while, in the Koksai Formation and the Khodjaakhmet Formation, no prominent occurrence of such ore deposits is recognized.

Tungsten stockwork deposits occur chiefly within granitic intrusives and occasionally in the surrounding host rocks, as well. They are comprised of vein-veinlets emplaced in fracture zones.

The known important gold·silver mineralization is controlled by fracture zones with the WNW-ESE, NE-SW and NNW-SSE trends.

Based on analysis of the existing data, the Bulutkan deposit (Au) was extracted as a promising exploration target.

2-2 Analysis of Geophysical Survey Data

The roles of geophysical prospecting in the survey area are summarized as follows:

(1) Many of the known ore deposits in the survey area are located near granitic rocks. The granitic rocks are lower in density than the surrounding host rocks, showing distinctly low anomalies in the gravity distribution. The gravity survey proved to be effective for exploring the location, depth and extent of concealed or mostly concealed intrusive rock bodies.

(2) Both skarn deposits and vein deposits being often accompanied by pyrrhotite, high magnetic anomalies are detected around known ore deposits and showings, which provide important information for the exploration of ore deposits in the survey area.

(3) The gravity survey and the magnetic survey have been applied extensively and successfully in the survey area. If precision survey by electrical and electromagnetic methods is incorporated into the future exploration, it will provide additional information on the electrical characteristics, which will serve for further clarification of occurrence of ore deposits

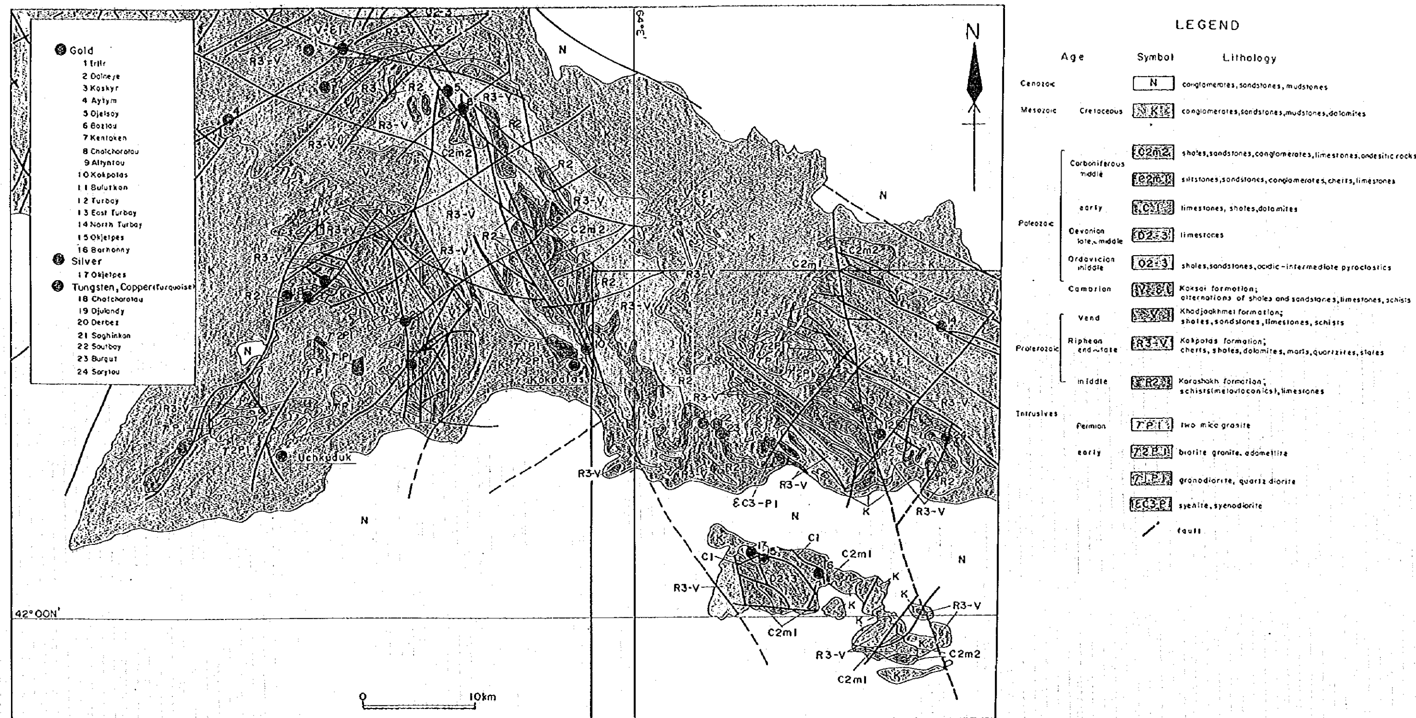


Fig. II-2-1 Ore Deposits and Showings in the Eastern Bukantu Area

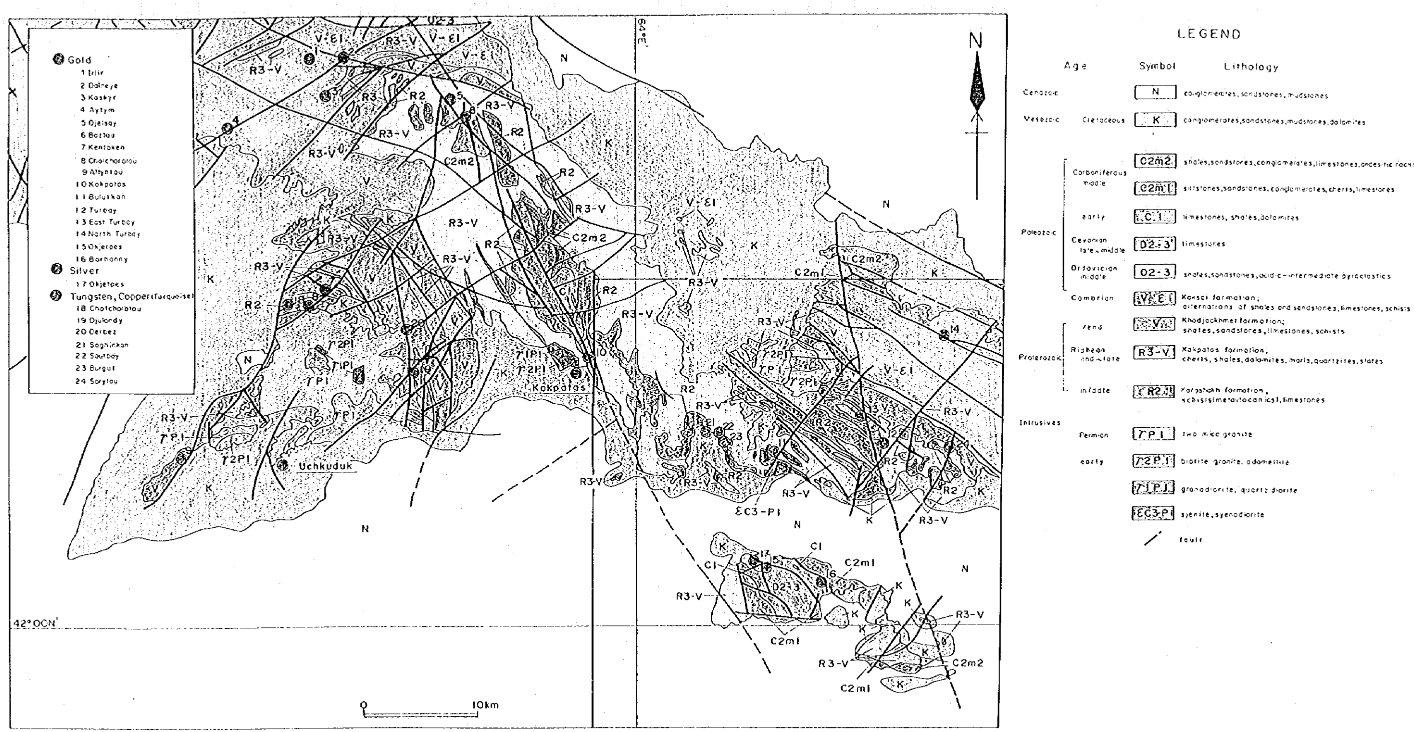


Fig. II-2-1 Ore Deposits and Showings in the Eastern Bukantu Area

Table II-2-1 List of Ore Deposits and Ore Showings in the East Bukantau Area(1)

Name	Ore Field	Host Rock	Mineralization	Type of Ore bodies	Size	Grade	Ore Reserves	Exploration
Sarytau ore deposit	Sarytau	Kokpatas Formation Granodiorite-Adamellite	W	Stockwork Skarn-Skarnoid	Stockwork (4 ore bodies):l=2km, w=300-800m, d=350-400m Skarn-Skarnoid (10 ore bodies):l=60-690m, w=from 10-15m to 50-70m, d=60-590m	stockwork: WO_3=0.153% on average Skarn-Skarnoid: WO_3=0.2-0.4% on average	(1990) cut off WO_3=0.08, 0.1% C_1+P_1: 49,175 thou.t WO_3= 0.277% WO_3= 136,174t Au = 11t Mo = 5 thou.t	Suspended Prospecting activities(1978-1988); Geological mapping-2km², gravity and magnetic survey, trenching-10,806m³, exploration shaft(about 30m deep)-261m, cross cuts(one level)-2,000m, non-coring drilling -20,383m, coring drilling-11,621m, survey of 80m×80m, 160m grid.
Bektash ore showing	Sarytau	Kokpatas Formation	W	Skarn-Skarnoid	w=3.5-4.5m	WO_3=0.15-0.33%	—	Suspended Prospecting activities; 2 drilling holes(up to 300m).
Katirtas ore showing	Sarytau	Kokpatas Formation	W	metasomatite	Unknown	WO_3=0.15-0.21% (In one mapping hole)	—	Underway Prospecting activities; 150 mapping drillings(100m×5m grid).
Kazgan ore showing	Sarytau	Kokpatas Formation Granitoid	W	metasomatite	w=6m	WO_3=0.32% on average	—	Suspended Prospecting activities; mapping drilling.
					w=24m	WO_3=0.14% on average		
East Kazgan ore showing	Sarytau	Kokpatas Formation Granitoid	W	Skarnoid-Stockwork	w=8m	Granitoid WO_3=0.18%	—	Suspended Prospecting activities; drilling.
						Skarnoid WO_3=0.07-0.27%		
Central Sarytau ore showing	Sarytau	Kokpatas Formation Lamprophyre dyke	Au,Ag, Sulphide	Vein, Veinlets	w=0.3-5.0m	Au=2.0-4.0g/t, Ag=18.0-55.0g/t	—	Suspended Prospecting activities; drilling.
					w=2-4m	Au=0.4-1.0g/t		
South Sarytau ore showing	Sarytau	Kokpatas Formation	W,Au	Skarn-Skarnoid	l=40-120m, w=2-4m	WO_3=not morethan 0.05%	—	Suspended Prospecting activities; drilling.
					w=4-10m	WO_3=0.03-0.8%		
					w=2-5m	Au=0.2-0.6g/t		
North Sarytau ore showing	Sarytau	Granitoid	Au,Ag, Cu,Sn	Vein	l=500m, w=3-5m	Au=1.5-2.0g/t, Ag=19.5-34.2g/t, Cu=0.265-0.612%, Sn=0.012-0.187%, Bi=0.064-0.068%	—	Suspended Prospecting activities; drilling.

Table II-2-1 List of Ore Deposits and Ore Showings in the East Bukantau Area (2)

Name	Ore Field	Host Rock	Minerali-zation	Type of Ore bodies	Size	Grade	Ore Reserves	Exploration
Sautbay·Burgut Ore deposits	Sautbay	Kokpatas Formation Karashakh Formation Granodiorite (stock)	W (Au)	Skarn (Stockwork)	21 skarn ore bodies l=1,600m(total) w=0.5-50m d=0-600m	(1993) WO_3=0.20-0.87% (Grade of ore bodies) (MMAJ,1997) WO_3=0.09-0.49% (Grade of ore bodies)	(1993) cut off WO_3=0.05, 0.08% $C_1+C_2+P_1$: 39,539,352t WO_3=0.43%, Au=0.34g/t (MMAJ,1997) cut off WO_3=0.05% Reserves: 15,195,300t WO_3=0.29%, Au=0.23g/t	Underway Prospecting activities(1985-1993): magnetic survey 70km² and 10km², trenching-9,044m³, non-coring drilling-4,440m, coring drilling 300m deep on average-42,030m, exploration shaft with drifts and cross-cuts-3,294m. (MMAJ,1996) Coring drilling-4 drillholes-1,509.9m.
Saghinkan Ore deposit	Sautbay	Karashakh Formation	W	Skarn	14 skarn ore bodies l=460-960m w=1-40m d=110-400m	(1994) WO_3=0.12-0.64% (Grade of ore bodies) (MMAJ,1997) WO_3=0.10-0.54% (Grade of ore bodies)	(1994) cut off WO_3=0.10% C_2+P_1: 12,710,000t WO_3=0.32% (MMAJ,1997) cut off WO_3=0.10% Reserves: 8,132,880t WO_3=0.28%	Completed Prospecting activities: trenching-1,152m³, mapping drilling-3,456m, coring drilling by 160m×80m and 80m×80m grid-19,051m.
Bulutkan Ore deposit	Sautbay	Kokpatas Formation Lamprophyres (dikes)	Au	Silicified rocks Skarn	1 ore bodies l=50m w=34.1m, Au=7.3g/t(T-2) d=0-110m	l= 0.7M, Au= 1.4g/t(MJUB-1) l= 2.0M, Au= 2.8g/t(MJUB-1) l=10.4M, Au= 4.4g/t(MJUB-7) l= 1.0M, Au= 6.6g/t(MJUB-7) l=14.9M, Au=21.2g/t(MJUB-7)	(MMAJ,1997) Reserves: (tentative estimate) 108,434t Au=7.8g/t	Underway Prospecting activities(1993-1994): trenching, 70 non-coring drillings(depth up to 70m), shaft(28.5m), tunnel(400m). Further prospecting works such as trenching, drilling and geophysical survey are scheduled until 1998.
Another showings in Bulutkan district	Sautbay	Kokpatas Formation	Au	Silicified rocks Skarn	w= 2.0m, Au= 1.2g/t(T-11) w= 1.0m, Au= 3.8g/t(T-23) l=12.0m, Au= 1.3g/t(T-29) w= 2.0m, Au=74.7g/t(P-819) w= 8.0m, Au=31.0g/t(P-822)	l= 2.0M, Au= 2.3g/t(MJUB-3) l= 1.2M, Au= 1.1g/t(MJUB-8) l= 9.7M, Au= 4.4g/t(MJUB-8) l= 1.0M, Au= 8.5g/t(MJUB-9) l= 2.0M, Au=11.9g/t(MJUB-13) l= 3.0M, Au= 1.3g/t(MJUB-17) l= 0.7M, Au= 6.0g/t(MJUB-17) l= 0.5M, Au= 9.8g/t(MJUB-18)	(MMAJ,1997) Reserves: (tentative estimate) 166,421t Au=16.4g/t	(MMAJ,1996 - 1997): Coring drilling-21 drillholes-3,130m Trenching-8,310m.

Table II-2-1 List of Ore Deposits and Ore Showings in the East Bukantau Area(3)

Name	Ore Field	Host Rock	Minerali-zation	Type of Ore bodies	Size	Grade	Ore Reserves	Exploration
Southeast Sautbay ore showing	Sautbay	Kokpatas Formation	W	Skarn-Skarnoid	Unknown	–	–	Suspended
Kizilkashkar ore showing	Sautbay	Kokpatas Formation Karashakh Formation	W	Skarn-Skarnoid, Stockwork (?)	Unknown	–	–	Suspended
Sarydjoy ore showing	Sautbay	Kokpatas Formation Karashakh Formation	W	Skarn-Skarnoid	Unknown	–	–	Suspended
Turbay ore deposit	Turbay	Kokpatas Formation	Au	Stockwork, metasomatite	3 mineralized zones (Northern, Central, Southern) l=1,200m(total) w=100-400m each d=more than 400m Ore body l=up to 600m w=1-12m d=370m	Au=0.5-27.5g/t (average Au=0.8-1.9g/t)	(1994) Southern zone C_2+P_1: 8,232 thou.t Au=1.11g/t (cut off Au=0.5g/t)	Will be finalized in 1995. Prospecting activities(1974-1994); trenching-13,570m³, 3 exploration shafts(40m deep) and cross cuts-2,165m, detailed survey of 100m×20m grid, non-coring drilling up to 100m deep-31,794m, coring drilling-6,347m.
West-Turbay ore showing	Turbay	Kokpatas Formation Karashakh Formation	Au,Ag	Vein, metasomatite	Northern mineralized area 8 ore deposites Deposite No.1: l=260m, w=40m, d=170m	–	–	Suspended Prospecting activities; drilling.
Central ore showing	Turbay	Kokpatas Formation	Ag	Vein, Stockwork	l=few hundred meters w=50-70m	Au=0.1-1.0g/t Ag=2-10g/t	–	Suspended
Daikovoe ore showing	Turbay	Koksai Formation	Au	metasomatite	Alteration zone w=1-5m	Au=0.1-0.9g/t	–	Suspended

Table II-2-1 List of Ore Deposits and Ore Showings in the East Bukantau Area(4)

Name	Ore Field	Host Rock	Minerali-zation	Type of Ore bodies	Size	Grade	Ore Reserves	Exploration
Kayansai ore showing	Turbay	Kokpatas Formation	Au	Vein	l=250m w=26m	Au=0.1-1.2g/t	-	Suspended
East Turbay ore showing	Turbay	Kokpatas Formation Granodiorite porphyries	Au	Stockwork	Northern mineralized area w=10-15m(rarely 40m)	Au=4.5-9.3g/t (most enriched part)	-	Suspended Prospecting activities; drilling.
					Southern minerarized area l=500-600m w=30-50m	Au=12.1g/t (highest grade)		
South Turbay ore showing	Turbay	Kokpatas Formation	Au	Vein, Stockwork	Southern minerarized zone l=about 1,000m w=more than 150m d=up to 200m	Au=1.8-2.22g/t	-	Suspended
Taraubay ore showing	Turbay	Kokpatas Formation	Au	Vein	l=several meters w=0.2-0.5m l=350m, w=6-8m	Au=0.6g/t, Ag=13.4g/t (one sample)	-	Mapping drillings are scheduled in 1995. Prospecting activities; mapping drilling and geochemical prospospecting(Hg).
Okjetpes ore deposit	Okjetpes	Carboniferous Devonian	Ag (Au)	Vein	minerarized zone No.1(Ag) l=1,050m w=8-10m d=100-120m	-	(1982) C₁: 2,968,240t Ag=135.9g/t Au=0.17g/t (cut off Ag=30g/t)	Suspended Prospecting activities(1974-1982); detailed survey of 40 m×20-30m grid, tunnels on 3 levels, trenching-43,400m³, 2 exploration shafts(60m deep) and cross cuts-3,078m, mine shaft-94m, horizontal tunnels-2,942m, raises-165m, coring drilling-22,333m and non-coring drilling-24,383m.
					minerarized zone No.2(Au) l=200m w=1.0m d=more than 50m	Au=21.3g/t(surface) Ag=2.0g/t(-50m)		
Barkhanny ore showing	Okjetpes	Carboniferous	Au	Vein	l=500m w=up to 100m d=100m	Au=1.5-34.0g/t (uneven)	-	Non core drillings and One coring drilling are scheduled in 1995. Prospecting activities(1978-1986); geochemical and geophysical(ground magnetic prpspecting) works, core drilling(100-150m)-7,000m, trenches and 2 vertical shafts.

l : length
w : width
d : depth

Chapter 3 Sautbay District

3-1 Geology

Sautbay district is composed of sediments of the Karashakh and the Kokpatas Formations of Proterozoic. The former forms the axis of the Sautbay Anticline while the latter forms its wings. (Figs.II-3-1~4)

The Karashakh Formation, more than 500m thick, is composed of green rocks of volcanic origin and schists associated with quartzite, dolomite and limestone.

The Kokpatas Formation has the base composed of dolomite and limestone beds, 100-150m thick, which intercalate sandstone, slate and quartzite and is overlain by thick sandstone accompanied by slate, quartzite, schist, limestone and dolomite. The upper part of the formation is composed of sandstone and slate occasionally intercalating dolomite and chert. The total thickness of the Kokpatas Formation reaches 1,000m or more. The relationship between the Kokpatas Formation and the underlying Karashakh Formation is conformable and presumed to be partially interfingering.

Stocks and dikes of Late Carboniferous ~ Early Permian granodiorite, aplite, diorite, lamprophyre, etc. intrude into the Proterozoic.

The folding system in the district is represented by the Sautbay Anticline. The Sautbay stock of granodiorite, situated in the axis of the fold, controls the occurrence of skarn accompanied by tungsten mineralization.

The horizon including carbonate rocks which controls the ore corresponds mainly to the upper part of the Karashakh Formation or the lower part of the Kokpatas Formation, the extent of mineralization in the vertical section reaching 500m.

3-2 Mineralization

The main type of the mineralization in the district is that of tungsten, as represented by the Sautbay-Burgut deposits and Saghinkan deposit. These ore deposits have two types of tungsten mineralization: stratiform deposits of skarn along carbonate rocks and stockwork deposits in granodiorite stocks, skarns, quartzite and hornfels.

The skarn-type stratiform ore deposits occur at contact zones of the intrusive granodiorite body with the carbonate rocks in Proterozoic.

The carbonate rocks which control the mineralization appear at various horizons in Proterozoic and the mineralization extends over about 500m in the vertical section, whilst the horizons, at which orebodies are mainly controlled, are in the upper portion of the Karashakh Formation and in the lower portion of the Kokpatas Formation. The Sautbay-Burgut deposits are controlled mainly by the lower portion of the Kokpatas Formation, where some 20 skarn orebodies are confirmed. The Saghinkan deposit is controlled by the upper portion of the Karashakh Formation where 14 skarn orebodies have been confirmed.

These skarn orebodies are stratiform and almost conformable with the bedding plane of the host rocks.

Bonanzas are generally formed between 50 and 100m -- rarely 200m -- from the contact points with the granodiorite bodies.

The ore of the Sautbay skarn orebodies is amphibole-pyroxene skarns accompanied by scheelite and amphibole-pyroxene-pyrrhotite skarns, containing pyrite, pyrrhotite, chalcopyrite and marcasite, occasionally accompanied by bismuthinite, native bismuth, arsenopyrite, sphalerite, galena, chalcocite and covelline.

In addition to these stratiform orebodies, stockwork-type tungsten mineralization consisting of quartz veins-veinlets controlled by fractures develop mainly within granodiorite bodies, which has no economic value because of the low grades.

Although skarn orbodies contain some gold, auriferous minerals are not recognized by the microscopic observation of polished sections. The fluid inclusions of two samples of quartz veins are of vapor-liquid phases and the homogenization temperatures range between 110°C and 346°C, showing occurrence similar to those of the Bulutkan district.

3-3 Drilling survey

Drilling survey was performed, in order to investigate mineralization in the portion under the planned open-pit mining area of the Sautbay deposit thereby ascertaining its continuity into the depths.

3-3-1 Drilling work summary

With the personnel and equipment arranged by the Samarkandgeology, drilling work of four drillholes totaling 1,509.9m was performed. To supervise the operation, a drilling engineer was sent from Japan. The locations of the respective drillholes are shown in Fig. II-3-4.

Three drilling machines -- two Russian-made SKB-4100 (drilling cap. φ 76mm : 350-400m and φ 59mm : 500m) and a SKB-4110 (drilling cap. φ 76mm : 350-400m and φ 59mm : 500m) -- were used for the work.

Buldozers were used for the transportation of drilling machines and supplies, road construction, site leveling and preparations.

The wireline method was applied to the drilling operation in an effort to improve core recovery and work progress.

For the surface soil drilling, single diamond bits and metal bits of φ 112mm or φ 76mm were used, while, after reaching the rock, φ 73mm casing pipes were inserted and installed. Afterwards, the drilling continued with the SSK-59 wireline diamond bits as the final diameter. Mud water preparation was not done at the drilling site but at a mud water plant of the Kokpatas Expedition and conveyed to the site by a $8m^3$ tank truck. The drilling length and coodinate by drillholes are tabulated in Table II-3-1.

Table II-3-1 List of Drilling in the Sautbay District

District	Hole No.	Coodinate		Elevation	Direction	Dip	Length
		X	Y	(m)			(m)
Sautbay	MJUS-1	86,764.60	71,230.00	230.72	S60°W	-75°	352.0
	MJUS-2	86,804.65	71,163.53	221.20	S60°W	-75°	426.5
	MJUS-3	86,807.00	71,070.00	224.39	S60°W	-75°	381.4
	MJUS-4	86,825.28	70,986.12	226.06	S60°W	-75°	350.0
	Total	-	-	-	-	-75°	1,509.9

3-3-2 Drilling survey results

Ore showings confirmed by the drilling survey are listed in Table II-3-2. The survey results are shown in the geological cross sections along the drillholes(Figs.II-3-6~9).

The drilling aimed at the lower part of the No.1 orebody intersected a skarn orebody containing scheelite at the drillholes MJUS-3 and -4, and regular-grade tungsten mineralization at MJUS-2, whereas no prominent indications of mineralization were caught at MJUS-1.

The drilling survey at four holes ascertained that the No.1 orebody -- the main ore body -- strikes NNW-SSE and dips about 70° E and that the mineralization is continued up to about 400m below the surface in the southeast of MJUS-2.

Portions where WO_3 grades in excess of 0.30% were seized over 2m or more of true width were located at the No.1 ore body (true width 13.2m; WO_3 0.35%) captured between the depths of 319.8m and 338.5m of the borehole MJUS-3, the No.3 ore body (true width 2.3m; WO_3 2.31%) captured between 359.6m and 362.9m, and the No.1 ore body (true width 5.0m; WO_3 0.84%) captured between 309.3m and 315.8m of MJUS-4. In the light of the relationship between the locations of these bonanzas and those of bonanzas on the surface, the bonanzas of the orebody presumably plunge in the SSE direction.

Therefore, the tungsten mineralization is highly likely to continue downward and south-southeastward.

3-4 Ore Reserves Estimation of Sautbay, Burgut and Saghinkan deposits

3-4-1 Calculation method

Based on the data collected during Phases I thru III, ore reserves estimation of the Sautbay, Burgut and Saghinkan deposits at the Sautbay district was effected with a view to revaluating the ore deposits and to drawing up mining plan(Fig.II-3-10).

Used for the calculation was the microLYNX Plus of Geosystems Inc. of Canada, a software designed for ore reserves calculation, suitable for skarn-type and vein-type ore deposits.

At and around Sautbay and Burgut deposits, some 700 holes have so far been drilled, of which 244 holes were used in the ore reserves estimation(Fig.II-3-11). Samples collected from the walls of the 193m-level tunnel at the Sautbay deposit were included in the calculation. Only WO_3 and Au were considered in the estimation. The numbers of samples for WO_3 and Au were 14,597 and 16,516, respectively. Figs.II-3-12~19 indicate the inferred grade distribution of WO_3 and Au.

3-4-2 Results of calculation

1) Sautbay and Burgut deposits

Results of calculation of the Sautbay and Burgut ore reserves are shown in Table II-3-3.

Table II-3-3 Ore Reserve Estimation Result of Sautbay and Burgut Deposits

Cutoff (WO_3%)	Reserves (t)	WO_3 (%)	Au (g/t)	WO_3 (t)	Au (kg)
0.05	15,195,300	0.29	0.23	44,282.0	3,438.3
0.08	13,898,100	0.31	0.24	43,453.2	3,302.5
0.10	13,074,960	0.33	0.24	42,713.1	3,201.7
0.20	8,104,050	0.44	0.28	35,355.9	2,299.5
0.30	4,640,460	0.58	0.34	26,972.3	1,595.2
0.40	3,089,100	0.70	0.39	21,595.5	1,193.0
0.50	2,038,140	0.83	0.45	16,903.0	907.9

The total reserves of Sautbay and Burgut deposits are 15,195,000t at the cutoff grade of 0.05%(WO_3), averaging 0.29% WO_3 and 0.23 g/t Au, or about 44,000t of WO_3 and 3.4t of Au in terms of metal contents.

Table II-3-4 compares the Phase III(1997) results with those of Phase I(1995) and of the Sarydjoy report(1993). The three estimates are approximate to each other, as for the ore reserves within the open pit of Sautbay deposit, at the 0.05% cutoff.

Table II-3-4 Comparison of Ore Reserve Estimation Results by MMAJ(1997), MMAJ(1995)and Sarydjoy Team(1993) (on the Whole Area Basis)

Area	Reported by	Reserves (t)	WO_3 (%)	Au (g/t)	WO_3 (t)	Au (kg)
Open pit of Sautbay deposit	Sarydjoy(1993)	2,606,250	0.38	0.16	9,960.5	411.4
	MMAJ(1995)	2,621,000	0.35	0.13	9,173.5	340.7
	MMAJ(1997)	2,712,142	0.36	0.12	9,764.4	319.6
Sautbay,Burgut deposits	Sarydjoy(1993)	39,539,352	0.43	0.34	168,701.5	13,530.7
	MMAJ(1995)	25,885,000	0.27	0.24	70,631.7	6,335.1
	MMAJ(1997)	15,195,300	0.29	0.23	44,282.0	3,438.3

As regards the entire deposits of Sautbay and Burgut , however, significant differences come out between the three estimates, as seen in Table II-3-4.

The differences in ore reserves are considered attributable to the following causes. In the Phase III estimation of ore reserves, definition of orebodies are in principle based on the Sarydjoy geologic sections, but some modifications based on the latest data were added to them. In interpolating average grade of an ore block, search distances were limited on the basis of variogram analysis. The Sarydjoy calculation method has no such limitation, since all the portions once incorporated in the estimation area are regarded as orebodies. In the Phase I calculation, clear variogram for WO_3 in the B-axis direction was unavailable; the search distance was made 100m on the supposition that the variogram is the same as that in the A-axis direction. In the Phase III calculation, however, clear variogram for WO_3 in the B-axis direction was obtained as drilling data built up, and the search distance was revised to 45m. The mentioned difference between the methods produces little difference in ore reserves in a densely drilled area such as the Sautbay open pit, whereas in a sparsely drilled area, a large difference comes out.

As regards the difference in the average grades, the following two causes are conceived:

① When calculating average grade of a component mineral in a section, the Sarydjoy method ignores area of the section, simply applying the length-weighted average of analysis values of samples as the average grade of the section. Therefore, a drillhole with accidentally high grade in a sparsely drilled area, if any, will increase the average grade of the section.

② The Sarydjoy method divides one orebody into several blocks and calculates ore reserves of each block. When calculating average grade of a block of inferred ore reserves(P1), it chooses the highest grade of all the sections intersecting the block, to use the grade as the average grade of the block. Consequently, the overall average grade increases.

2) Saghinkan deposit

Estimation of the Saghinkan ore reserves was made in Phase II, which has been recalculated in Phase III, utilizing new variogram for WO_3 and Au of the Sautbay deposit. Results of the calculation is shown in Table II-3-5.

Table II-3-5 Ore Reserve Estimation Result of Saghinkan Deposit

Cutoff (WO3%)	Reserves (t)	WO3 (%)	Au (g/t)	WO3 (t)	Au (kg)
0.05	10,061,580	0.24	0.02	24,415	236
0.08	9,061,710	0.26	0.02	23,749	207
0.10	8,132,880	0.28	0.02	22,934	198
0.20	4,073,190	0.42	0.02	17,141	95
0.30	2,391,390	0.55	0.03	13,061	66
0.40	1,568,010	0.65	0.03	10,225	51
0.50	1,153,950	0.72	0.03	8,357	37

In case the cutoff grade is 0.05%(WO_3), the ore reserves of the entire deposit of Saghinkan are 10,062,000t, averaging 0.24% WO_3. The metal content comes to about 24,000t of WO_3. The average grade of Au is as low as 0.02 g/t. The ore deposit is considered to be of practically no economic value for gold.

Table II-3-6 Comparison of Ore Reserve Estimation Results by MMAJ(1997), MMAJ(1996) and Kokpatas Expedition (on the Whole Area Basis)

Area	Reported by	Reserves (t)	WO_3 (%)	WO_3 (t)
Saghinkan	Kokpatas(1994)	12,710,000	0.32	40,470
	MMAJ(1996)	13,944,000	0.27	37,830
	MMAJ(1997)	8,132,880	0.28	22,934

Table II-3-6 compares the results of Phases II and III with those of the Uzbek estimation. The Phase III estimation is lower than the Uzbek estimation in terms of ore reserves and grade. The differences are considered to be attributable to the same causes as those in the case of the Sautbay and Burgut deposits.

Table II-3-7 Ore Reserve Estimation Result of Sautbay,Burgut and Saghinkan Deposits

Area	Reported by	Reserves (t)	WO_3 (%)	Au (g/t)	WO_3 (t)	Au (kg)
Sautbay,Burgut deposts	MMAJ(1997)	15,195,300	0.29	0.23	44,282	3,438
Saghinkan deposits	MMAJ(1997)	10,061,580	0.24	0.02	24,415	236
Total	MMAJ(1997)	25,256,880	0.27	0.15	68,697	3,674

Table II-3-7 indicates the ore reserves of these orebodies at the cutoff grade of 0.05%(WO_3).

The total ore reserves of the Sautbay, Butgut and Saghinkan deposits at the cutoff of 0.05% WO_3 came up to 25,257,000t, averaging 0.27% WO_3 and 0.15 g/t Au, or approx. 69,000t(WO_3) and 3.7t(Au) in terms of metal contents.

The WO_3 grades of skarn-type tungsten mines operating since 1980 in the Western countries, such as USA, Canada, Australia, Korea and Turkey, are mostly 0.5% or higher in case of open-pit mining while, in case of underground mining, 1% or higher. Compared to these, the WO_3 grades of the Sautbay, Burgut and Saghinkan are considerably low.

3-5 Studies on Mining Plans

Based on the results of ore reserves estimation of the Sautbay, Burgut and Saghinkan deposits and of the field survey, mining plans were studied, details of which are exhibited in Appendix 2.

At the cutoff grade of 0.05%(WO_3), the total ore reserves of Sautbay and burgut deposits combined are 15,195,000t, grading 0.29%, while those of Saghinkan deposit are 10,062,000t, grading 0.24%. In terms of minable crude ore for the optimum operation, the Sautbay has 1,194,000t(minable grade 0.48%) at a cutoff of 0.2%, the Burgut has 2,072,000t(0.68%) at a cutoff of 0.5%, and the Saghinkan has 2,325,000t(0.52%) at a cutoff of 0.4%.

The mining plans were based on the assumptions that the WO_3 processing equipment is to be installed at the No.3 ore dressing plant(Au) at Uchkuduk while existing facilities are utilized as far as possible, in order to minimize the initial investment costs. Ore is assumed to be hauled to the Kokpatas gold mine by trucks, from where to the No.3 plant by rail(Fig.II-3-20).

Feasibility study for development of the Sautbay, Burgut and Saghinkan deposits indicated that separate development of each of these deposits is unfeasible due to the low WO_3 grades. Instead, feasibility for combined development of plural deposits was studied(Table II-3-8), which indicated that the operation is optimized by combining 700-tpd open-pit mining of the portion over the +100m(above sea level) at the Sautbay deposit for the 6.6-year operation, with 800-tpd underground mining of the Burgut deposit for the 10-year operation. The optimized operation would earn a revenue of 1,607 sum(32.14$) per ton of crude ore, in case the WO_3 concentrate price is assumed at 61$/t-%.

As the initial investment cost is 601 sum(12.02$)/t and the operating cost is 1,015 sum(20.3$)/t, the total expenditures come to 1,616 sum(32.32$)/t. Therefore, even the optimized operation would suffer a loss of 9 sum(0.18$) per ton.

Table II-3-8 Comparison of Total Income

	Sautbay open pit	Burgut underground	Saghinkan underground	Sautbay OP+ Burgut UG
Ore cut-off grade(%)	0.2	0.5	0.4	0.2,0.5
Minable ore(10^3t)	1,194	2,072	2,325	3,266
Minable grade(%)	0.48	0.68	0.52	0.61
Production (t/day)	700	800	800	700→800
Mine life(years)	6.6	10.0	11.2	16.6
Initial investment(10^3sum)	961,790	1,688,715	1,688,715	1,964,415
Crude ore value(sum/t)	1,220	1,830	1,342	1,607
Initial investment(sum/t)	806	815	726	601
Operating cost(sum/t)	972	1,040	1,044	1,015
Income(sum/t)	-558	-25	-428	-9
Total income(10^3sum)	-666,252	-51,800	-995,100	-29,394

The feasibility study revealed that even the optimized operation would leave accumulated deficits of 30 million sum(600,000$) as against the initial investment of about 2 billion sum(40 million$). The estimation was based on the assumptions that the entire investment is catered for by own funds while no escalation of labor and materials expenses nor costs for equipment replacement, mine closure and taxes are considered. Due to the lack of profitablity even under such exceptionally favorbale conditions, development of the tungsten deposits in the Sautbay district is considered economically unfeasible, under the current levels of ore reserves, grade and WO_3 price.

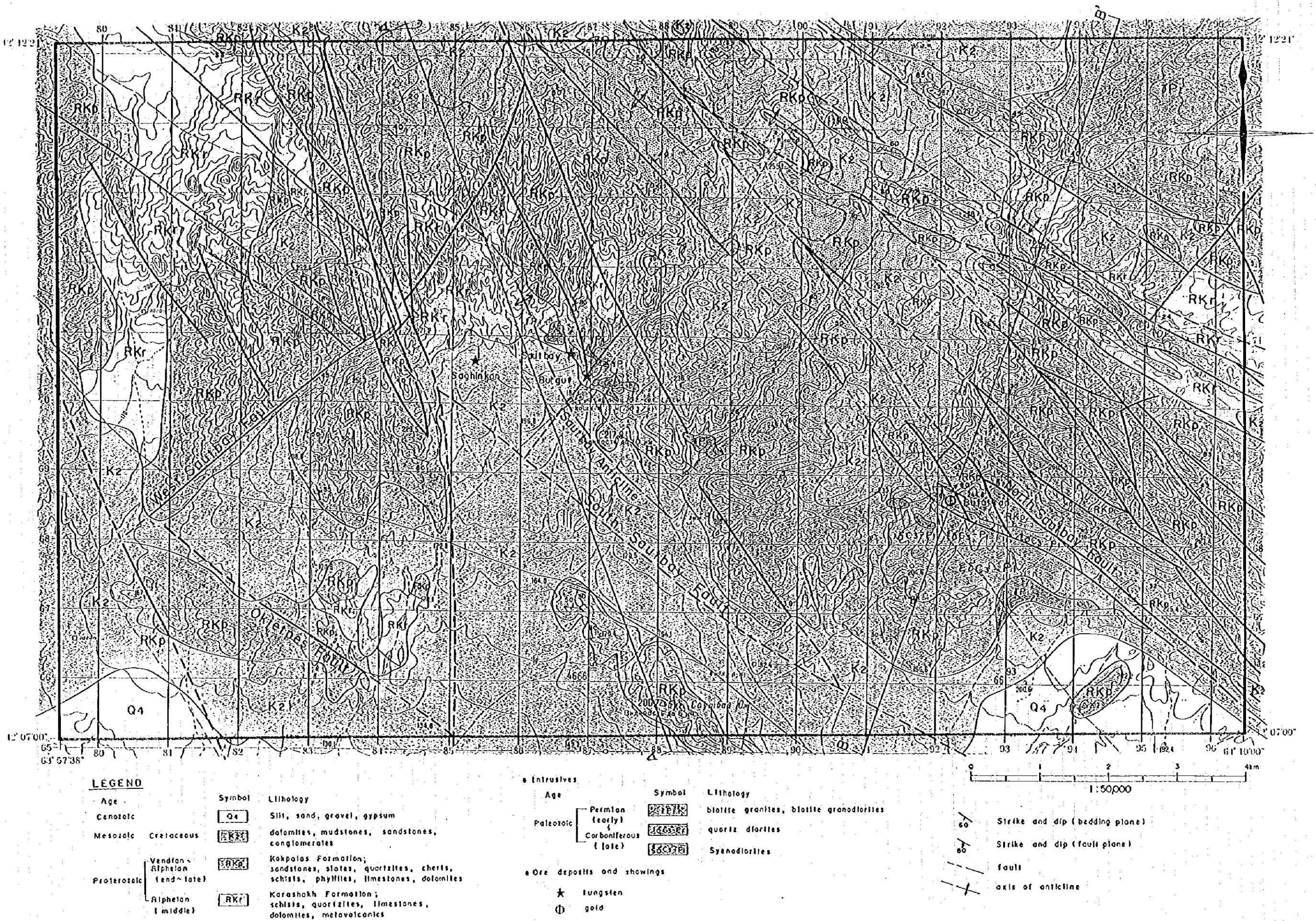


Fig. II-3-1 Geological Map of the Sautbay-Bulutkan District

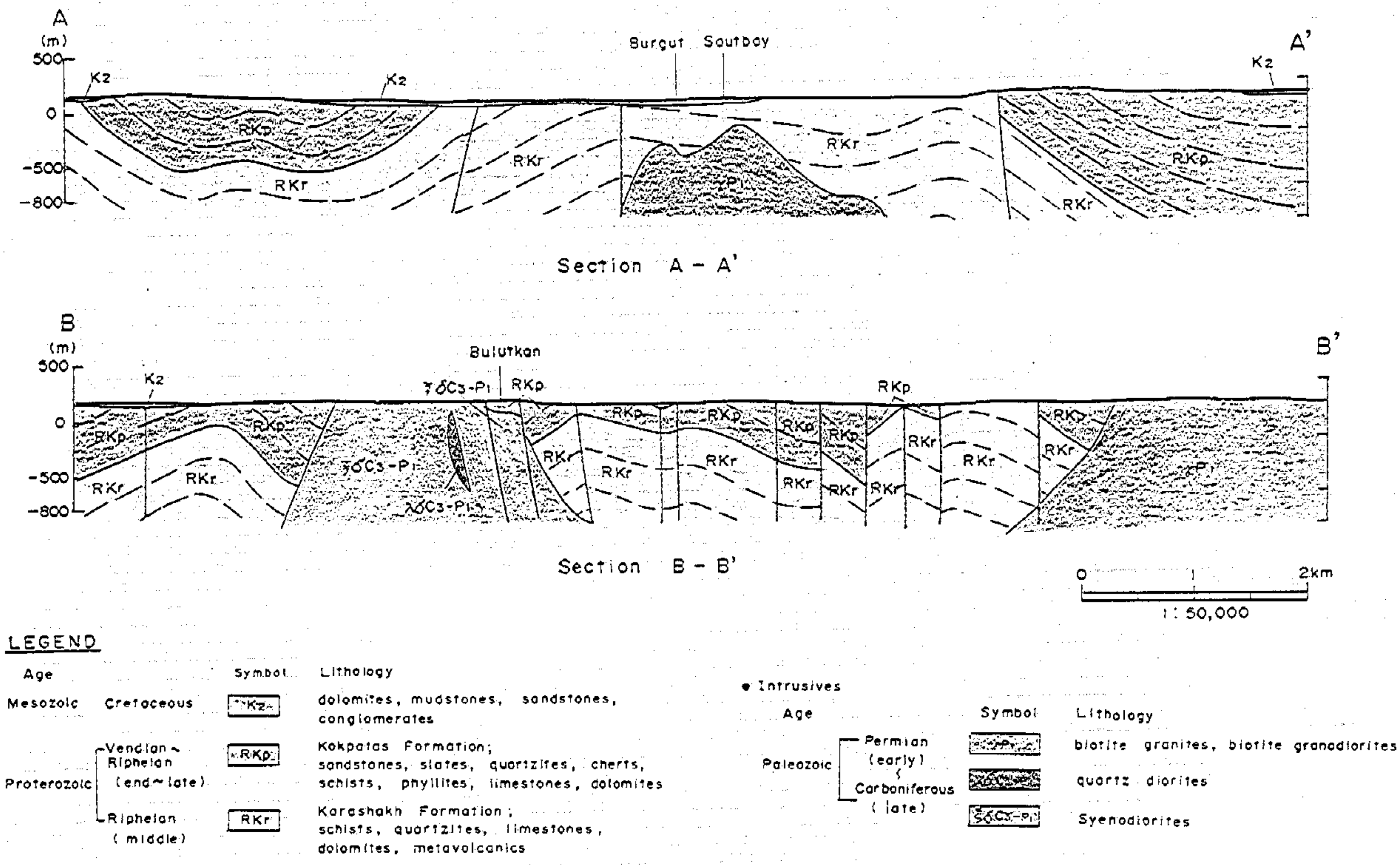


Fig. II-3-2 Geological Cross Section of the Sautbay-Bulutkan District

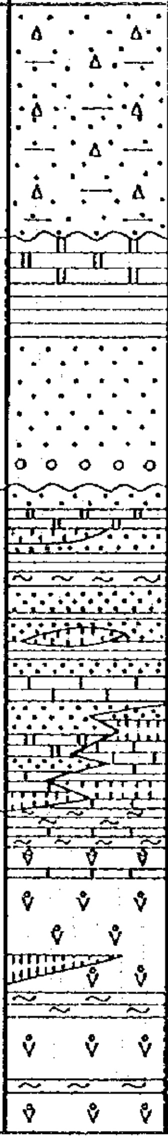
Age			Formation	Thickness (m)	Geologic Column	Lithology
Cenozoic	Quaternary			< 10		silt, sand, gravel, gypsum
Mesozoic	Cretaceous			< 80		dolomites mudstones sandstones conglomerates
Proterozoic	Vendian		Kokpatas	>1,000		sandstones, slates quartzites, cherts schists, phyllites limestones, dolomites
Proterozoic	Riphean	end ∫ late	Kokpatas	>1,000		schists, quartzites limestone, dolomites metavolcanics
Proterozoic	Riphean	middle	Karashakh	> 500		

Fig. II-3-3 Schematic Geologic Column of the Sautbay-Bulutkan District

(after V.A.Aleksashechkin;1993)

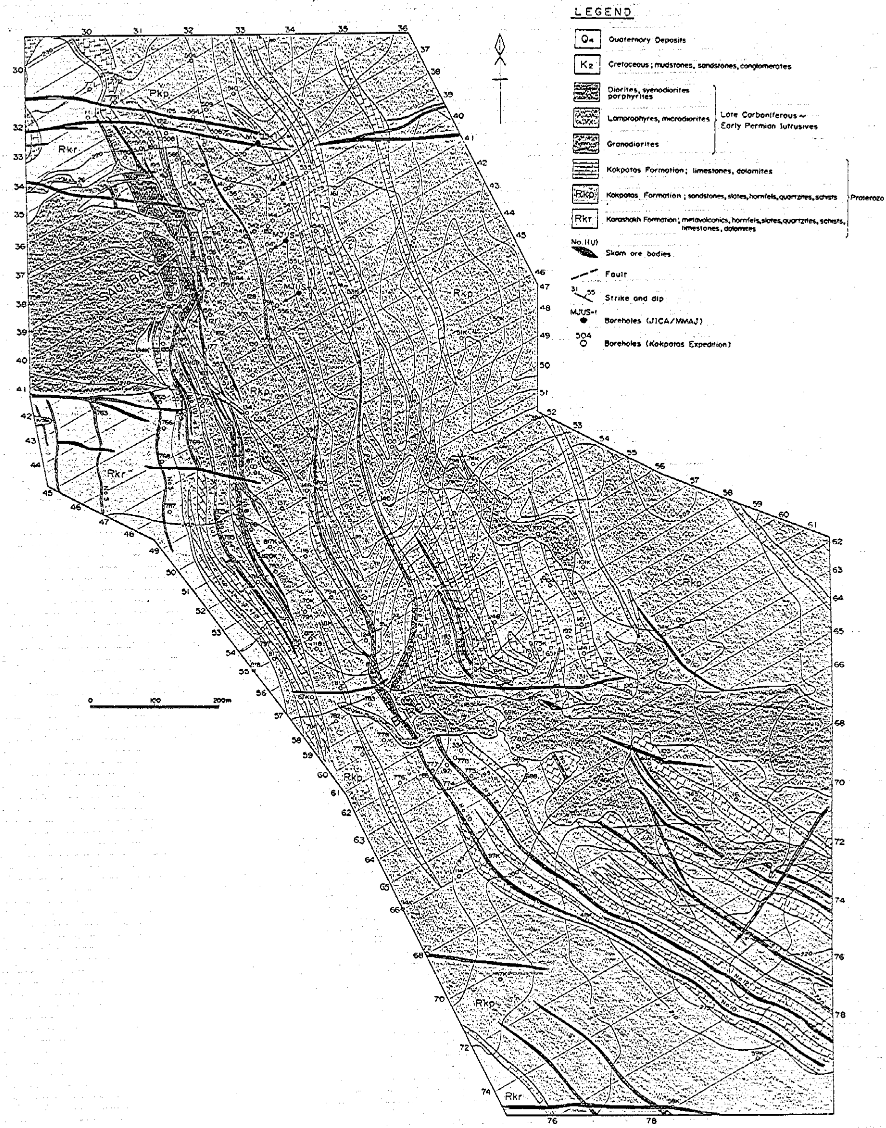


Fig. II-3-4 Geological Map of the Sautbay District

(after T.P.Radajeva,H.B.Khan,O.G.Kim;1994)

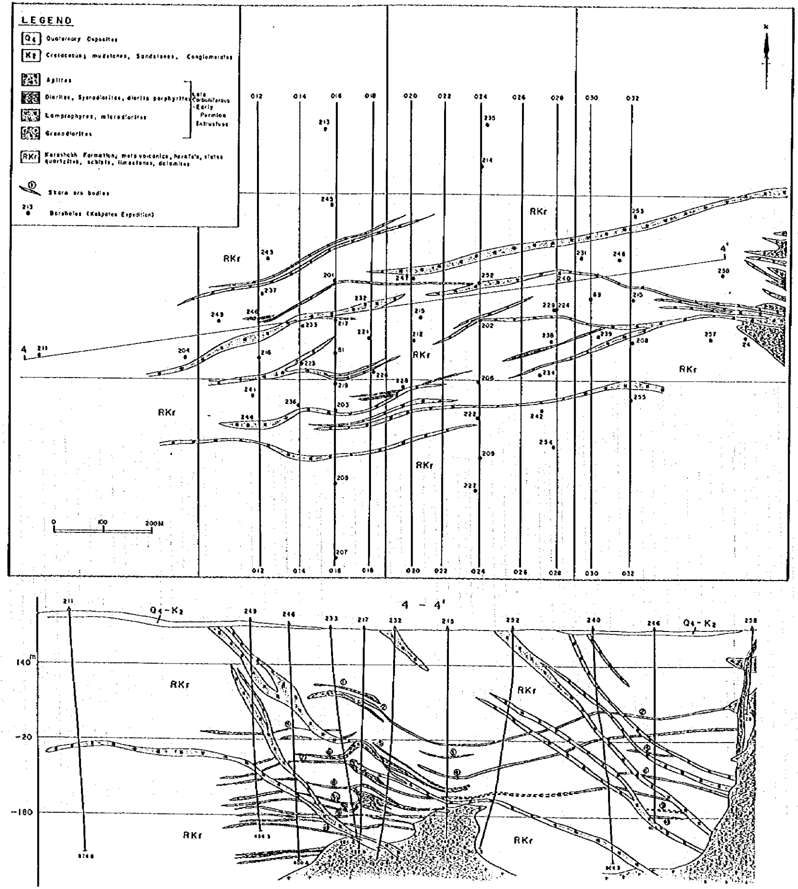


Fig. II-3-5 Schematic Geological Map and Cross Section of the Saghinkan Deposit

Table II-3-2 Major Mineralized Zones Caught by Drillings in the Sautbay District

Hole No	Depth (m)	True width (m)	Au (g/t)	Ag (g/t)	Cu (%)	Bi (%)	Mo (%)	WO_3 (%)	Remarks
MJUS-1	89.0- 91.0 (2.0)	1.3	tr		0.05	tr	tr	0.04	Skarnized phyllite
	316.2-318.2 (2.0)	1.3	tr		tr	tr	tr	0.03	Skarnized quartzite
	319.3-320.4 (1.1)	0.7	tr		tr	tr	tr	0.04	Skarn
	344.5-348.6 (4.1)	2.6	0.1		tr	tr	tr	0.02	Skarnized quartzite and limy slate
MJUS-2	359.3-360.0 (0.7)	0.5	0.7	tr	tr	tr	tr	0.17	Skarn
	368.3-369.2 (0.9)	0.7	0.3	tr	tr	tr	tr	0.15	Skarn
	404.0-405.8 (1.8)	1.4	2.8	tr	tr	tr	tr	tr	Slate with skarn
	406.9-408.0 (1.1)	0.8	2.2	tr	0.03	tr	tr	tr	Skarn
	413.0-415.0 (2.0)	1.5	0.2	tr	tr	tr	tr	0.18	Skarnized limestone and chert
	416.7-419.0 (2.3)	1.8	0.2	tr	0.05	tr	tr	0.28	Skarn and skarnized limestone
	419.9-420.7 (0.8)	0.6	0.3	tr	0.10	tr	tr	0.42	Skarn
MJUS-3	137.2-145.5 (8.3)	5.9	tr		0.02	tr	0.03	0.11	Skarnized quartzite
	182.8-183.5 (0.7)	0.5	0.8	tr	tr	tr	tr	0.60	Skarnized limestone
	210.0-210.4 (0.4)	0.3	1.0	tr	0.01	tr	tr	0.27	Silicified and skarnized metasomatite
	293.4-301.0 (7.6)	5.4	0.3	tr	tr	tr	tr	0.20	Skarn, skarnized sandstone and limestone
	319.8-338.5(18.7)	13.2	0.5		tr	tr	tr	0.35	Skarn and skarnized limestone
	359.6-362.9 (3.3)	2.3	1.6	1.9	0.08	tr	tr	2.31	Silicious skarn
MJUS-4	27.3- 28.1 (0.8)	0.6	tr	tr	0.03	tr	tr	0.12	Quartz-Pyrite vein
	303.9-306.1 (2.2)	1.7	tr	tr	0.03	tr	tr	0.12	Quartz vein and silicified metasomatite
	309.3-315.8 (6.5)	5.0	0.6	tr	0.06	tr	tr	0.84	Skarn

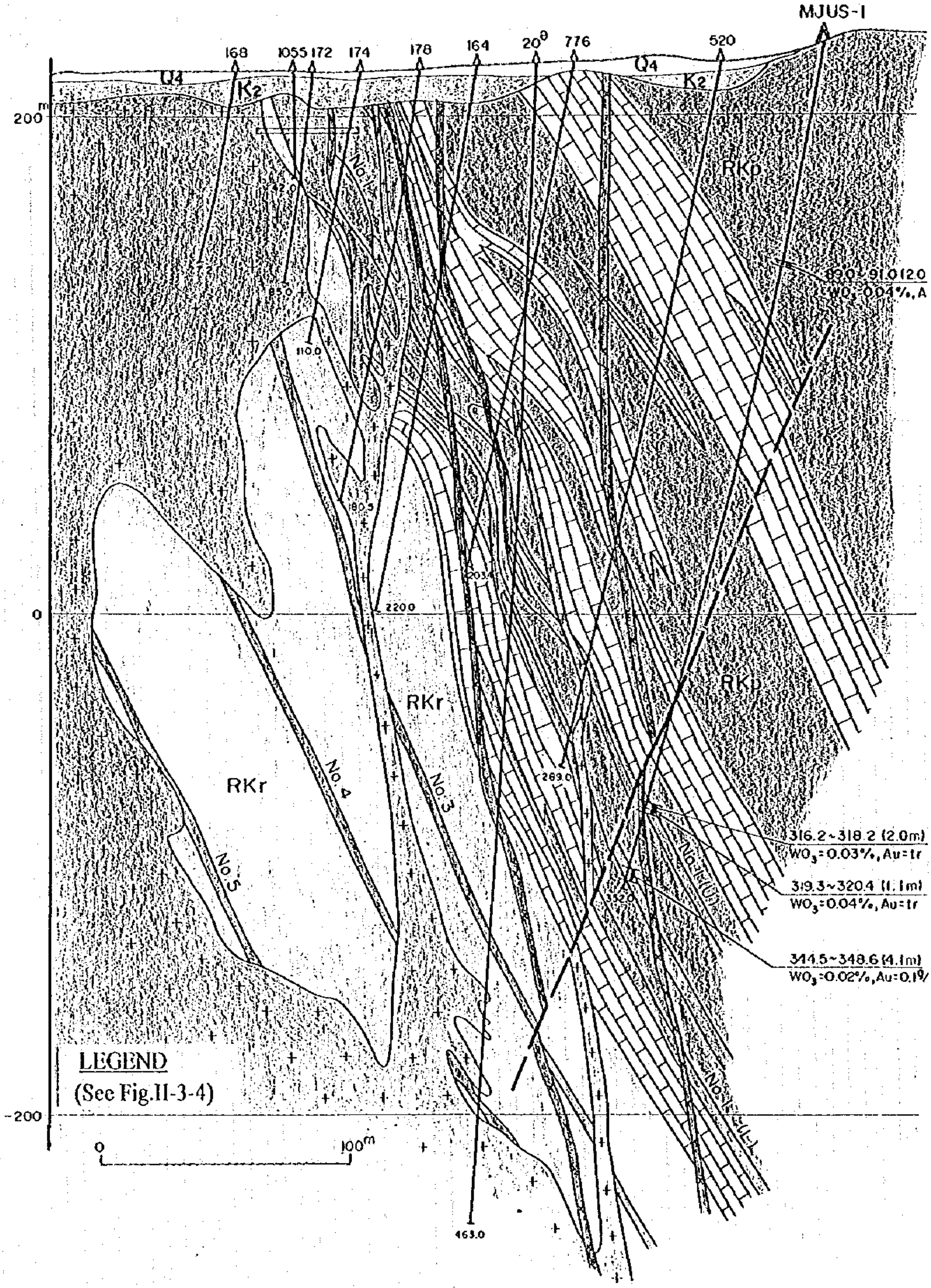


Fig. II-3-6 Geological Cross Section along MJUS-1

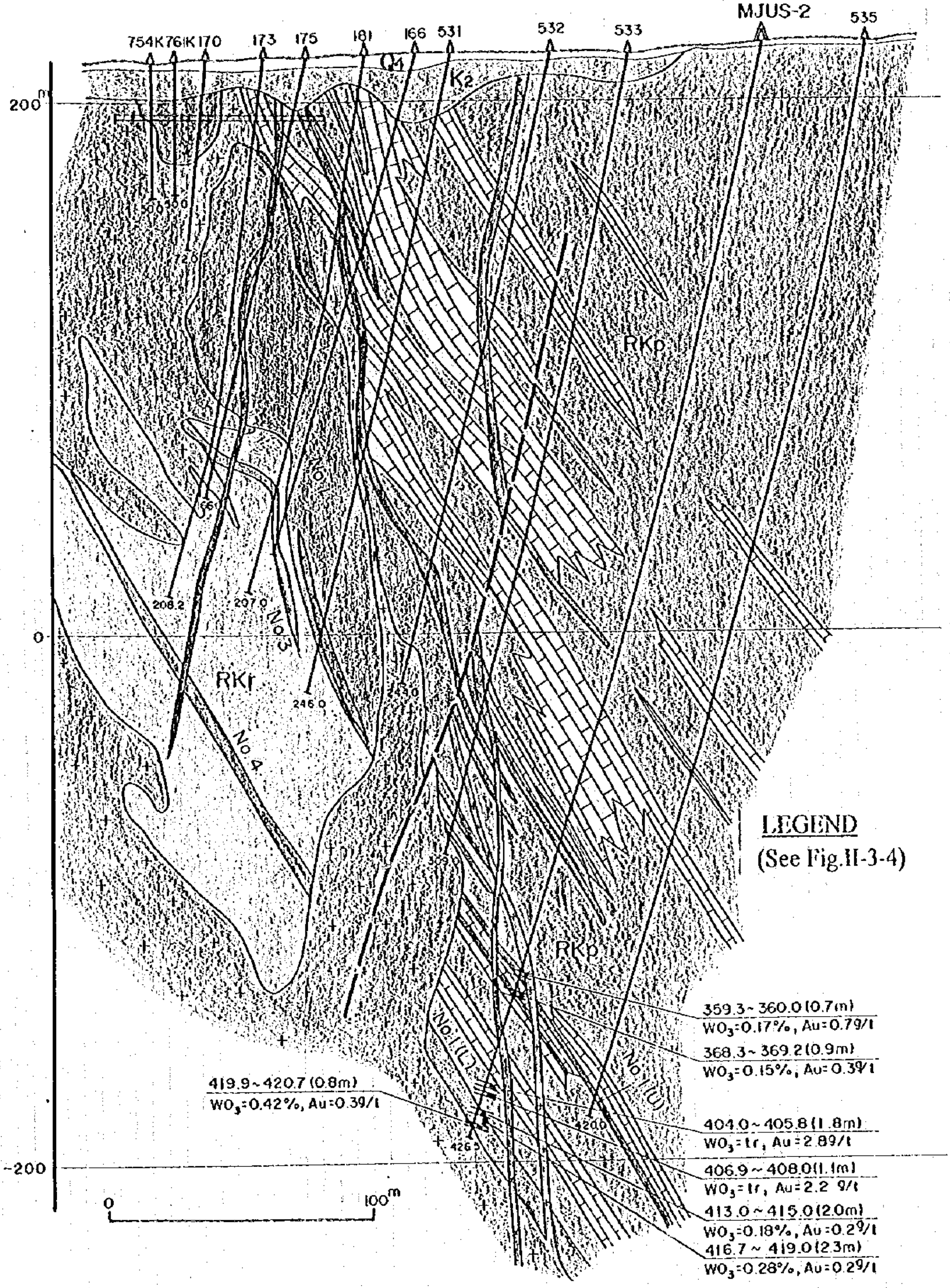


Fig. II-3-7 Geological Cross Section along MJUS-2

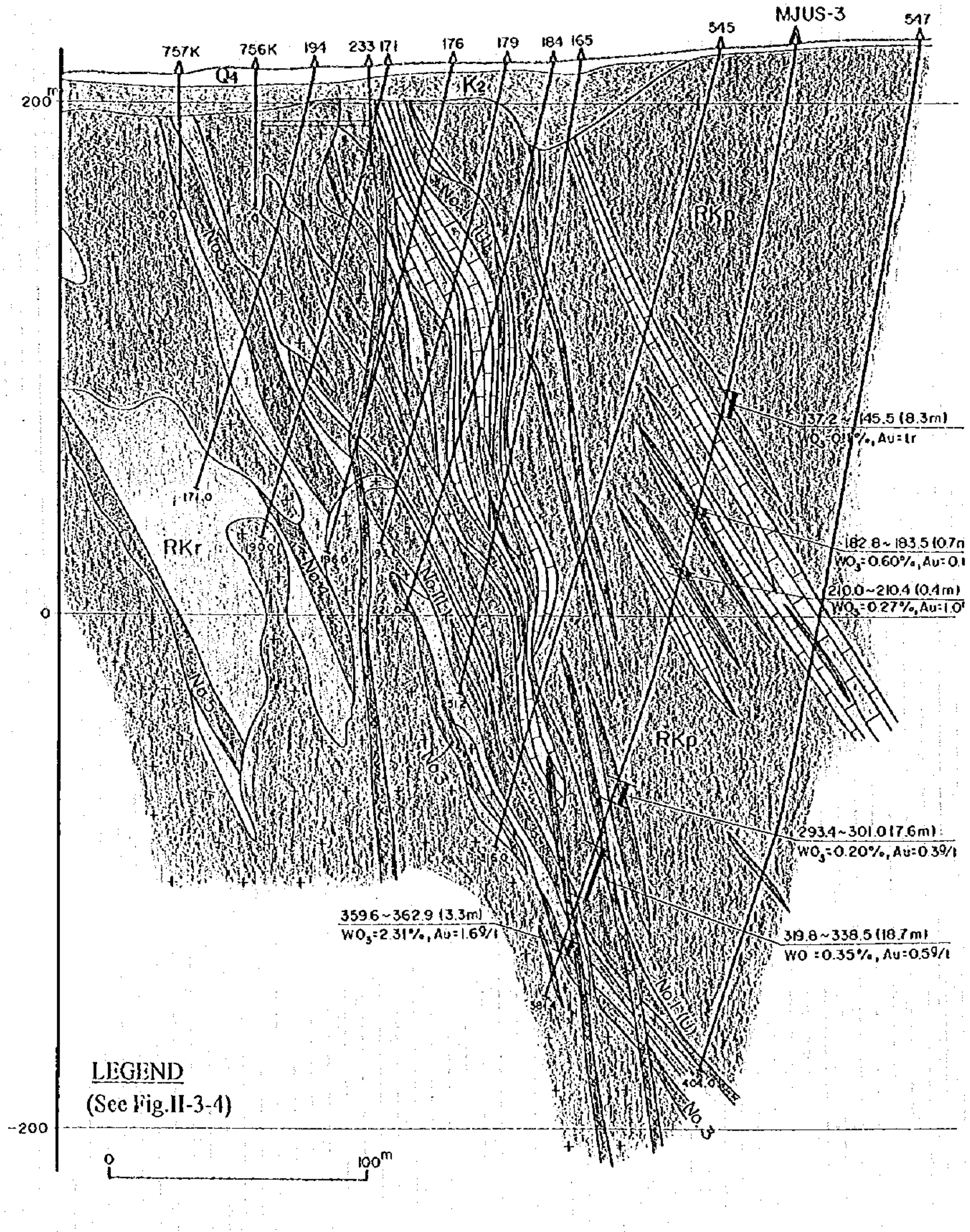


Fig. II-3-8 Geological Cross Section along MJUS-3

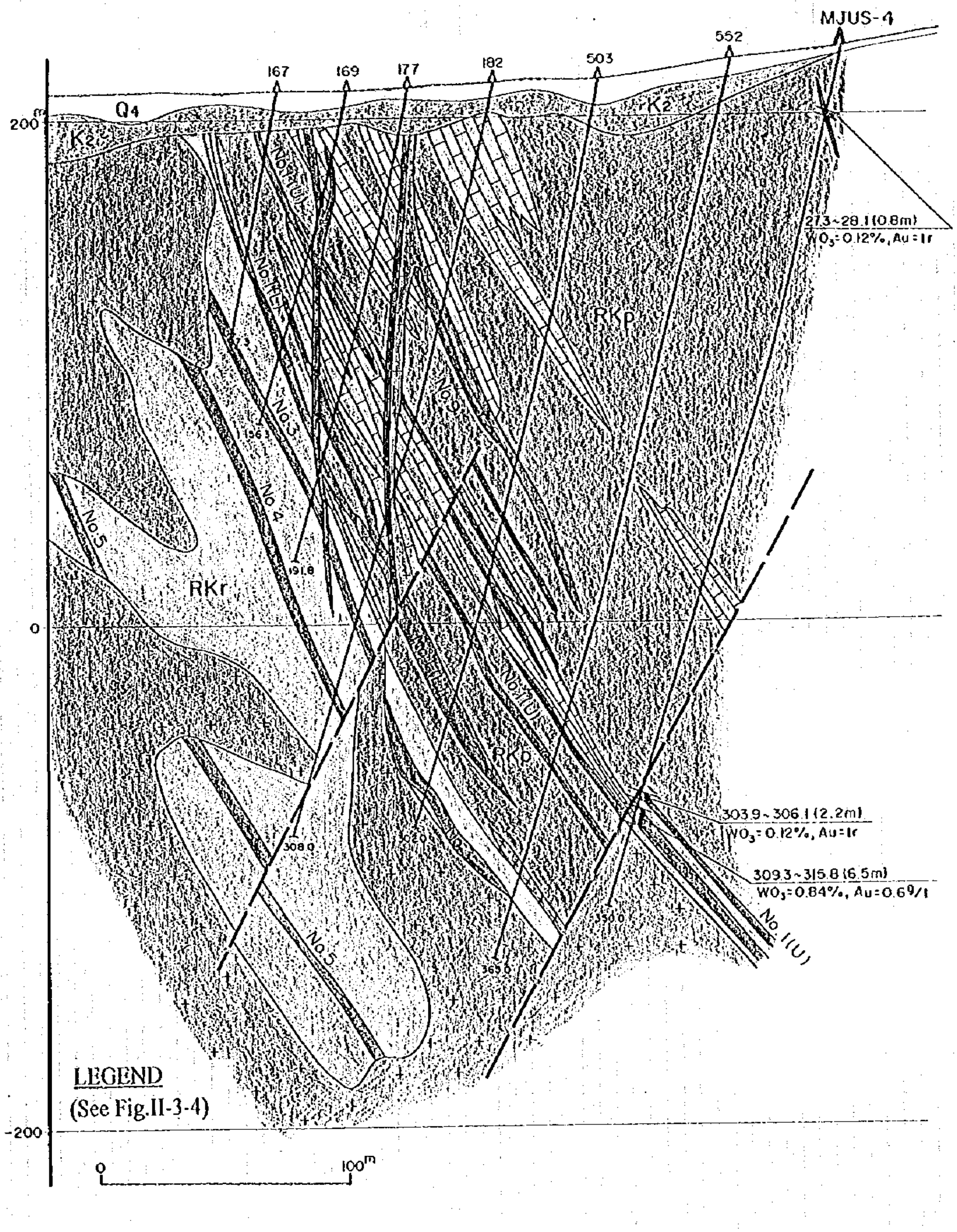


Fig. II -3-9 Geological Cross Section along MJUS-4

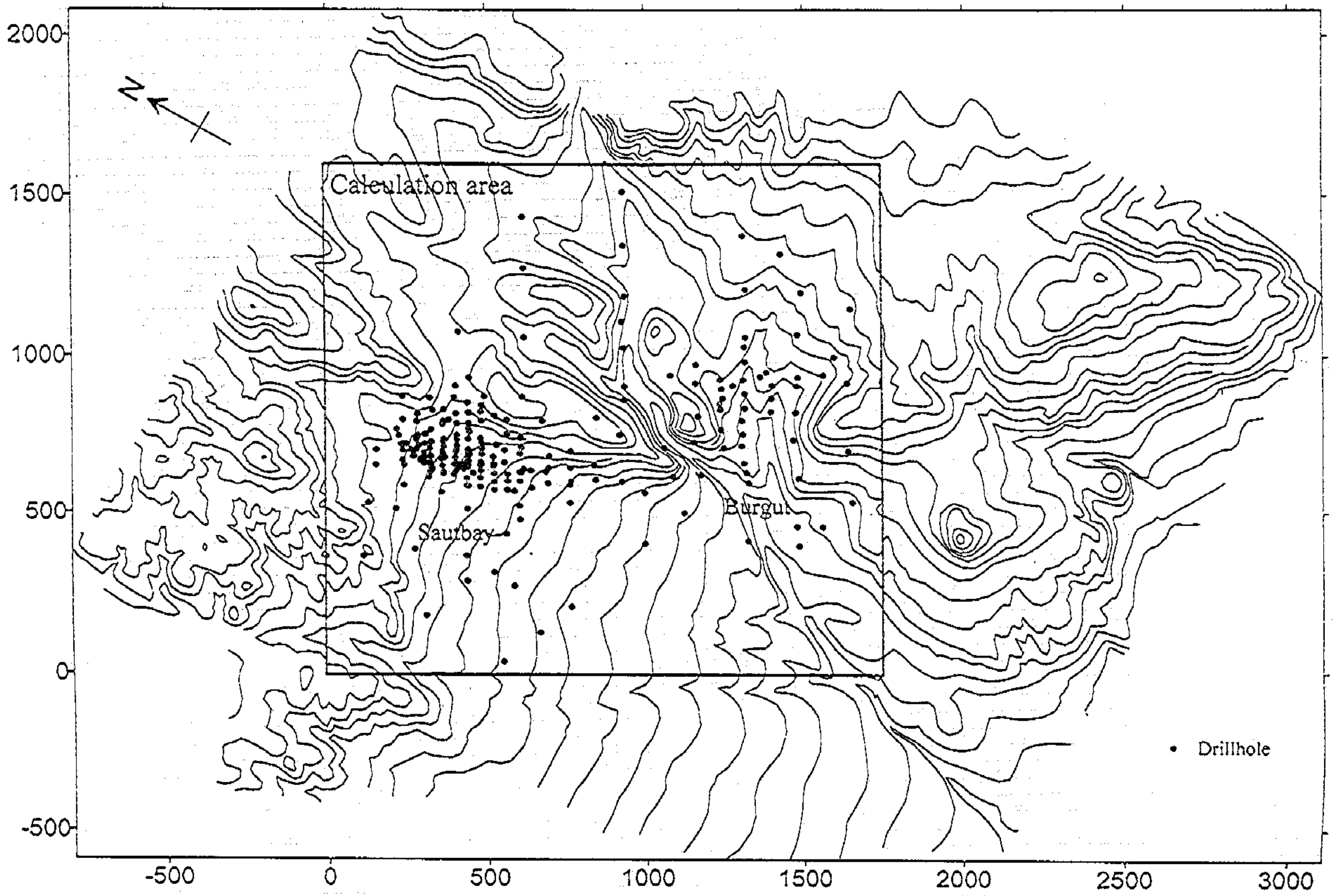


Fig. II-3-10 Location Map of the Ore Reserve Estimation Area

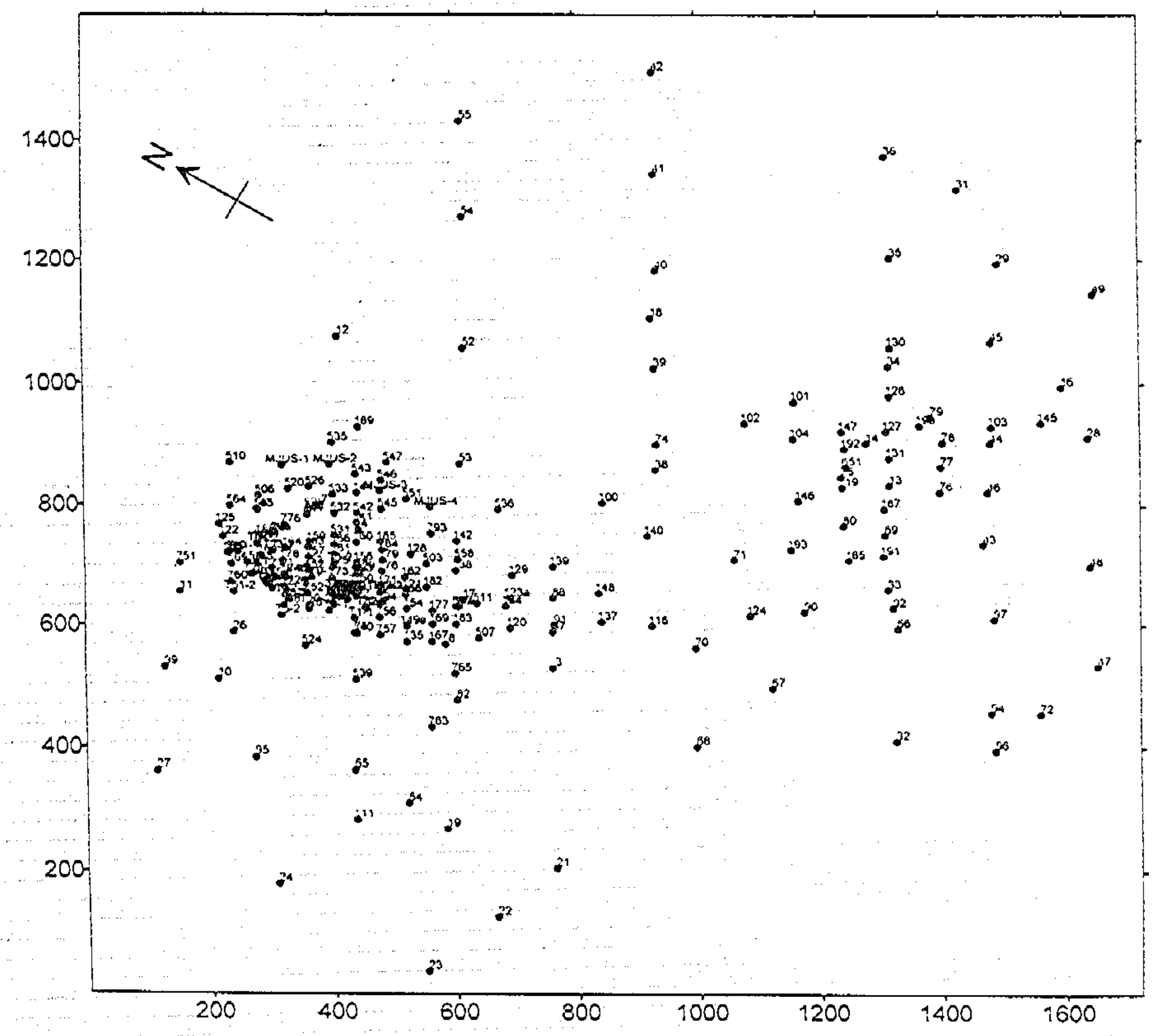


Fig. II-3-11 Location Map of the Drillholes Used in the Ore Reserve Estimation

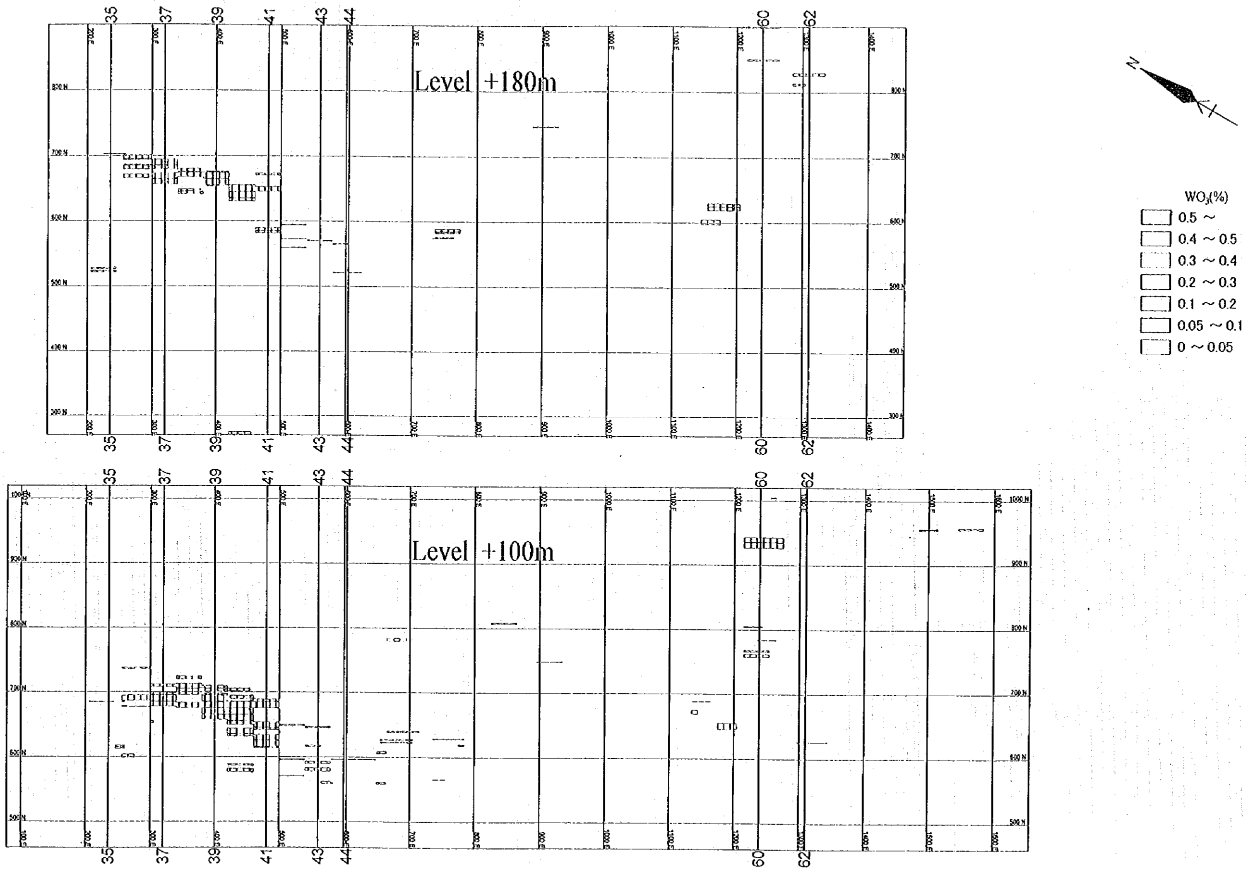


Fig. II-3-12 Estimated Grades of WO_3 at the Level of +180m, +100m

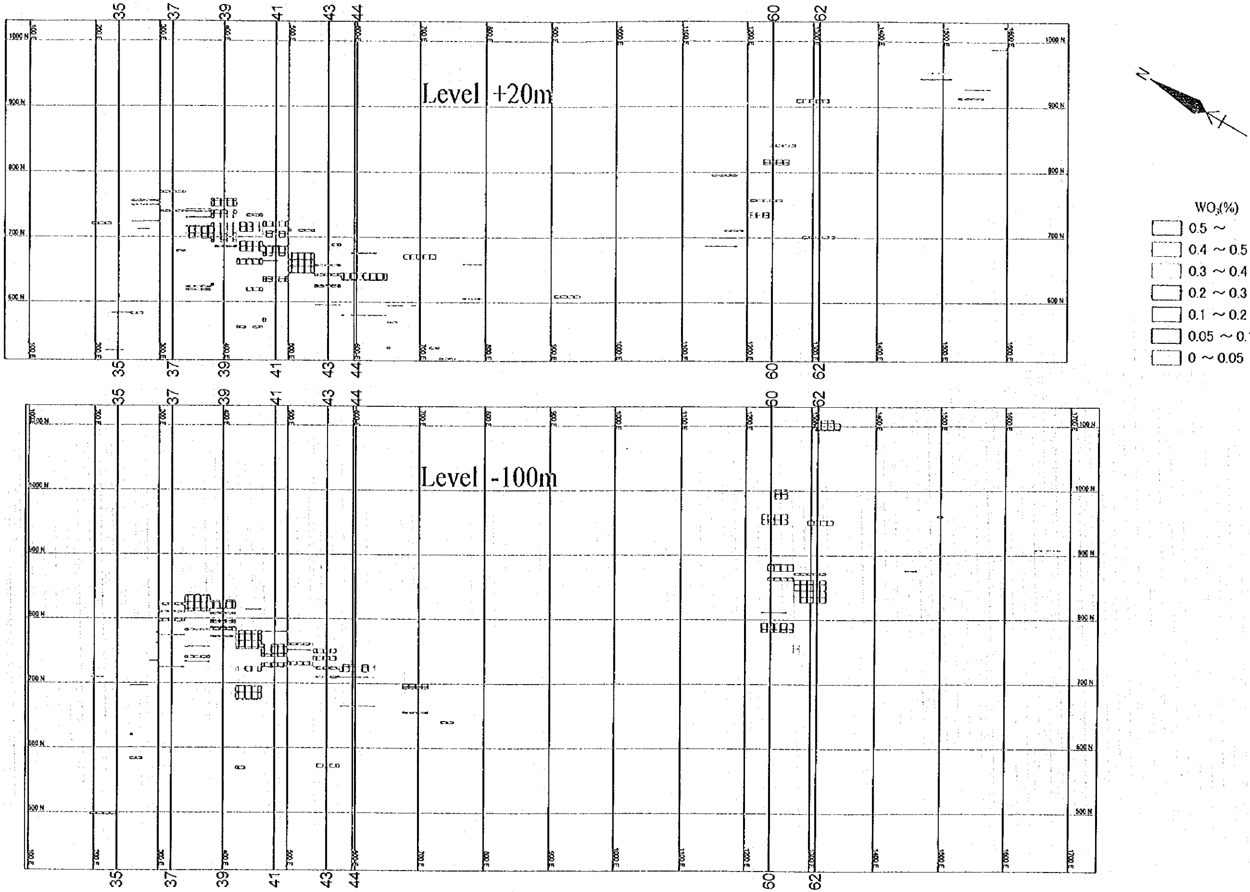


Fig. II-3-13 Estimated Grades of WO_3 at the Level of +20m, -100m

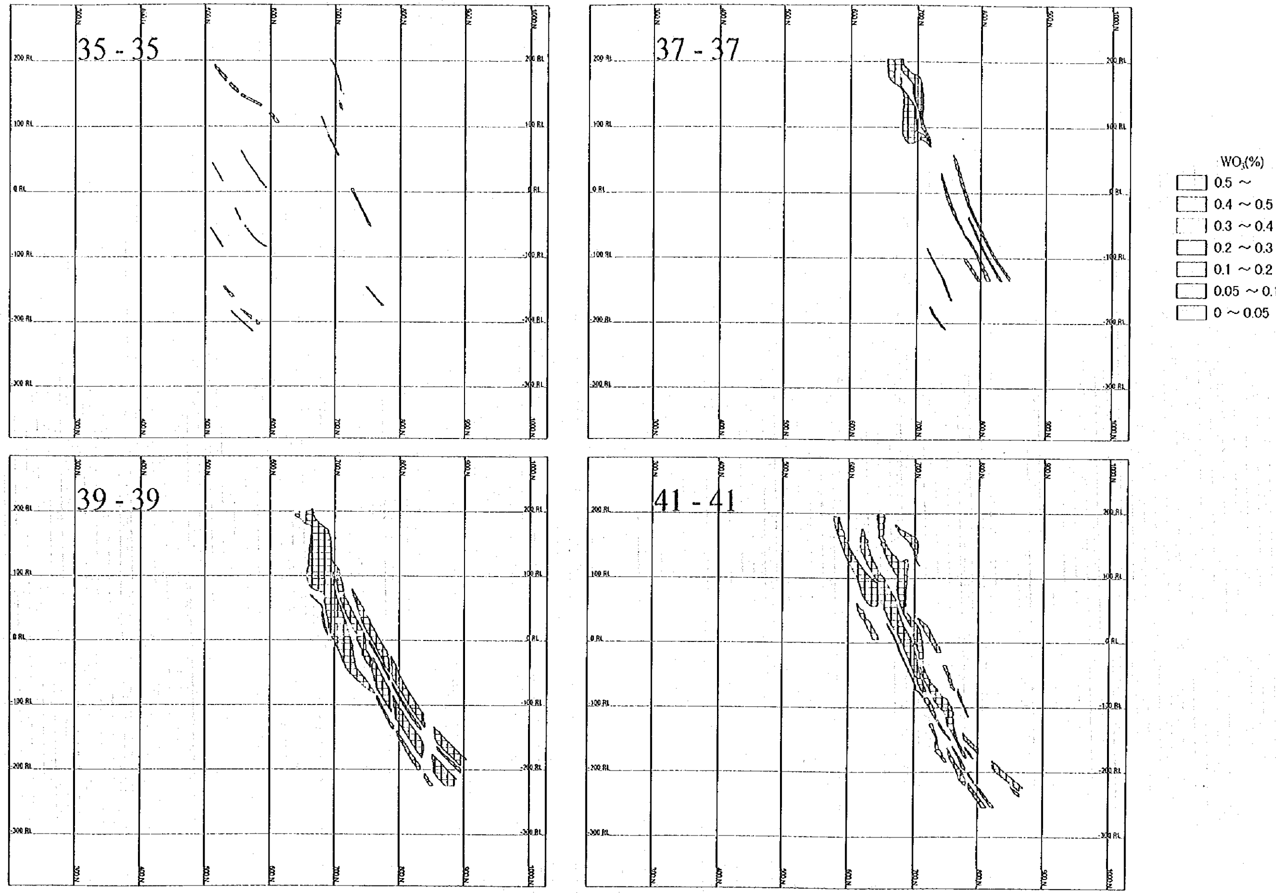


Fig. II-3-14 Estimated Grades of WO_3 along Line 35-35, 37-37, 39-39, 41-41

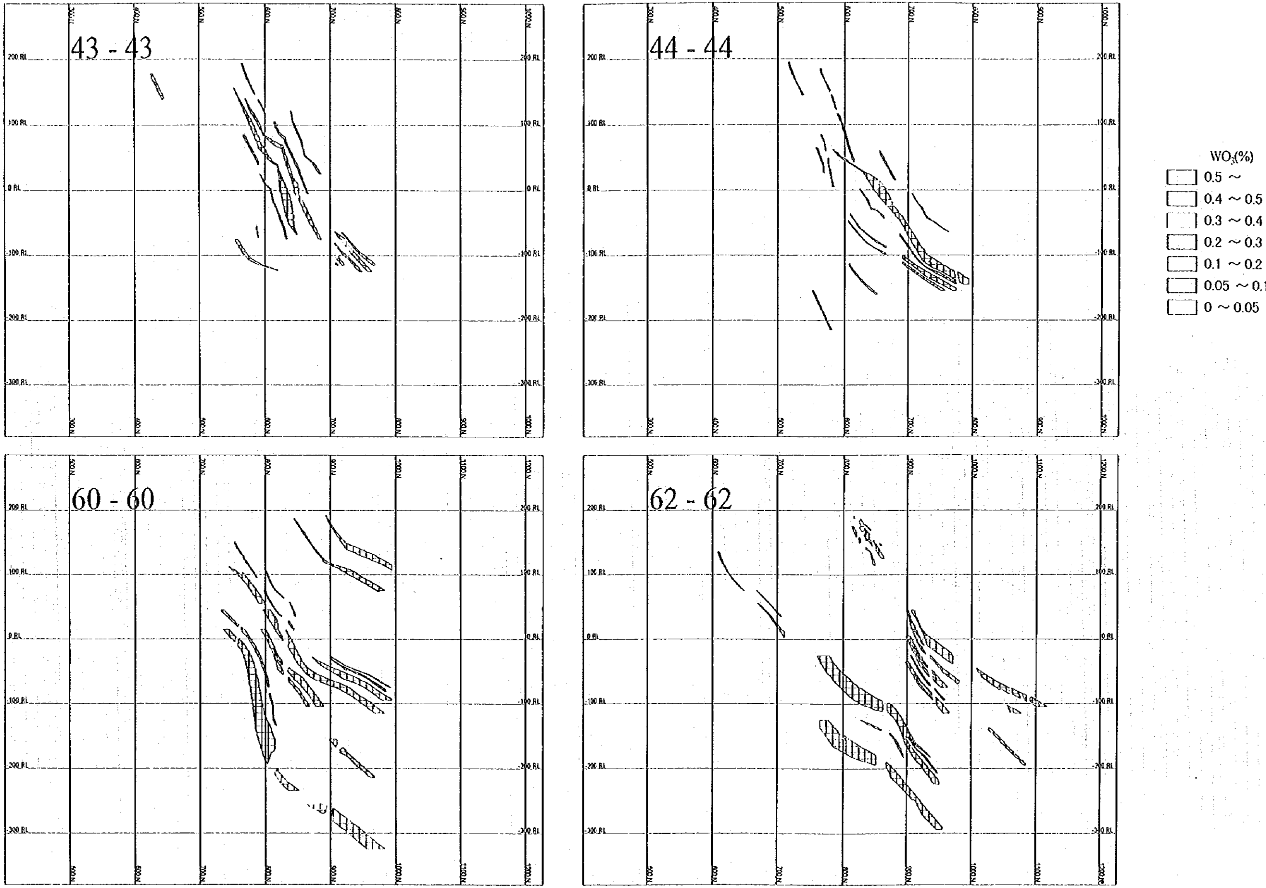


Fig. II-3-15 Estimated Grades of WO_3 along Line 43-43, 44-44, 60-60, 62-62

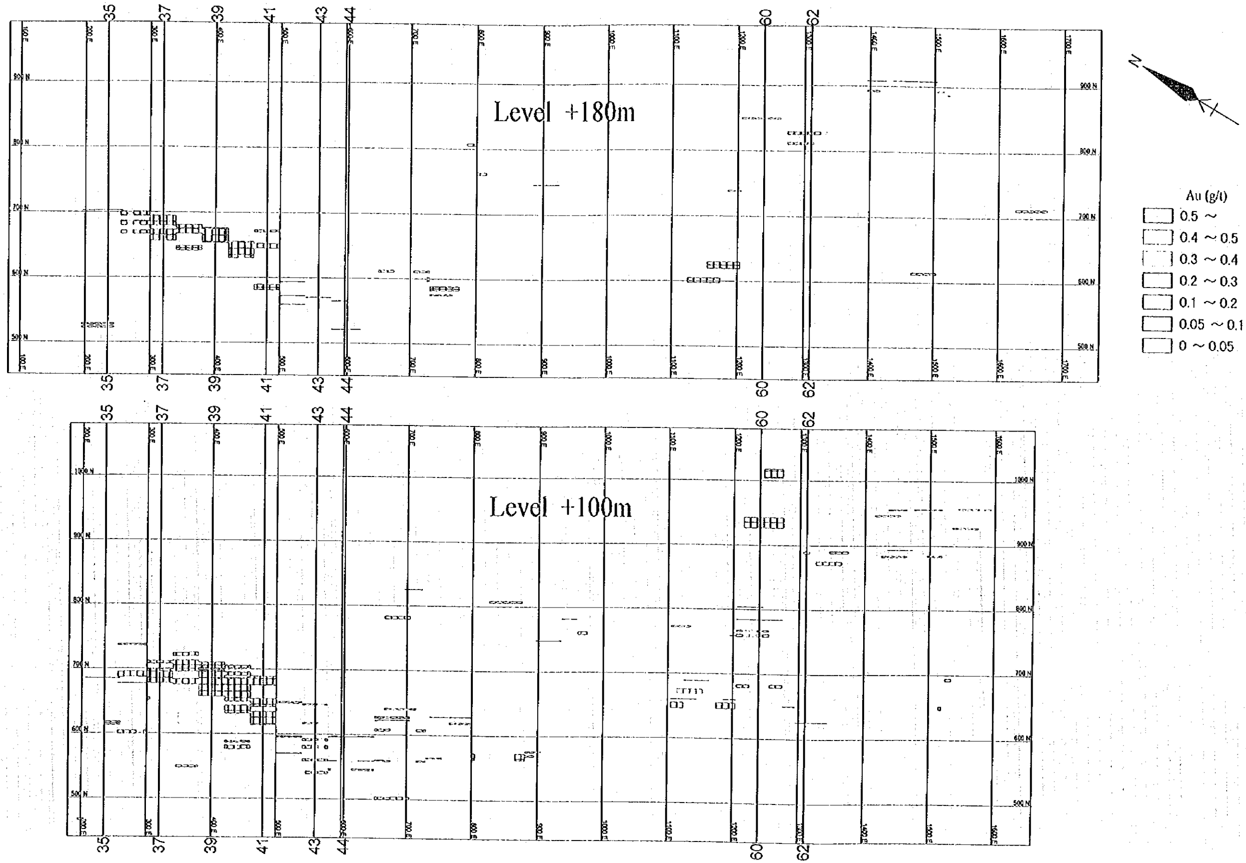


Fig. II-3-16 Estimated Grades of Au at the Level of +180m, +100m

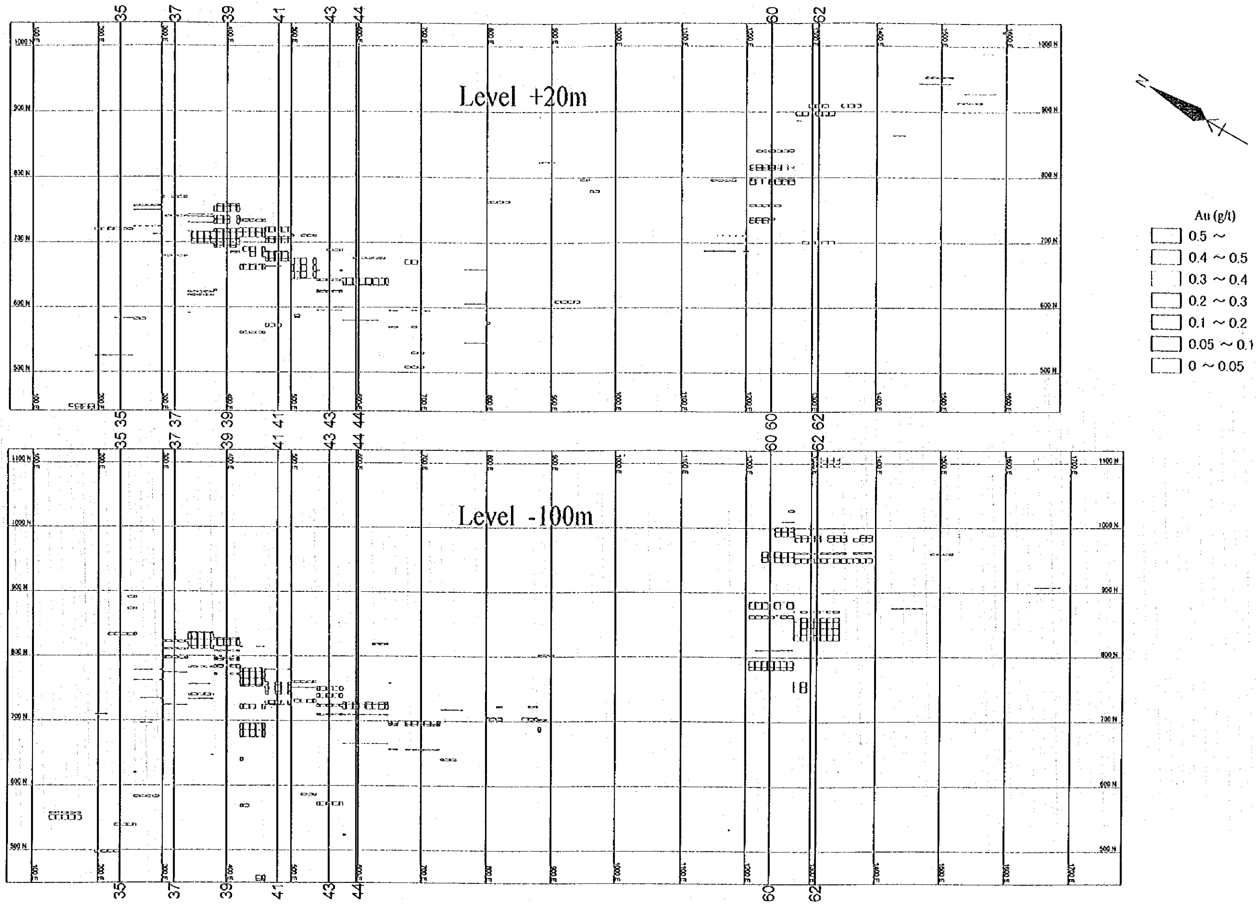


Fig. II-3-17 Estimated Grades of Au at the Level of +20m, -100m

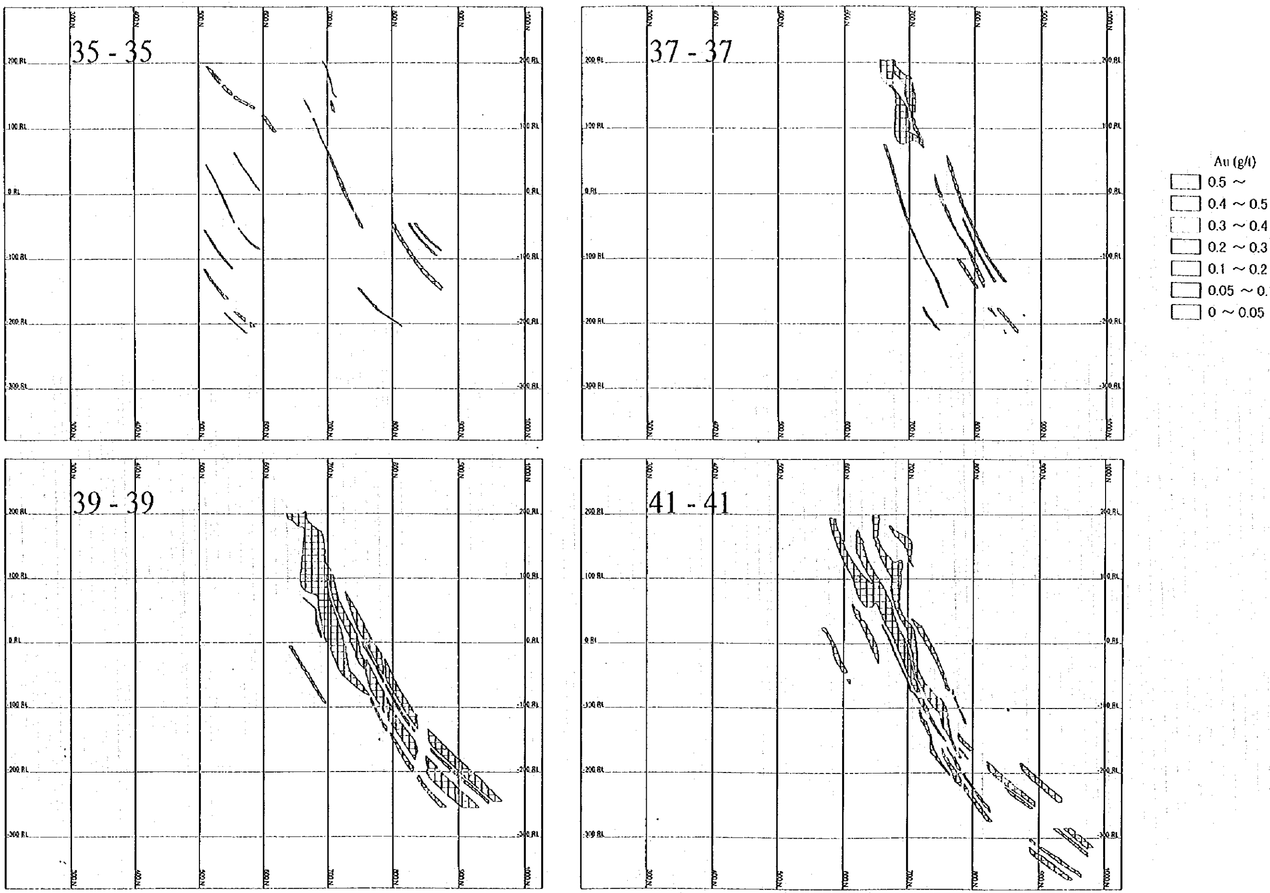


Fig. II-3-18 Estimated Grades of Au along Line 35-35, 37-37, 39-39, 41-41

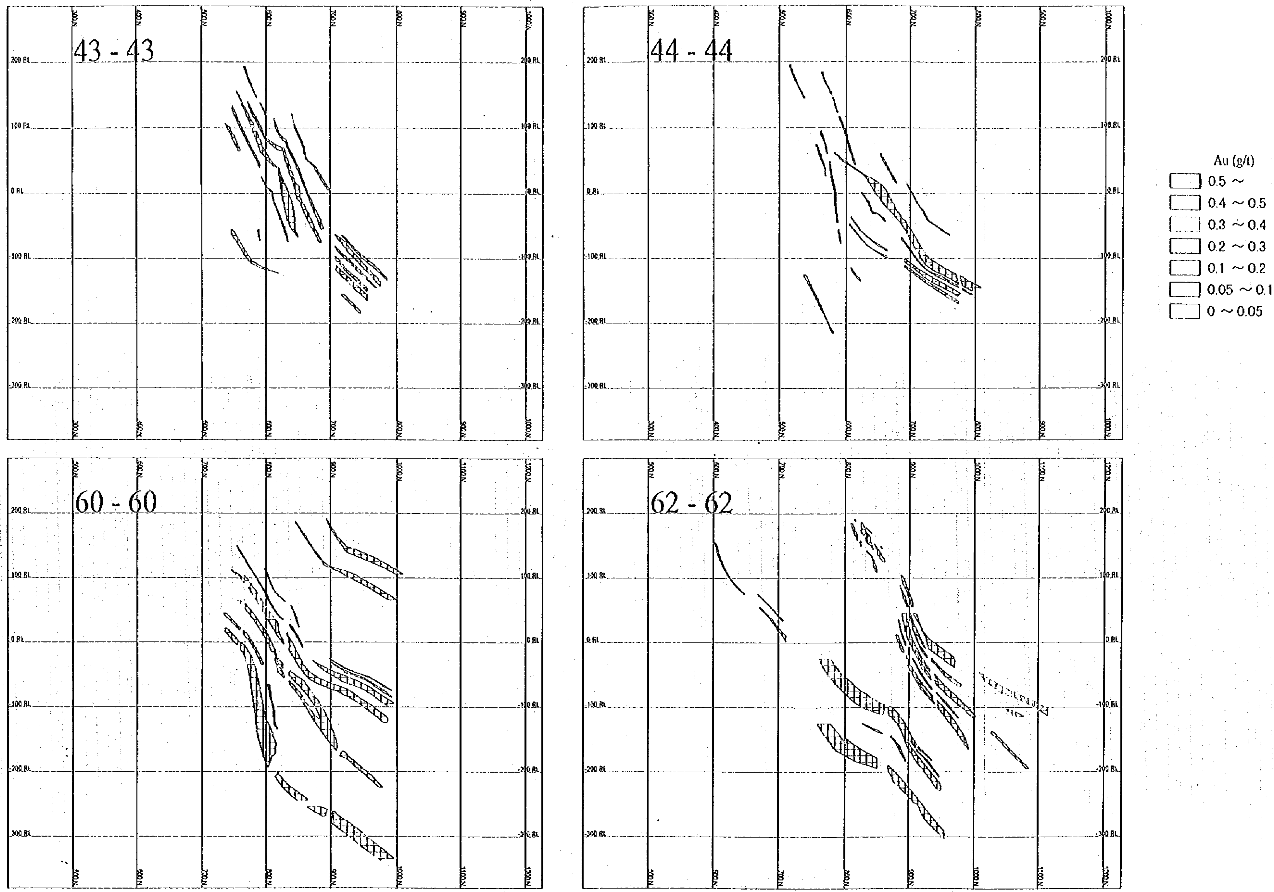


Fig. II-3-19 Estimated Grades of Au along Line 43-43, 44-44, 60-60, 62-62

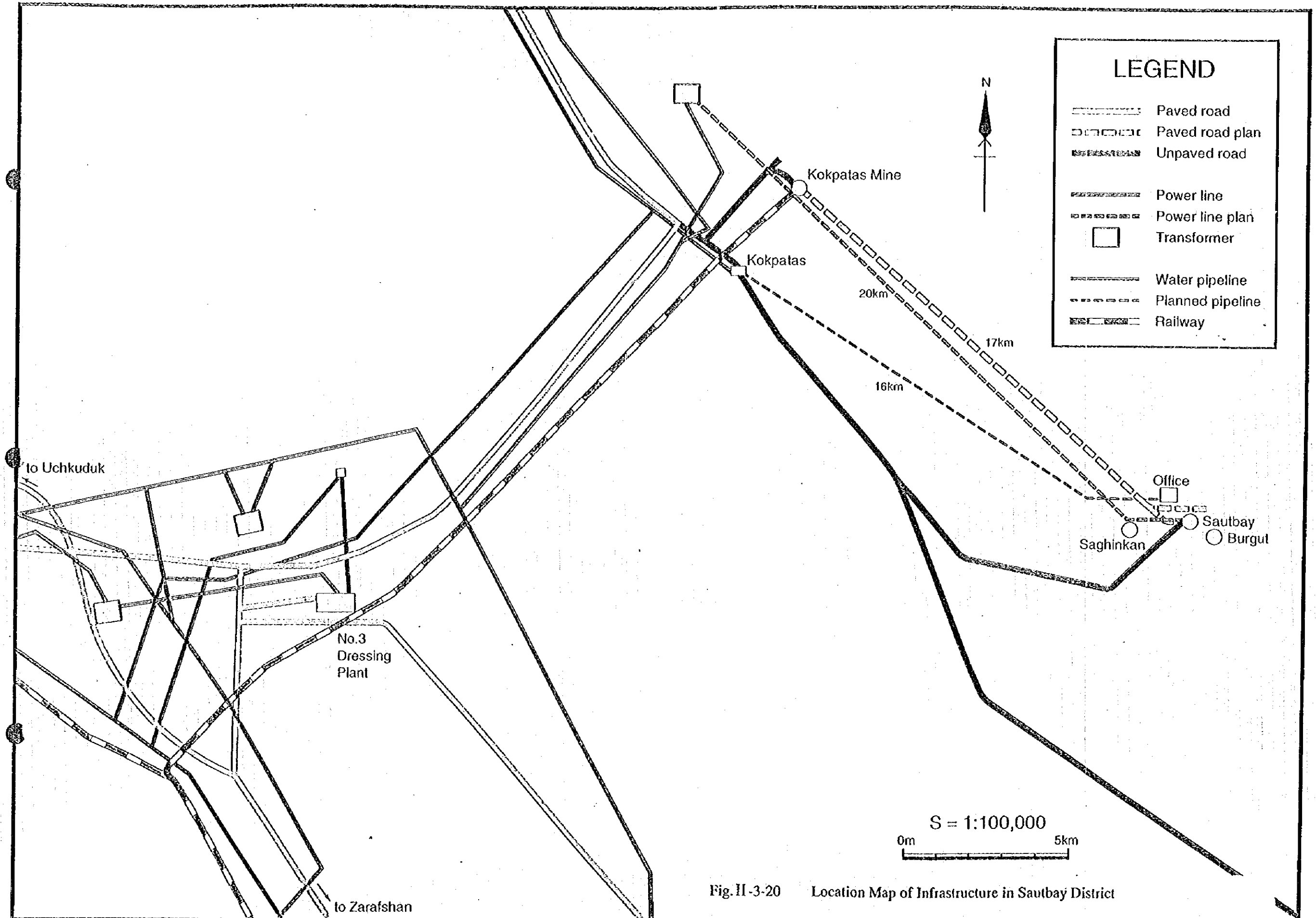


Fig. II-3-20 Location Map of Infrastructure in Sautbay District

Chapter 4 Bulutkan District

4-1 Geology

The geology in the Bulutkan district is composed mainly of sediments of the Kokpatas Formation of Proterozoic. The Kokpatas Formation, more than 1,000m thick, consists of slate and sandstone accompanied by quartzite-chert lenses, limestone and dolomite. (Figs.II-4-1,2) Stocks and dikes of the Late Carboniferous ~ Early Permian syenodiorite, diorite, granite, porphyrite, lamprophyre, etc. intrude into these rocks.

Unconformably overlying the Proterozoic and intrusive rock, Cretaceous and Quarternary Systems occur. The Cretaceous consists of marine mudstone, sandstone, conglomerates and dolomite whereas the Quarternary comprises continental silt, sand, gravels and gypsum.

Conspicuous faults in this district are with the WNW-ESE and NNW-SSE trends. Along the north side of a syenodiorite stock, the North Sautbay Fault extends, intersected by a fault with a NNW-SSE trend.

4-2 Mineralization

Mineralization is observed in gold-bearing quartz-silicified veins and skarn orebodies. Ore deposits and showings including the Bulutkan deposit are scattered around in a zone, more than1,200m long in strike and 100m-150m wide, in the Proterozoic close to the northern periphery of the syenodiorite stock.

According to results of the exploration conducted independently by the Uzbekistan at the +210m-level tunnel, the bonanzas of the Bulutkan deposit occur at intersections of the faults with WNW-ESE, NW-SE and ENE-WSW trends and the horizon including carbonate rocks.

The orebody is presumed to take the shape of a polygonal pyramid or pipe with a broad upper face(the surface portion), upright or inclined sharply northwestward. The upper portion of the orebody is composed of silicified rocks accompanied by ferrous oxide, fine-grained quartz veins and chalcedony while the lower portion comprises skarn orebodies accompanied by sulfide veins, which is also accompanied by gold mineralization. Component minerals of the silicified rocks in the upper portion are mainly quartz, chalcedony, calcite, siderite and goethite accompanied by pyrrhotite and gypsum. Those of the skarns in the lower portion are amphibole-pyroxene skarns composed mainly of tremolite, actinolite, chlorite, pyrite, marcasite, geothite, pyrrhotite, arsenopyrite and chalcopyrite, as well as wollastonite, scheelite, epidote and grossular in small quantities.

According to the Uzbek mineralogical study, native gold occurs in quartz veins, calcite veins, and siderite veins, associated with graphite. Native gold is occasionally associated with sulfide minerals in amphibole-pyroxene skarns but not recognized in sulfide minerals. The gold grains take the oval, fine vein, porphrytic and xenomorphic forms, while the grain sizes are 0.003mm or less ~ 0.1mm.

Alteration of the host rock is silicification, pyritization or skarnization. Alteration zones are mainly quartz-sericite zones or sericite-chlorite zones, accompanied by smectite and some kaolinite.

During the survey, the homogenization temperature of fluid inclusions was measured of 55 trenching samples and 32 drill-core samples of the Bulutkan district. The samples represent quartz in veins, quartz or calcite in veinlets or networks and silicified rock.

The fluid inclusions are mostly with vapor-liquid phase, while some of them are of solid phase, presumaly halite, or polyphasic fluid inclusions containing liquid-phase carbon dioxide.

The homogenization temperatures of liquid inclusions range from 100℃ to 378℃.

In case of trenching samples collected in the vicinity of the Bulutkan deposit and showings near the syenodiorite body, the homogenization temperatures range from 150℃ to 250℃, whereas those of samples taken from skarn or syenodiorite range from 250℃ to 350℃. Drilling samples of the Bulutkan deposit taken from a zone where gold mineralization and skarnization are overlapped are in a range of 150℃-330℃. Samples taken from sedimentary rocks of the Kokpatas Formation away from the syenodiorite body tend to show a wide range from around 100℃ to 300℃ or higher. In the vicinity of samples showing high temperatures, diorite dikes occur.

From these findings, it is presumed that the quartz veins were formed through plural stages and the gold mineralization was accompanied by low-temperature quartz of a late stage.

The process of occurrence of the Bulutkan deposit may be concluded as follows:

(1) By intrusion of the syenodiotite stock, the hornblende-clinopyroxene skarns were formed, which have paragenetic mineral composition of chalcopyrite-pyrrhotite and pyrite-arsenopyrite in the horizon including carbonate rocks of the Kokpats Formation.

(2) Subsequently, gold mineralization accompanying quartz, pyrite and calcite veins was added. Graphite is considered to have occurred by alteration of carbonaceous substances in the carbonate rocks under reaction with gold-bearing silicious solution.

4-3 Trenching Survey

Trenching survey was conducted in the Bulutkan district, in order to ascertain the metallogenic characteristics and horizontal extension of the gold mineralization zones.

4-3-1 Trenching survey work

In the area including the Bulutkan deposit and known ore showings, 29 trenches, totaling 8,310m were excavated, in the direction intersecting at right angles the strike of presumed mineralization zones(in principle, N20° E) and also in the direction pursuing confirmed mineralization zones in strike.

Locations of the trenches are shown in Fig.II-4-5. Of all the trenches, observation and sketching of geology and mineralization, sample collection and laboratory tests were effected.

Trenching were performed by manpower, while explosives were used when necessary. The trenches, about 1m wide, were excavated to the maximum depth of 2m. Immediately before geological observation, the trench floor was cleaned by manpower.

Since most parts of the side walls comprize sand or gypsum beds, or strongly weathered rocks, sketching was done with a scale of 1/1,000 of trench floors and with a 1/100 scale of portions with mineral indications.

The laboratory tests consisted of chemical analysis of ore, microscopic observation of thin sections of rocks and polished sections of ore, X-ray diffractive analysis and measurement of homogenization temperature of fluid inclusions. As regards ore samples, some 10kg of them were taken from 1~2m-long channels, to be sujected to chemical analysis.

4-3-2 Results of trenching survey

Generally, in the district, fractures and faults develop in the NW-SE ~ E-W directions, along which dikes of lamprophyre, diorite and syenodiorite, 20cm to several meters wide, 'intrude abundantly. These dikes, also observable in the syenodiorite body, are presumed to have intruded mainly after the intrusion of the syenodiorite body. The fractures and dikes are accompanied by silicification and skarnization.

Gold mineralization is accompanied by silicified rocks and skarns in the vicinity of fracture zones and dikes in the NW-SE ~ E-W directions. Fig.II-4-6 shows the main gold mineralization zones confirmed by the trenching survey.

The mineralization at the Bulutkan district is considered to have been accompanied by intrusion of the syenodiorite body and controlled by faults and fractures chiefly in the NW-SE ~ E-W directions. The strongest mineralization is seen in the Kokpatas Formation along the syenodiorite body whilst, at zones away from syenodiorite bodies, mineralization presumably spreads all over the Bulutkan district along fracture zones.

In many cases, ore minerals of the samples collected from the trenches have altered into goethite and lepidochrocite due to oxidization. By observation of polished sections of samples collected from the Bulutkan orebody at the trench T-2, native gold was identified in quartz veins. The other ore minerals observed are pyrite, arsenopyrite, pyrrhotite, chalcopyrite, chalcocite, covelline, rutile, titanite, etc.

By the X-ray diffractive analysis, quartz, amphibole, clinopyroxene, calcite, dolomite and serpentine are identified as the component minerals of skarn samples. Dikes which underwent silicification and skarnization comprize quartz, smectite, or combinations of sericite and chlorite.

4-4 Geophysical Survey

In the Phase II survey, the transient electromagnetic (TEM) survey and the time domain induced polarization (TDIP) survey were carried out to grasp the distribution of gold mineralization in the survey area.

In the Phase III survey, TEM survey was carried out (1) to grasp the extensions of the gold mineralization zone confirmed in the Phase II survey, (2) to clarify the relationship between the alteration zone and the geological structures, and (3) to pick up prospects in the survey area.

4-4-1 Outline of the geophysical survey

The location of the survey lines and sites for TEM survey and TDIP survey are shown in Fig.II-4-7 and Fig.II-4-8, respectively.

In the Phase II, TEM survey was carried out on 10 survey lines (L-1 - L-10), using Geonics EM-47 transmitter and PROTEM(D) receiver. Measurement interval on each line was 10 or 20m. The square transmitter loop 40m on a side was used for the measurement and the eceiver coil was located at the center of the transmitter loop at each site. TDIP survey was carried out on six survey lines (L-1 - L-6), using Zonge GGT-6 transmitter and GDP-16 receiver. Gradient Array configuration with 20m and 40m of potential electrode spacing was applied for this measurement. From drilling core, 40 rock samples were collected and resistivity and IP value (chargeability) measurement were conducted for these rock samples.

In the Phase III survey, TEM survey was carried out on 13 survey lines (L-11 - L-23) to complement the previous survey results on the lines between L-10 and L-7. The specification of the survey (equipment and its settings, etc.) was same as that of the Phase II survey. The results of the TEM survey in the Phase II were re-interpreted and examined with the Phase III results.

4-4-2 Survey Results

Resistivity structure sections as the TEM survey results are shown in Fig.II-4-9(1)~(6). Resistivity structure maps at the level of 200m A.S.L, 150m A.S.L and 100m A.S.L. are shown in Fig.II-4-10(1)~(3), respectively.

IP value distribution map with 40m of potential electrode spacing is shown in Fig.II-4-11 as the TDIP survey results.

Resistivity and IP value of the drilling core samples are listed in Table II-4-1.

The results of the geophysical survey in Bulutkan District is summarized as follows:

(1) The average of resistivity / IP value of drilling core samples are; syendiorite: 14,200 ohm-m, 4 mV/V; sulfide vein: 1 ohm-m, 240 mV/V; altered rocks: 9,000 ohm-m, 89 mV/V, respectively. IP values of rocks which contain pyrite are different from that of the rocks with no pyrite content. The average IP value among the rocks contain pyrite was 140 mV/V and that of the rocks with no pyrite content was 9 mV/V.

(2) The area underlain by syenodiorite is correlated with medium - high resistivity zone near the surface. Near the contact of the syenodiorite and the sedimentary rocks, resistivity is lower than in the southern edge of survey area.

(3) In the central part of the survey area, high resistive zones extend along northern boundary of syenodiorite. The shallower zones are located closer to the boundary. The area contains these zones seems to dip northward apparently.

(4) The northern part of the survey area is underlain by conductive zone, which appears to be layered structure. This zone tend to become thick northward. This zone is correlated with the area underlain by slate and limestone.

(5) The southern part of the survey area exhibits low IP value (chargeability). A high IP value anomaly (more than 60 mV/V) extends from the WNW to the ESE thorough the central part of the survey area. Along northern edge of low IP value area, the IP value rise sharp northward (IP boundary).

(6) The horizontal distribution of resistivity and IP value are controlled by major fault directions, WNW-ESE and NNE-SSW.

(7) Most of the ore manifestations caught in the trenching survey are located within the shallower resistive - very resistive zones adjacent to the IP boundary. From the comparison of results among the trenching survey, the drilling survey and the geophysical survey, IP boundary is correlated with the northern contact of syenodiorite stock and sedimentary rocks and the adjacent shallow resistive - very resistive zone correlate with diorite dikes, quartzite, silicified zone and the area where many quartz veins are developed.

(8) Most of the ore manifestations caught by drilling survey at the level of 100-150m A.S.L. are located within the deeper resistive - very resistive zones. From the comparison of the results among the drilling survey and the geophysical survey, these zones are correlated with dikes of syenodiorite and diorite, quartzite, silicified zone, skarnized metasomatite and the area where many quartz veins are developed .

4-4-3 Recommendation for future geophysical prospecting

For the geophysical prospecting in the east extension of this survey area or in the area which have similar geological situations, it is recommended to target the very resistive zones adjacent to the IP boundary. In the area where very high grounding resistance is expected, it is difficult to carry out deep sounding based on the electric potential measurement. A combination of (1) a shallow IP survey with small electrode spacing which ensure good data quality and (2) deep resistivity sounding using source which have no direct contact with the earth, such as a TEM survey is recommended for future prospecting in these area.

4-5 Drilling Survey

Aimed at the Bulutkan gold deposit which accompanies the quartz-silicified veins, drilling survey was carried out to clarify mineralization at the depths. It was also aimed to clarify mineralization at the depths of the ore showings caught by the trenching and geophysical surveys in Phases II and III and of the portions where occurrence of gold mineralization is anticipated in the light of the resistivity structure and the IP anomalies.

4-5-1 Drilling operation

With the personnel and equipment arranged by the Samarkandgeology, drilling of 21 holes totaling 3,130.0m was performed.

The respective locations of drillholes are shown in Figs. II-4-5.

The drilling machines used were two of SKB-5P(drilling cap. ϕ 76mm:600-650m; ϕ 59mm:800m) for the Phase II survey, and two of SKTO-65(drilling cap. ϕ 76mm: 650m; ϕ 59m: 1,000m) for the Phase III survey, both Russian-made.

Two buldozers and a trailer were used for the transportation of drilling machines and supplies, road construction, drill site leveling and preparations.

The wireline method was applied to the drilling operation in an effort to improve core recovery and work progress.

For the surface soil drilling, single diamond bits and metal bits of ϕ 112mm or ϕ 93mm were used. After reaching the rock, ϕ 108mm and ϕ 89mm casing pipes were inserted and installed. The drilling was continued with diamond bits of ϕ 76mm or ϕ 59mm as the final diameter. Mud water was not arranged at the drilling site but at the Kokpatas Expedition's mud water plant, and was conveyed to the site by an $8m^3$ tank truck.

The drilling length and coodinate by drillhole are tabulated in Table II-4-2.

Table II-4-2 List of Drilling in the Bulutkan District

District	Hole No.	Coodinate		Elevation (m)	Direction	Dip	Length (m)
		X	Y				
Bulutkan	MJUB- 1	68,639.74	92,184.10	237.96	S16°W	-75°	150.0
	MJUB- 2	68,672.64	92,190.62	236.49	S16°W	-75°	200.0
	MJUB- 3	68,374.22	92,879.70	231.77	S35°W	-75°	143.5
	MJUB- 4	68,442.38	92,679.28	241.50	S30°W	-75°	130.0
	MJUB- 5	69,346.80	92,247.76	234.41	S5°W	-76°	134.0
	MJUB- 6	69,124.28	92,291.05	207.15	S20°W	-80°	153.0
	MJUB- 7	68,619.89	92,180.76	240.08	S16°W	-80°	100.5
	MJUB- 8	68,674.96	92,126.40	231.57	S25°W	-80°	100.0
	MJUB- 9	68,710.24	92,137.70	234.24	S25°W	-80°	100.0
	MJUB-10	68,597.50	92,236.75	239.16	S25°W	-80°	110.0
	MJUB-11	68,627.66	92,248.90	240.93	S25°W	-80°	152.0
	MJUB-12	68,656,57	92,261.07	243.38	S25°W	-80°	194.0
	MJUB-13	68,295.81	93,132.81	234.04	S20°W	-80°	100.0
	MJUB-14	68,332,39	93,144.74	235.02	S20°W	-80°	161.0
	MJUB-15	68,591,46	92,394.96	239.44	S20°W	-80°	102.0
	MJUB-16	68,633.00	92,403.84	242.56	S20°W	-80°	151.0
	MJUB-17	68,372.88	92,828.53	233.68	S35°W	-80°	100.0
	MJUB-18	68,395.26	92,848.21	233.17	S35°W	-80°	154.0
	MJUB-19	68,339.69	93,010.41	235.05	S20°W	-80°	150.0
	MJUB-20	69,188.26	92,326.07	222.92	S20°W	-80°	440.0
	MJUB-21	68,310.04	93,003.05	233.23	S20°W	-80°	105.0
	Total	-	-	-	-	-	3,130.0

4-5-2 Results of Drilling survey

Ore showings confirmed by the drilling survey are listed in Table II-4-3, and the geologic sections along the drilling are shown in Figs.II-4-12 thru 23.

Au grades of 1g/t or more were confirmed at drillholes aimed at the lower portion of the Bulutkan deposit: MJUB-1 (depth 86.0-88.0m; true width 1.1m; Au 2.8g/t) and MJUB-7(0-10.4m; 5.5m; 4.3g/t and 36.1-51.0m; 7.9m; 21.2g/t)

Gold mineralization was observed at drillholes aimed at the western extension of the Bulutkan deposit: MJUB-8(depths18.1-19.3m; true width 0.5m; 1.1g/t Au and 27.7-37.4m; 4.9m; 4.4g/t) and MJUB-9 (47.0-48.0m; 0.5m; 8.5g/t). Gold mineralization was confirmed also in the other areas than Bulutkan deposit: MJUB-3(82.0-84.0m; 1.6m; 2.3g/t), MJUB-13(39.5-41.5m; 1.1m; 11.9g/t), MJUB-17(23.4-26.4m; 2.0m, 1.3 g/t and 74.8-75.5m; 0.5m; 6.0g/t) and MJUB-18(69.0-69.5m; 0.5m; 9.8g/t). These orebodies are presumed to be poor in continuity and small in size(extension 50-150m; depth up to 100m), in the light of the trenching and drilling survey results.

4-6 Ore Reserves Estimation of the Bulutkan District

The orebodies in the Bulutkan district have varied shapes, sizes and grade distribution, as the survey findings indicate. The exploration so far conducted is not sufficient for clarification in detail of the orebodies nor for accurate estimation of ore reserves, therefore, tentative calculation was made for rough estimation of ore reserves and grade.

4-6-1 Calculation method

(1) Of the orebodies occurring in the Proterozoic close to the north side of the syenodiorite stock, those which occur between the western limit in the vicinity of the Bulutkan orebody and the eastern limit close to the trench T-6 constitute the subject area of this estimation.

(2) Of the orebodies confirmed by the trenching, drilling and tunneling surveys, the estimation is limited to those which have the true width not less than 1m and Au grade not less than 3 g/t.

(3) The extent of an ore block is defined by straight lines of max. 50m in strike and max. 30m perpendicularly from the center point of respective ore zones caught by the trenching, drilling and tunneling surveys. In case no ore zone is confirmed by trenching or drilling at an extension of an ore body, the extent of ore block is limited only up to the median point. In case an extension of an orebody cuts in strike and perpendicularly the syenodiorite body at the footwall of the ore deposit, the extent of ore block is limited only up to the intersection. Fig. II-4-24 shows the sections of ore blocks.

(4) The specific gravity is assumed to be 2.9.

(5) Ore reserves of respective blocks are calculated by the following formula:

① In case of the Bulutkan orebody(Block 1):

$$V = (A + B + \sqrt{A \cdot B}) \times 1/3 \times H \times SG$$

where, A: Area(m²) of the top face

B: Area(m²) of the bottom face

H : Height(m)

SG: Specific gravity(2.9)

② In case of the other orebodies:

$$V = L \times H' \times TT \times SG$$

where, L: Length(m) of orebody

H': Inclined length(m) of orebody

TT: True thickness(m) of orebody

SG: Specific gravity(2.9)

4-6-2 Results of calculation

The tentative calculation indicated ore reserves of 275,000t, grading 13.1g/t Au, or 3.6t of Au content(Table II-4-4).

Table II-4-4 Ore Reserves Calculation of Bulutkan Ore Deposits

Ore body	Ore block	Area (m^2)	True Thickness (m)	Volume (m^3)	Tonnge* (t)	Grade Au (g/t)	Grade Ag (g/t)	Metal content Au (kg)	Metal content Ag (kg)
Bulutkan	1(1)	910	29.7	26,989	78,268	5.9	1.5	461.8	117.4
	1(2)	1,155	9.0	10,402	30,166	12.9	3.4	389.1	102.6
	Sub total	2,065	18.1	37,391	108,434	7.8	2.0	850.9	220.0
The others	2	756	0.5	378	1,096	8.5	7.8	9.3	8.5
	3	338	4.9	1,656	4,802	4.4	4.6	21.1	22.1
	4	1,400	1.8	2,520	7,308	74.7	tr	545.9	0
	5	7,820	1.3	10,166	29,481	2.5	10.8	73.7	318.4
	6	5,166	3.9	20,147	58,426	29.0	2.4	1,689.9	140.2
	7	6,375	1.6	10,200	29,580	2.3	36.1	68.0	1,067.8
	8	12,320	1.0	12,320	35,728	9.2	tr	328.7	0
	Sub total	34,175	1.7	57,387	166,421	16.4	9.4	2,736.6	1,557.0
Total		36,240	2.6	94,778	274,855	13.1	6.5	3,587.5	1,777.0

*Specific gravity : 2.9

4-7 Mining Plan for the Bulutkan District

A mining plan was drawn up on the basis of the results of tentative calculation of the Bulutkan ore reserves and the field survey, details of which are demonstrated in Appendix 2.

In the mining plan, two orebodies were selected for open-pit mining, the ore reserves of which is 115,000t, grading 11.1 g/t Au, while the minable ore is 115,000t, grading 10 g/t Au.

The minable ore reserves are so small that development of the orebodies as an independent mine is considered difficult. Instead, planning was made on the assumptions that the orebodies are developed as a subsidiary mine of the nearby Kokpatas gold mine currently operating at a rate of 10,000tpd of crude ore, and the Bulutkan ore is sent to the Uchkuduk No.3 plant for mineral processing(Fig.II-4-25).

If 115,000t of ore is to be mined over several years, accumulated maintenance and administration costs put a strain on the project income; therefore, the mining operation shoud desirably be finished in a short period. Thus, it was planned to mine out the orebodies in one year, at the operation rate of 450tpd and 260 operating days per year(same as those of the Kokpatas mine). It was assumed that the ore is hauled by 45-t dump trucks to the Kokpatas mine, from where to the Uchkuduk No.3 plant by the existing railroad, as in the case of the kokpatas ore.

On the assumptions of flotation recovery at 95%, cyanidation recovery at 85%, electrolytic refining recovery at 99%, and the gold price at 360$/tr.oz, the revenues per ton of crude ore come to 4,630 sum(92.6$). Revenue from the by-produced silver was not considered.

On the other hand, the development cost including the infrastructure and mining machinery costs is estimated at 2,944 sum(58.9$)/t, while the mining cost at 719 sum(14.4$) and the toll ore processing cost at 842 sum(16.8$). The total expenditures per ton of crude ore add up to 4,505 sum(90.1$)/t. Therefore, the operating income per ton of crude ore comes to 125 sum(2.5$), or a total operating profit of approx. 15,000,000 sum(300,000$) would be generated from the mining operation of 115,000t of minable ore.

As to the other ore deposits scattered around in the district, partial(selective) development is considered feasible.