silicification. The mineralization is malachite dissemination with malachite films along the fractures in granodiorite rocks accompanied with hematite and limonite.

As the results of X-ray diffraction analysis, alteration minerals of quartz, K-feldspar, albite, sericite and chlorite were detected as shown in Appendix 4.

Ore mineral observation indicates that ore mineral assemblage consists of disseminated pyrite, hematite, goethite and limonite. Analytical values for ore assay show Cu 4.078 %, Pb 5.575 %, Zn 2.644 % and Ag 221 ppm. The results of the rock chemical analysis indicate that the values are Cu 4,879 ppm, Pb 5,258 ppm, Zn 5,664 ppm, Ag 22 ppm and Fe 1.61 % to 4.69.

(iii) MK-5 mineral showing

This showing is observed in the trench. The host rock is Triassic granodiorite with weak silicification. The mineralization is quartz stockwork in granodiorite and malachite dissemination with films along the fractures with hematite and limonite.

According to the results of X-ray diffraction analysis, alteration minerals of quartz, K-feldspar, albite, sericite and chlorite were detected as shown in Appendix 4.

Ore mineral observation indicates that ore mineral assemblage consists of disseminated pyrite, hematite, goethite and limonite. Analytical values for five ore assay samples show Cu 0.332 % to 11.131 %, Pb 0.145 % to 1.062%, Zn 0.052 % to 0.072 %, Ag 17 ppm to 111 ppm and Mo 0.014 % to 0.269 %.

The results from fluid inclusion presented an average temperature of 244.7 ℃ to 288.7 ℃ and salinity of 3.0 % to 4.0 %.

(iv) MK-6 mineral showing

The host rock is Triassic granite to syenite. The mineralization is quartz stockwork in granodiorite and malachite dissemination and films along the fractures with hematite and limonite.

Analytical values for five ore assay samples show Cu 0.360 %, Pb 0.478%, Zn 0.060 % and Ag 39 ppm.

The results from fluid inclusion presented an average temperature of 244.7 ℃ to 288.7 ℃ and salinity of 3.0 % to 4.0 %.

(4) Previous geophysical survey

The previous geophysical survey carried out in the north mineral showing in the Mogoin gol area shows the following characteristic in the geophysical magnetic and IP surveys. Refer to Appendix 13.

i) North mineral showing located in relatively low magnetic zone along EW direction

ii) High chargeability zone showed elliptic shape with high chargeability along south

iii) Mineral showing located in the south in highest chargeability zone

iii) Mineralized zone located in a relatively low resistivity zone

The western mineral showing in the Khujiriin gol area shows the following characteristic in the magnetic and IP surveys. Refer to Appendix 14.

i) Western mineral showing located in relatively low magnetic zone

ii) High chargeability zone of western mineral showing indicated horseshoe-shape opened toward south

iii) Mineral showing located in the higher chargeability zone indicating horseshoe-shape

iv) Mineralized zone located in a relatively low resistivity zone along EW direction.

(5) Summary

Two mineralized zones in Mogoin gol area and a mineralized zone in Khujiriin gol area are observed in the Mogoin gol/Khujiriin gol area. In the two mineral showing areas, previous geological, geophysical and drilling surveys were conducted.

Hematite veins mineralized zone and the secondary quartzite zone exist in the Mogoin gol mineralized zone.

In the north mineral showing, alteration minerals assemblages are quartz- K-feldspar-kaoline-pyrophyllite-lunite. The alteration mineral assemblage indicates that porphyry copper type ore body occurred at deep parts from surface ground.

In the south mineral showing, the secondary quartzite consists of white silicified zone with secondary quartz. The alteration minerals assemblage consists of quartz-sericite-kaolinite-topaz -andalusite. The ore assay results show that the analytical value of copper is very low. Analytical value of Al is 0.56 % and very low in the silicified rock. According to the results, chemical activity shows that the alteration zone corresponds to the leached zone.

In Khujiriin gol mineralized zone, it had been confirmed that 6 sample location points presented values of more than Cu 0.10 %. Four mineral showings were observed in the Khujiriin gol mineralized zone. The mineralizations consists of quartz stockwork in granodiorite, accompanied with malachite. The host rock is accompanied with pyrite dissemination with hematite and limonite.

The alteration mineral assemblage consists of quartz-K-feldspar-albite-sericite-chlorite in the Khujiriin gol mineralized zone. Secondary biotite is observed in the zone.

Analytical maximum values for ore assay show Cu 11.13 %, Pb 5.78 %, Zn 2.64 %, Mo 0.269% and Ag 221 ppm. The results from fluid inclusion presented an average temperature of 244.2 ℃ to 289.0 ℃ and salinity of 3.0 % to 4.0%.

The previous geophysical survey of the Khujiriin gol mineralized zone indicated as follows:

i) Western mineral showing located in relatively low magnetic zone

ii) High chargeability zone of western mineral showing indicated horseshoe-shape opened toward south

iii) Mineral showing located in the higher chargeability zone indicating horseshoe-shape

iv) Mineralized zone located in a relatively low resistivity zone along EW direction.

The previous existing data shows that the drilling survey was conducted in the Khujiriin gol mineralized zone during the period of the Soviet assistance. However, the drilling data were taken back by them and as a result, the ore assay from these drillings could not be examined.

(6) Discussion

According to the results of the geological survey in the Mogoin gol area as shown Fig. II-2-10, the alteration mineral assemblages of quartz-sericite- (K-feldspar)-(kaolinite), quartz-pyrophylite-kaolinite, quartz- andalusite and quartz-andalusite-sericite are confirmed in the strong altered zone and the alteration mineral assemblages of sericite-(smectite), sericite-chlorite-(smectite) and chlorite are confirmed around the strong altered zone. These two alteration mineral assemblages are generally observed in the epithermal and acidic alteration zone under high sulfidation system. The alteration zone was generally developed on the upper part of alteration system of the porphyry copper type mineralization. The results of the rock geochemistry indicate that leached zone existed in the alteration zone. However, factor 2 scores (factor 2 indicates the chemical activity of the porphyry copper type mineralization) of more than 0.5 are not found distributed in the zone. Consequently, it is inferred that the porphyry copper type mineralization exists in the deeper part of the Mogoin gol area.

As the results of the geological survey in then Khujiriin gol area as shown Fig. II-2-10, the alteration mineral assemblage of sericite-(smectite), sericite-chlorite-(smectite) and chlorite are distributed in the area. The distribution of the alteration mineral assemblages is similar to the distribution in Erdenet mine area. In view of the results of the rock chemistry, high copper values of more than Cu 50 ppm and Cu 5,5072 ppm in maximum is concentrated in the center of the Khujiriin gol mineralization zone. The factor 2 scores of more than 0.5 are also concentrated in the center of the Khujiriin gol mineralization zone. The ore samples with copper oxides show a high value of Cu 11.13 %, Pb 5.78 %, Zn 2.64 %, Mo 0.269 % and Ag 221 ppm in maximum. Mineralization type of the Khujiriin gol mineralization zone may not be the only porphyry copper type mineralization but the poly-metallic type mineralization may be also present in the zone. The results from fluid inclusion presented an average temperature of 244.2 ℃ to 289.0 ℃ and salinity of 3.0 % to 4.0%. The low temperature of porphyry copper type mineralization system indicates epithermal mineralization. Consequently, it is considered that not only the porphyry copper type mineralization but also the poly-metallic mineralization occurred in the Khujiriin gol mineralization zone.

2-4-3 The Tsagaan Chuluut area

(1) Generality

The area is located in Erdenet city northwest at approximately 1,300m to 1,700m above sea level. As shown in Fig.II-2-22, the topography shows steep to gentle mountain. The vegetation in the area is composed of coniferous forests and tall grass in the hill and valley and low grass along streams.

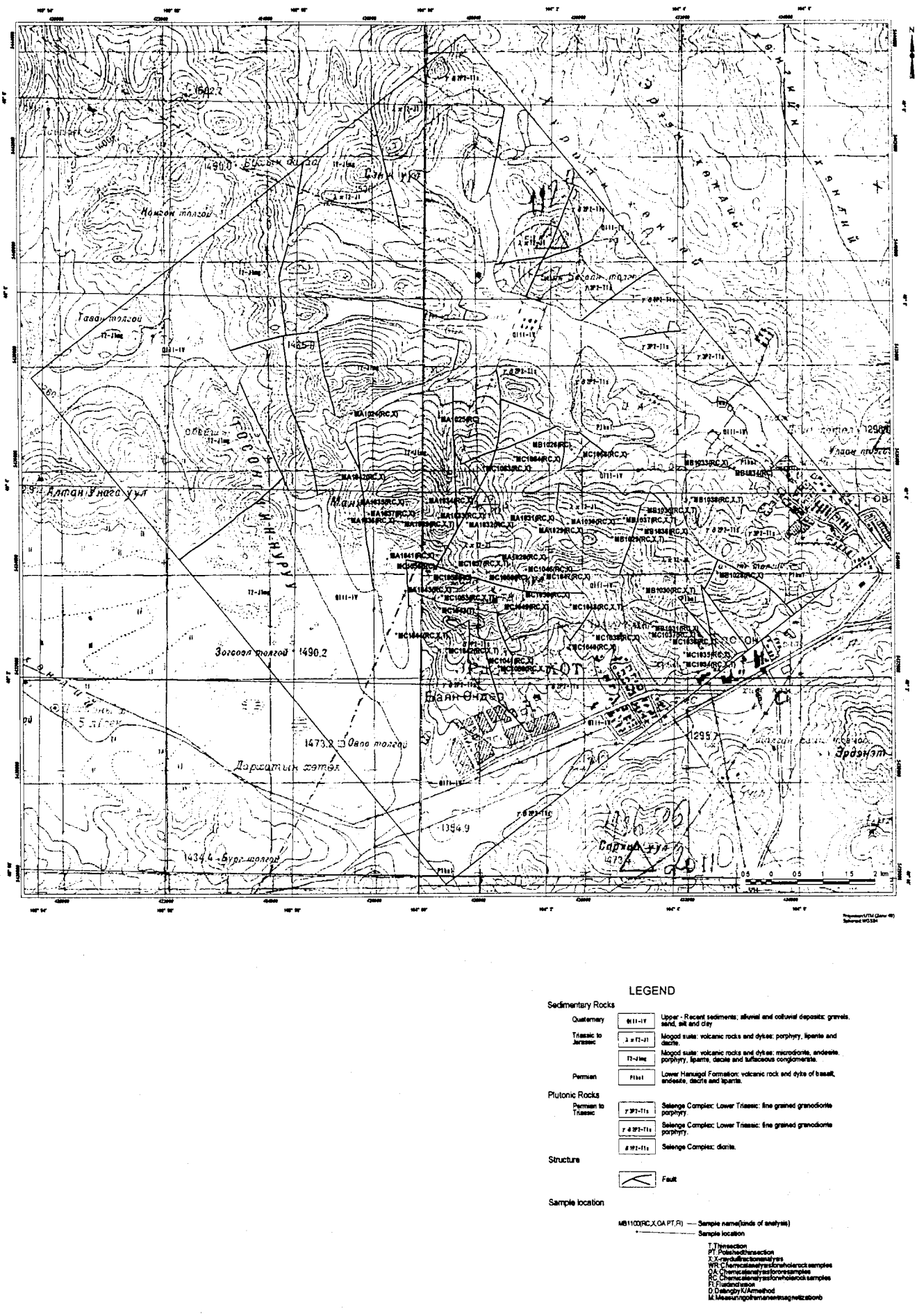


Fig. II-2-22 Survey location and sample locations map of the Tsagaan Chuluut area

Since the area was adjacent to the Erdenet Mine area, the geological, geochemical, geophysical and drilling surveys were carried out in the area (Table II-3-2).

The previous geological survey indicated that the Selenge complex occurred in the deeper part from ground surface. Cold spring water was observed in northern part of the area and the water contents include high values of sulfate. According to the results of drilling survey in south part of the Tsagaan Chuluut Mountain, the sulfide content becomes high at the lower part of the drilling holes. As the results of drilling survey, copper values of Cu: 0.75% was detected every 15m intervals down to 275m in depth.

(2) Geology

The geology of the area is shown in Fig. II-2-23. Stratigraphy, Geological structure and mineralization are as follows:

(i) Stratigraphy

The area presents Permian volcanic rocks, Permian to Triassic granites, Triassic to Jurassic volcanic rocks and stocks, dykes and Quaternary deposits.

The Permian called as Hijii Formation (P1hn1) in the area is composed of first suite consisting trachybasalt, trachybasalt, basalt, trachyandesite-basalt, andesite-basalt, andesite, its tuff, sandstone, gravel stone, conglomerate. The formation is distributed in the eastern part of the area.

Triassic to Jurassic volcanic rocks (T2-J1mg) called as Mogod Suite in the area consists of andesite – basalt, basalt, trachybasalt, tuff, tuffaceous conglomerate. The suite is distributed from the central part to the northwestern part of the area.

Triassic to Jurassic is composed of stocks of liparite porphyry, syenitic diorite porphyry.

Permian to Triassic granites called as Selenge complex in the area are mainly composed of late Permian to early Triassic diorite(δ 1P2-T1s), granodiorite($\delta\ \gamma$ 2P2-T1s) and granite(γ 3P2-T1s). The diorite(δ P2-T1s) is distributed in southern part of the Tsagaan Chuluut mountain. The granodiorite($\delta\ \gamma$ 2P2-T1s) is distributed in the southern and eastern parts of the area. The granite(γ 3P2-T1s) is distributed in the eastern part of the area.

Dykes consist of andesitic basalt.

Quaternary deposits are composed of boulder, single, loan and clay.

(ii) Geological structure

Fault structures are developed in the area. The main directions of the faults are NW-SE to NS and other are EW and NE-SW. The granitic bodies are elongated to the NW-SE direction.

(3) Mineralization

Alterations in the white argillized zone and silicified zone are developed in and around the

Tsagaan Chuluut Mountains of the southern parts of the area. The geology of the area is shown in Fig. II-2-24. Hydrothermal breccias are also observed in the alteration zone. Mineralized zones containing copper minerals were not confirmed in the alteration zone. However, concentrations of minerals of limonite and hematite are observed along the fractures. In the northern part of the area, white silicified zones without sulfide minerals are observed along the faults zones.

The alteration zone including white silicification and argillization as shown Fig. II-2-25 are widely distributed in the southwestern part of the Tsagaan Chuluut area. However, important mineralizations and mineral showings including sulphides could not be confirmed in the area.

As the results of X-ray diffraction test, alteration mineral assemblages indicated below are distributed in and around the Tsagaan Chuluut mountains.

1) quartz-(jarosite)-(kaolinite)
2) quartz-alunite-(pyrophylite)-(kaolinite)
3) quartz-alunite-sericite-(kaolinite)
4) sericite-chlorite-(smectite)
5) chlorite

The alteration zone with quartz-(jarosite)-(kaolinite) type is distributed in the eastern ridge of the Tsagaan Chuluut mountains. The alteration zone with quartz-alunite-(pyrophylite)-(kaolinite) type is widely distributed in the eastern ridge of the eastern part of the Tsagaan Chuluut mountains and is bordered by NW-SE fault in the edge of the area. The distribution of the alteration zone with sericite-chlorite- (smectite) type is controlled by fault systems with NS and NW-SE direction in the area. The chlorite alteration zone is distributed around these alteration zones.

As shown in Fig. II-2-26 and Fig. II-2-27, the results of the rock geochemistry indicated that the samples of more than Cu 100 ppm occurred in the alteration zone with quartz-(jarosite)- (aolinite) type and in northwester part of the Tsagaan Chuluut mountains. It is inferred that this distribution is controlled by faults.

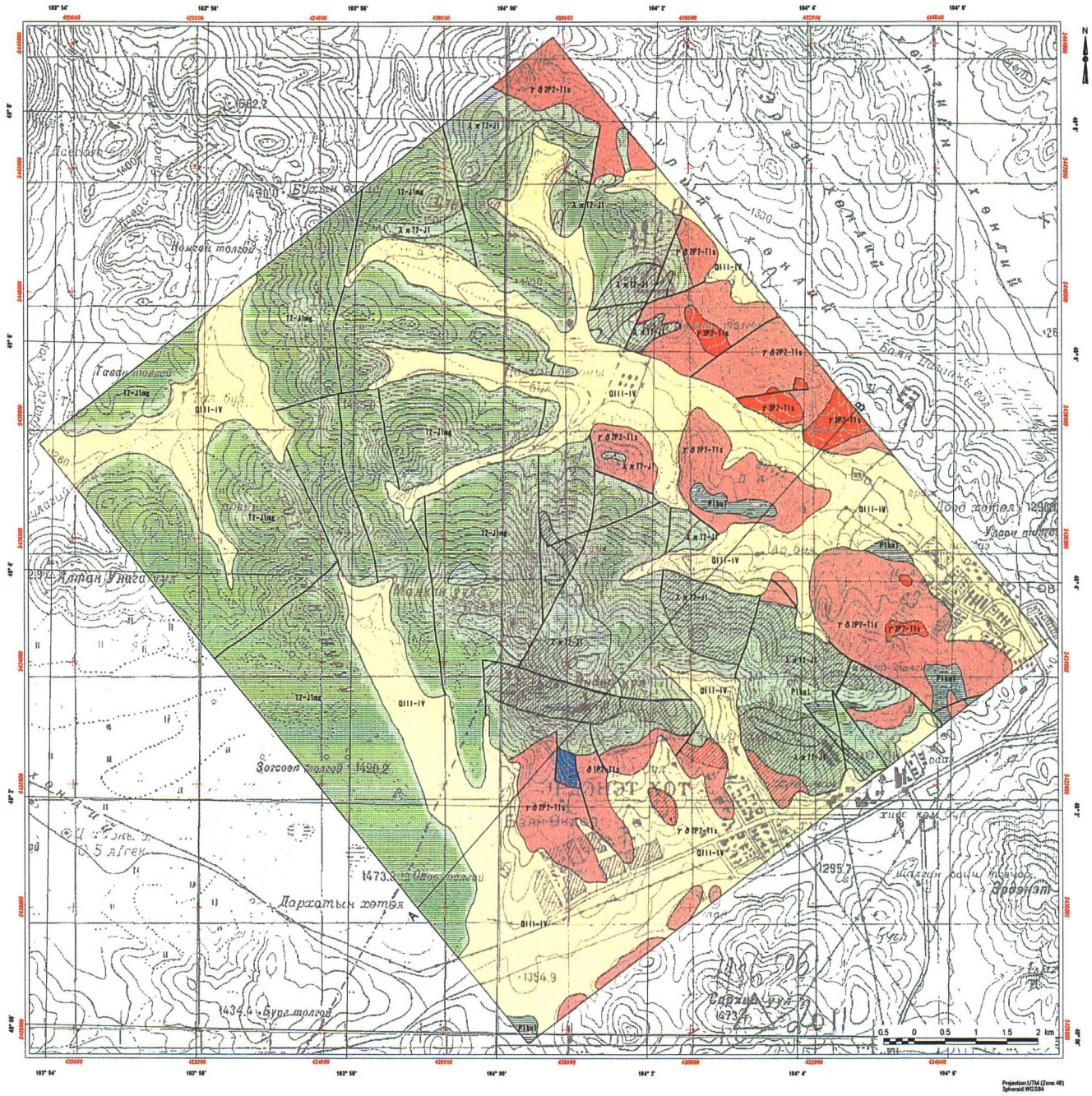
(4) Previous geophysical survey

Previous geophysical survey carried out in the south alteration zone in the Tsagaan Chuluut area shows the following characteristic in the geophysical magnetic and IP surveys as shown in Appendix 15.

i) South alteration zone located in relatively low magnetic zones along NW-SE direction in the south central area
ii) High chargeability zone along NW-SE direction in the southwestern area.
iii) South alteration zone located in the southwestern highest chargeability zone

(5) Summary

The geological survey indicated that white argillized silicified zones are developed in and around



LEGEND

Sedimentary Rocks

Quaternary	Q III–IV	Upper - Recent sediments; alluvial and colluvial deposits: gravels, sand, silt and clay
Triassic to Jurassic	λ πT2–J1	Mogod suite: volcanic rocks and dykes: porphyry, liparite and dacite.
	T2–J1mg	Mogod suite: volcanic rocks and dykes: microdiorite, andesite, porphyry, liparite, dacite and tuffaceous conglomerate.
Permian	P1hn1	Lower Hanuigol Formation: volcanic rock and dyke of basalt, andesite, dacite and liparite.

Plutonic Rocks

Permian to Triassic	γ ΣP2–T1s	Selenge Complex: Lower Triassic: fine grained granodiorite porphyry.
	γ δ ΣP2–T1s	Selenge Complex: Lower Triassic: fine grained granodiorite porphyry.
	δ ΣP2–T1s	Selenge Complex: diorite.

Structure

Fault

Alteration

Alteration Zone: silicification, sericitization, chloritization

Mineralization

Mineral showing.

Section line

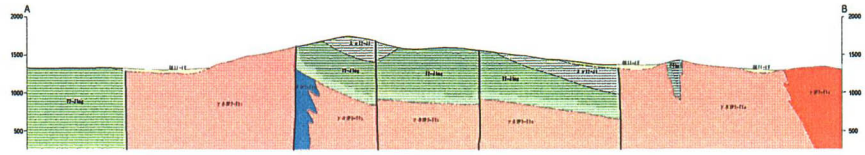
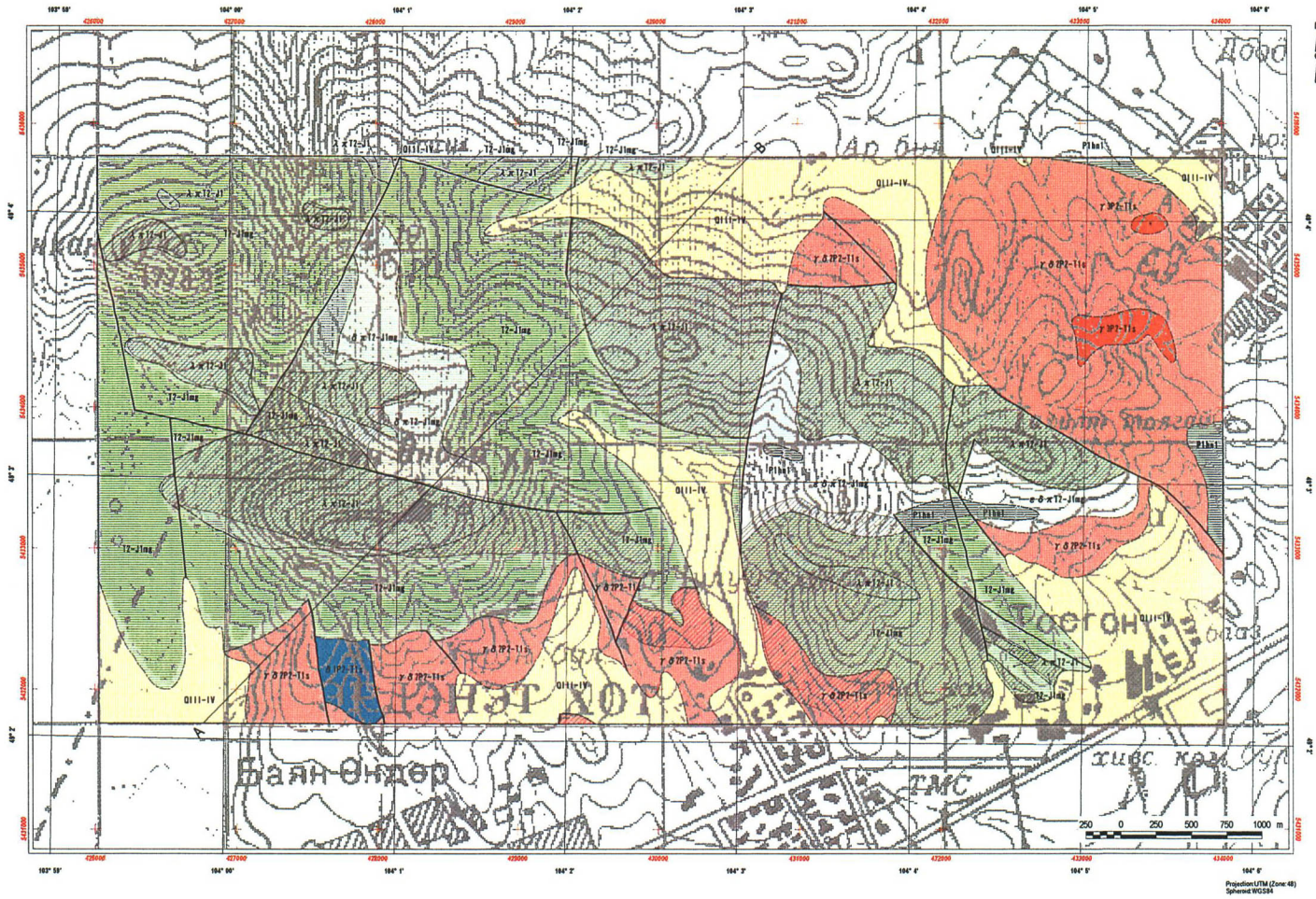
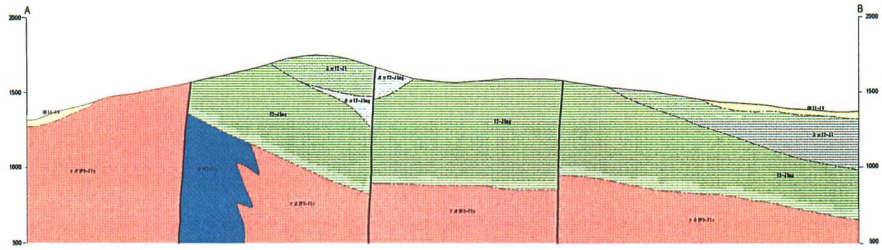


Fig. II-2-23 Geological map, cross section and mineral showings of the Tsagaan Chuluut area





LEGEND

Sedimentary Rocks

Quaternary	Q111-IV	Upper - Recent sediments; alluvial and colluvial deposits: gravels, sand, silt and clay
Triassic to Jurassic	ε δ πT2-J1mg	Mogod suite: volcanic rocks and dykes: porphyry, liparite and dacite.
	δ πT2-J1mg	Mogod suite: volcanic rocks and dykes: porphyry, liparite and dacite.
	T2-J1mg	Mogod suite: volcanic rocks and dykes: microdiorite, andesite, porphyry, liparite, dacite and tuffaceous conglomerate.
	λ πT2-J1	Mogod suite: volcanic rocks and dykes: porphyry, liparite and dacite.
Permian	P1hn1	Lower Hanuigol Formation: volcanic rock and dyke of basalt, andesite, dacite and liparite.

Plutonic Rocks

Permian to Triassic	γ ΣP2-T1s	Selenge Complex: Lower Triassic: fine grained granite porphyry
	γ δ ΣP2-T1s	Selenge Complex: Lower Triassic: fine grained granodiorite porphyry.
	δ ΣP2-T1s	Selenge Complex: diorite.

Structure

Fault

Alteration

Alteration Zone: silicification, sericitization, chloritization

Mineralization

Mineral shwing.

Section line

Fig. II-2-24 Geological map, cross section and mineral showings of the Tsagaan Chuluut area

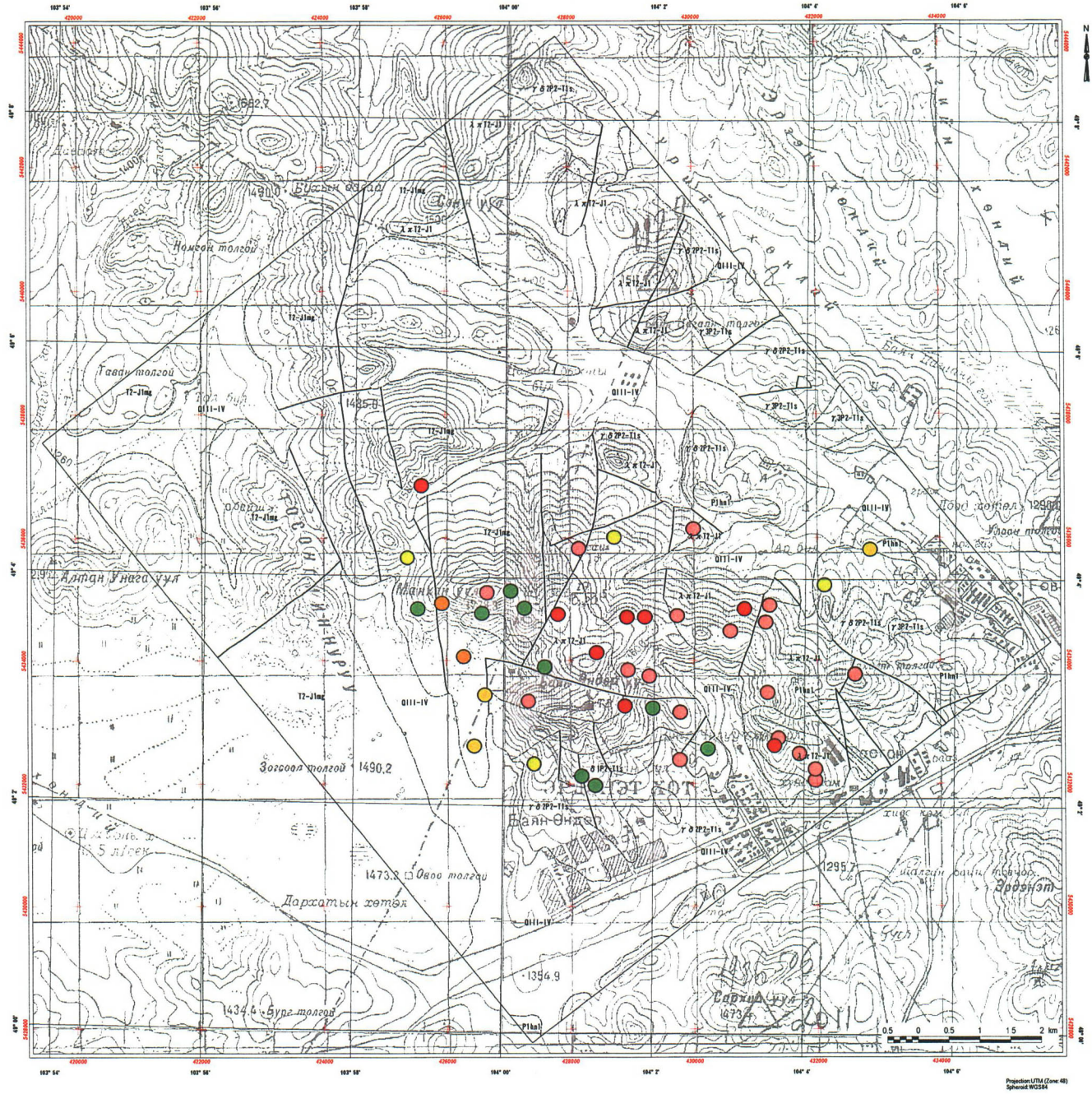


Fig. II-2-25 Distribution map of alteration mineral assemblages in the Tsagaan Chuluut area

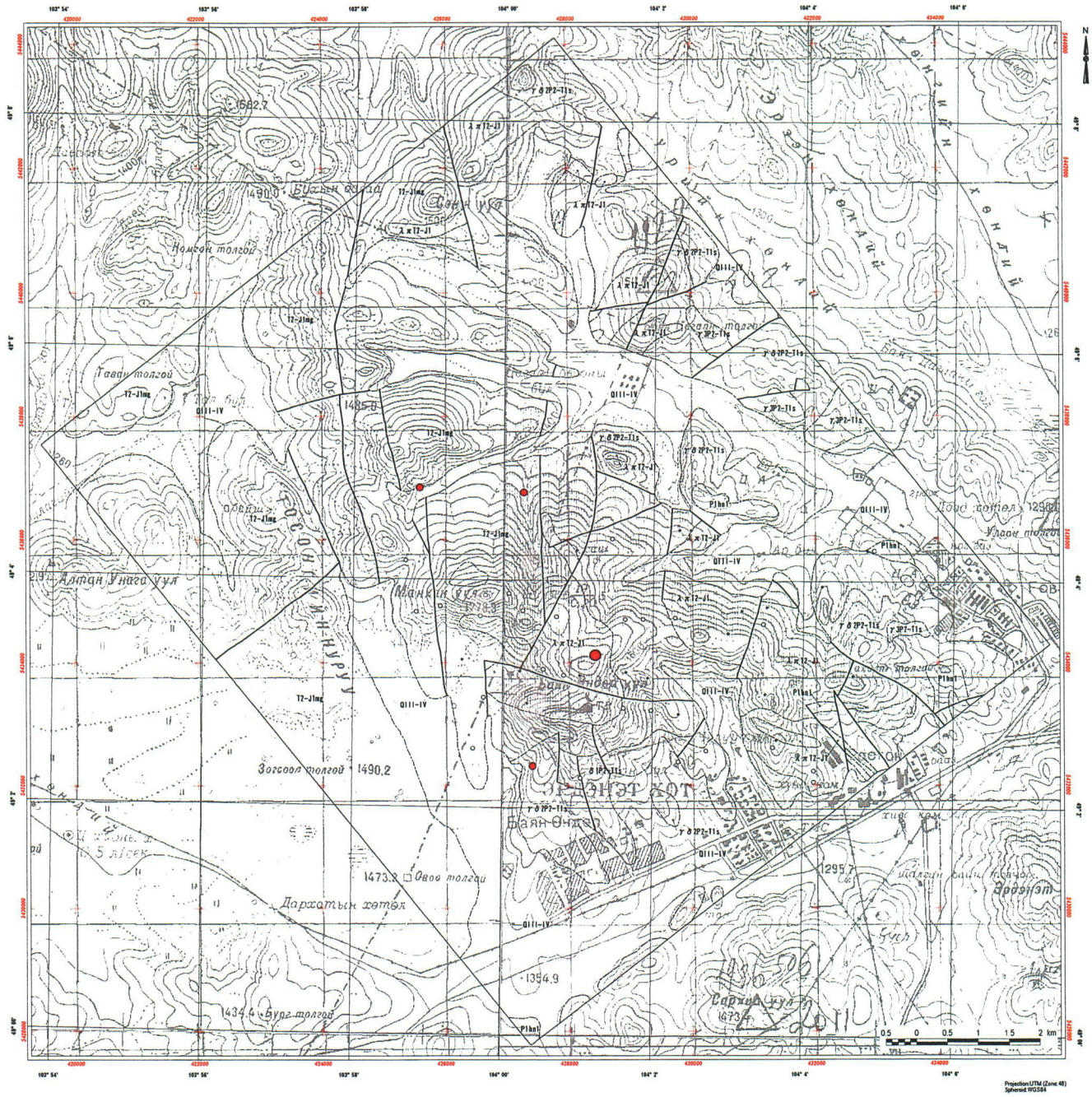
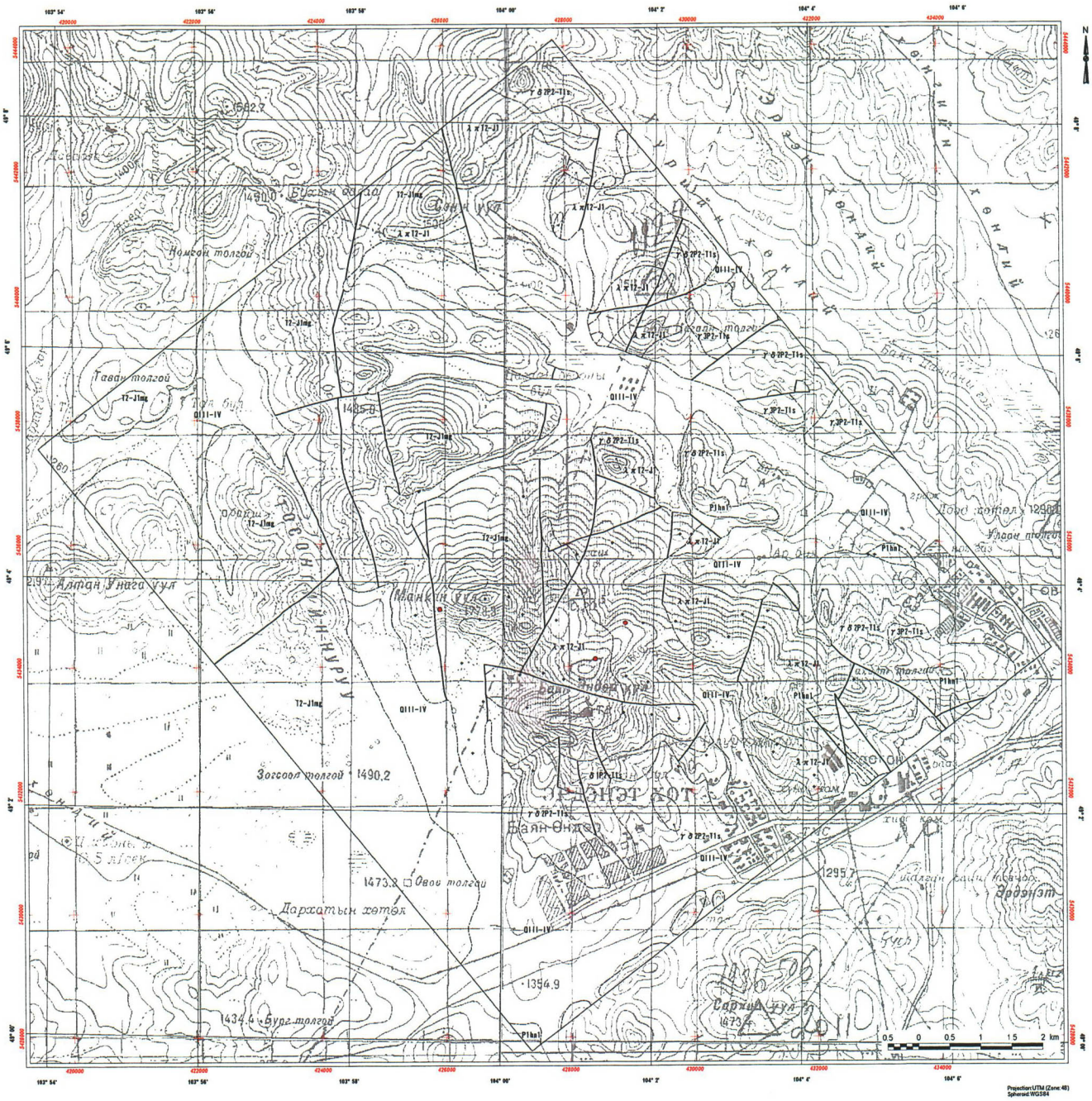


Fig. II-2-26 Distribution map of Cu anomaly in the Tsagaan Chuluut area



LEGEND

Sedimentary Rocks

Quaternary	Q III–IV	Upper - Recent sediments; alluvial and colluvial deposits: gravels, sand, silt and clay
Triassic to Jurassic	λ κ T2–J1	Mogod suite: volcanic rocks and dykes. porphyry, liparite and dacite.
	T2–J1mg	Mogod suite: volcanic rocks and dykes: microdiorite, andesite, porphyry, liparite, dacite and tufaceous conglomerate.
Permian	P1hn1	Lower Hanuigol Formation: volcanic rock and dyke of basalt, andesite, dacite and liparite.

Plutonic Rocks

Permian to Triassic	γ δ P2–T1s	Selenge Complex: Lower Triassic: fine grained granodiorite porphyry.
	γ δ P2–T1s	Selenge Complex: Lower Triassic: fine grained granodiorite porphyry.
	δ P2–T1s	Selenge Complex: diorite.

Structure

Fault

Geochemical Anomaly

Factor 2 score

1.5 ≦
1.0 – 1.5
0.5 – 1.0
≦0.5

Fig. II-2-27 Distribution map of factor 2 scores in the Tsagaan Chuluut area