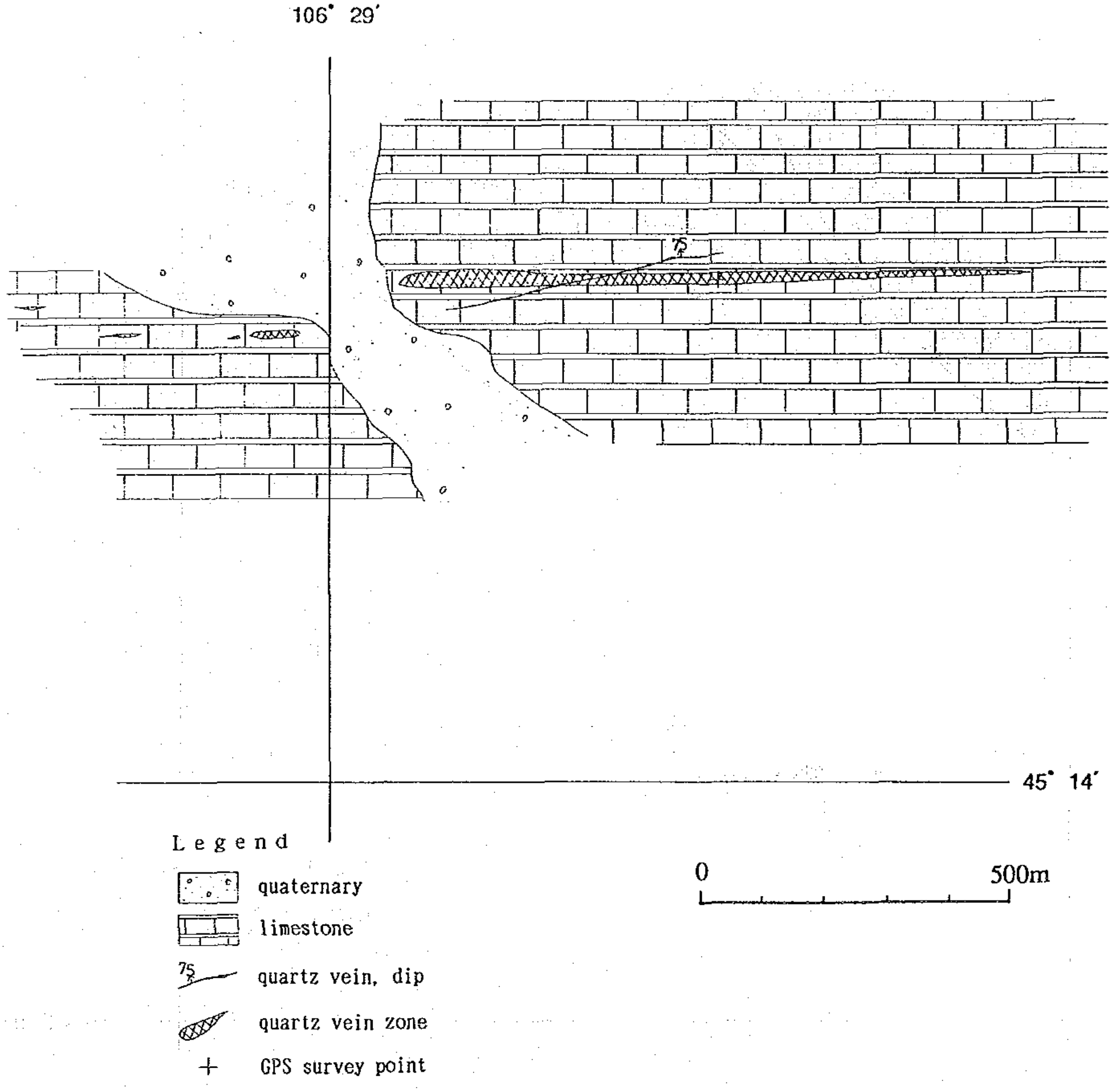


Fig. Ⅱ-1-34 Geologic map of ore-showing No. 70

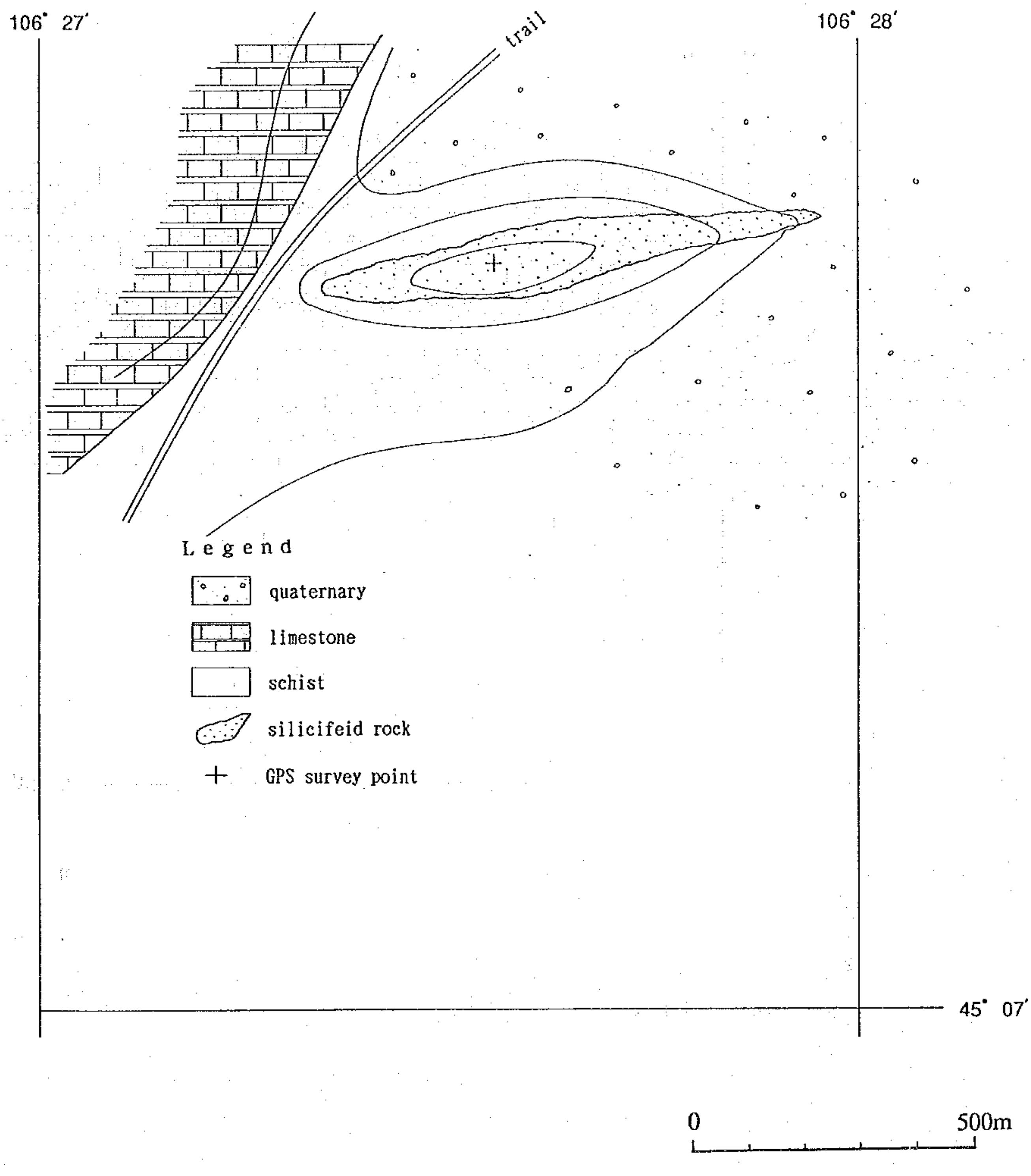


Fig. Ⅱ-1-35 Geologic map of ore-showing No. 73

Table Ⅱ-1- 8 Ore-showings in the Sologoi area(1)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate		Characteristics and Size	Host Rock	Assay			Filling Temp ℃	Alteration type	Remarks
				Longitude	Latitude			Au(g/t)	Ag(g/t)	pcs			
57	Dersen Us HUdag	Au	Qz-v	106°52'00" ~ 106°50'51"	45°31'59" ~ 45°29'20"	many quartz veins, silicified rocks and stock works are seen in the area of 3 km×6 km. vein size Max.15m×6.5 km chalcedonic quartz vein has banded structure.	granite(PZ1), tuff, tuff-breccia, conglomerate sandstone (P_{1-2})	0.03 ~ 0.15	< 0.3 ~ 0.4	7	136~195 Av. 155	Qz-pl-K-fel	Strike: N80°E~N60°E~N20°E~N-S~N45°W~N80°W dip: 50°~90° to both side hydro-fracturing and geyserite are seen. fluorite occures
58		Au	Qz-v	106°51'39"	45°27'45"	milky white chalcedonic mono-quartz veins (parallel veins) vein size Max.10m×120 m vein zone 300 m×300 m Southeastern end of Dersen Us Hudag	granite(PZ1),	–	–	–	–	–	Strike: N45°~70°E, N50°W dip: 90°? hematite-bearing hydro-fracturing. csg mono qz
59		Au	Qz-v	106°53'41"	45°30'33"	milky white chalcedonic mono-quartz veins(parallel veins) vein size Max. 0.6m×50m vein zone 100 m×300 m Eastern end of Dersen Us Hudag	diorite, schist	0.05 ~	< 0.3 ~	2	–	Qz-pl-K-fel	Strike: N45°~70°W, dip: 60°~90°SW banded
60	Morit	Au	Qz-v	106°59'29" ~ 106°58'28"	45°22'32" ~ 45°19'58"	Six major quartz veins and silicified rocks are distributed in a couple of vein zones vein size Max. 5m×1,000 m vein zone 1 km×6.5 km pyrite, pyrrhotite, chalcopyrite	granite(PZ,) limestone($V\text{-}C_1$)	0.03 ~ 0.46	<0.3 ~ 21.6	11	115 ~209 Av. 156	Qz-ser-K-fel-pl	Strike: N65°~80°E, dip: 50°~80°N, 75°~80°S
61		Au	Qz-v	106°45'43" ~ 106°46'46"	45°19'39" ~ 45°19'47"	Silisified rocks and quartz veins in three vein zones. vein size: Max. 10m×500 m area: EW 1.5 km ×NS 1.2 km	diorite(C_{2-3})	0.04 ~ 0.05	< 0.3 ~ 0.6	5	–	–	N25°W·45°E, N60°W·44°NE, N50°W·45°E, N70°~80°E·60~76°NE
62	Botul Us	Au	Qz-v	106°39'51" ~ 106°44'25"	45°16'15" ~ 45°17'05"	milky white quartz veins in the area of 2 km×7 km fluorite occures in the eastern part. vein size: Max. 8 m×500 m	graphite gneiss($V\text{-}C_1$) diabese, diorite, gabbro	0.04 ~ 0.06	< 0.3	6	140 ~260 Av. 205	Qz-ser-Musc-pl-K-fel	N25°E·70°W, N75°E·50°NW N75°W·80°N, N80°W·75°N hydro-fracturing is commonly seen
63	Ulzlit Ovoo	Au	Qz-v	106°36'21" ~ 106°38'48"	45°10'45" ~ 45°10'24"	More than ten milky white quartz veins are seen in the area of EW 3,500m×NS 1,000m Maximum size of a vein is 1.5 m wide × 100m long.	limestone ($V\text{-}C_1$) basalt	0.03 ~ 0.04	< 0.3 ~ 2.9	9	142 ~237 Av. 156	Qz-ser	N80°W·45°S, N60°W·60°S N80°W·70°S, N60°W·70°S E-W·75°N, N85°E·50°S N60°W·80°NE, N40°W·50°SW green copper and galena
64	Sologoi Bayan	Au	Massive silicified r. + Qz-v	106°44'25" ~ 106°45'41"	45°10'41" ~ 45°10'39"	Three massive silicified bodies with network of quartz veinlets. Unit size Max. 120m× 800m area 500m× 1900 m South side is covered by dune and colluvial deposits.	limestone ($V\text{-}C_1$)	0.04 ~ 0.04	< 0.3 ~ 0.8	4	–	Qz-Ka-pyp	N65°E·70°S, N65°W·70°N E-W·50°S, N50°W·60°SW
65		Au	Qz-v	106°53'18"	45°05'36"	parallel quartz veins and silicified rock vein size: Max. 5m×400 m vein zone: Max. 80m×400 m	granite	0.04	0.3	1	–	(Qz-Ser)	Strike: N80°W, dip: 75°S? graphite bering

Table Ⅱ-1- 8 Ore-showings in the Sologoi area(2)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Coodinate Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Assay Ag(g/t)	Assay pcs	Filling Temp ℃	Alteration type	Remarks
66	Hetsuu Tsagaan Uul	Au	Hot spring type	106°53′14″ ~ 106°53′53″	45°06′23″ ~ 45°05′48″	silicified zone with silicious and calcaleous sinter cones. siliceous sinter is cut by chalcedonic quartz veinlets. silicified zone: EW 2.5 km×NS 2.5 km	limestone(R/) siltstone. sandstone(J-K)	0.04 ~ 0.05	< 0.3 1.9	8	119 ~133 Av. 124	Qz-cal	N80°E-60°N, N-S and others. surface of the sinter-cones are widely covered by the fragments of siliceous sinter and dune. This zone is located at southeastern lim of the mesozoic depression.
67		Au	massive silicified rock	106°58′09″	45°06′28″	a couple of massive silicifid rocks vein size: Max. 15 m×280 m *vein zone: Max. 100m×300 m*	limestone(R/)	0.04	0.3	2	—	(Qz-cal)	Strike: N50°-60E° dip: 55°-60°NW Silicified rock bodies are *located at the southeast*ern corner of the Mesozoic basin.
68		Au	Qz-v	107°08′49″ ~ 107°07′59″	45°10′43″ ~ 45°10′21″	a couple of milky white monoquartz vein cut by two faults. vein size: Max. 15 m×1,200 m insufficiently surveyed	granite (PZ_1)	—	—	—	—	—	Strike: N75°-85°E. dip: 40°-45°S about 12 km east of Sologoi area
69		Au	*silicified zone*	*107°07′01″*	*45°11′35″*	*silicified zone along the lim* of the Mesozoic depression. zone: Max. 23m×> 1 km	sandstone. siltstone ($J-K_1$)	—	—	—	—	(Qz-?)	Strike: N50°E. dip: 50°S insufficiently surveyed
70		Au	Qz-v	106°29′29″	45°14′27″	parallel quartz vein swarm in limestone($V-C_1$) vein size: Max. 40m×1.5 km	limestone (R/)	—	—	—	—	(Qz-?)	strike and dip: E-W-80°N, N78°E-75°N insufficiently surveyed
71		Au	Qz-v with sil sinter	106°02′18″	45°10′52″	milky white chalcedonic monoquartz veins with siliceous sinter. two parallel veins vein size: Max. 5 m×100 m	granite. granodiorite (P_2)	—	—	—	—	(Qz-?)	parallel quartz veins N30°E-90°? insufficiently surveyed
72		Au	Qz-v & alteration zone	106°10′55″	45°01′31″	parallel quartz veins and silicified rocks in wide hydrothermal alteration zones. vein size: 1~5 m×100 m zone: 500 m×> 5 km	pelitic~psammitic schist (PZ_1)	—	—	—	—	(Qz-Ser)	N10°W-90° There are about ten alteration zones in a profile.
73			massive silicified rock	106°21′36″	45°01′42″	single massive silicified rock body at the lim of the Mesozoic depression. size: 100 m×800 m	limestone(R/)	—	—	—	—	(Qz-?)	N70°W-90° insufficiently surveyed

1-3-8 Undur Uda area

1. Geology (Ref. Fig. II-1-36)

The area is located in the north of CMTL and geology is quite different between southern half and northern half of the area.

Geology is composed of, in ascending order, Undifferentiated Paleozoic (Pz), Silusian (S), Siluro-Devonian (S-D), Devonian (D_1a, D_1b, D_1g, D_1l, D_2, D_2g), Devonian-Carboniferous (D-C) and Cretaceous (K).

Undifferentiated Paleozoic crops out as small exposures in the central to southern part of the area.

Silurian is composed of bluish grey schists derived from basaltic volcaniclastics and alternation of sandstone and siltstone and is developed in the northeastern part of the area.

Siluro-Devonian is composed of bluish grey schists derived from alternated sandstone and siltstone and it crops out in a small size in the southeastern part of the area associated together with lower Devonian limestone.

Devonian is widespread in the southern and the northern parts of the area and is composed of bluish grey folded beds of alternated sandstone, siltstone and shale (D_1b), pelitic rock (D_1a) and limestone (D_1l) and intrusive rocks of medium-grained granite (D_2G) and trachy-rhyolite (D_1g).

Devonian-Carboniferous crops out in a small exposure in the southwestern part of the area.

Cretaceous is composed of weakly consolidated sandstone, shale and siltstone and crops out in the centeral and the southern parts of the area burying lowland as flat-lying beds.

2. Ore deposits and mineral indications

Mineralization is quartz vein type with strike of N60°-80°E in the Paleozoic country rocks. Quartz veins are too small to be economical.

Assay results of 4 samples showed maximum gold value of 0.05 g/t and silver 0.9 g/t.

The results of the survey in shown on the Table II-1-9.

1-3-9 North Harmagtai

1. Geology (Ref. Fig. II-1-37)

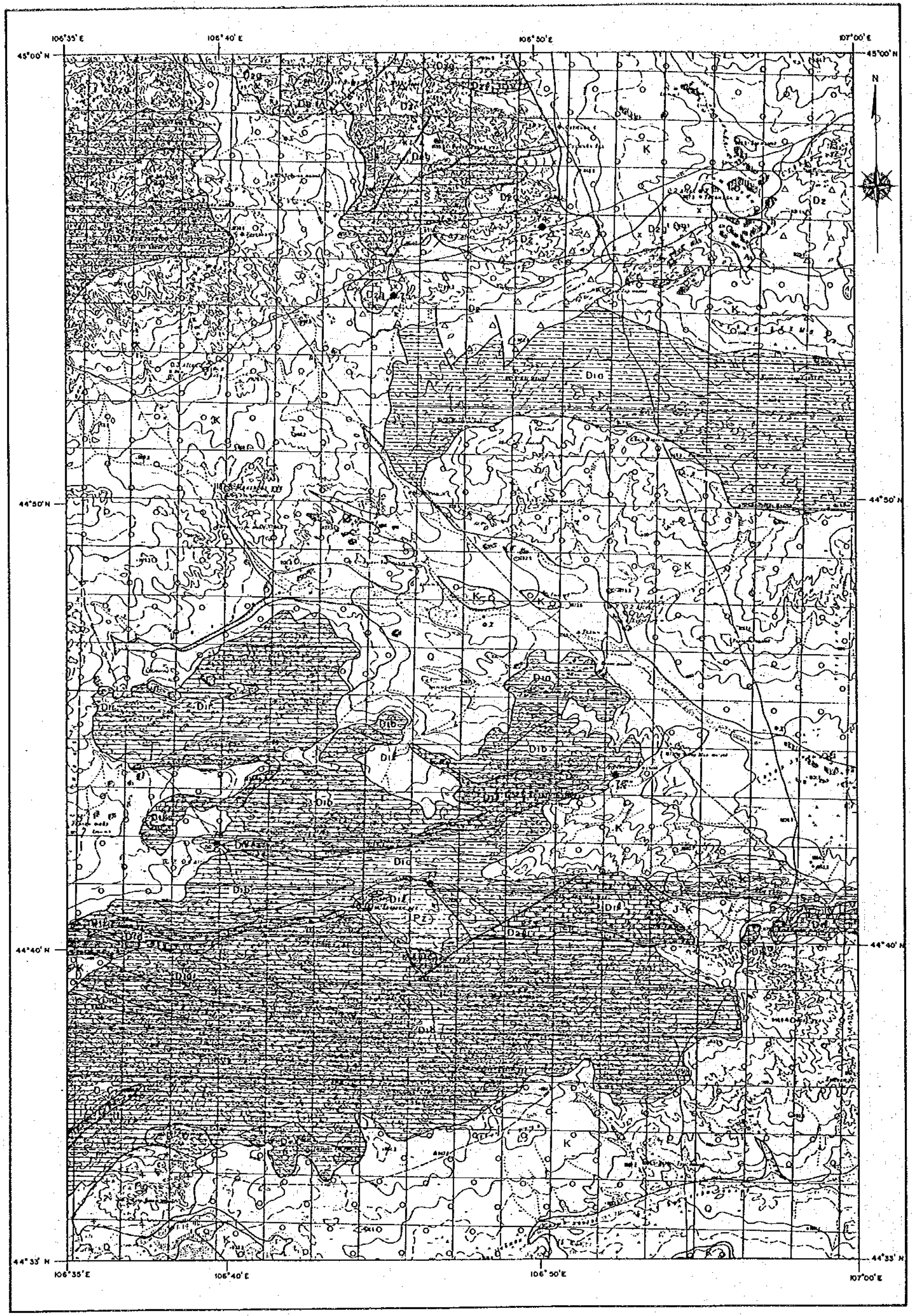
The area is located in the zone of CMTL and geology of the area is composed of, in ascending order, Siluro-Devonian (S-D), Devonian (D_1a, D_1b, D_1l), Carboniferous (C), Carboniferous-Permian (C-P, C-Pg) and Cretaceous (K).

Paleozoic formations crop out in the central to northern part and southern part of the area and have a form of E-W elongated uplifted block.

Siluro-Devonian (S-D) is composed of bluish grey crystalline schists derived from alternated sandstone, siltstone and shale and andesitic volcanics. The formation is severely folded with axis of N80°W and cut by strike slip faults in several places. The formation constitutes a southern wing of the uplifted block.

Devonian occupies a major part of north-western area and is composed of highly folded alternation of bluish grey sandstone and siltstone (D_1a), tuffaceous ~ pelitic rock (D_1b) and limestone (D_1l). The formation suffered a dynamic metamorphism changing almost whole the rocks into phyllitic rocks.

Carboniferous (C) is made of alternation of sandstone and siltstone and crops out in



LEGEND

Geologic Age	Geologic Unit	Symbol	Rock Types
Quaternary	Q		sand, gravel, loam
Tertiary	Tv		olivine basalt
Cretaceous	K		sandstone, siltstone, conglomerate, limestone, coal
Jurassic-Cretaceous	J-K		conglomerate, siltstone, sandstone
	J-Kv		basalt, trachybasalt-trachyandesite, trachyte
Jurassic	J		conglomerate, siltstone, sandstone
	Jv		trachyte-dacite, trachyrhyolite
Permian	P		trachyte, andesite, trachyandesite, dacite, tuff
Carboniferous-Permian	C-P		basalt, trachyandesite, andesite, tuff, conglomerate
Carboniferous	C		sandstone, siltstone, conglomerate, mudstone
Devonian-Carboniferous	D-C		tuffaceous conglomerate, sandstone, siltstone
Devonian	D2ℓ		limestone
	D2		basalt, trachybasalt, andesite, dacite, rhyolite, tuff
	D1ℓ		limestone
	D1b		sandstone, shale, siltstone
	D1a		shale, siltstone, sandstone
Silurian-Devonian	S-Dℓ		limestone
	S-D		dacite, rhyolite, andesite, tuff, phyllite, shale
Silurian	S		sandstone, siltstone, shale, phyllite
Undifferentiated Paleozoic	PZ		sandstone, siltstone, clayey shale
Riphean	Rℓ		recrystallized limestone
	R2		quartzite, phyllite, siltstone, sandstone, amphibolite
	R1-2		shale, amphibolite, quartzite, phyllite, gneiss
Intrusive Rocks	e		granodiorite porphyry
	d		diorite, microdiorite, diorite porphyry
	Pγ		granite, granosyenite
	Pr		rhyolite, quartz porphyry
	C-Pγ		granite, granodiorite, granosyenite, diorite
	D2γ		granite, granodiorite
	D2d		diorite, gabbro
	D1r		rhyolite, dacite

● ore showing

K	unit name and boundary
	strike and dip directon
	anticline
	syncline
	fault
	inferred fault
	thrust fault

PL. II – 1 – 10

MINERAL EXPLORATION
IN
THE UUDAM TAL AREA, MONGOLIA (PHASE II)

Geologic Map of the Undur Uda Area

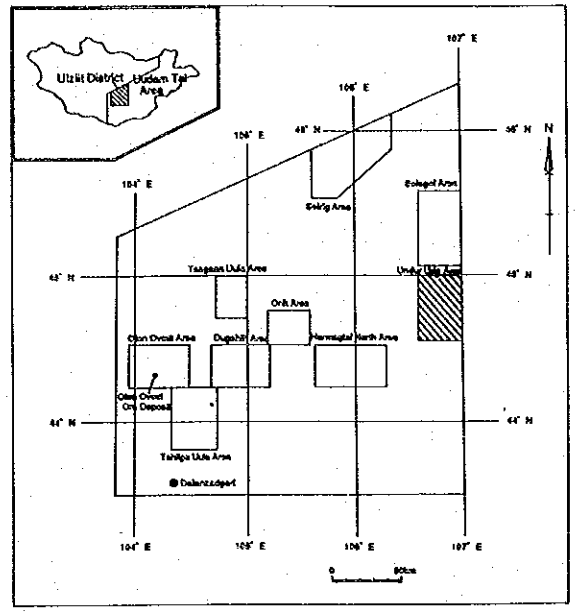


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Fig. II-1-36 Geologic map of the Undur Uda area

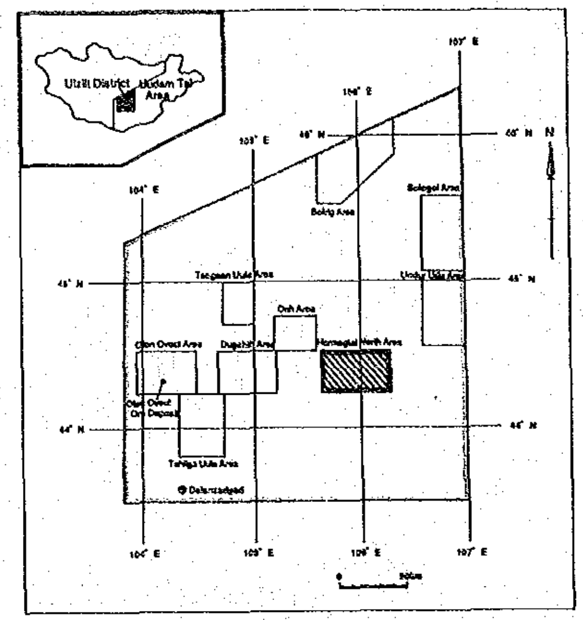
Table Ⅱ-1- 9 Ore-showings in the Undur Uda area

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Coodinate Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Assay Ag(g/t)	Assay pcs	Filling Temp ℃	Alteration type	Remarks
74		Au	Qz-v	106°50′14″	44°56′08″	a couple of small quartz veins in the area of 20 m×20m.	fng amphibolite~melanocratic gns	–	–	–	–	epidotization	E-W·90°, N80°W, 80°S no other ore-showings around
75		Au	Qz-v	106°45′32″	44°54′37″	milky white single quartz vein vein size: Max. 0.8m×150 m	granodiorite-porphyry	0.04	0.9	1	–	–	N75°W·60°N, N40°E·40°SW N70°W·60°N
76		Au	Qz-v	106°52′27″	44°43′50″	three parallel quartz veins. vein size: Max. 0.6 m×20m	chl-ser sch. phyllitic	–	–	–	–	(chl-ser)	N85°W· 75°~80°S
77		Au	Qz-v	106°45′39″	44°41′23″	quartz-pipe formed at the contact between granite and limestone size: Max. 25m×45m	granite and limestone (PZ_1)	0.04	< 0.3	1	–	Qz-ser-pl-K-fel	elongated to N80°E direction
78		Au	Qz-v	106°39′51″	44°42′20″	parallel quartz veinlets. vein size: Max. 0.3 m×3 m area: 10m×15m	chl-ser sch. lithoidite dike	–	–	–	–	Qz-Ka-ser	N80°W· 50°S
79		Au	Hot spring type	106°32′51″	44°53′26″	quartz vein, siliceous sinter and mud pots aligned to N 75°E direction size of sinter cone: Max. 50m ×50m area: 50m×500 m	chl-ser sch. phyllitic	–	–	–	–	Qz-Ka-K-fel	extending to N75°E Sinter cones are alined along the northern lim of the Mesozoic depression.
80		Au	silicified zone	106°08′43″ ~ 105°43′19″	44°42′17″ ~ 44°38′38″	massive silicified rocks containing fragments of milky quartz size: Max. 20m×800 m	limestone (D_2)	–	–	–	–	–	N45°~60°E· 75°S

PL. II－1－8

MINERAL EXPLORATION
IN
THE UUDAM TAL AREA, MONGOLIA (PHASE II)

Geologic Map of the North Harmagtai Area



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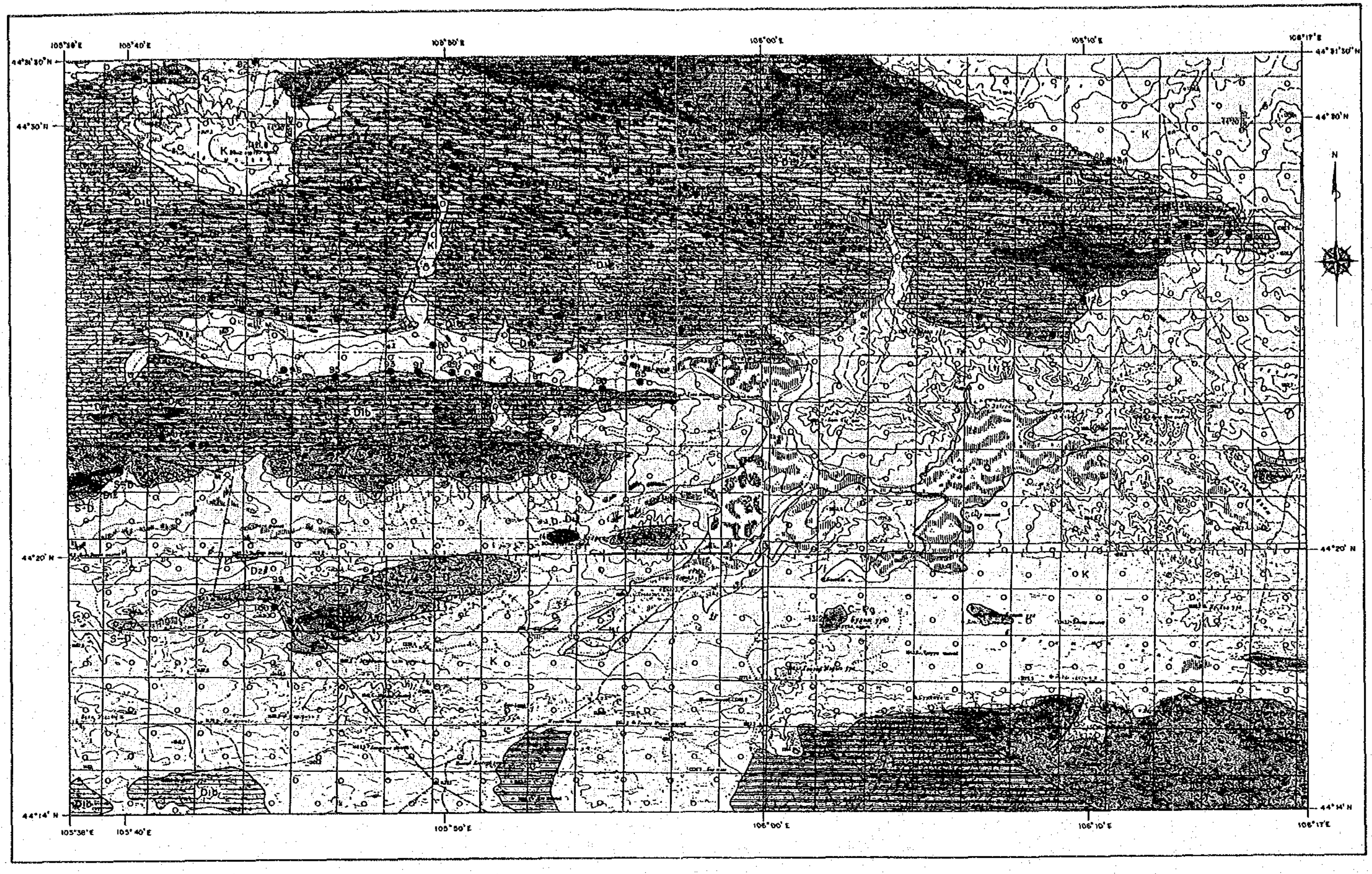


LEGEND

Geologic Age	Geologic Unit	Symbol	Rock Types
Quaternary	Q		sand, gravel, loam
Tertiary	Tv		olivine basalt
Cretaceous	K		sandstone, siltstone, conglomerate, limestone, coal
Jurassic-Cretaceous	J-K		conglomerate, siltstone, sandstone
	J-Kv		basalt, trachybasalt-trachyandesite, trachyte
Jurassic	J		conglomerate, siltstone, sandstone
	Jv		trachyte-dacite, trachyrhyolite
Permian	P		trachyte, andesite, trachyandesite, dacite, tuff
Carboniferous-Permian	C-P		basalt, trachyandesite, andesite, tuff, conglomerate
Carboniferous	C		sandstone, siltstone, conglomerate, mudstone
Devonian-Carboniferous	D-C		tuffaceous conglomerate, sandstone, siltstone
Devonian	D2ℓ		limestone
	D2		basalt, trachybasalt, andesite, dacite, rhyolite, tuff
	D1ℓ		limestone
	D1b		sandstone, shale, siltstone
	D1a		shale, siltstone, sandstone

Silurian-Devonian	S-Dℓ		limestone
	S-D		dacite, rhyolite, andesite, tuff, phyllite, shale
Silurian	S		sandstone, siltstone, shale, phyllite
Undifferentiated Paleozoic	PZ		sandstone, siltstone, clayey shale
Riphelan	Rℓ		recrystallized limestone
	R2		quartzite, phyllite, siltstone, sandstone, amphibolite
	R1-2		shale, amphibolite, quartzite, phyllite, gneiss
Intrusive Rocks	e		granodiorite porphyry
	d		diorite, microdiorite, diorite porphyry
	Pg		granite, granosyenite
	Pr		rhyolite, quartz porphyry
	C-Pg		granite, granodiorite, granosyenite, diorite
	D2g		granite, granodiorite
	D2d		diorite, gabbro
	D1r		rhyolite, dacite

● ore showing

	unit name and boundary
	strike and dip directon
	anticline
	syncline
	fault
	inferred fault
	thrust fault

Fig. II-1-37 Geologic map of the North Harmagtai area

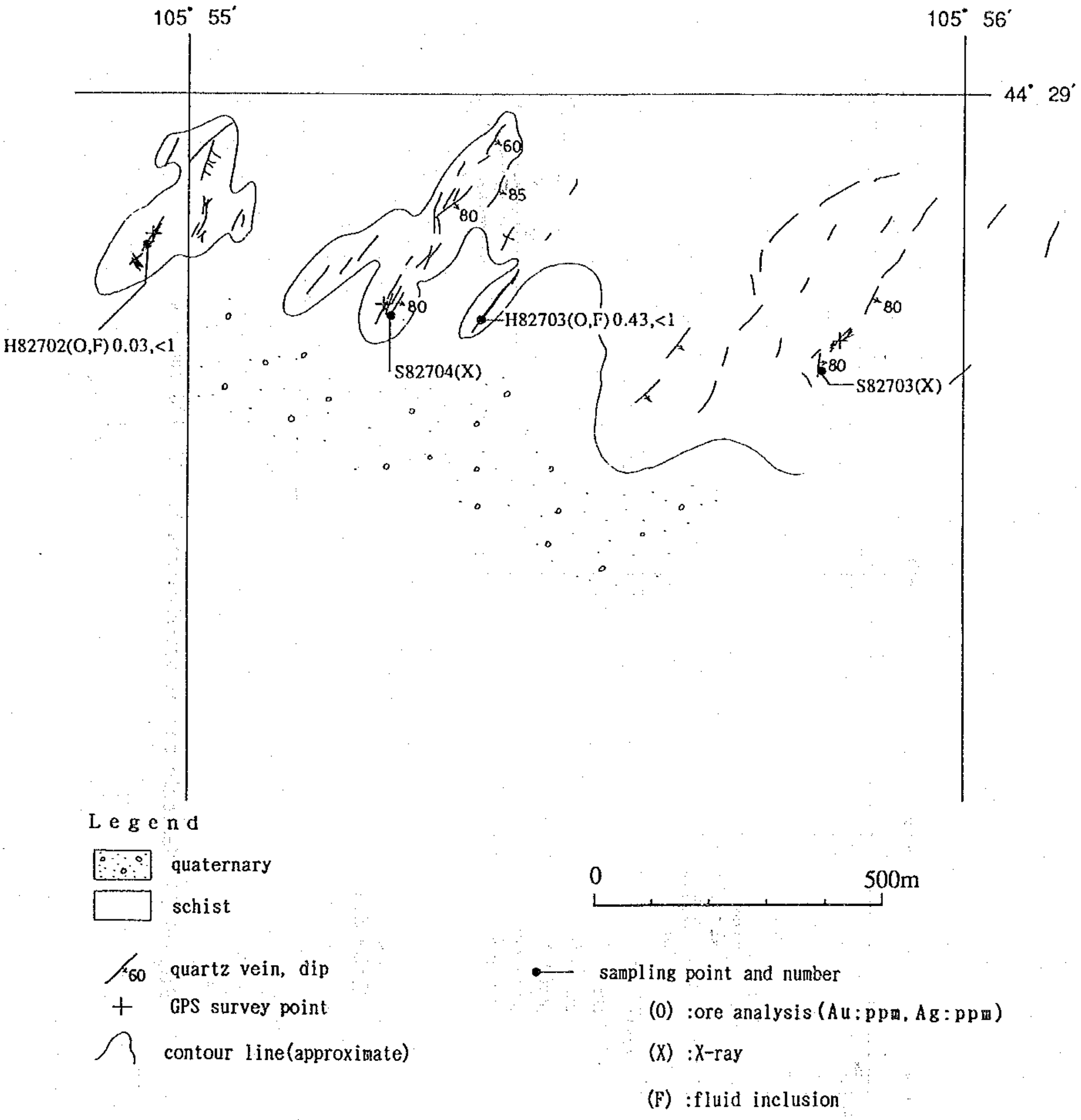


Fig. II-1-38 Geologic map of ore-showing No. 83

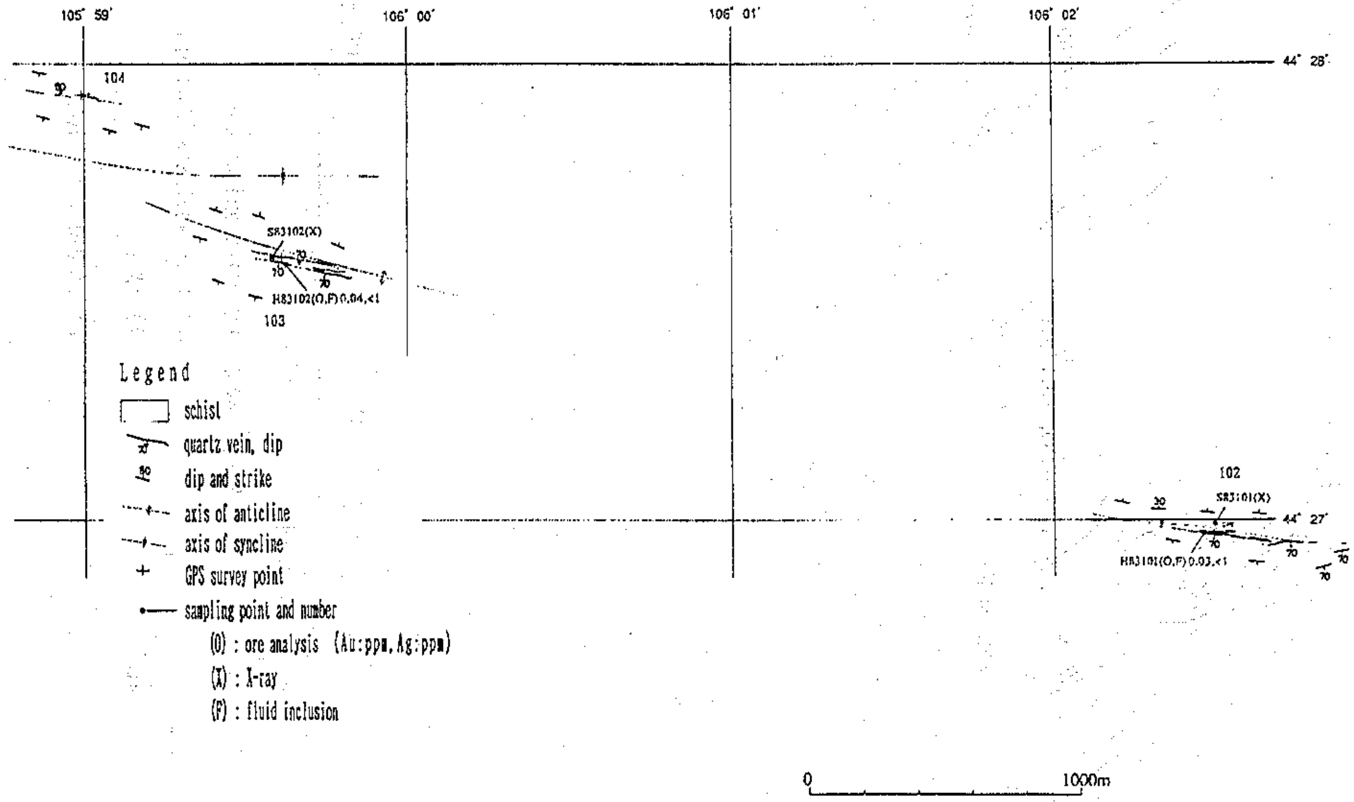


Fig. Ⅱ-1-39 Geologic map of ore-showings No. 102, 103 and 104

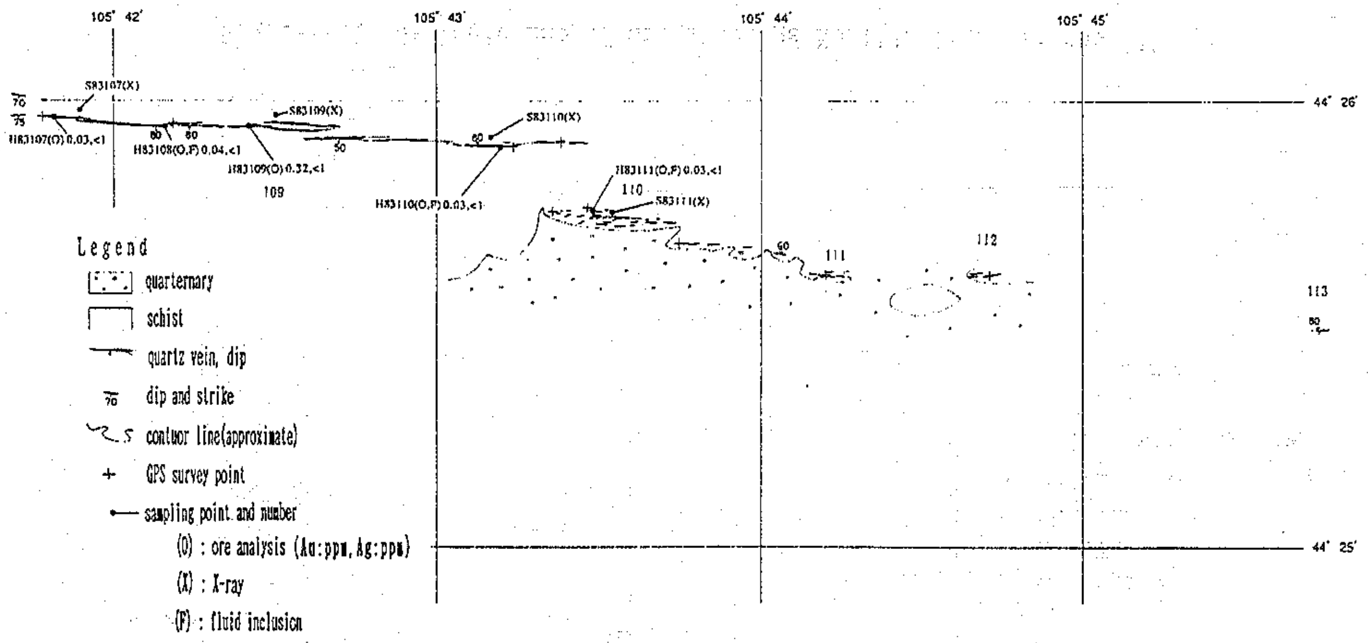


Fig. II-1-40 Geologic map of ore-showings No.109, 110, 111, 112 and 113

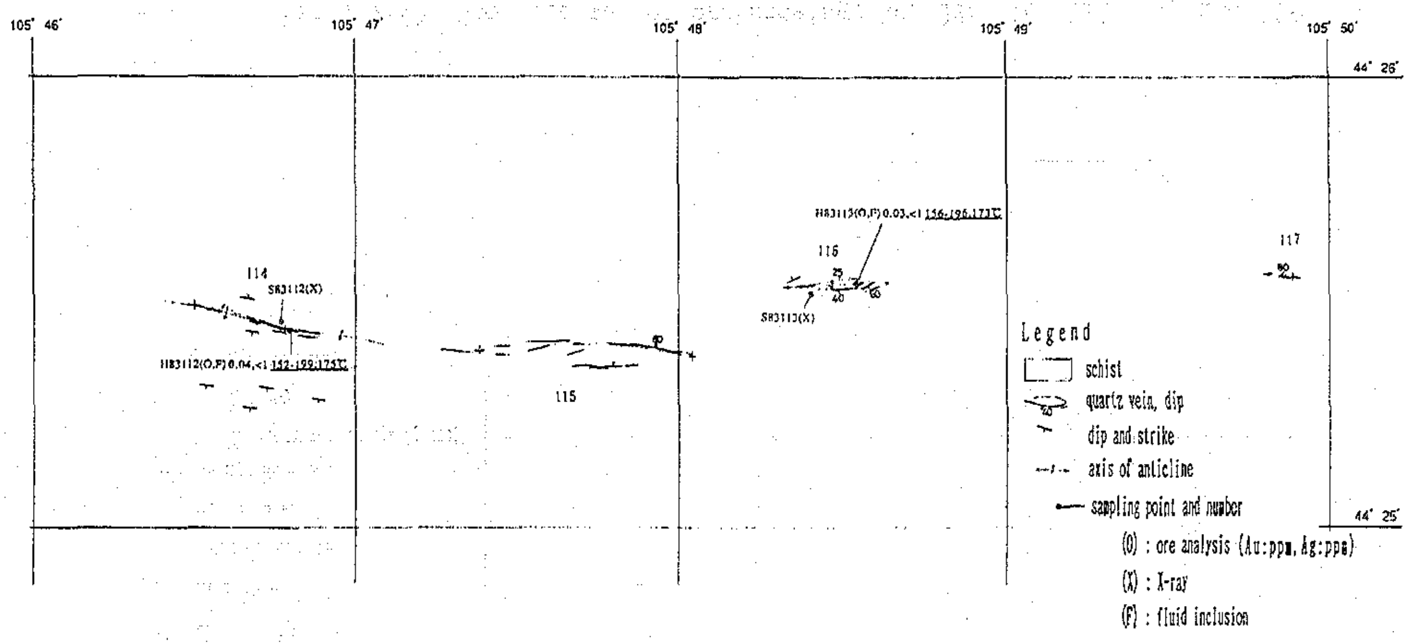


Fig. II-1-41 Geologic map of ore-showings No. 114, 115, 116 and 117

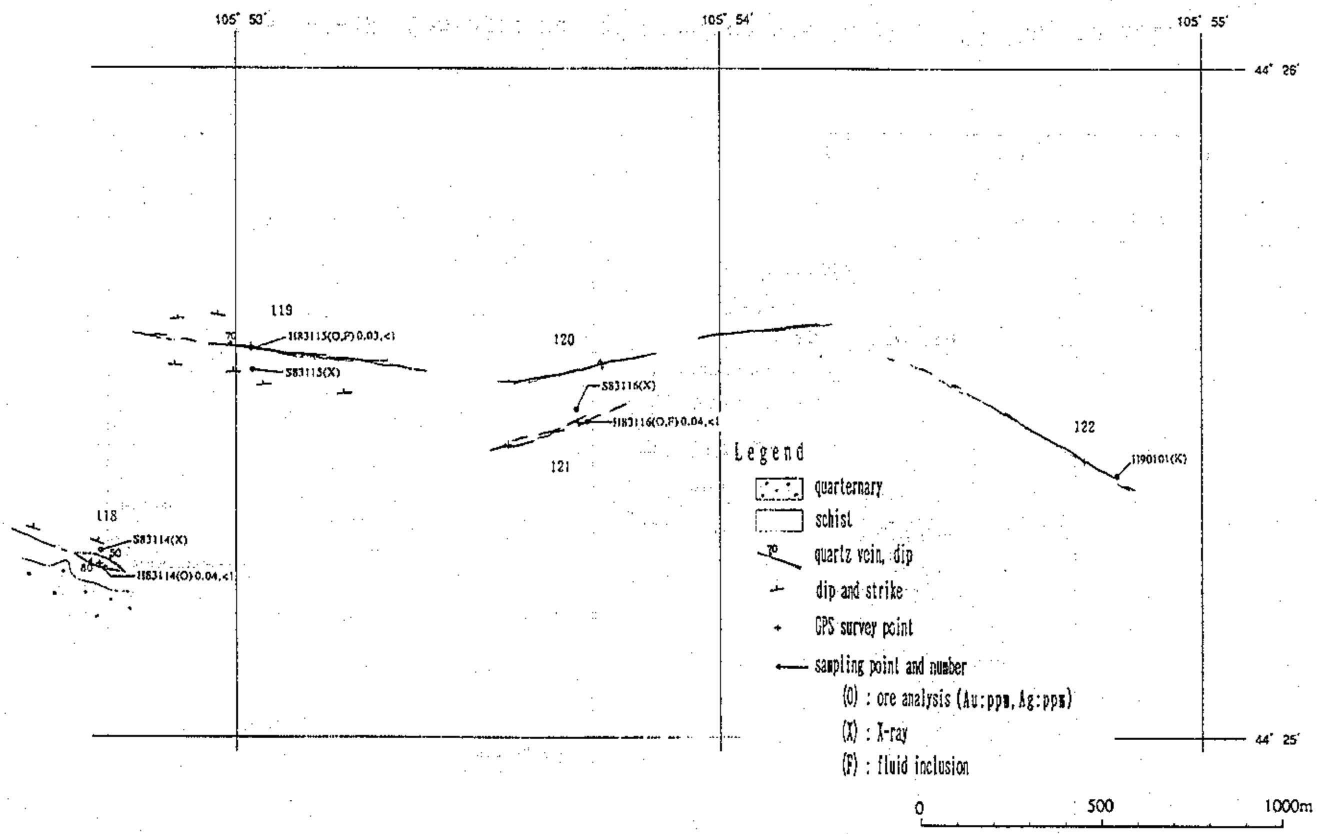


Fig. II-1-42 Geologic map of ore-showings No. 118, 119 and 122

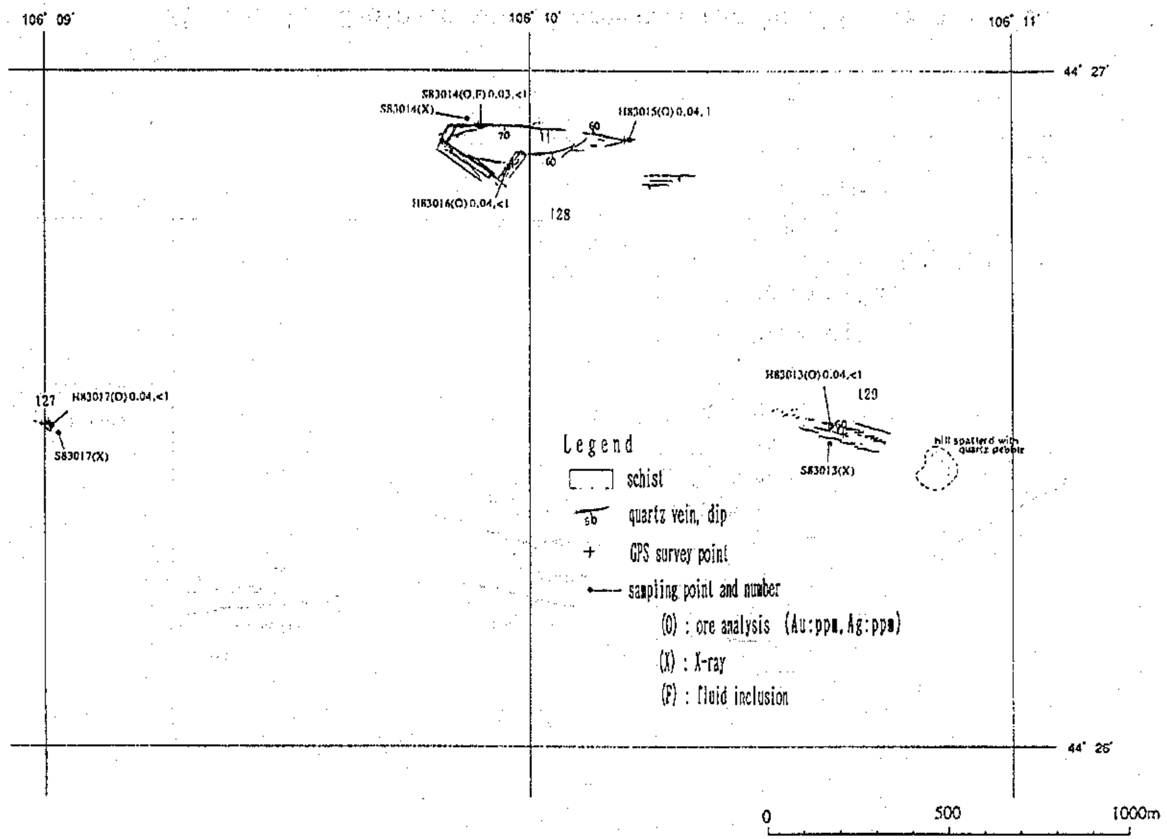


Fig. II-1-43 Geologic map of ore-showings No. 128, 129 130 and 131

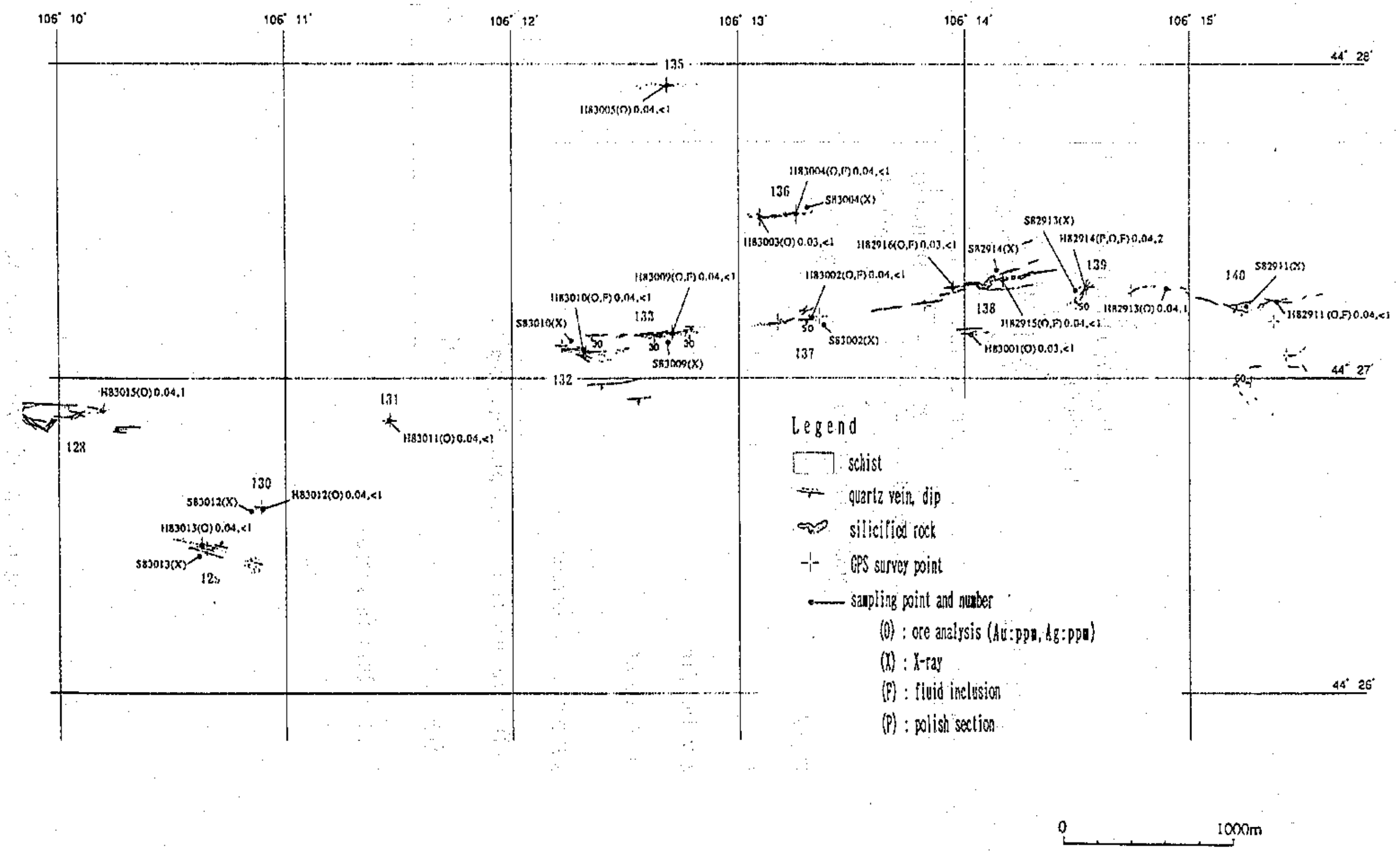


Fig. II-1-44 Geologic map of ore-showings No. 128 ~140

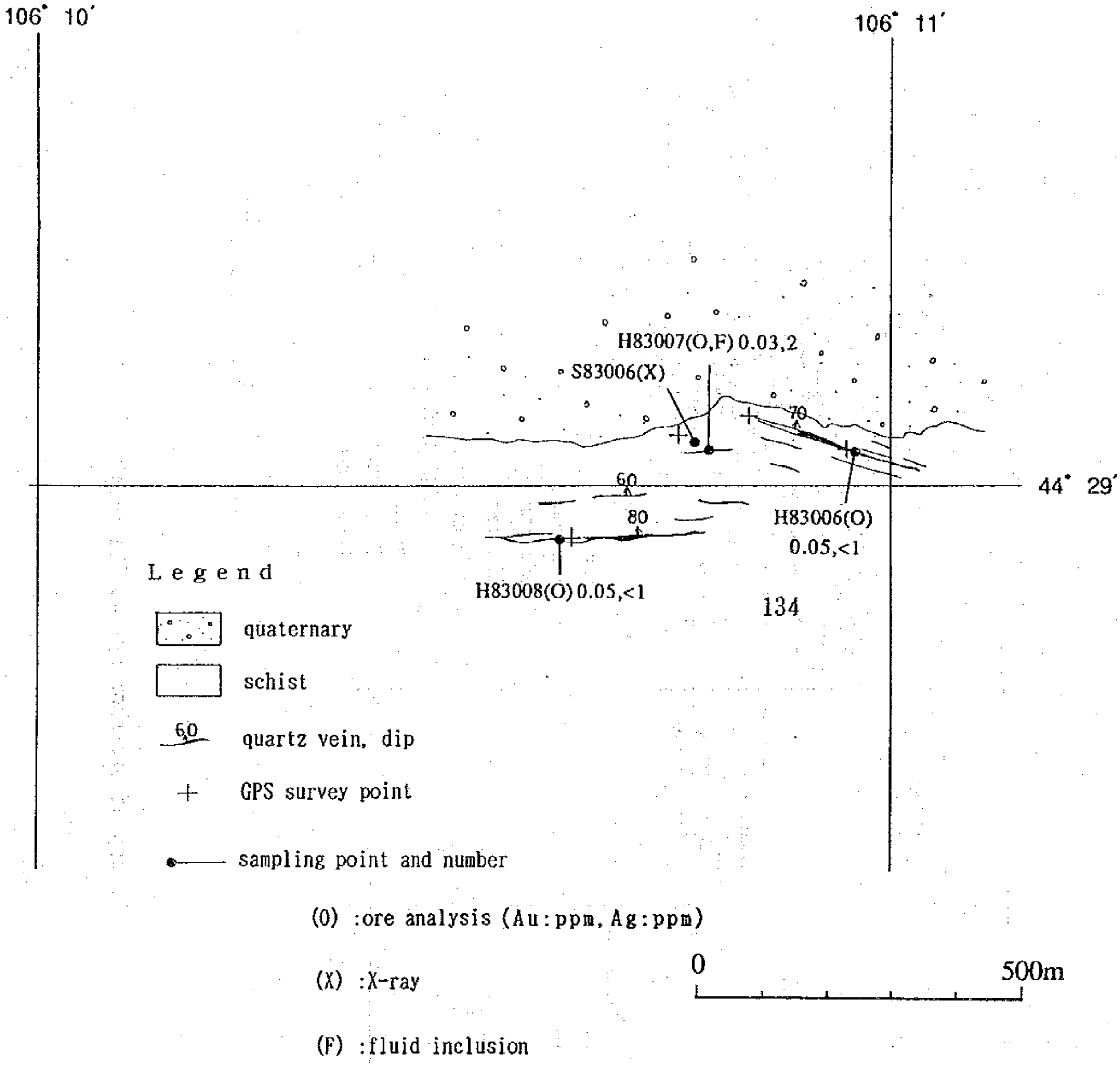


Fig. Ⅱ-1-45 Geologic map of ore-showing No. 134

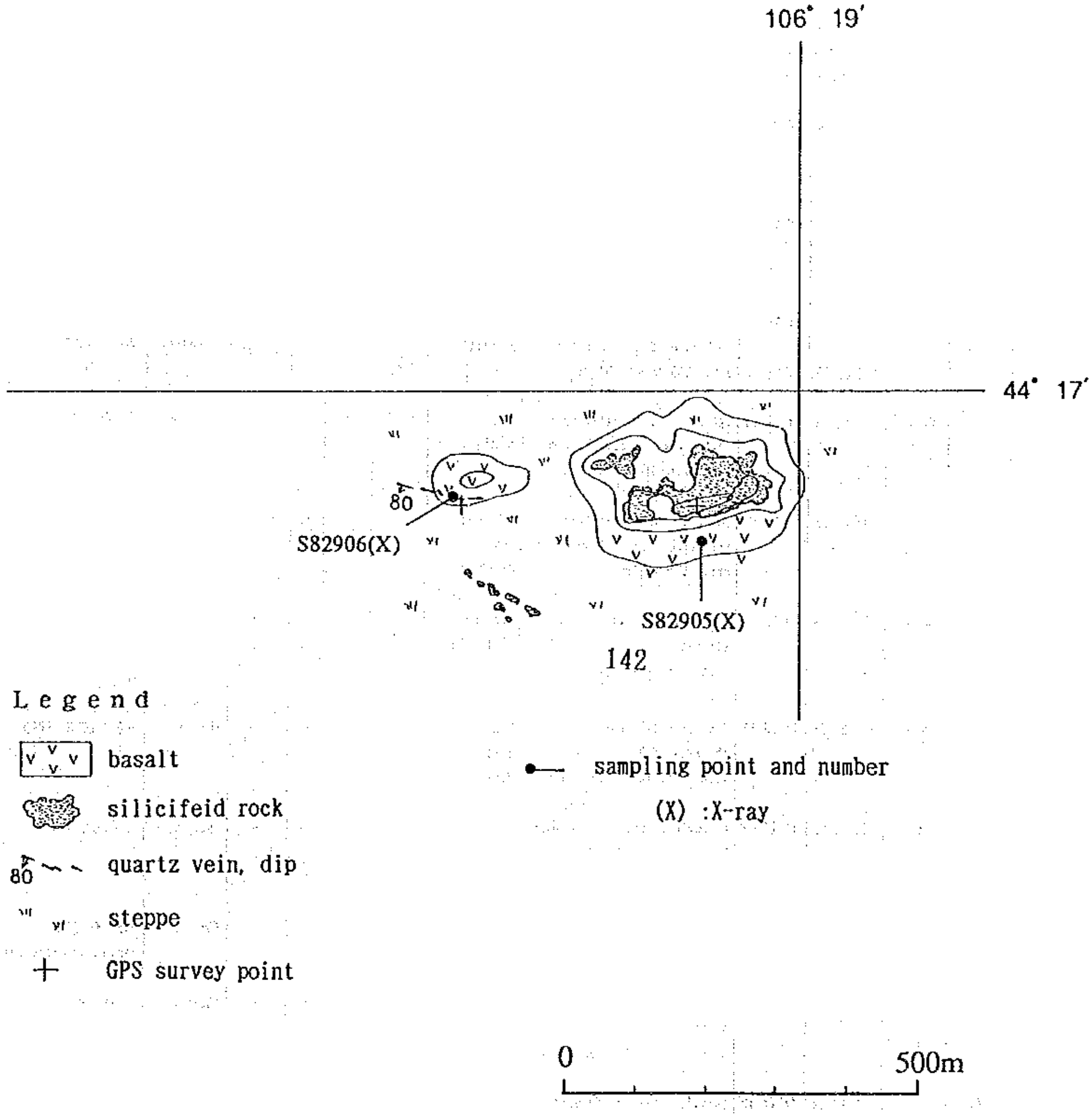


Fig. II-1-46 Geologic map of ore showing No. 142 (Shvuun Hudag)

Table Ⅱ-1-10 Ore-showings in the North Harmagtai area(1)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Coodinate Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Assay Ag(g/t)	Assay pcs	Filling Temp ℃	Alteration type	Remarks
81		Au	Qz-v	105°43'38'	44°32'01'	parallel quartz vein swarm in the area of 40m×140 m. no wall rock alteration	grn-gry sch phyllitic (D₁)	–	–	–	–	(chl-ser)	The zone extends approx-imately three km to the insufficiently surveyed
82		Au	Qz-v	105°44'03'	44°31'26'	milky white mono-quartz veins vein size: Max. 2 m×25m zone: 50m×300 m	pelitic sch (D₁)	–	–	–	–	(ser-py)	N80°W·50°S hydro-fracturing
83		Au	Qz-v	105°54'57' ~ 105°55'50'	44°28'52' ~ 44°28'46'	parallel mono-quartz veins vein size: Max. 0.8 m×400 m zone: 600 m×1,500 m	chl-ser sch. phyllitic (D₁)	0.02 ~ 0.03	< 0.3	3	162~229 Av. 185	Qz-chl-ser pl-cal-py	veins: N3 0°E· 80°~85°SE zone: N70°W
84		Au	Qz-v	105°57'10'	44°29'18'	aggrigate of parallel quartz veins. milky white chalcedonic size: Max. 20 m×500 m	dk gry phyl sch(D₁)	0.02	0.8	1	–	Qz-pl-ser	N80°W·50°N
85		Au	Qz-v	105°56'07'	44°23'55'	parallel quartz veinlets. vein size: Max. 0.6 m×6 m area: 10m×25m	blk pelitic sch. phyllitic (D₁)	–	–	–	–	(Qz-ser)	E-W· 70°~80°S
86		Au	Qz-vl	105°54'59'	44°23'48'	three small quartz veins aligned. vein size: Max. 0.6 m×3 m total length: 30m	ser sch. phyllitic (D₁)	–	–	–	–	(Qz-ser)	extending to N60°W
87		Au	Qz-v	105°52'58'	44°23'53'	four parallel quartz veins in the area of 30m×50m. vein size: Max. 2 m×20m	blk sch. phyllitic(D₁) dio-por stock	–	–	–	–	(Qz-ser)	N80°W·80°S. E·W90°
88		Au	Qz-v	105°51'03'	44°24'08'	a couple of milky white tour-Qz veins aligned size: 0.6 m×15m. 0.6m×10m	red alt ser sch(D₁)	–	–	–	–	(ser-py)	N50°W·80°~90°S
89		Au	Qz-v	105°50'13'	44°24'11'	single milky white quartz vein size: Max. 1.2m×60m	blk ser sch. phyll (D₁)	–	–	–	–	(Qz-ser)	N75°W· 75°N manganese oxide bearing
90		Au	Qz-v	105°49'37'	44°24'49'	a couple of parallel quartz veins. size: 2.5 m×20m. 1.5m×10m	blk sch. phyllitic(D₁)	–	–	–	–	(Qz-ser)	E-W·80°N
91		Au	Qz-v	105°49'12'	44°24'12'	parallel milky white quartz veins in the area of 100m× 200 m. six veins in a profile size: 2 m×15m. 0.6m×10m	gry alt ser sch. phyllitic (D₁)	–	–	–	–	(Qz-ser)	N80°W·70°~80°N Σv =4 m
92		Au	Qz-v	105°48'48'	44°24'08'	four parallel milky white quartz veins vein size: Max. 2 m×30m area: 20m×50m	dk gry sch. phyll (D₁)	0.02	1.0	1	–	(Qz-ser)	N80°W· 90° Σv =2 m
93		Au	Qz-v	105°43'20'	44°24'14'	milky white single quartz vein vein size: Max. 2 m×50m	grn-gry sch (D₁)	0.02	0.8	1	–	(Qz-ser)	N85°E· 90°
94		Au	Qz-v	105°48'25'	44°24'02'	aggregate of for parallel quartz veins vein size: max. 2.5 m×45m zone: 5 m×60m	alt diorite	0.02	1.1	1	–	(ser)	N75°W·80°N

Table Ⅱ-1-10 Ore-showings in the North Harmagtai area(2)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate		Characteristics and Size	Host Rock	Assay			Filling Temp ℃	Alteration type	Remarks
				Longitude	Latitude			Au(g/t)	Ag(g/t)	pcs			
95		Au	Qz-v	105°46'35"	44°24'06"	milky white parallel quartz veins and Qz-network in diorite dike vein size: Max. 4 m×20m zone: 100 m×150 m	blk ser sch. phyll (D_1) & alt. diorite	0.03	< 0.3	1	–	(Qz-ser)	N80°W・60°S central part of Dayangol South zone. Veins are shattered and dislocated too much.
96		Au	Qz-v	105°44'55"	44°24'16"	aggregate of parallel quartz veinlets. area: 30m×60m. vein size: Max. 0.3 m×5 m	gry sch. phyllitic(D_1)	–	–	–	–	(Qz-ser)	N80°E・80°N
97		Au	Qz-v	105°42'03"	44°22'34"	six parallel quartz veins exist in the area of 100 m×400 m. milky white mono quartz unit vein size: 1.5 m×20m	blk sch. phyll (D_1)	0.03	1.1	1	–	(Qz-ser)	E-W・40°N There are three vein zones The veins are dislocated and dispersed too much
98		Au	Qz-v	105°41'04"	44°22'47"	ten parallel quartz veins are seen in the area of 150m×400m vein size: Max. 0.5 m×40m	gry sch. phyll (D_1)	0.02 ~ 0.03	0.4 ~ 0.6	2	–	(Qz-ser)	E-W・75°N Density of the quartz vein is too much dilute.
99		Au	Qz-v	105°44'41"	44°19'16"	floats of milky white quartz-blocks size: Max. 1.5m×4 m	green sch(D) serp. basic r.	–	–	–	–	(chl)	arrangement of blocks:E-W. remnant of eroded Qz-v
100		Au	Qz-v	105°44'35"	44°18'49"	single quartz vein. galena and green copper bearing milky Qz vein size: max. 0.5 m×50m	alt diorite	–	–	–	–	(epi-chl)	N20°E・55°SW
101		Au	Qz-v	105°45'02" ~ 105°45'07"	44°18'32" ~ 44°18'27"	aggregate of parallel quartz veinlets. area: 80m×250 m. vein size: Max. 0.5 m×80m	alt granite	0.03	< 0.3	1	101~160 Av. 134	Qz-ser-chl	N-S~N50°W・45°~80°NE average width ≒20 cm for 250 m
102		Au	Qz-v	106°02'29"	44°26'58"	single quartz vein located at anticlinal axis size: Max. 10 m×450 m	grn-gry sch. phyllitic (D_1)	0.03	< 0.3	1	190~221 Av. 211	Qz-ser-chl	N80°W・60°~70°S
103		Au	Qz-v	105°59'37"	44°27'34"	three parallel quartz veins emplaced at anticlinal axis. milky white mono Qz unit vein size: 1.5 m×350 m zone: 40m×350 m	grn-gry sch. phyllitic (D_1)	0.04	< 0.3	1	138~262 Av. 226	pl-ser	N80°W・70°S There are three veins
104		Au	Qz-v	105°58'59"	44°27'56"	four parallel quartz veins are seen in the area of 40m ×350m vein size: Max. 0.5 m×80m	gry sch. phyll (D_1)	–	–	–	–	(Qz-ser)	N75°W・80°N
105		Au	Qz-v	105°57'53"	44°28'15"	parallel quartz vein zone size: 8 m×100 m	grn gry sch. phyll (D_1)	0.03	< 0.3	1	–	Qz-ser-chl-cal	N60°W・80°S
106		Au	Qz-v	105°57'23"	44°28'17"	aggregate of parallel quartz veins size: Max. 1 m×80m. Av. width 0.1 ~0.3 m zone: 8 m×150 m. Σwv= 4 m	grn-gry sch (D_1)	0.03	< 0.3	1	–	ser	N70°W・70°~85°SW
107		Au	Qz-v	105°56'30"	44°28'33"	parallel quartz vein swarm vein size: max. 0.5 m×80m area 150m×200 m	grn-gry sch (D_1)	0.03	< 0.3	1	–	Qz-ser	N65°~70°W・70°~80°SW Σwv=5 m
108		Au	Qz-v	105°55'07"	44°28'47"	vein swarm of milky quartz vein size: Max. 0.8 m×5 m area: 300 m×800 m.	grn-gry sch (D_1)	0.03	< 0.3	1	–	(Qz-ser)	E-W~N50°W veins are too small and the density is too dilute

Table Ⅱ-1-10 Ore-showings in the North Harmagtai area(3)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Coodinate Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Assay Ag(g/t)	Assay pcs	Filling Temp ℃	Alteration type	Remarks
109		Au	Qz-v	105°41′54″ ~ 105°43′23″	44°25′58″ ~ 44°25′55″	single quartz vein size: Max. 6m×2,000 m	grn-gry sch. phyllitic (D_1)	0.03 ~ 0.32	< 0.3 ~ 0.4	4	140~200 Av. 168	Qz-ser-Xfd	N85°W・80°S~N
110		Au	Qz-v	105°43′22″ ~ 105°43′45″	44°25′45″ ~ 44°25′41″	parallel quartz vein swarm vein size: Max. 0.8 m×50m area: 100 m×900 m.	gry sch. phyll (D_1)	0.03	< 0.3	1	134~166 Av. 155	Qz-ser	N80°W・60°N?
111		Au	Qz-v	105°44′11″	44°25′36″	parallel quartz vein swarm vein size: Max. 0.5 m×50m area: 50m×180 m.	grn gry sch. phyll (D_1)	–	–	–	–	–	N80°W・60°N?
112		Au	Qz-v	105°44′43″	44°25′37″	parallel quartz veins, size: 1 m ×50 m×5. total L =150 m	grn gry sch. phyll (D_1)	–	–	–	–	–	N80°W・60°N?
113		Au	Qz-v	105°45′44″	44°25′29″	four quartz veins uint size Max. 0.3m×15m. total length 50 m	gry sch. phyllitic (D_1)	–	–	–	–	–	E-W・80°N
114		Au	Qz-v	105°46′27″ ~ 105°46′47″	44°25′29″ ~ 44°25′25″	two vein zones along anticlinal axis unit size: Max. 2 m×300 m zone: 50m×450 m	pelitic sch (D_1)	0.04	< 0.3	1	152~199 Av. 175	Qz-ser-cal pl	N80°E・60°S
115		Au	Qz-v	105°47′23″ ~ 105°48′02″	45°25′23″ ~ 44°25′23″	five mono-quartz veins vein size: Max. 1 m×180 m zone: 150 m×850 m	pelitic sch. phyllitic (D_1)	–	–	–	156~196 Av. 173	–	veins: N80°W・80°N, E-W・90°, zone: N70°W
116		Au	Qz-v	105°48′24″	44°25′32″	quartz veins conformably formed at anticlinal axis (saddle leef) size: Max. 30 m×250 m	dk gry phyl sch(D_1)	0.04	< 0.3	1	–	Qz-ser-cal pl	E-W・25°~30°N, 30°~60°S Thickness of the leefs are unknown
117		Au	Qz-v	105°49′54″	45°25′33″	six parallel quartz veins, formed along anticlinal axis vein size: Max. 0.5 m×20m area: 20m×150 m	blk pelitic sch. phyllitic (D_1)	–	–	–	–	–	N80°W・80°~90°N
118		Au	Qz-vl	105°52′43″	44°25′16″	ring-shaped quartz veins formed at anticlinal axis vein size: Max. 1 m×160 m total length: 30m	ser sch. phyllitic (D_1)	–	–	–	–	Qz-ser	N70°W・80°N
119		Au	Qz-v	105°53′02″	44°25′35″	single quartz vein along anticlinal axis vein size: Max. 4 m×800 m	gry psammitic sch (D_1)	0.03	0.3	1	142~192 Av. 173	Qz(ser-chl)	N84°W・60°~70°N. insufficiently surveyed
120		Au	Qz-v	105°53′34″	44°25′26″	single milky white quartz vein size: 1 m×450 m	gry psammitic sch (D_1)	–	–	–	–	–	N84°W・90° insufficiently surveyed
121		Au	Qz-v	105°53′43″	44°25′28″	aggregate vein of milky white quartz veins unit vein size: Max. 2m×80m total size: 20m×450 m	gry psammitic sch (D_1)	0.04	0.3	1	148~198 Av. 163	Qz-dol	E-W・80°S
122		Au	Qz-v	105°54′50″	44°25′25″	single quartz vein. milky white chalcedonic quartz size: 2 m×400 m	blk sch. phyllitic(D_1)	–	–	–	–	Qz-ser	N60°W・60°~90°N
123		Au	Qz-v	105°57′25″	44°25′08″	parallel milky white quartz veins in the area of 70 m× 400 m. Σvw = 4m unit size: Max. 4 m×400 m	gry alt ser sch. phyllitic (D_1)	0.05	< 0.3	1	–	Qz-ser-cal	N80°W・70°~80°N Σv =4 m

Table Ⅱ-1-10 Ore-showings in the North Harmagtai area(4)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate Longitude	Latitude	Characteristics and Size	Host Rock	Assay Au(g/t)	Ag(g/t)	pcs	Filling Temp ℃	Alteration type	Remarks
124		Au	Qz-v	106°06′45″	44°25′23″	vein swarm of milky white quartz veins unit size: Max. 0.5 m×50m zone: 60m×150 m	dk gry sch. phyll (D_1)	−	−−	−	−	Qz-ser	an oval area elongated to E-W direction density of the vein is too dilute
125		Au	Qz-v	106°08′58″	44°24′59″	milky white single quartz vein vein size: 2m×500 m	gry phyll sch (D_1)	0.03	< 0.3	1	171~213 Av. 190	Qz-pl	N70°W· 70°S~80°N
126		Au	Qz-v	106°09′57″	44°25′47″	aggregate of quartz veinlets vein size: max. 0.5 m×6 m zone: 10m×40m	gry phyll sch (D_1)	0.03	< 0.3	1	−	Qz-pl-ser	an oval area elongated to E-W direction
127		Au	Qz-v	106°09′00″	44°26′29″	network of quartz veins vein size: Max. 0.5m×15m zone: 15m×60m	grn sch. phyll (D_1)	0.04	0.3	1	−	ser-chl	mainly N80°W· 80°S. partly N50°W· 60°SW. N80°E· 80°N
128		Au	Qz-v	106°09′54″ ~ 106°10′12″	44°26′55″ ~ 44°26′54″	aggregate of quartz veins unit vein size: Max. 4 m×500m area: 200 m×700 m	blu-gry sch. phyll (D_1)	0.03 ~ 0.04	< 0.3 ~ 1.4	3	149~204 Av. 181	Qz-pl-ser	N80°W·70°S. N80°W· 60°N. N55°W·70°Sw. E-W· 60°S.
129		Au	Qz-v	106°10′39″	44°26′28″	four parallel quartz vein zones in the area of 100 m×300 m. milky white mono quartz unit vein size: 0.6 m×80m	blu-gry sch. phyll(D_1)	0.04	< 0.3	1	−	ser-chl	N70°W· 60°~80°N
130		Au	Qz-v	106°10′54″	44°26′35″	aggregate of quartz veins in the oval area unit vein size: Max. 5m×35m area: 25m×70m	gry sch. phyll (D_1)	0.04	< 0.3	1	−	Qz-pl-ser	N55°W· 80°S. E-W·50°S. N20°W· 60°S. partly saddle leef
131		Au	Qz-v	106°11′28″	44°26′52″	net work of milky white quartz veins size: Max. 0.6m×8 m area: 30m×40m	blu-gry alt sch (D_1)	0.04	< 0.3	1	−	−	N80°E· 80°S. N70°E·80°S. N10°E· 80°E. N40°E· 80°E N40°W· 60°SW
132		Au	Qz-v	106°12′20″ ~ 106°12′13″	44°27′05″ ~ 44°27′06″	parallel quartz vein zone unit vein size: max.1 m×250m vein zone: 200m×300 m	grn-gry sch. phyll (D_1)	0.04	< 0.3	1	170~202 Av. 181	ser-chl	N70°~80°W· 80°S N55°W· 50°~60°NE
133		Au	Qz-v	106°12′42″	44°27′08″	parallel quartz vein zone vein size: 0.1 m~0.2 m×9 zone: 5 m×300 m	dk gry sch (D_1)	0.04	0.3	1	184~258 Av. 227	Qz-ser-chl pl	E-W· 30°S
134		Au	Qz-v	106°10′57″ ~ 106°10′38″	44°29′02″ ~ 44°28′57″	parallel quartz vein zone vein size: Max.8m~400 m zone: 200 m×400 m	dk gry sch. phyllitic (D_1)	0.03 ~ 0.05	< 0.3 ~ 1.7	3	244~258 Av. 251	Qz-pl(ser)	N65°W· 70°~80°N
135		Au	Qz-v	106°12′41″	44°27′56″	single quartz vein milky white mono quartz vein size: Max.1.5m×350 m	dk gry sch. phyllitic (D_1)	0.04	0.3	1	−	−	N70°W· 90° size of the major part is 1 m×120 m
136		Au	Qz-v	106°13′06″ ~ 106°13′15″	44°27′30″ ~ 44°27′31″	aggregate of saddle reef and ladder veins vein size: Max. 0.5 m×30m zone: 20m×300 m	gry sch. (D_1)	0.03 ~ 0.04	< 0.3 ~ 0.4	2	207~250 Av. 231	Qz-pl-ser	unit vein N25°W·30°~50°E zone: E-W
137		Au	Qz-v	106°13′21″ ~ 106°13′10″	44°27′12″ ~ 44°27′10″	aggregate of saddle reef and ladder veins vein size: Max. 4 m×40m zone: 100 m×400 m	gry sch. phyll (D_1)	0.04	0.3	1	−	Qz-ser-chl	unit vein : E-W·50°~80°S N20°~40°W· 30°~45°SW zone: E-W

Table Ⅱ-1-10 Ore-showings in the North Harmagtai area(5)

No.	Name of deposit	Mineral	Type of Deposit	Coodinate		Characteristics and Size	Host Rock	Assay			Filling Temp ℃	Alteration type	Remarks
				Longitude	Latitude			Au(g/t)	Ag(g/t)	pcs			
138		Au	Qz-v	106°14′11″ ~ 106°13′49″	44°27′19″ ~ 44°27′14″	aggregate of parallel quartz veins unit vein : Max. 35 m×800 m Av. total width of veins =3 m zone: 140 m×1,150 m	gry sch. phyll (D_1)	0.03 ~ 0.04	< 0.3	3	217~275 Av. 238	Qz-ser	E-W· 45°~60°N, E-W·50°S
139		Au	Qz-v	106°14′32″	44°27′17″	a couple of quartz veins containing galena vein size: max. 0.8 m×50m area 20 m×80m	gry sch. phyll·(D_1)	0.04	1.4	1	—	Qz-ser-chl	N30°E·80°SE N60°E·50°~80°SE
140		Au	Qz-v	106°15′26″ ~ 106°14′53″	44°27′04″ ~ 44°27′16″	aggregate of quartz veins veins size: Max. 2 m×100 m more than eight veins zone: 250 m×1,100 m	grn-gry sch. phyll (D_1)	0.04	0.3 ~ 1.1	2	—	Qz-pl-ser-chl	N60°W· 90°, N65°W· 90° N10°E· 60°W N70°W· 80°S
141		Au	Qz-v	106°18′54″ ~ 106°18′29″	44°26′54″ ~ 44°27′05″	a quartz vein swarm veins size: Max. 15m×400 m more than ten veins are seen *zone: 1,000 m×1,500 m*	grn-gry sch. phyll (D_1)	—	—	—	—	—	E-W, N40°E, N60°E, N10°E dip is not obvious very insufficiently observed
142	Shvuun Hudag	Au	Qz-v	106°18′54″ ~ 106°18′38″	44°16′55″ ~ 44°16′55″	massive silicified rocks and milky white quartz vein size of silicified rocks 100 m×250 m cut by Qz vlets 5 m×120 m size of quartz vein 1 ~2 m×140 m *zone: 200 m×600 m*	basalt (C_3 - P_1)	—	—	—	—	Qz-pl-chl K-fel	quartz vein: N70°W·90° silicified rocks: N60°E, N60°W hydro-fracturing is seen

the southern part of the area as a small exposure.

Carboniferous-Permian (C-P, C-Pg) is composed of volcanics such as trachyandesite, andesite and rhyolite and intrusives of granodiorite and diorite and crops out in the southeastern part of the area.

Cretaceous (K) is composed of weakly consolidated conglomerate, sandstone and mudstone and is widely distributed in the eastern to southwestern part of the area filling a lowland.

2. Ore deposits and mineral indications

Main mineralization in the area is quartz veins and as a subordinate mineralization massive silicified rock is found at the eastern end of the area. Quartz veins concentrate in the uplifted Paleozoic block in the centeral part of the area. Veins are formed mainly along the E-W trending faults and along axes of anticlines. These quartz veins found along anticlinal axes often display saddle shape and partly stockwork. A lots of large scale quartz veins continues more than 30 km in the forms of either parallel or echelon pattern along the faults and anticlinal axes. In this area there exist four zones of above-mentioned aggregates of quartz veins.

Characteristics of the quartz veins is lacking of sulfide minerals and they are mainly composed of milky white to semi-transparent quartz and partly associated with coarse-grained transparent quartz or well-crystalline quartz. Texture of hydrofracturing is observed which suggests that boiling of ore forming fluid might occur during mineralization.

Massive silicified rock is found at a southeastern rim of the area with association of milky white quartz vein.

Homogenization temperature of fluid inclusion ranges from 150°C to 220°C. As to alteration, quartz sericite predominates.

Chemical analysis of 52 samples showed less than 0.32 g/t of gold and below 2 g/t of silver.

The results of the survey is shown in the Table II-1-10.

1-4 Consideration and Conclusion

1-4-1 Consideration

As a result of reconnaissance geological survey, remakable gold concentration is observed in quartz veins of Olon Ovoot, Horimt Hudag and North Olon Ovoot in the Olon Ovoot area. Whereas a lot of large scale quartz veins and silicified rocks are confirmed in the areas of Soirig, Sologoi and North Harmagtai, but surface grade of these mineralization show generally low grade.

All of the above-mentioned mineralization has common geological characters such as; ① country rocks of the mineralization belong to Central Mongolian fold belt of Paleozoic age, ② mineralization was formed in milky white colored hydrothermal quartz veins with very few sulfide minerals, ③ K-Ar age of wall rock alteration sericite of quartz veins showed nearly the same age, namely 283± 14 Ma at Olon Ovoot and 286 ± 15 Ma at North Harmagtai.

Possibility of gold mineralization is considered in the big quartz veins and/or silicified rocks of Sogoloi, Soirig and North Harmagtai areas.

Following three aspects are considered which are controlling concentration of gold mineralization:

① A diagram, homogenizing temperature of fluid inclusion versus gold assay grade, is drawn plotting each mineral indications data on it.

Range of temperature is shown by a line with average figure designated by each locality marking. Gold value stands for the highest value at each locality. (Ref. Fig. II-1-47)

By reading this diagram it is found that gold concentration occurs below 250°C of homogenization temperature and higher the temperature lesser the gold grade.

② A pressure-temperature diagram is drawn plotting homogenizing temperature of fluid inclusion at each locality and boiling curve of water on it. (Ref. Fig. II-1-48) Assuming mineralized solution of the area is under a higher pressure than a static condition due to self-sealing effects, since it is observed presence of shallow forming massive silicified rocks and occurrence of hydrofracturing phenomena which suggests a boiling of ore-forming fluid.

As a result, it is assumed that quartz veins in Sologoi, Soirig and Harmagtai North areas were formed 20° ~ 50°C lower temperature than Olon Ovoot, that is, depthweise 200 ~ 400 m shallower than Olon Ovoot area.

③ Alteration mineral facies of Olon Ovoot deposit is chlorite whereas that of Sologoi, Soirig and North Harmagtai area is rich in sericite. This is harmonizing with the ideas stated above.

In conclusion there is a fairly big potential in the subsurface of Sologoi, Soirig and North Harmagtai quartz vein outcrops.

1-4-2 Conclusion

Reconnaissance geological survey leads to following conclusions.

1. A lot of big quartz veins and massive silicified rocks are present in the Soirig, Sologoi and North Harmagtai areas. Total volume of hydrothermal quartz in the Ulziit district probably exceeds five hundred million tons.

2. Epochs of mineralization are early Permian at Olon Ovoot, Onh and North Harmagtai areas, Late Carboniferous at Olon Ovoot deposit and Cretaceous at Sologoi area.

3. Gold mineralization is observed at Olon Ovoot, Tsagaan Uula and Tahilga Uula areas.

4. Homogenization temperature of liquid inclusion ranges from 170° to 250°C at the place of gold concentration in the Olon Ovoot, Tsagaan Uula and Takhilga Uula areas.

5. Homogenization temperature exceeds 250°C at majority of quartz veins in Dugshih, east of Olon Ovoot, central part of Tsagaan Uula and south of Onh area.

6. The temperature is below 210°C at Soirig, Sologoi, North Harmagtai, west of Tsagaan Uula, west of Olon Ovoot and northwest of Onh area.

7. Alteration mineral products are chlorite facies and/or chlorite-sericite facies at Olon Ovoot and Horimt Hudag and sericite predominates at the rest of the area.

8. A lot of big massive silicified bodies distributed in Soirig and Sologoi areas and siliceous sinter, aragonite sinter and geiserite are found in Sologoi area.

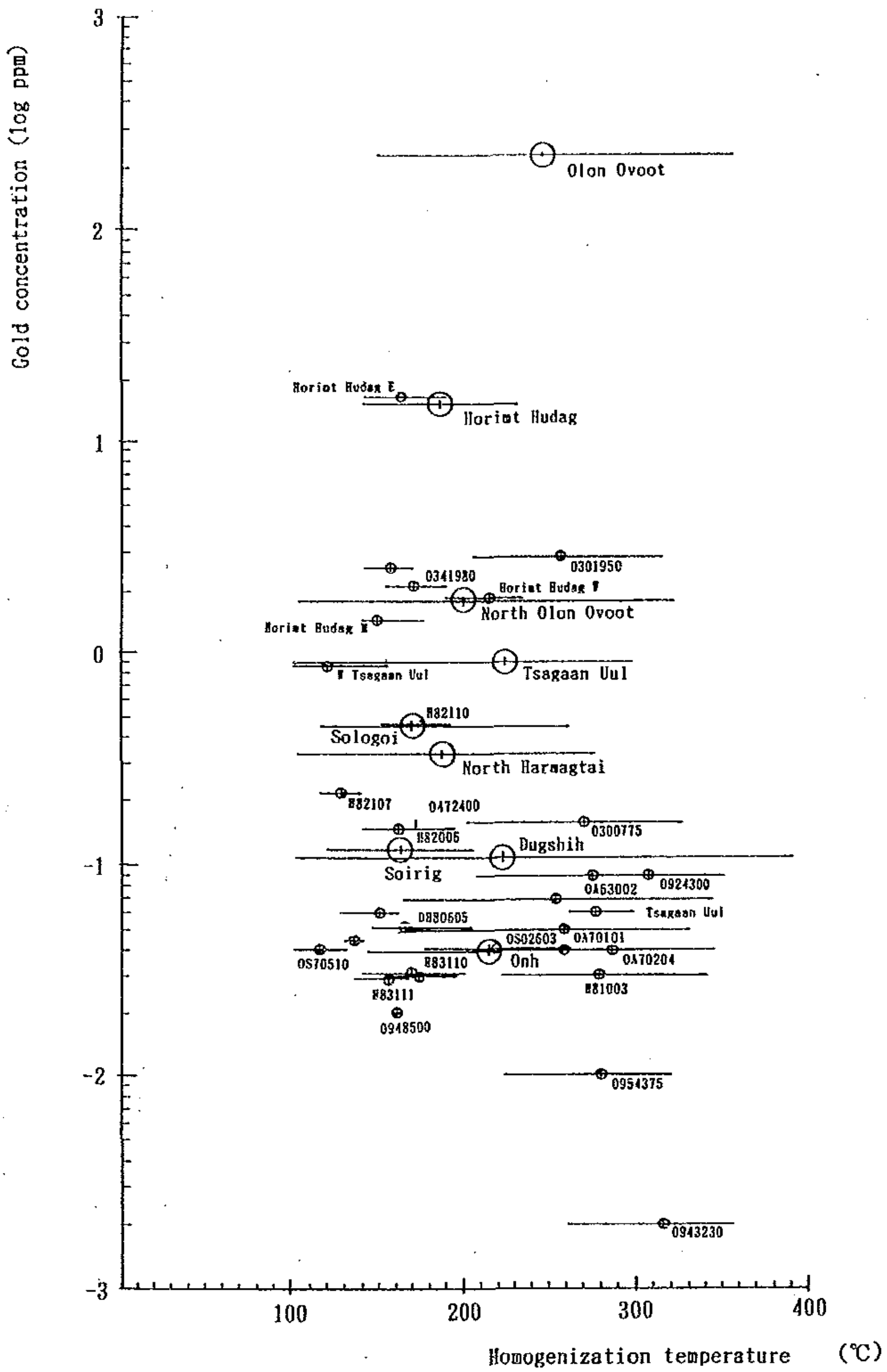
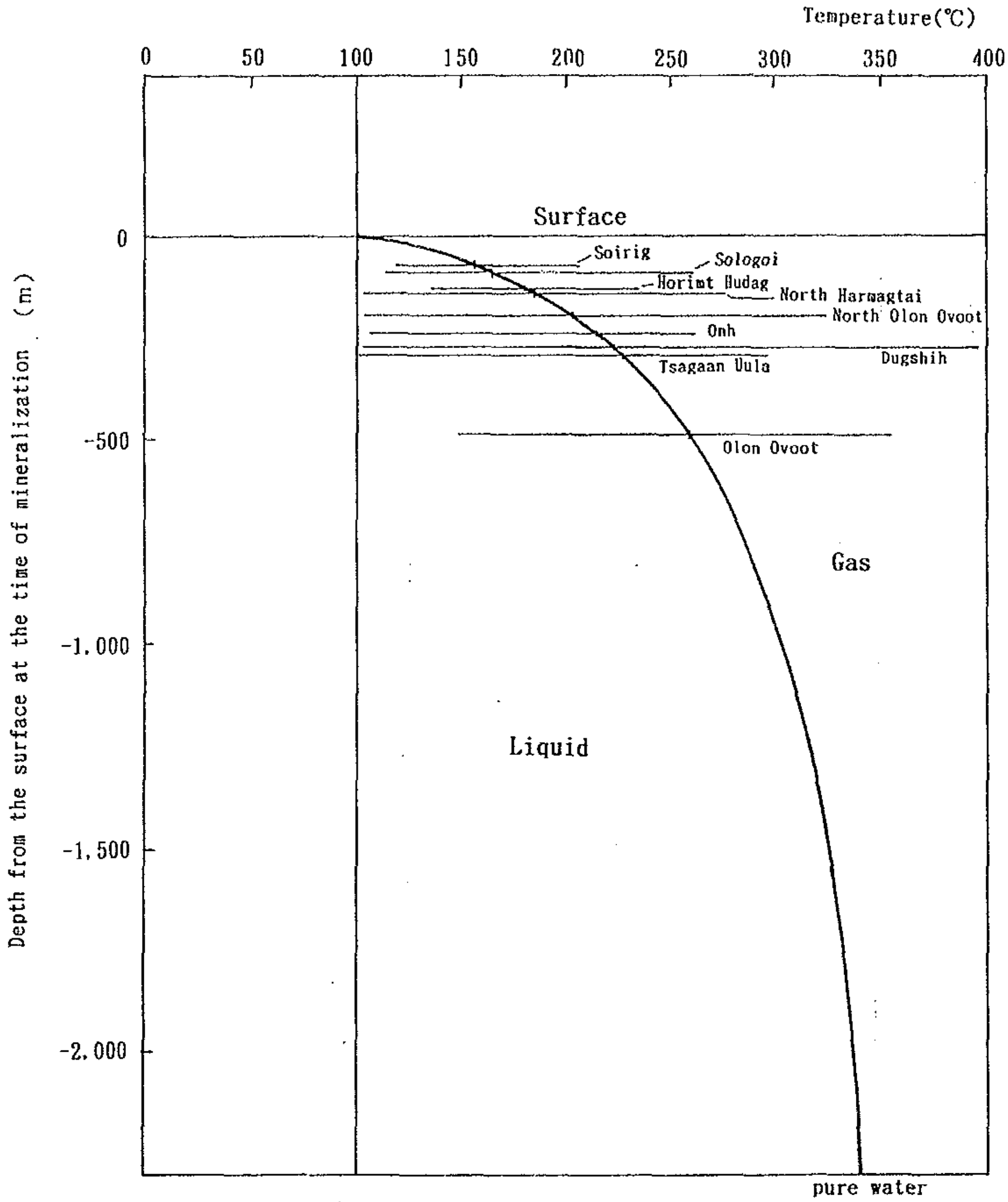


Fig. II-1-47 Gold concentration in relation to the homogenization temperatures of the fluid inclusions

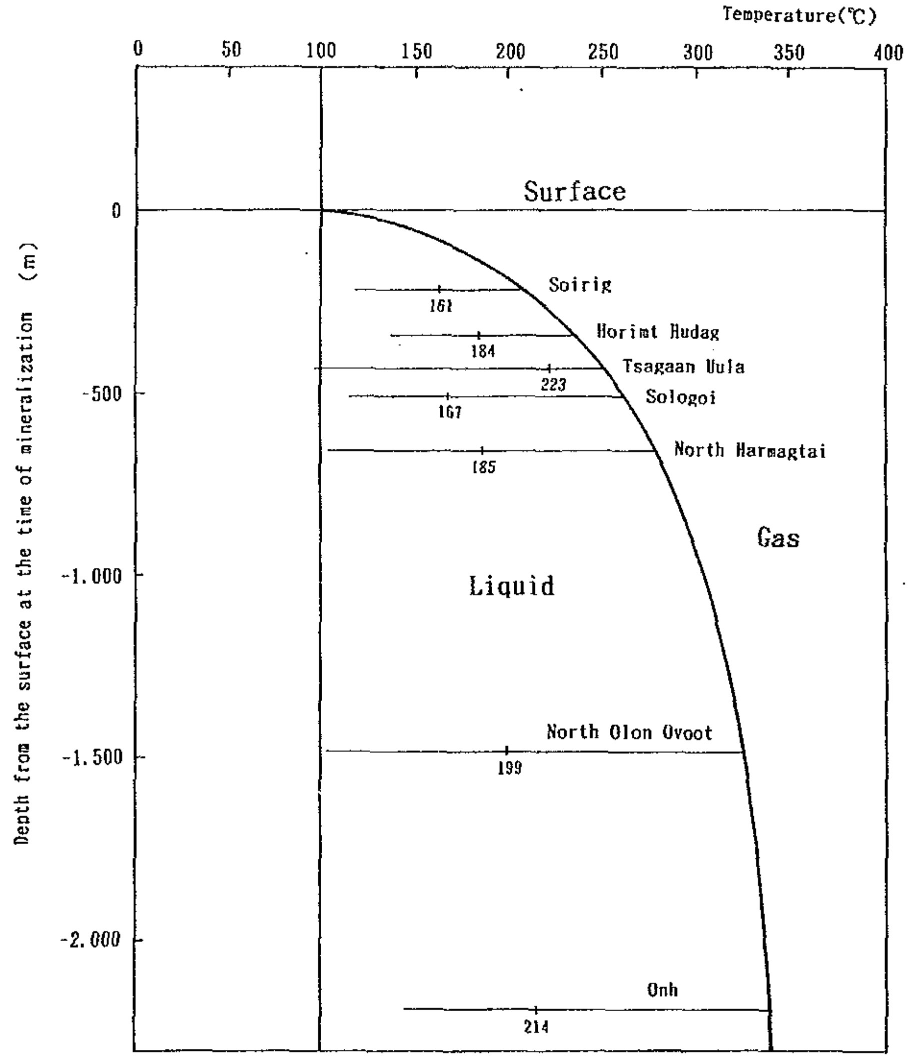


Average homogenization temperatures were adopted taking self-sealing effect into consideration.

Fig. II-1-48 Depth of ore-formation in relation to the homogenization temperatures of the fluid inclusions in self-sealing model

Homogenization temperature of the ULZIIT DISTRICT

Name of the area	Temperature Range (℃)				Number of	N o t e
	Min.	Max.	Av.	Mode	measuring	
Horimt Hudag	138	232	184	220	25	multiple peaks
North Olon Ovoot	102	323	199	219	20	dispersed
Olon Ovoot	148	356	256	172	181	multiple peaks
Tsagaan Uula	98	298	223	285	21	double peaks
Dugshih	101	392	222	172	235	single peak ?
Onh	142	340	214	162	87	multiple peaks
Soirig	119	205	161	180	102	multiple peaks
Sologoi	115	260	167	160	135	double peaks
North Harmagtai	101	275	185	170	234	single peak



Hydrostatic Condition (maximum temperature=boiling temperature)
In this case, depth of Dugshih(Max. T. = 392 ℃) and Olon Ovoot(Max. T. = 356 ℃) comes unreasonably large. Uniaxial strength of the schists in the Ulziit district looks insufficient to sustain large caverns (tension cracks) to form quartz veins in such a deep place.

Fig. Ⅱ-1-49 Depth of ore-formation in relation to the homogenization temperatures of the fluid inclusions in hydrostatic model

9. Hydrofracturing phenomena are widely observed in the entire survey area.

10. Judging from the relationship between gold concentration and homogenizing temperature of fluid inclusion, big quartz veins and massive silicified rocks of Soirig, Sologoi and North Harmagtai areas are worthwhile to make an exploration work to verify blind gold ore deposits.

11. There remain lots of mineralized areas untouched in the Ulziit District, therefore further and additional mineralization survey should be conducted to the area.

Chapter 2 Semi-detailed Geological Survey

2-1 Purpose of the survey

The survey aims to clarify geology and mineralization of the Olon Ovoot deposit and to provide necessary data for interpretation of geophysical survey to be conducted.

2-2 Methods and contents of the survey

Target area covers 12 km^2 which includes the Olon Ovoot deposit (Fig. II-2-1).

A base camp for the survey was located 5 km away from the area toward southeast. Three survey teams composed of one each engineer from Mongolian and Japan to make one survey team were organized and conducted the survey.

Routes of the survey was the same as geophysical survey which were planned every 300 m apart of magnetic north to south directed lines. Total length of survey routes amounted to 63 km including a base line survey. During a course of survey geochemical rock sampling and mapping of routes were conducted producing a map on a scale of 1:5,000 using a pocket compass and measuring tape.

Rock samples for geochemical survey were chosen and collected to stand for lithology and geological situation of the area and at places digging pits were made to obtain unweathered specimen.

Laboratory tests were conducted as to following items: microscopic observation, whole rock analysis, absolute age determination, chemical analysis of ore sample and measurement of homogenizing temperature of fluid inclusion.

Gold and silver were analysed for ore samples, using atomic absorption method after extracting elements by aqua regia. Assay results were checked by comparing conventional fire assay results. Detection limit of the analysis is 0.01 ppm for gold and 0.2 ppm for silver, respectively.

Analysis for geochemical samples was conducted for the following seven elements: Au, Ag, Ag, As, Sb, W & Mo using ICP method with detection limit of for Au 1 ppb, Ag 0.2 ppm, Hg 10 ppb, As 2 ppm, Sb 2 ppm, W 2 ppm and Mo 1 ppm.

2-3 Survey results

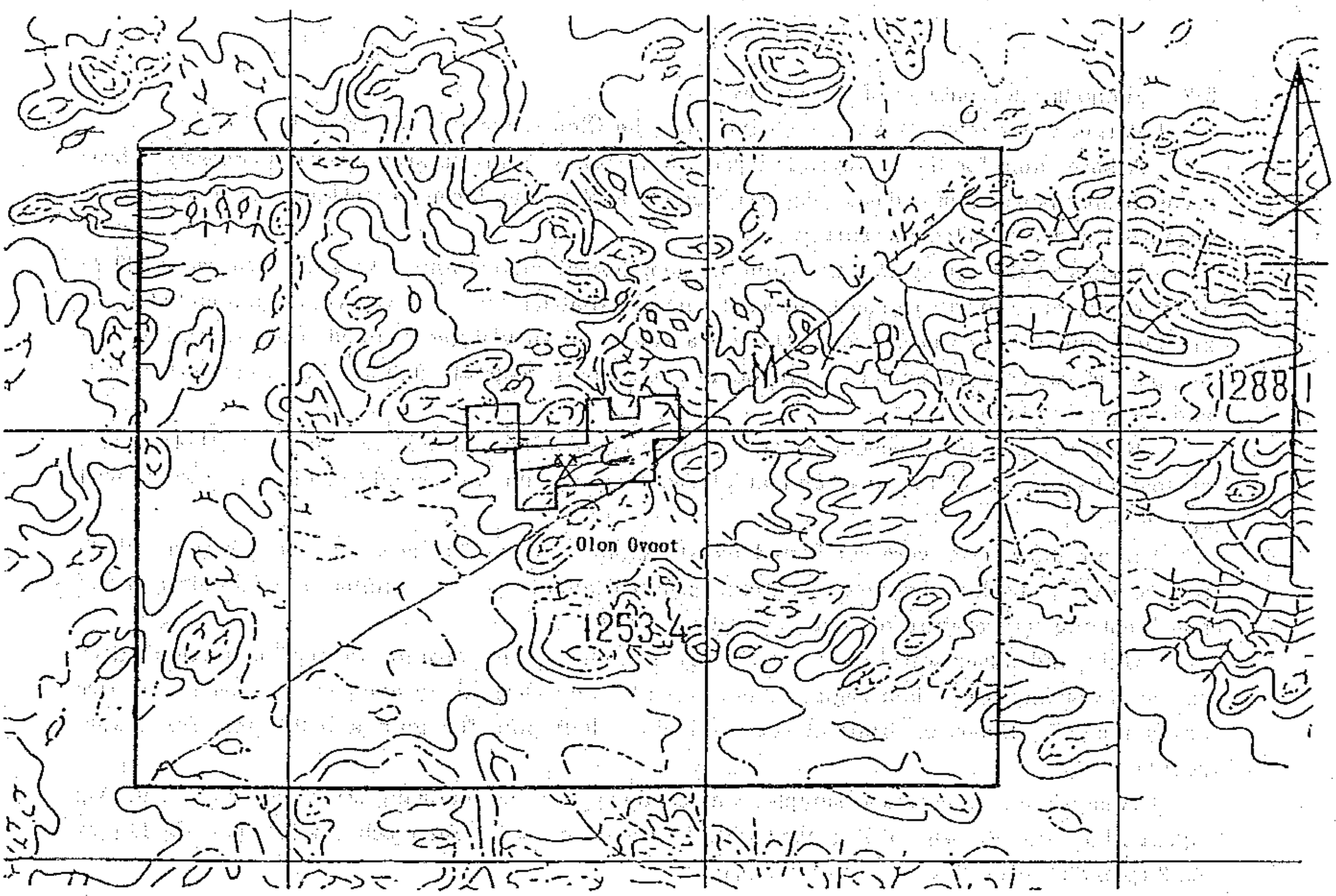
2-3-1 Geology

Geology of the area is composed of Silurian, Devonian, Jurassic and intrusives within Paleozoic formations (Fig. II-2-2).

Silurian is composed of crystalline schists derived from marine sediments and covers most of the survey area. The formation is composed of, in ascending order, alternation of sandstone and siltstone, siltstone, medium ~ fine-grained sandstone, greenschist and mudstone which were intruded by medium ~ fine-grained diorite ~ granodiorite, basaltic andesite, basalt and trachyte.

Devonian is made of white limestone with abundant crinoid fossils and crops out in the northwestern, southern and northeastern parts of the area. Thickness of the formation amounts to over 50 m. The formation is folded with E-W directed fold axis and the structure is discordant with the underlying Silurian formation. Boundary to the Silurian is sharp and distinct and no basal conglomerate is observed in the area.

Jurassic is composed of basalt and biotite rhyolite lava, both of them unaltered, and crops out in the northeastern part of the area. The formation which forms flat topography occupies a periphery of uplifted Paleozoic blork.



Semidetailed Survey Area (12km²)

0 1,000 m

Fig. Ⅱ-2- 1 Location map of the semidetailed survey area

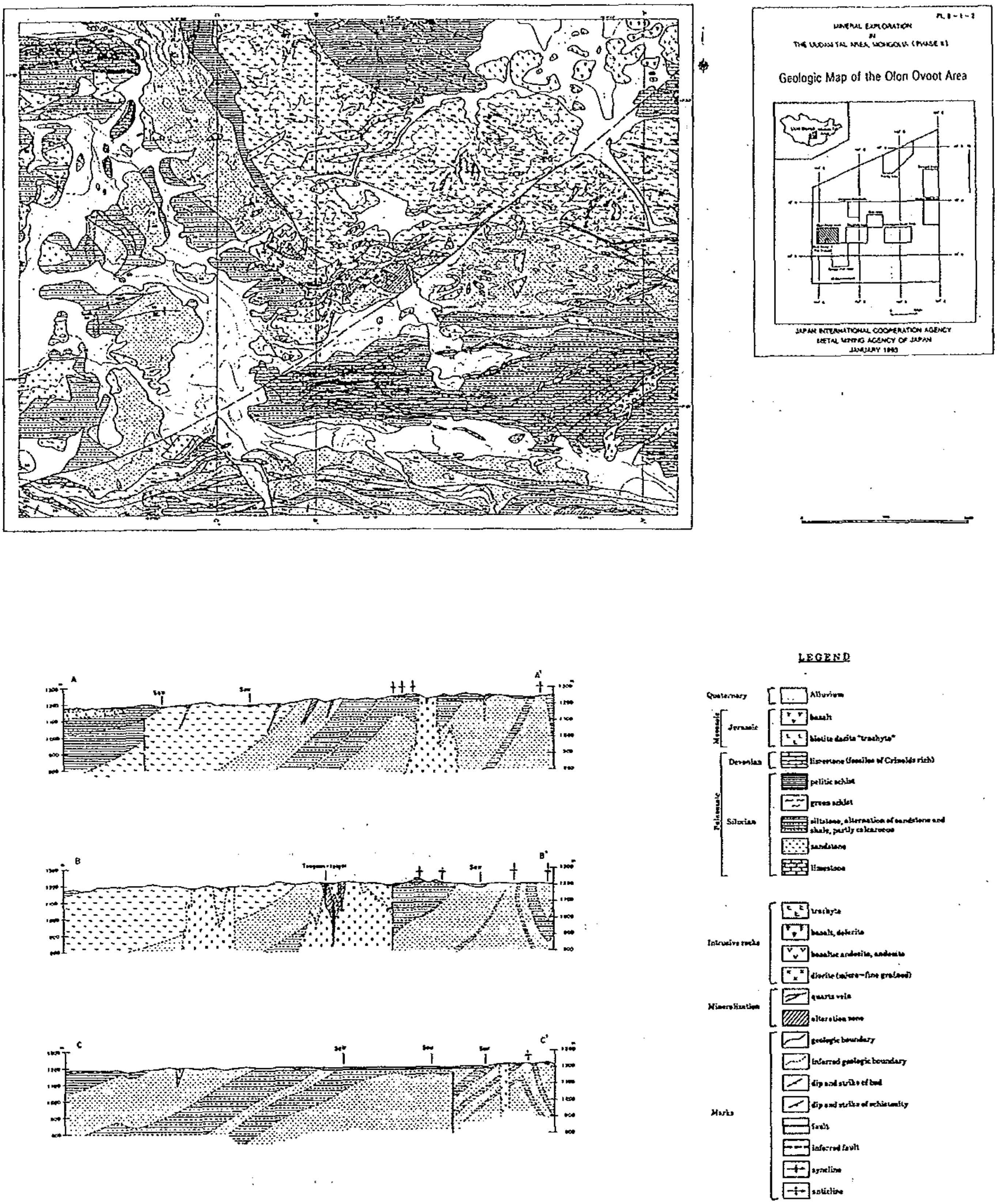
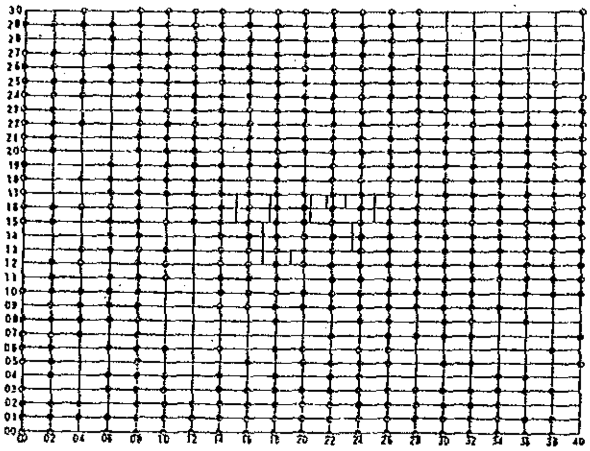
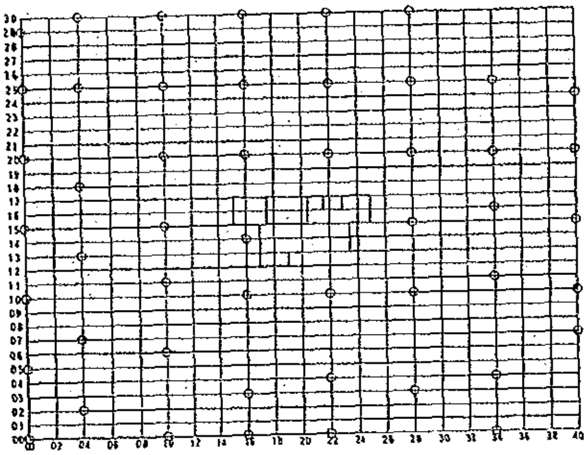


Fig. II-2- 2 Geologic map of the semidetailed survey area



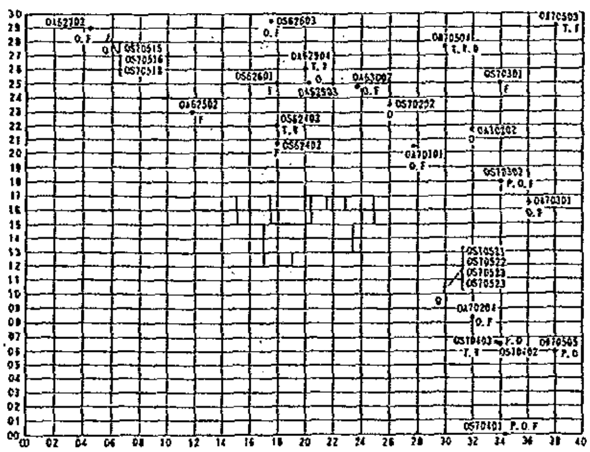
○ sampling points

Geochemical Survey



○ sampling points

X-Ray Diffraction

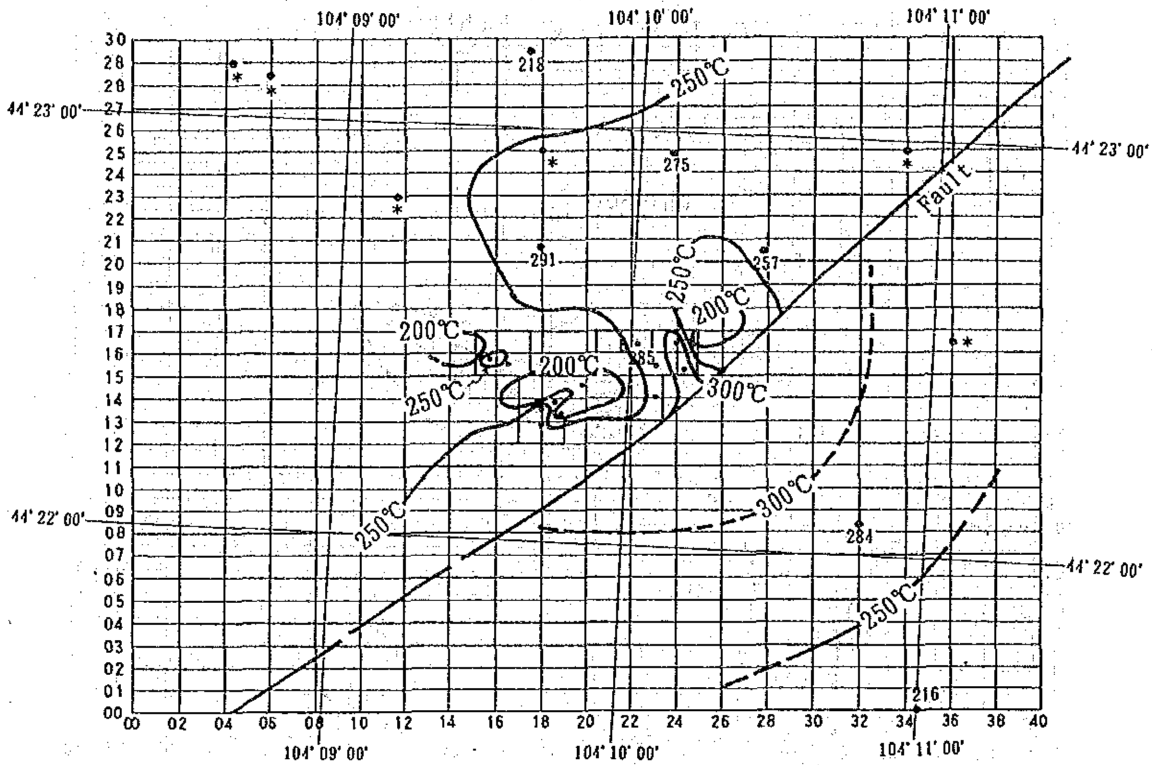


Other Laboratory Tests

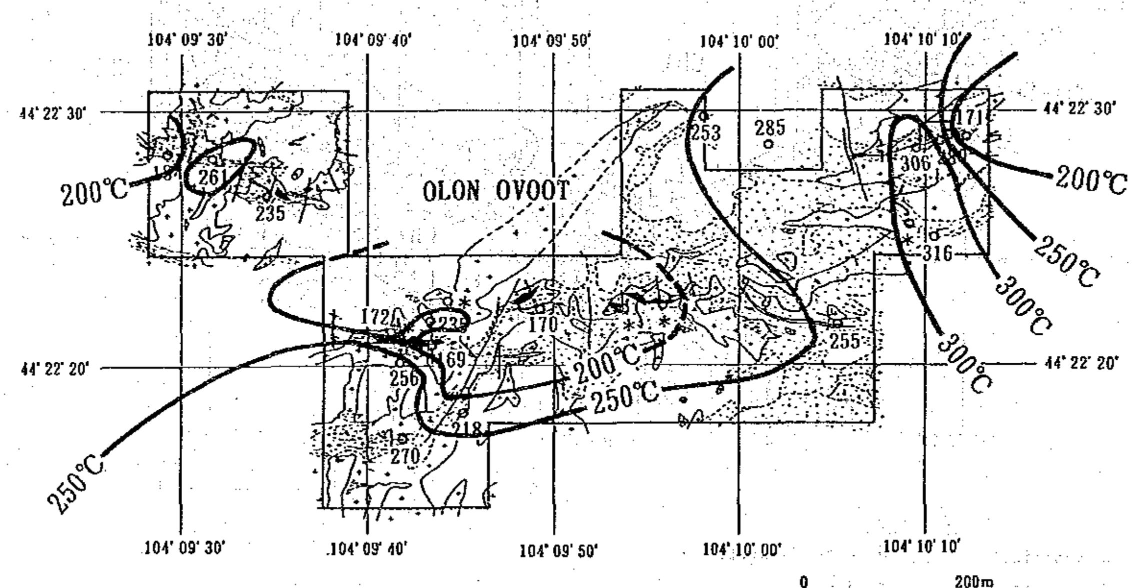
L E G E N D

· sampling points
T: Thinsection
P: Polished section
O: Ore analysis
W: Whole rock chemical analysis
D: Dating(K-Ar)
F: Fluid inclusion test

Fig. Ⅱ-2-3 Location of the rock samples in the semidetailed survey area



Semidetailed Survey Area



Geochemical Survey Area

Fig. II-2-4 Areal distribution of the homogenization temperature of the fluid inclusion in the semidetailed survey area

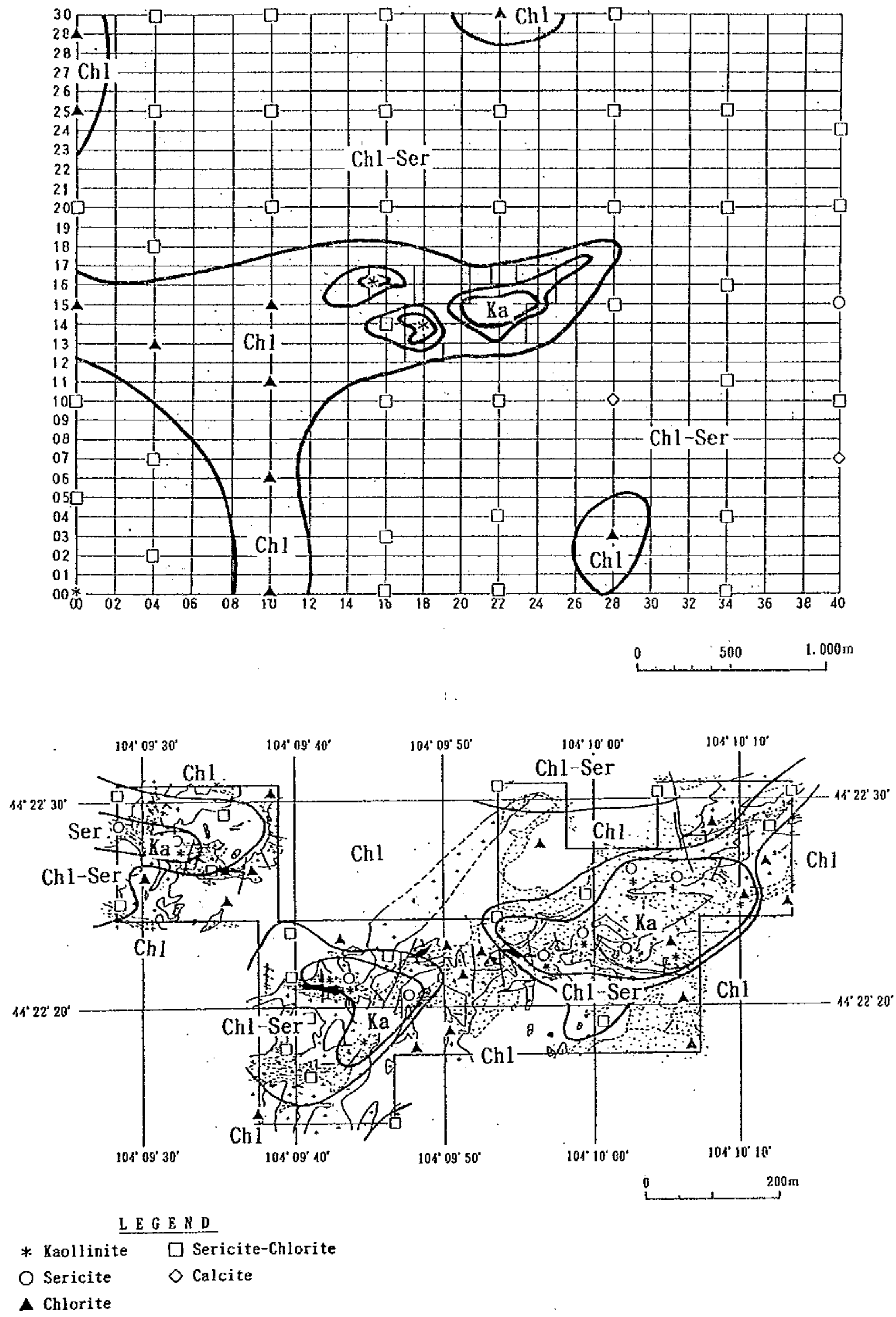


Fig. II-2-5 Alteration zoning of the semidetailed survey area

Intrusive rocks are composed of medium ~ fine-grained diorite, medium ~ fine-grained granodiorite, basaltic andesite, basalt and trachyte. Diorite and granodiorite crop out as small intrusives in the entire survey area with special concentration near the Olon Ovoot deposit. Basaltic andesite and basalt crop out in the western part of the area as small intrusive bodies.

A fault which is running through the center of the area with a direction of NE-SW divides the survey area into two structurally different blocks: the eastern block shows a fold structure with its axis of E-W direction which is concordant to the regional geological structure, the western block, on the contrary to that, shows NW-SE trend of strike near the fault and becomes an tectonically anomalous block.

The Olon Ovoot deposit is located at a crossing of NE-SW fault with sandstone and there found are lots of intruve rocks.

Six zones of quartz veins, maximum width 20 m x extention 50 ~ 100 m, are distributed on the western side of the fault with a chain of arcuate form. Total length of quartz veins reaches around 1,000 m at Olon Ovoot deposit. Aside from that near the deposit is developd a silicified-pyritized alteration zone with maximum width of 200 m and a part of it extends over 1 km toward NE along the fault. Similar alteration zones are found on the east of the fault and northeast of the area.

A new quartz vein zone is discovered at the northwestern tip of the area and its western extension.

Homogenization temperature of fluid inclusion is over 250°C at north and east of the Olon Ovoot deposit and below 250 ° at gold concentrated part of Olon Ovoot deposit. Alteration mineral facies of the adjacent part of the Olon Ovoot deposit is usually chlorite and a partly serite-chlorite or chlorite associated with plagioclase and minor amounts of calcite.

2-3-2 Geochemical survey results

Statistic study on assay data was conducted as follows: making cumulative frequency diagrams of seven elements analysed, determination of threshold value and anomalous maps of each elements (Fig. II-2-6 ~ II-2-9), correlation of each elements and other statistical analysis (Table II-2-1).

The following are results of the study.

Au: Anomalous values are found at and near the Olon Ovoot deposit and on the fault zone in the southwestern part of the area.

Ag: Generally silver values are low. Anomalous values are encountered in the following points; the center of the Olon Ovoot deposit, fault zone, manganese oxide-containing alteration zone in the southeastern part of the area and silicified zone within sandstone in the southern part of the area.

Hg: N-S trending anomalous zone is found in the central-eastern part of the area.

As: Two anomalous zones are detected, one is forming a doughnut shape surrounding the Olon Ovoot deposit and the other in silicified sandstone zone in the southern part of the area.

Sb: N-S trending anomalous zone is found in the western part of the area and a small anomalous zone near the deposit.

W: Anomalous zone containing more than 2 ppm is detected in the western part of the area.

Mo: N-S trending anomalous zones are found in the centerel and eastern parts of the area.

Correlation study revealed that no element is admitted to show statistically significant correlation. Comparison between geologic distribution and geochemical study showed that any elements do not reflect lithological difference of the country rocks.

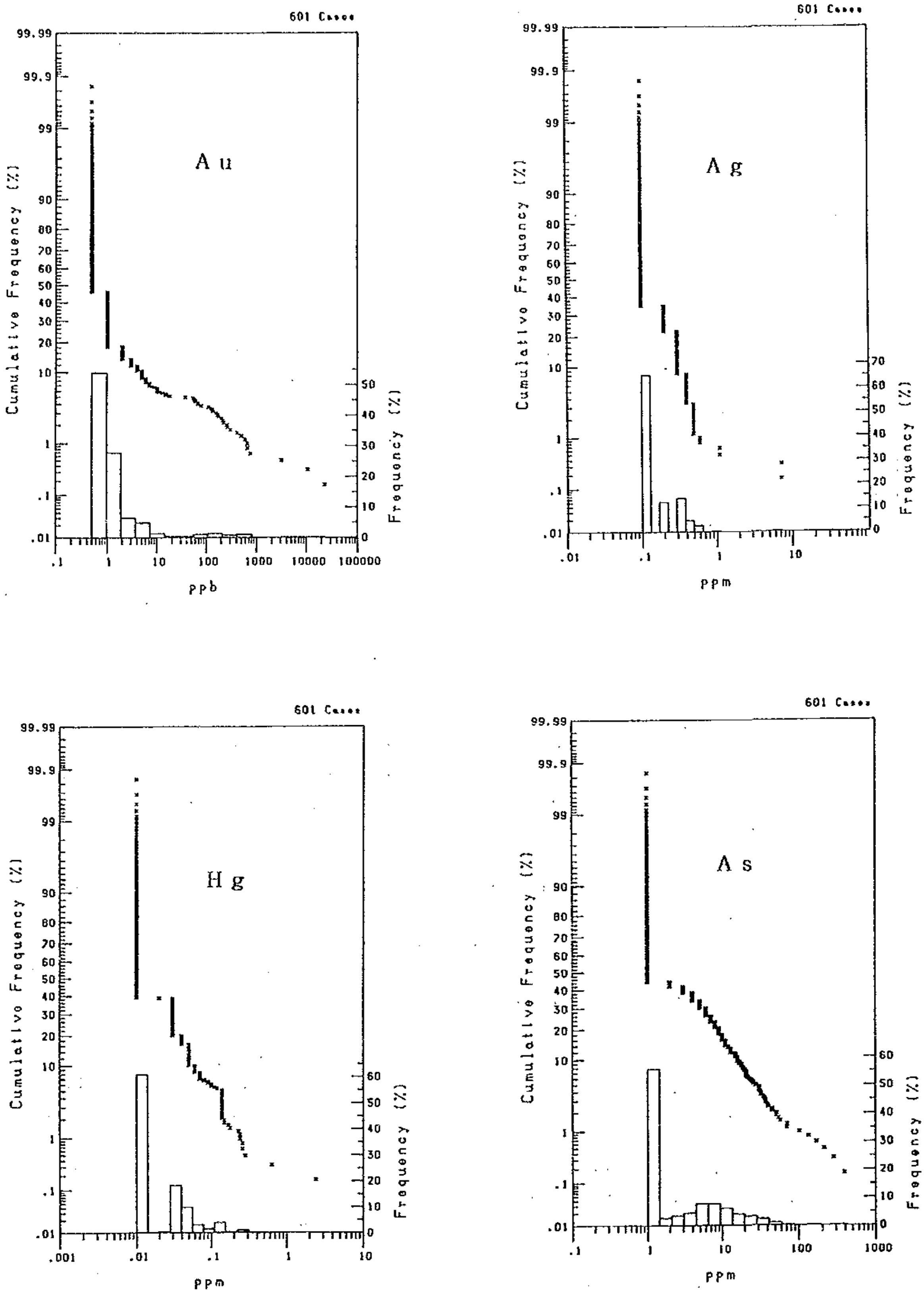
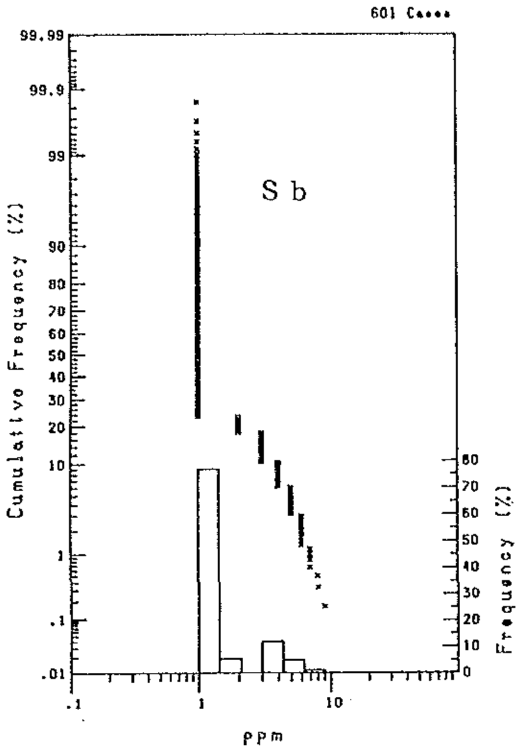
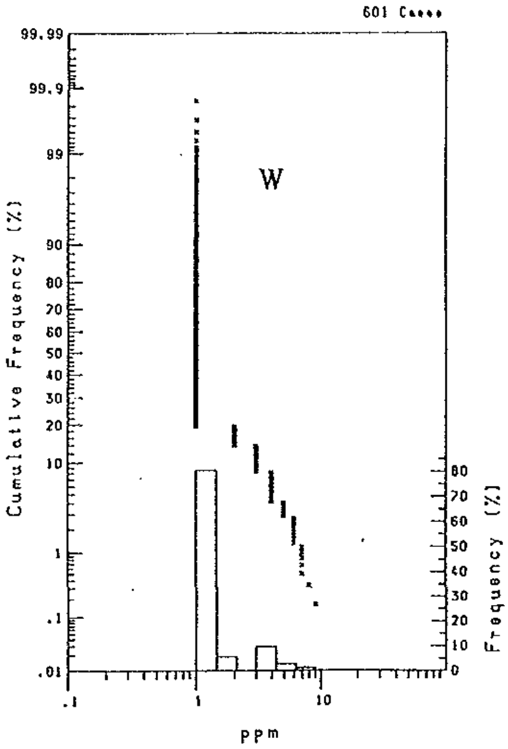


Fig. Ⅱ-2- 6 Cumulative frequency curves of assay results (Au, Ag, Hg, As)





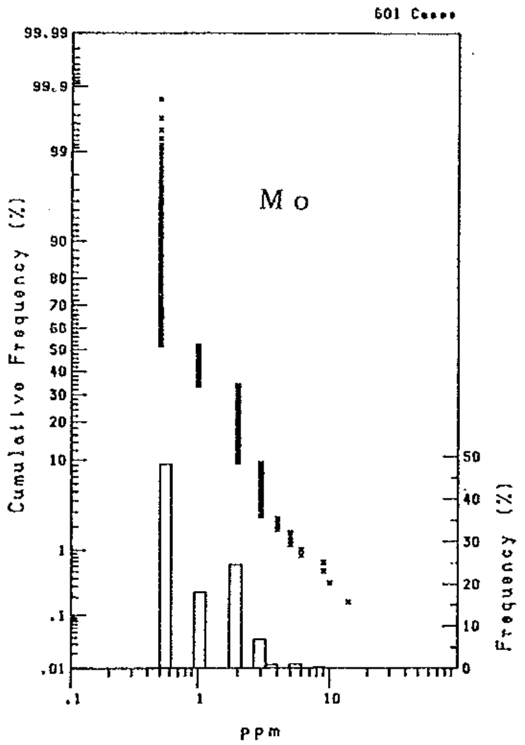
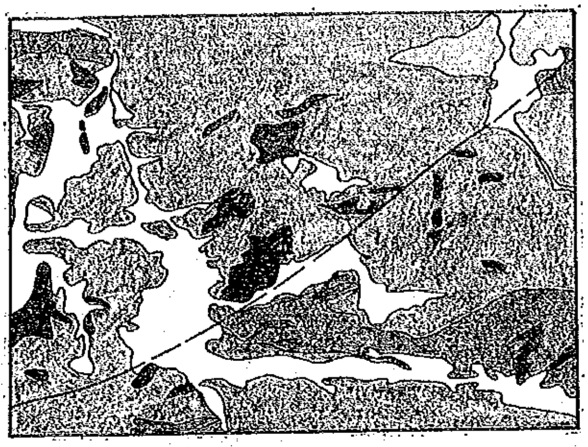


Fig. II-2- 7 Cumulative frequency curves of assay results (Sb, W, Mo)

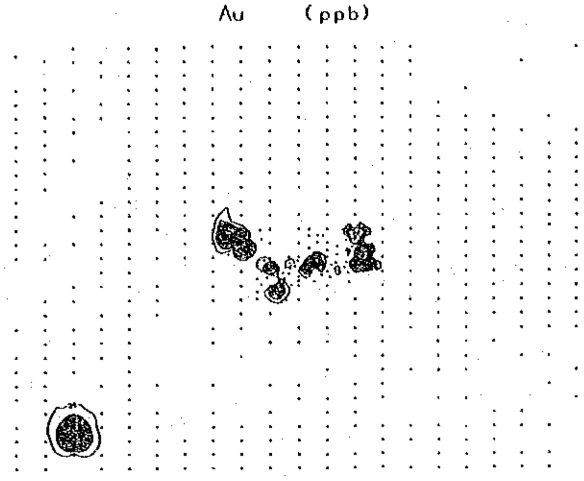


LEGEND

- Quaternary
- Jurassic(basalt, trachyte)
- Limestone
- Schist(pelitic-psammitic)
- Intrusive rocks
- Fault

Modified Geologic Map of the Semidetailed Geological Survey Area

Au (ppb)

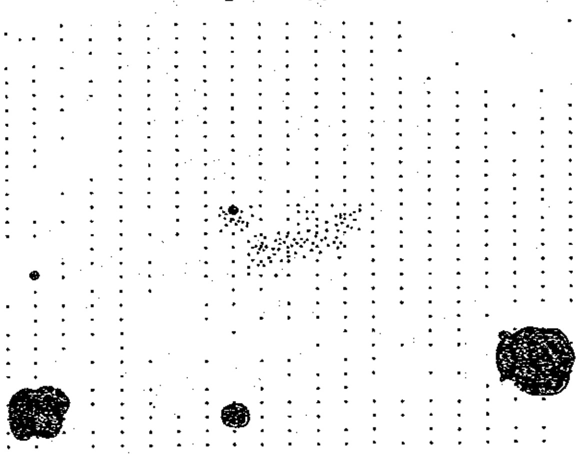


LEGEND (ppb)

- 20 ≦ Au < 50
- 50 ≦ Au < 700
- 700 ≦ Au

Gold

Ag (ppm)

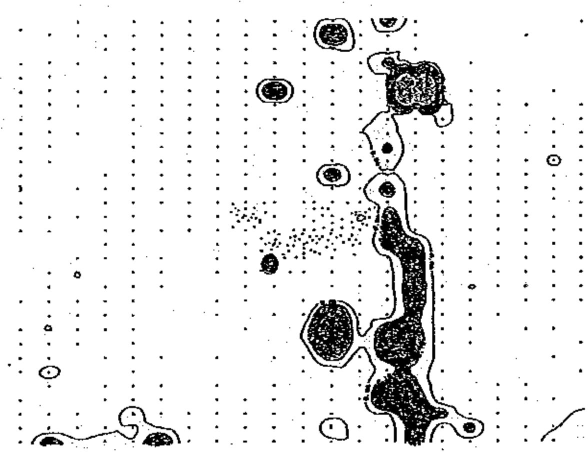


LEGEND (ppm)

- 0.5≦ Ag

Silver

Hg (ppm)



LEGEND (ppm)

- 0.06 ≦ Hg < 0.1
- 0.1 ≦ Hg < 0.3
- 0.3 ≦ Hg

Mercury

0 1 km

Fig. II-2-8 Distribution of minor elements in the rocks of semi-detailed geological survey area (Au, Ag, Hg)

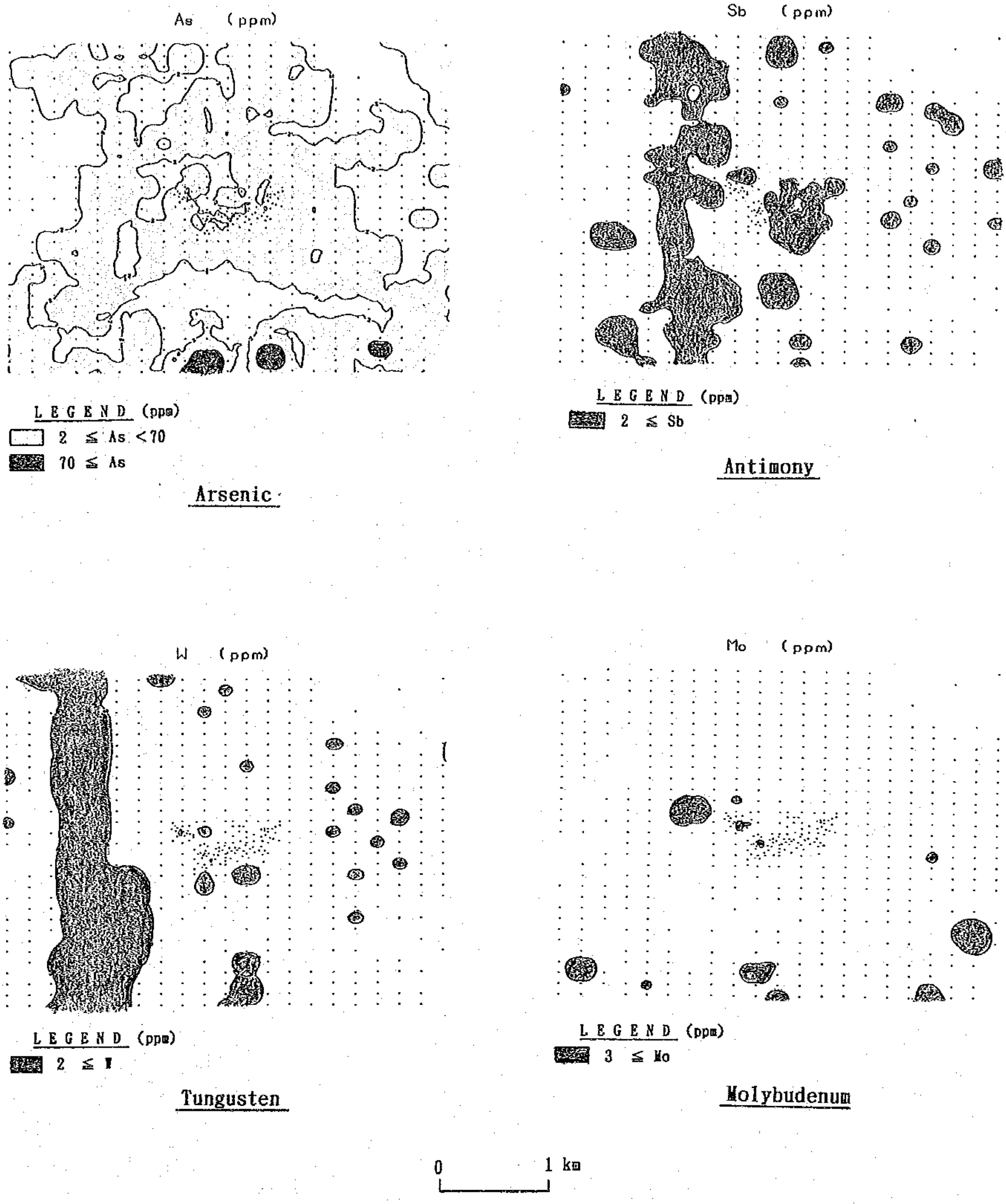


Fig. II-2-9 Distribution of minor elements in the rocks of semi-detailed geological survey area (As, Sb, W, Mo)

Table Ⅱ-2- 1 Statistical numbers on geochemical survey elements

	Au	Ag	As	Sb	Mo	Hg	W
試料数	601	601	601	601	601	601	601
最大値	23260	7.2	390	9	14	2.43	9
最小値	0.5	0.1	1	1	0.5	0.01	1
平均	73.93	0.19	7.72	1.62	1.27	0.03	1.49
Auとの相関係数	1	0.0371	0.0217	-0.027	0.1382**	-0.0104	-0.0211

**: 有意(有意水準=0.001)

2-4 Consideration

Mineralization in the area is divided into following three groups; ① quartz vein without wall rock alteration, ② quartz vein associated with silicification and pyritization and ③ silicified–pyritized alteration zone free from quartz veins. Distribution of quartz vein and silicified pyritized alteration zone does not always coincide with each other and this suggests that hydrothermal mineralization of the area has occurred several times.

None of the six elements demonstrates correlation with gold might be interpreted that the area had been affected by repeated igneous activities since Paleozoic age.

As a case of arsenic (As), gold mineralization at Olon Ovoot will be shown by a doughnut-shape distribution of the element.

Chapter 3 Geophysical Survey

3-1 Purpose of the survey

A transient electromagnetic(TEM) survey was carried out to map alteration zones around Olon Ovoot in the Ulziit district. The survey area, which covers 12 square kilometers(NS: 3 km, EW: 4 km) is shown in Fig.II-3-1.

3-2 Outline of the survey

3-2-1 Principles of the TEM method

In the TEM method, often referred to as time-domain electromagnetic method, the ground is energized by passing a strong direct current(dc) through an ungrounded loop which is usually situated on or above the surface of the earth.

The frequency-domain electromagnetic(FEM) method employs an alternating current(ac). The primary electromagnetic(EM) field induces eddy currents in all conductors present in the earth. The secondary EM fields of these induced currents, and the primary field, are measured at various points in space. Since the secondary EM field at the receiver may be several orders of magnitude smaller than the primary field, separation of the total EM field into its primary and secondary parts is difficult.

In TEM method, the dc current is abruptly interrupted and the secondary fields due to induced eddy currents can be measured in the absence of the primary field. The time derivative of the transient magnetic field which results from these currents can be measured by a coil sensor. The rate of change of the magnetic field depends upon the conductivity, size, and shape of the underground conductor. For poor conductors, the receiver coil output voltage, which is proportional to the time rate of change of the secondary magnetic field, is initially large but decays rapidly. The response of a good conductors is initially lower but the voltage decays slower. The TEM method was selected for this survey, for the following reasons; (1)stability of the transmitter signal, (2)lack of static shift, (3)no near field phenomena, (4)uniqueness of results, and (5) high production rate by using ungrounded source in rock desert.

3-2-2 Equipment

The specifications of the Geonics Corp., PROTEM57(C) system, which was used in this survey, are shown in following table.

	MODEL	SPECIFICATION	NUMBER
Receiver	PROTEM Receiver MODEL 57RX	BASE FREQUENCY: 3, 7.5, 30 Hz or 2.5, 6.25, 25 Hz TIME GATE: 20 channels	1
Coil		EFFECTIVE AREA: 100 square meters	1
Transmitter	TEM57 Transmitter Model TX	MAXIMUM CURRENT: 20 A OUTPUT VOLTAGE: 20 or 40 V CURRENT WAVEFORM: Bipolar rectangular current with 50 % duty cycle	1
Generator	HONDA EM650	OUTPUT: 600 W/120 V/60 Hz	1

Base frequencies of 3 and 30 Hz were used in this survey. The decay voltages can be recorded at 20 gates from 0.0867 to 70 ms after the current is turned off. The channel positions, or gate times, of 20 geometrically spaced time gates are shown in following table.

GATE NO	BASE FREQUENCY				GATE NO	BASE FREQUENCY			
	30 Hz		3 Hz			30 Hz		3 Hz	
	START	CENTER	START	CENTER		START	CENTER	START	CENTER
1	0.0780	0.0867	0.771	0.875	11	0.775	0.858	7.69	8.56
2	0.095	0.108	0.943	1.066	12	0.942	1.066	9.43	10.64
3	0.120	0.138	1.19	1.37	13	1.189	1.37	11.87	13.70
4	0.157	0.175	1.55	1.74	14	1.555	1.74	15.51	17.40
5	0.193	0.218	1.93	2.17	15	1.922	2.17	19.23	21.70
6	0.242	0.278	2.42	2.77	16	2.41	2.77	24.14	27.70
7	0.313	0.351	3.13	3.50	17	3.12	3.50	31.21	35.00
8	0.389	0.438	3.88	4.37	18	3.88	4.37	38.80	43.70
9	0.487	0.558	4.86	5.56	19	4.86	5.56	48.61	55.60
10	0.628	0.702	6.27	6.98	20	6.25	7.03	69.59	70.30
					21	*)	7.81		78.06

UNIT; msec *) end of gate 20

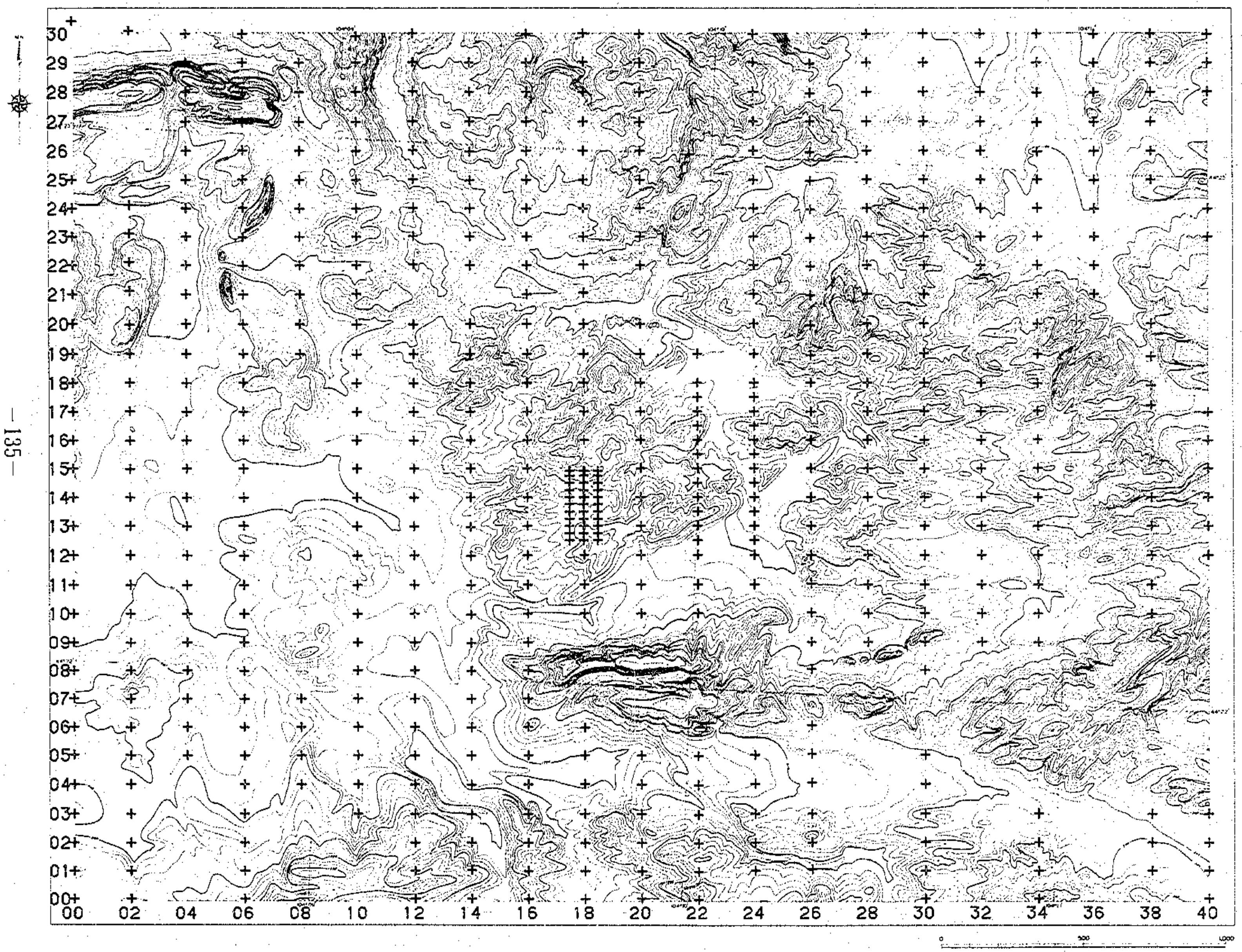


Fig. II−3−1 Station location map