Chapter 2 Analysis of Existing Data

2-1 Ore Deposits and Manifestations

In the survey area, there are about 20 known ore deposits and manifestations of gold, silver tungsten-molybdenum, iron-manganese, tantalum-niobium, copper, tin, etc. (Fig. I-3-1, Table II-2-1). The ore deposits and manifestations in the area can be classified in the following categories:

① Gold-silver bearing quartz vein : Karamechet, Kurai, Berkut, Kazanbulak, Altynsai, Bitab, Bashtut, Maidan, Maulyan, Taulyan, Beshbulak, Shur, Sebistan
② Tungsten-molybdenum bearing skarn : Lyangar
③ Tungsten-copper bearing skarn and copper bearing quartz vein : Takhku
④ Tantalum-niobium pneumatolytic deposit : Sartakchi
⑤ Tin placer deposit : Sulukyz, Tulyasai
⑥ Iron-manganese hydroxide deposit : Akmulla

Ore deposits and manifestations mainly of gold extend along the fracture zones in the WNW-ESE direction, forming the Karatau ore zone (70 km E-W and 2 km to 4 km N-S) along the northern side of the Karatau granite bodies (270-274 Ma) and the Aktau ore zone (70 km E-W and 2 km to 5 km N-S) along the southern side of the Aktau granite bodies (295-322 Ma, 260-286 Ma, 265-268 Ma). The two ore zones, aligned in parallel along the respective granite bodies, are inferred to have been formed by mineralization accompanying activity of the granites.

Based on analysis of the existing data, the Altynsai deposit (Au) and Maulyan manifestation (Au) were extracted as promising exploration targets.

2-2 Analysis of Geophysical Prospecting Data

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

1) Airborne magnetic prospecting

The prospecting has revealed that magnetic anomalies are basically related to dioritic rocks and corresponding to granitic and granodioritic intrusive rock bodies. Concealed granitic intrusive rock bodies were extracted, while dioritic portions of rock bodies abundant with ferromagnetic minerals were differentiated.

2) Ground magnetic prospecting

Basic and ultrabasic rocks were traced by ground magnetic prospecting, which led to the mapping of granodioritic intrusive rock bodies. Besides, by detailed ground magnetic prospecting, granodioritic intrusive rock bodies were mapped and many magnetic anomalies were confirmed in the vicinity of the intrusive rocks, which,

combined with other prospecting methods, permitted extraction of promising areas of useful minerals.

3) Electric prospecting

The prospecting was conducted in ore deposits and promising manifestations, to trace sulfide mineralization as the negative anomaly and silicified zones, and intensive quartz vein zones as the positive anomaly. Between 1963 and 1967, electric prospectings on a scale of 1:10,000 were carried out at the Subashi-Sarmich and Kurai-Karamechet manifestations to trace sulfide mineralization as the negative anomaly and silicified zones, and intensive quartz vein zones as the positive anomaly and resistivity transition zones. Sites with high sulfide mineral contents were extracted by the IP method as local anomalies whilst fracture zones were indicated with low resistivity.

4) Gravity prospecting

The prospectings have clarified the deep structure of the earth crust, depth and approximate structure of the concealed Paleozoic, as well as occurrence of the granitic rock bodies.

5) Seismic prospecting

By the prospectings, the concealed Paleozoic structure was mapped.

6) Airborned gamma-ray prospecting

Radioactivity and magnetism of rocks are characterized by inverse relationship; acidic rocks are high in radioactivity and low in magnetism, whilst basic rocks are high in magnetism and low in radioactivity. Intermediate or acidic intrusive rocks related to the gold deposits and manifestations in the survey area are distinguished by the weak positive magnetism (+150 gamma or less), clearly showing uranium, potassium and thorium anomalies. Thus, the combination of airborne gamma-ray prospecting and magnetic prospecting is considered effective for exploration of gold deposits related to concealed intermediate / acidic intrusive rocks.

Table II-2-1 List of Ore Deposits and Ore Manifestations in the Survey Area (1)

Ore deposit / manifestation	Location, elevation and infrastructure	Geology and mineralization	Size and grade				Prospecting	Ore reserves				Exploration right
			Length (m)	Width (m)	Au grade (g/t)	Ag grade (g/t)		Category	Reserves (thou.t)	Grade (g/t)	Metal (t)	
1. Bitab ore manifestation	Located in southern Nuratau Range (Aktau), 1km SE of village of Yukary-Bubak. Located at 75km from Railway station Kermine.	Zone of silicification, brecciation in sandstones and slates of L.- M. Cambrian-L.Silurian Oxidized zone develops in the surface. Mineral ;Pyrite,sphalerite, arsenopyrite,malachite, gold	37	10.5	4.1	1.8	1974 ; Trenching, shaft sinking, & sampling 1992 ; Clearing, drilling(1) & sampling					Goskomgeology (Samarkandgeology)
2. Bashtut ore manifestation	Located in southern Nuratau Range (Aktau), 30km SE of regional center of Nurata.	Quartz veins in quartz sandstones of M. Cambrian-L.Ordovician Two ore zone. Mineral ;Pyrite, goethite, lepidochrocite, arsenopyrite,	Ore zone : 2,000	1-20	1-4.2 (average 0.6)		1974-1976 ; Trenching, shaft sinking, drilling & sampling					Goskomgeology (Samarkandgeology)
3.Kurai-Karamechet, ore manifestations	Located in southern Nuratau Range (Karatau), 15-16 km SW of Lyangar mine. Located at 15 km west of Altynsai. It takes about one hour by car.	Zone of crushing with quartz veins in slates of L.Silurian. 11 ore bodies. Mineral ; Gold, pyrite, arsenopyrite, galena, sphalerite, chalcopyrite, marcasite	Kurai; 200 Karamechet; 50-700 (10 orebodies)	1.74 0.7-11	8.0 1.1-2.4	7.0 0-28.5	1963-1970 ; Trenching & sampling 1974-1976 ; Trenching & sampling 1977-1983 ; Trenching, drilling (sludge = 51, core = 2), geochemical prospecting(rock)	P	1,125	Au = 8 g/t Ag = 7 g/t	Au = 9 t Ag = 11 t	Goskomgeology (Samarkandgeology)
4. Maidan ore manifestation	Located in southern Nuratau Range (Karatau), 10km SE of Lyangar mine. Located at 30km north of regional center Khatyrchi.	Zone of crushing and silicification in sandstones, and slates of M. Cambrian to L. Silurian. Oxidized pyrite develops in the surface.	Ore zone ; 1,000	1-5	0.09-1		1965 ; Trenching & sampling					Goskomgeology (Samarkandgeology)
5. Tashkuduk placer	Located in southern Nuratau Range (Karatau), 8km south of Gordijak village, 22km NW of regional center Khatyrchi.	Placer of river-bed type. Gold is fine and pellitized.	Ore zone ; 1,000		Au 1 g/m^3 (max.5g/m^3)		1950-1955 ; Shaft sinking & sampling (9)					Goskomgeology (Samarkandgeology)
6.Taulyan ore manifestation	Located in southern Nuratau Range (Aktau), 1km SW of Taulyan village, 4km north of Maulyan.	Zone of crushing with quartz veins in slates and sandstones of L. Silurian. Limonite develops in the surface. Gold is in limonitized quartz.	Ore zone ; few meters-200-500	0.1-2.0	max. 4		1965-1966 ; Trenching (16), sampling (96), sampling from shaft (370) 1970-1972 ; Trenching (19), Electric prospecting					Goskomgeology (Samarkandgeology)

Table II-2-1 List of Ore Deposits and Ore Manifestations in the Survey Area (2)

Ore deposit / manifestation	Location, elevation and infrastructure	Geology and mineralization	Size and grade				Prospecting	Ore reserves				Exploration right
			Length (m)	Width (m)	Au grade (g/t)	Ag grade (g/t)		Category	Reserves (thou.t)	Grade (g/t)	Metal (t)	
7.Sebistan ore manifestation	Located in southern Nuratau Range (Aktau), 40km east of Altynsai .	Zone of silicification and limonitization in slates of L. Silurian.	Ore zone ; 2,500	20-150	0.1-2		1970-1972 ; Trenching (17), sampling (1,200) 1985-1989 ; Trenching, sampling (2,000), geochemical prospecting (rock) 1970-1972 ; Electric prospecting					Goskomgeology (Samarkandgeology)
8.Maulyan ore manifestation	Located in southern Nuratau Range (Aktau), left bank of Maulyan stream, 25km east of Altynsai.	Zone of crushing with silicification, graphitization and limonitization in slates and sandstones of M.Ordovician-L. Silurian. Mineral;Pyrite, pyrrhotite, arsenopyrite, chalcopyrite.	3 ore bodies ; 200-1,000 No.1; 1,000 No.2; 400 No.3; 200	 1-4 1.65 1.45 0.75	 0.1-33.4 3.8 5.0 4.2	 0.1-47.2 1.0 1.6 6.3	1965 ; Trenching (13) 1970-1972 ; Trenching (6), electric prospecting 1985-1989 ; Trenching (25) & sampling 1998-1999 (MMAJ); 22 drillholes-984.1m Under prospecting; Trenching, drilling and adits.	(MMAJ, 1999) Cut off Au=1 g/t	252	Au = 4.2 Ag = 1.6	Au = 1.1 Ag = 0.4	Goskomgeology (Samarkandgeology)
9.Beshbulak ore manifestation	Located in southern Nuratau Range (Aktau), 3km SE of Maulyan , 35-40km to regional center Khatyrchi.	Three mineralization zones with quartz veins and veinlets in slates and sandstones of M.Ordovician-L. Silurian. Mineral ; Pyrite, chalcopyrite, arsenopyrite	Ore zone; 450 Ore vein ; 25-75	11-17 1.7-2.5	 4.0(max.)		1966 ; Trenching (2) & sampling 1970-1972 ; Trenching, sampling & electric prospecting					Goskomgeology (Samarkandgeology)
10.Berkut ore manifestation	Located in southern Nuratau Range (Karatau), 15-16km south of Lyangar mine, 2km west of Altynsai .	Zone of crushing with mineralization in sandstone and slates of M.Ordovician - L. Silurian. Stockwork quartz and quartz-tourmaline veins. Tungusten mineralization (scheelite) is accompanied by a lamprophyre dyke. Mineral ; Pyrite, arsenopyrite	Zone of crushing ; 1,000	0.1-1.5	0.1-27.8	10.6 (max.)	1954-1958 ; Trenching (44), shaft (2), drilling (1) & sampling (205) 1968-1971 ; Trenching, sampling & electric prospecting 1974-1976 ; Detailed survey of the above 1995 ; Trenching (several) & sampling					Goskomgeology (Samarkandgeology)
11.Shur ore manifestation	Located in southern Nuratau Range(Aktau), 2km east of Beshbulak	Zone of crushing with quartz veins and silicification in slates and sandstones of L. Silurian. Mineral : Pyrite, chalcopytite, arsenopyrite.	Ore vein ; 7-8	1.2	1.4 (max.)		1995-1999 ; Trenching Under prospecting					Goskomgeology (Samarkandgeology)

Table II-2-1 List of Ore Deposits and Ore Manifestations in the Survey Area (3)

Ore deposit / manifestation	Location, elevation and infrastructure	Geology and mineralization	Size and grade				Prospecting	Ore reserves				Exploration right
			Length (m)	Width (m)	Au grade (g/t)	Ag grade (g/t)		Category	Reserves (thou.t)	Grade (g/t)	Metal (t)	
12.Altynsai (Altynkazgan) ore deposit	Located in southern Nuratau Range (Karatau), 18km south of Lyangar mine. Elevation ; 625-875m Located at 105km WNW of Samarkand, 140km along the road. It takes 2hrs. and 15min. by car from Samarkand.	Zone of crushing with quartz veins and veinlets bearing gold and silver. Country rocks are metamorphosed slates and sandstones of M.Ordovician-L. Silurian. There are 20 ore zones. Mineral ; Gold, pyrite, arsenopyrite, scorodite, sphalerite, galena, chalcopyrite, wittichenite, native bismuth.	No.1 vein ; 300 No.2 vein ; 550 No.8 vein; 400	1-7 (ave.1.92) 1-7 (ave.1.98) 0.5-2.5 (ave.1.17)	1-40 (10.3) 1-16 (6.9) 1-45 (17.0)	1-18 (5.4) 1-7 (1.5) 1-64.5 (2.8)	1952-1960 ; Trenching & shaft sinking (20m) 1953-1954 & 1958-1959 ; Adit (3 adits, 2,333m), drilling (4), Trenching (1,810m) sampling (572) & shaft (2.4m) 1968-1970 ; Trenching, sampling & electric prospecting 1970-1972 ; Trenching, drilling (4 holes, 872.8m), sampling, electric & magnetic prospecting 1974-1976 ; Detailed survey of the above Since 1995 ; Trenching, drilling, adit & shaft sinking	MMAJ (1999) Cut off Au=2 g/t	423	Au=9.6 Ag=2.8	Au=4.0 Ag=1.2	Goskomgeology (Samarkandgeology)
13.Kazanbulak ore manifestation	Located in southern Nuratau Range (Karatau), 1km west of Altynsai, 15km south of Lyangar mine.	Zone of crushing and silicification. There are many veins and veinlets in sandstones and slates of M.Ordovician-L. Silurian. Mineral ; Au, galena, scorodite, scheelite	Ore zone ; 300+	1.5-5	0.1-217.8	1-34.6	1955 ; Sampling 1968-1971 ; Trenching, sampling & electric prospecting 1974-1976 ; Detailed survey of above trenches Since 1995 ; Clearing & channel sampling					Goskomgeology (Samarkandgeology)
14.Lyangar ore deposit	Located in southern Nuratau Range (Aktau), near Lyangar village, NNE slopes of Mt. Takhku (2,003m). Located at 18km north of Altynsai.	Garnet-pyroxene skarns with impregnations of scheelite at the contact between the Carboniferous Aktau granitoids and the Silurian-Devonian crystalline limestone. Mineral ; scheelite, molybdenite, powellite, chalcopyrite, pyrite, marcasite, pyrrhotite.	Ore zone ; max.3,000 Ore body ; 20-500	1-40 0.2-12	WO_3 = 0.25- 0.6% Cu = max.2.68% Mo = 0.007%		1935-1959 ; Exploration tunnel (14,190m), drilling (53,974m), trenching (22,093 m^3), sampling (28,089) 1946-1980 ; Mining	C1 C2			WO_3 =1,119 WO_3 =3,273	Republican Organizati-on "Special Alloy"

Chapter 3 Altynsai District

3-1 Outline of Geology

The district is underlain by slate, siltstone, sandstone and phyllite of Ordovician to Silurian System and slate, siltstone and sandstone of Lower Silurian System and lamprophyre dikes from late Permian to early Triassic time (Figs.II-3-1, 2).

Sedimentary rocks in the district are folded in anticlines and synclines with the WNW-ESE trend. There are many fracture zones with the WNW-ESE and NW-SE trends and numerous joints with the N-S trend.

3-2 Mineralization

Geologically, the Altynsai district belongs to the Karatau ore zone, together with the Sarmich deposit, and Kurai and Karamechet manifestations to the west (Fig. I-3-1). Among ore deposits in the district, the best known is the Altynsai deposit. The Altynsai deposit is vein type deposit consisting of gold bearing quartz veins, controlled by fracture zones with the WNW-ESE trend and those with NW-SE trend intersecting the former, and tourmaline-quartz veins accompanying joints with the N-S trend. In an area, 2.5 km long and 500 m to 800 m wide, ore bodies of quartz veins such as the Nos. 1, 2, 8 ("Northwest Vein"), 9 ("Kazanbulak Vein") and 10 ("Berkut Vein") have been confirmed in hornfelsed sedimentary rocks. Tourmaline-quartz veinlet zones with the N-S trend are also developed in the areas where the ore zones occur (Figs.II-3-5, 6). Among these veins, Nos. 1, 2 and 8 veins have been mainly explored.

Extension of the Nos. 1 and 2 echelon veins, having the WNW-ESE trend, reaches 1,300 m, along which ancient stopes excavated up to an approximate depth of 30m remain over 470m (Figs.II-3-7, 8). Although gold grades of the surface level of the No.1 and No.2 veins are unclear because of the ancient mining of bonanzas, the following grades have been obtained at the Adit No.4 (+698.89m level), 25m to 35m under the surface (Fig.II-3-3):

No.1 vein: Extension 135 m; average width 2.29 m; Au 15.7 g/t, Ag 5.7 g/t

No.2 vein: Extension 55 m; average width 4.28 m; Au 4.5 g/t, Ag 2.1 g/t

Ancient stopes remain in a surface portion of the No. 8 vein, as well (Fig.II-3-4). The vein has been prospected to about 100 m under the surface by two drillholes of the Phase III, eleven drillholes of the Uzbek side, a 25 m exploration shaft and a 35 m prospecting drift (Fig. II-3-9). By these explorations, high-grade gold mineralization has been found in the west of ancient stopes.

Bonanzas in veins trending in the WNW-ESE direction (the veins Nos. 1, 2 and 8) occur at the intersections of a fracture of the same trend with fractures in the NW-SE direction (Figs.II-3-3, 4). The number, width and gold grade of N-S trending

tourmaline-quartz veins increase in sandstone rather than in slate.

Component minerals in quartz veins occurring in fracture zone with the WNW-ESE trends are mainly quartz, pyrite, marcasite, arsenopyrite, chalcopyrite, sphalerite, goethite and lepidocrocite, accompanied by galena, native bismuth, aikinite, wittichenite, scheelite, tourmaline, rutile and electrum.

In the tourmaline-quartz veins accompanying the joints with the N-S trend, main component minerals are quartz, tourmaline, pyrite and arsenopyrite. The Uzbek studies indicate that wolframite, cassiterite, topaz, beryl and native gold are included, which has not been verified by the subject survey.

Homogenization temperatures of fluid inclusions of quartz veins with the WNW-ESE and NW-SE trends, and the tourmaline-quartz veinlets with the N-S trend generally range between 270°C and 370°C. There was no significant difference observable between them. The quartz veins and tourmaline-quartz veinlets are inferred to have been formed during the similar period of mineralization and under similar temperature ambience. No significant correlation was observed between homogenization temperature and gold grade, nor between homogenization temperature and depth at which drilling samples were taken (Appendix 5-2, 3).

The occurrence of ore and hornfels zones and the anomalous zones of the Uzbek airborne magnetic survey mostly correspond to each other, which suggests the possible existence of concealed granites at shallow levels (Fig.II-3-5, 6). The ore zones are inferred to have been formed by the mineralization originating in the intrusion of granites.

3-3 Drilling Survey

Drilling survey aimed at verifying and describing stratigraphy and occurrence of ore deposits, and sampling and confirming the ore reserves was carried out in the Altynsai deposit.

3-3-1 Drilling work summary

With the personnel and equipment arranged by the Samarkandgeology, drilling work at 16 drillholes totaling 3,411.5 m was performed. Locations of the respective drillholes are shown in Appendix 1.

Four drilling machines -- a unit of Russian-made SKB-4 (drilling cap. ϕ76 mm:300 m, ϕ59 mm:500 m), two unit of SKB-41 (drilling cap. ϕ76 mm:300 m, ϕ59 mm:500 m) and a unit of ZIF-650 (drilling cap. ϕ76 mm:500 m, ϕ59 mm:650 m) -- were used for the work.

The drilling operation was generally performed in two 12-hour shifts with one foreman and one operator per unit.

A bulldozer and a trailer were used for the transportation of the drilling rig and supplies for the respective drill sites, road construction, drill site leveling and preparations.

The normal and wireline methods were employed for the drilling operation.

For the surface soil drilling, single diamond and metallic bits of 93 mm dia. or 76 mm dia. were used. After drilling reaches the rock, casing pipes of 89mm dia. or 73 mm dia. were inserted and installed. The drilling operation was continued with the diamond bits of 76 mm dia. or 59 mm dia. as the final diameter. Mud water was not prepared at the drilling site but at the mud water plant of the Altynkazgan Expedition's base and transported to the drilling site by 2 m^3 and 4 m^3 tank trucks.

The drilling operation is outlined in Table II-3-1.

3-3-2 Results of the drilling survey

The major mineralization 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 (Appendix 2-1～8).

The Phase I, II and Uzbek drilling surveys, aimed at the lower extension of the bonanzas confirmed in Adit No. 4 at veins Nos. 1 and 2, discovered that the mineralization degenerates below the depth of 100 m (600 m above sea level) under the adit (Figs.II-3-7, 8). This is presumably attributable to denudation of the main portions of the ore body by erosion.

The drillhole MJSN-16, aimed at the lower extension of the Northwest Vein (No. 8 vein) as confirmed by the Uzbek trenches, discovered the dominant mineralization (true width 0.98 m; Au 44.8 g/t) 60 m under the surface (Figs.II-3-9, Appendix 2-8). But the drillhole MJSN-15, aimed at the lower extension (50 m) of it, only confirmed low-grade gold mineralization (true width 1.06 m; Au 1.8 g/t). From these findings, it was confirmed that gold grade considerably varies though mineralization is continuous. The lower portion of No.8 vein remains unexplored, however, big increase of ore reserves can not be expected by further drilling because the mineralization is small in size.

The Phase I, II and Uzbek drilling surveys, aimed to examine mineralization of tourmaline-quartz veinlet zones with the N-S trend and also examine the feasibility of open pit mining, discovered low-grade gold mineralization (Au trace to 23.6 g/t) at various locations; however, the overall average of Au grade did not exceed 0.2 g/t which is insufficient for justifying open pit mining.

3-4 Ore Reserves Estimation of the Altynsai Deposit

The ore bodies in the Altynsai deposit, of which ore reserves estimation was made, have varied shapes, sizes and grade distribution, as the survey findings indicate.

Therefore, tentative calculation was made for rough estimation of ore reserves and grade.

3-4-1 Calculation method

(1) Ore vein of estimation

Among the ore veins with the WNW-ESE trend occurring in sediments of Ordovician-Silurian System, Nos. 1, 2 and 8 veins constitute the subject ore veins of this estimation.

(2) Definition of ore zone

Among the ore bodies confirmed by the trenching, drilling and tunneling surveys, the estimation is limited to those which have the horizontal width more than 1m and Au grade higher than 2 g/t.

(3) Definition of ore block

Ore reserves between trenches and ore zones confirmed by drillholes correspond to possible ore reserves (Uzbek's C2 ore reserves) (Figs.II-3-10～12). While ore reserves expected below the possible ore reserves are correspond to potential ore reserves (Fig.II-3-12).

The extent of possible ore block is defined by straight lines of max. 30 m in strike and max. 20 m 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. The potential ore blocks are set at the lower extension of possible ore blocks.

(4) Specific gravity

For specific gravities of the ore, those of No. 1 and No.2 vein ore (both 2.7) as determined by the Altynkazgan Geological Party of the Zarafshan Expedition were applied.

(5) Ore reserves by ore block

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

$$V = L \times H \times HT \times SG$$

where, L: Length (m) of ore body
H: Height (m) of ore body
HT: Horizontal thickness (m) of ore body
SG: Specific gravity (2.7)

(6) Grade of ore block

For the grade of an ore block, the length-weighted average (by the sampling length) of the ore-zone grade was applied. For the grade of a potential ore block, grade of an upper ore block was applied. However, the existence possibility of ore is assumed to be 75 %.

3-4-2 Results of estimation

Tentative calculation indicated that the total ore reserves of No.1, No.2 and No.8 veins combined are 423,000 t, grading 9.6 g/t Au, or approximately 4.0 t of Au in terms of metal content (Table II-3-3). While those of No.1, No.2 and No.8 veins are 109,000 t, grading 10.3 g/t Au (1.1 t of Au content), 239,000 t, grading 6.9 g/t Au (1.7 t of Au content) and 75,000 t, grading 17.0 g/t Au (1.3 t of Au content), respectively.

Table II-3-1 Results of Drilling Works in the Altynsai District (1)

Item		MJSN-1	MJSN-2	MJSN-3	MJSN-4	MJSN-5	MJSN-6	Sub total
Period of drilling								
Started date		Aug.24,'97	Oct. 5,'97	Aug.29,'97	Sept.14,'97	Sept.22,'97	Sept.10,'97	
Finished date		Oct. 1,'97	Nov.25,'97	Dec.28,'97	Nov. 29,'97	Nov. 14,'97	Oct. 6,'97	
Total day		39.0	52.0	122.0	77.0	54.0	27.0	
Drilling machine		SKB-4	SKB-4	SKB-41	SKB-41	ZIF-650	SKB-41	
Direction		N10° E	S10° W	N10° E	N10° E	N10° E	N10° E	
Inclination		-75°	-75°	-75°	-75°	-75°	-75°	
Drilled length (m)		190.00	160.10	341.40	320.00	320.00	173.00	1,504.5
Length of core (m)		155.95	129.70	275.55	261.40	269.20	144.80	1,236.6
Core recovery (%)		83.0	82.9	81.2	82.3	84.8	84.1	82.2
Bit	φ93mm	-	-	-	-	-	-	
	φ76mm	7.00m	8.50m	325.20m	4.00m	9.00m	4.50m	
	φ59mm	183.00m	151.60m	16.20m	316.00m	311.00m	168.50m	
Casing	φ89mm	-	1.00m	29.00m	-	-	-	
	φ73mm	23.00m	22.60m	-	5.00m	9.00m	4.50m	
Drilling (day)*		29.4	28.8	104.3	55.9	46.3	20.8	285.5
Drilling (day)**		39.0	52.0	122.0	77.0	54.0	27.0	371.0
Efficiency (m/day)*		6.46	5.56	3.27	5.72	6.91	8.32	5.27
Efficiency (m/day)**		4.87	3.08	2.80	4.16	5.93	6.41	4.06

* working days

** including no working days for recovery from accident and others

Table II-3-1 Results of Drilling Works in the Altynsai District (2)

Item		MJSN-7	MJSN-8	MJSN-9	MJSN-10	MJSN-11	MJSN-12	Sub total
Period of drilling								
Started date		Sept.22,'97	Oct.29,'97	Nov.26,'97	Nov.19,'97	Aug. 9,'98	July 27,'98	
Finished date		Oct.29,'97	Jan.16,'98	Jan.17,'98	Jan. 3,'98	Oct.10,'98	Sept.25,'98	
Total day		38.0	80.0	53.0	46.0	63.0	61.0	
Drilling machine		SKB-4	ZIF-650	SKB-41	SKB-4	SKB-41	SKB-41	
Direction		N10° E	N10° E	N10° E	N10° E	N10° E	S10° W	
Inclination		-75°	-75°	-80°	-75°	-75°	-75°	
Drilled length (m)		191.10	335.50	200.00	220.00	280.10	220.00	1,446.70
Length of core (m)		176.00	278.10	171.70	188.25	229.00	178.50	1,221.55
Core recovery (%)		92.6	83.4	87.6	86.0	81.8	81.1	84.4
Bit	φ93mm	-	5.00m	-	-	-	-	
	φ76mm	3.00m	4.30m	7.00m	3.70m	15.00m	5.00m	
	φ59mm	188.10m	326.20m	193.00m	216.30m	265.10m	215.00m	
Casing	φ89mm	-	5.00m	-	4.00m	-	-	
	φ73mm	25.00m	9.30m	7.00m	11.60m	15.00m	5.00m	
Drilling (day)*		29.9	63.3	46.6	40.1	53.0	53.9	286.8
Drilling (day)**		38.0	80.0	53.0	46.0	63.0	61.0	341.0
Efficiency (m/day)*		6.39	5.30	4.29	5.49	5.29	4.05	5.04
Efficiency (m/day)**		5.03	4.19	3.77	4.78	4.45	3.61	4.24

* working days

** including no working days for recovery from accident and others

Table II-3-1 Results of Drilling Works in the Altynsai District (3)

Item		MJSN-13	MJSN-14	MJSN-15	MJSN-16		Sub total	Grand total
Period of drilling								
Started date		Sept.20,'98	July 20,'98	Aug. 3,'99	July 7,'99			
Finished date		Oct.11,'98	Aug.22,'98	Sept.11,'99	Aug. 4,'99			
Total day		22.0	34.0	39.84	28.5			
Drilling machine		SKB-41	SKB-41	SKB-41	SKB-41			
Direction		S80° E	S10° W	N30° W	N30° W			
Inclination		-75°	-75°	-75°	-75°			
Drilled length (m)		128.00	162.30	110.00	60.00		460.3	3,411.5
Length of core (m)		105.10	131.60	89.10	48.40		374.2	2,832.35
Core recovery (%)		82.1	81.1	81.0	80.7		81.3	83.0
Bit	φ93mm	-	-	-	-			
	φ76mm	10.00m	6.00m	3.00m	3.50m			
	φ59mm	118.00m	156.30m	107.00m	56.50m			
Casing	φ89mm	-	-	-	-			
	φ73mm	10.00m	6.00m	3.00m	3.50m			
Drilling (day)*		18.4	27.4	31.6	13.1		90.5	662.8
Drilling (day)**		22.0	34.0	39.8	28.5		124.3	836.3
Efficiency (m/day)*		7.03	5.92	3.48	4.58		5.09	5.15
Efficiency (m/day)**		5.82	4.77	2.76	2.11		3.70	4.08

* working days

** including no working days for recovery from accident and others

Table II -3-2 Major Mineralization Zones Revealed by Drillings in the Altynsai District(1)

Hole No.	Depth (m)	True width (m)	Au (g/t)	Ag (g/t)	As (%)	W (%)	Remarks
MJSN-3	73.8 - 75.0 (1.2)	0.95	23.6	<1	<0.01	0.001	N-S Veinlets
	134.6 - 135.6(1.0)	0.78	3.2	<1	<0.01	0.008	N-S Veinlets
MJSN-4	77.95 - 79.2(1.25)	0.15	10.3	2.4	0.02	0.01	N-S Veinlets
	85.5 - 86.3 (0.8)	0.1	3.8	<1	0.04	0.003	N-S Veinlets
	87.6 - 88.5 (0.9)	0.11	11.2	3.8	0.04	0.003	N-S Veinlets
	103.8 - 105.0(1.2)	0.15	3.4	<1	0.07	0.004	N-S Veinlets
	155.1 - 157.55(2.45)	0.43	2.4	0.6	0.02	0.002	N-S Veinlets
	182.0 - 183.4(1.4)	0.24	2.2	6.4	0.37	0.004	N-S Veinlets
	188.9 - 189.9(1.0)	0.87	3.8	<1	0.02	0.01	N-S Veinlets
	194.4 - 195.6(1.2)	1.04	2.2	<1	0.1	0.01	N-S Veinlets
	234.9 - 236.0(1.1)	0.89	5.8	<1	0.03	0.68	N-S Veinlets
MJSN-5	19.5 - 21.3 (1.8)	0.44	3.0	2.2	0.05	0.003	N-S Veinlets
	23.3 - 24.3 (1.0)	0.24	2.4	<1	0.01	0.005	N-S Veinlets
	28.6 - 30.2 (1.6)	0.39	2.2	<1	0.01	0.07	N-S Veinlets
	48.2 - 49.7 (1.5)	0.36	2.4	2.0	0.01	0.004	N-S Veinlets
	72.0 - 73.0 (1.0)	0.21	16.4	8.6	2.2	0.005	N-S Veinlets
	84.0 - 85.0 (1.0)	0.22	3.6	1.4	0.05	0.004	N-S Veinlets
	177.2 - 177.65(0.45)	0.4	2.8	<1	0.1	0.002	No.2 Vein(hanging wall side)
	180.3 - 182.5(2.2)	1.98	2.1	<1	0.06	0.003	N-S Veinlets
	273.4 - 274.5(1.1)	0.87	2.0	<1	0.03	0.001	N-S Veinlets
	279.2 - 280.2(1.0)	0.79	3.2	<1	0.04	0.002	N-S Veinlets
	315.1 - 315.5(0.4)	0.32	2.8	<1	0.14	<0.001	N-S Veinlets
MJSN-8	80.4 - 80.8 (0.4)	0.39	2.2	<1	0.12	0.02	N-S Veinlets
	148.9 - 149.9(1.0)	0.91	3.0	<1	0.08	0.003	Hanging wall side vein of No.2 Vein
	159.6 - 160.6(1.0)	0.87	2.8	<1	0.03	0.02	N-S Veinlets
	179.2 - 180.2(1.0)	0.99	3.6	5.6	0.14	0.003	No.2 Vein(hanging wall side)
	186.0 - 186.7(0.7)	0.61	2.0	<1	0.07	0.08	No.2 Vein(hanging wall side)
	238.1 - 239.1(1.0)	0.87	2.0	<1	0.22	0.002	No.2 Vein(foot wall side)
	241.15 - 243.0(1.85)	1.6	15.3	0.7	0.23	0.003	No.2 Vein(foot wall side)
	254.3 - 255.2(0.9)	0.77	6.2	tr	0.15	0.48	No.2 Vein(foot wall side)
	315.0 - 315.8(0.8)	0.67	2.4	1.6	0.06	0.004	Foot wall side vein of No.2 Vein
MJSN-9	73.6 - 73.8 (0.2)	0.19	2.0	<1	0.04	0.002	N-S Veinlets
	93.5 - 94.2 (0.7)	0.69	4.6	3.4	0.04	0.002	N-S Veinlets
	94.9 - 96.0 (1.1)	1.09	2.2	4.6	0.08	0.007	N-S Veinlets
MJSN-10	120.1 - 120.45(0.35)	0.3	3.7	<1	0.03	0.002	No.1 Vein(foot wall side)
	125.3 - 125.58(0.28)	0.24	2.8	3.4	2.26	0.08	No.1 Vein(foot wall side)
	162.3 - 163.4(1.1)	0.99	2.0	2.4	0.02	0.002	N-S Veinlets

Table II -3-2 Major Mineralization Zones Revealed by Drillings in the Altynsai District (2)

Hole No.	Depth (m)	True width (m)	Au (g/t)	Au (g/t)	As (%)	Remarkas
MJSN-11	124.70~125.80 (1.10)	0.17	1.6	4.2	0.05	N-S Veinlets
	245.60~247.00 (1.40)	1.27	3.0	<1.0	0.01	No.2 Vein (foot wall side)
MJSN-12	27.00~28.00 (1.00)	0.16	2.0	<1.0	0.02	N-S Veinlets
	66.10~66.70 (0.60)	0.09	4.6	1.8	0.05	N-S Veinlets
	99.50~100.60 (1.10)	0.17	1.6	<1.0	0.02	N-S Veinlets
	123.30~125.40 (2.10)	0.33	3.3	<1.0	0.09	N-S Veinlets
MJSN-13	112.80~113.15 (0.35)	0.25	2.0	<1.0	0.16	N-S Veinlets
MJSN-14	45.00~47.00 (2.00)	0.31	1.7	1.2	0.05	N-S Veinlets
	57.00~58.00 (1.00)	0.16	2.0	<1.0	0.18	N-S Veinlets
	69.60~71.50 (1.90)	0.30	6.0	2.7	0.03	N-S Veinlets
	123.50~124.80 (1.30)	0.20	2.0	2.8	0.04	N-S Veinlets
	127.90~129.30 (1.40)	0.22	9.0	2.6	0.06	N-S Veinlets
	129.30~130.50 (1.20)	0.19	0.5	<1.0	0.02	N-S Veinlets
	137.30~137.80 (0.50)	0.08	1.8	2.2	0.10	N-S Veinlets
	148.10~148.30 (0.20)	0.03	1.8	<1.0	0.28	N-S Veinlets
	150.80~152.00 (1.20)	0.19	1.6	1.2	0.08	N-S Veinlets
	155.80~158.20 (2.40)	0.38	2.2	3.1	0.14	N-S Veinlets
MJSN-15	29.00~31.00 (2.00)	0.71	12.4	6.5	-	N-S Veinlets
	32.70~33.90 (1.20)	0.42	1.6	4.8	-	N-S Veinlets
	44.60~46.15 (1.55)	1.27	1.0	0.2	-	E-W Vein
	69.20~71.10 (1.90)	0.67	2.0	1.6	-	N-S Veinlets
	87.00~87.85 (0.85)	0.70	0.7	3.2	-	No.8 Vein
	90.20~91.50 (1.30)	1.06	1.8	<1.0	-	No.8 Vein
MJSN-16	12.40~13.50 (1.10)	0.39	1.2	<1.0	-	N-S Veinlets
	43.90~49.80 (5.90)	4.83	1.9	<1.0	-	No.8 Vein
	49.80~51.00 (1.20)	0.98	44.8	6.8	-	No.8 Vein
	51.00~51.80 (0.80)	0.66	1.8	<1.0	-	No.8 Vein

Table Ⅱ-3-3(1) Ore Reserves Calculation of Altynsai Deposit (No. 1 Ore Body)

Ore Body	Ore Block	Area			Horizontal Thickness	Volume (m^3)	Specific Gravity	Existence Possibility	Tonnage (t)	Grade		Metal Content		Note
		Length(m)	Height(m)	Area(m^2)						Au(g/t)	Ag(g/t)	Au(kg)	Ag(kg)	
No. 1	Ⅰ-1	88	max.18	1,096	3.03	3,321	2.70	1.00	8,966	15.8	5.9	141.7	52.9	Above AT-4
	Ⅰ-2	127	84	10,306	2.36	24,322	2.70	1.00	65,670	11.8	5.1	774.9	334.9	Below AT-4
	Ⅱ	52	22	1,124	1.01	1,135	2.70	1.00	3,065	5.8	7.5	17.8	23.0	Below AT-4
	Ⅲ-1	47	max.14	314	1.26	396	2.70	1.00	1,068	7.7	6.1	8.2	6.5	Above AT-4
	Ⅲ-2	62	90	5,274	1.10	5,801	2.70	1.00	15,664	5.8	6.4	90.8	100.2	Below AT-4
	Ⅳ	54	max.58	2,891	1.82	5,262	2.70	1.00	14,206	5.8	5.0	82.4	71.0	Hanging wall side vein
Total				21,005	1.92	40,237	2.70	1.00	108,640	10.3	5.4	1,115.8	588.6	

Table Ⅱ-3-3(2) Ore Reserves Calculation of Altynsai Deposit (No. 2 Ore Body)

Ore Body	Ore Block	Area			Horizontal Thickness	Volume (m^3)	Specific Gravity	Existence Possibility	Tonnage (t)	Grade		Metal Conter		Note
		Length(m)	Height(m)	Area(m^2)						Au(g/t)	Ag(g/t)	Au(kg)	Ag(kg)	
No. 2	Ⅰ-1	73	25	1,748	4.19	7,324	2.70	1.00	19,775	5.3	0.5	104.8	9.9	Above AT-4
	Ⅰ-2	125	76	9,141	3.34	30,531	2.70	1.00	82,434	5.8	1.8	478.1	148.4	Below AT-4
	Ⅱ-1	62	20	1,203	0.86	1,035	2.70	1.00	2,793	5.6	0.5	15.6	1.4	Foot wall side vein, above AT-4
	Ⅱ-2	104	100	10,274	1.47	15,103	2.70	1.00	40,778	4.8	2.0	195.7	81.6	Foot wall side vein, below AT-4
	Ⅲ	190	max.35	7,997	1.27	10,156	2.70	1.00	27,422	9.2	2.9	252.3	79.5	Surface to +762.05m
	Ⅳ	56	60	3,437	1.19	4,090	2.70	0.75	8,282	6.9	1.8	57.1	14.9	Foot wall side vein
	Ⅴ	177	85	15,080	1.89	28,501	2.70	0.75	57,715	9.5	0.6	548.3	34.6	Foot wall side vein
Total				48,880	1.98	96,740	2.70	0.92	239,198	6.9	1.5	1,652.0	370.3	

Table Ⅱ-3-3(3) Ore Reserves Calculation of Altynsai Deposit (No. 8 Ore Body)

Ore Body	Ore Block	Area			Horizontal Thickness	Volume (m^3)	Specific Gravity	Existence Possibility	Tonnage (t)	Grade		Metal Content		Note
		Length(m)	Height(m)	Area(m^2)						Au(g/t)	Ag(g/t)	Au(kg)	Ag(kg)	
No. 8	Ⅰ	max.35	max.26	869	0.60	521	2.70	1.00	1,408	4.0	2.9	5.6	4.1	Above AT-4
	Ⅱ-1	74	max.43	2,940	1.37	4,028	2.70	1.00	10,875	20.9	5.7	227.3	62.0	Below AT-4
	Ⅱ-2	74	97	7,151	1.32	9,439	2.70	1.00	25,486	23.0	3.6	586.2	91.8	
	Ⅱ-3	74	50	3,690	1.32	4,871	2.70	0.75	9,863	23.0	3.6	226.9	35.5	
	Ⅲ-1	36	max.26	768	1.28	983	2.70	1.00	2,654	6.9	2.4	18.3	6.4	
	Ⅲ-2	36	36	1,280	0.77	986	2.70	1.00	2,661	14.4	2.4	38.3	6.4	
	Ⅲ-3	36	116	4,220	0.77	3,249	2.70	0.75	6,580	14.4	2.4	94.8	15.8	
	Ⅳ-1	15	13	211	0.60	127	2.70	1.00	342	6.0	1.2	2.1	0.4	
	Ⅳ-2	max.73	max.55	1,858	1.55	2,880	2.70	1.00	7,776	5.7	0.7	44.3	5.4	
	Ⅴ	50	70	3,445	1.09	3,755	2.70	0.75	7,604	4.8	1.3	36.5	9.9	Foot wall side vein
Total				26,432	1.17	30,839	2.70	0.90	75,249	17.0	3.2	1,280.2	237.6	

Table Ⅱ-3-3(4) Ore Reserves Calculation of Altynsai Deposit (Total)

Ore Body	Area Area(m^2)	Horizontal Thickness	Volume (m^3)	Specific Gravity	Existence Possibility	Tonnage (t)	Grade Au(g/t)	Grade Ag(g/t)	Metal Content Au(kg)	Metal Content Ag(kg)
No. 1	21,005	1.92	40,237	2.70	1.00	108,640	10.3	5.4	1,115.8	588.6
No. 2	48,880	1.98	96,740	2.70	0.92	239,198	6.9	1.5	1,652.0	370.3
No. 8	26,432	1.17	30,839	2.70	0.90	75,249	17.0	3.2	1,280.2	237.6
Total	96,317	1.74	167,816	2.70	0.93	423,087	9.6	2.8	4,048.0	1,196.5

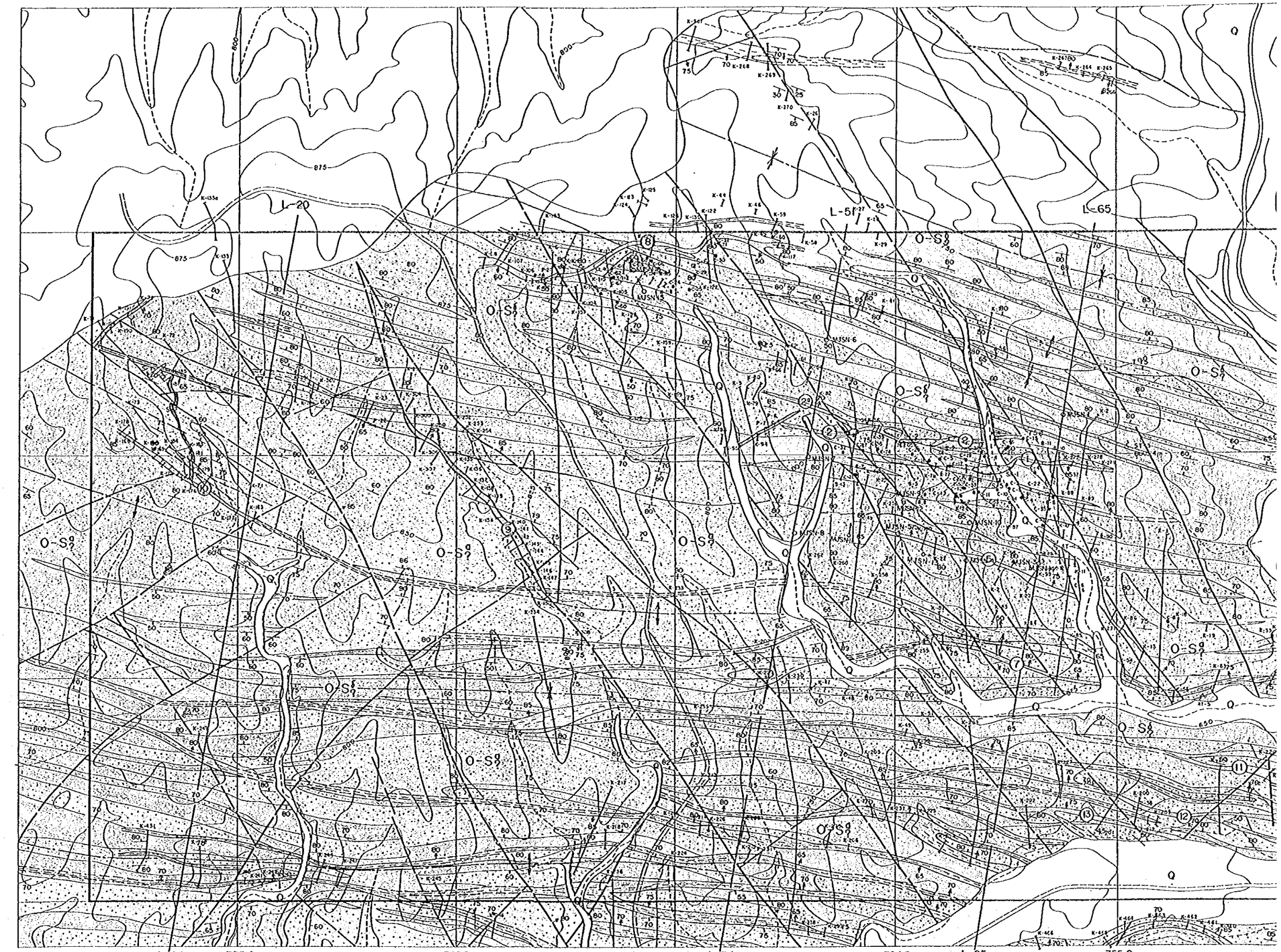


Fig. II-3-1 Geologic Map of the Altynsai Deposit

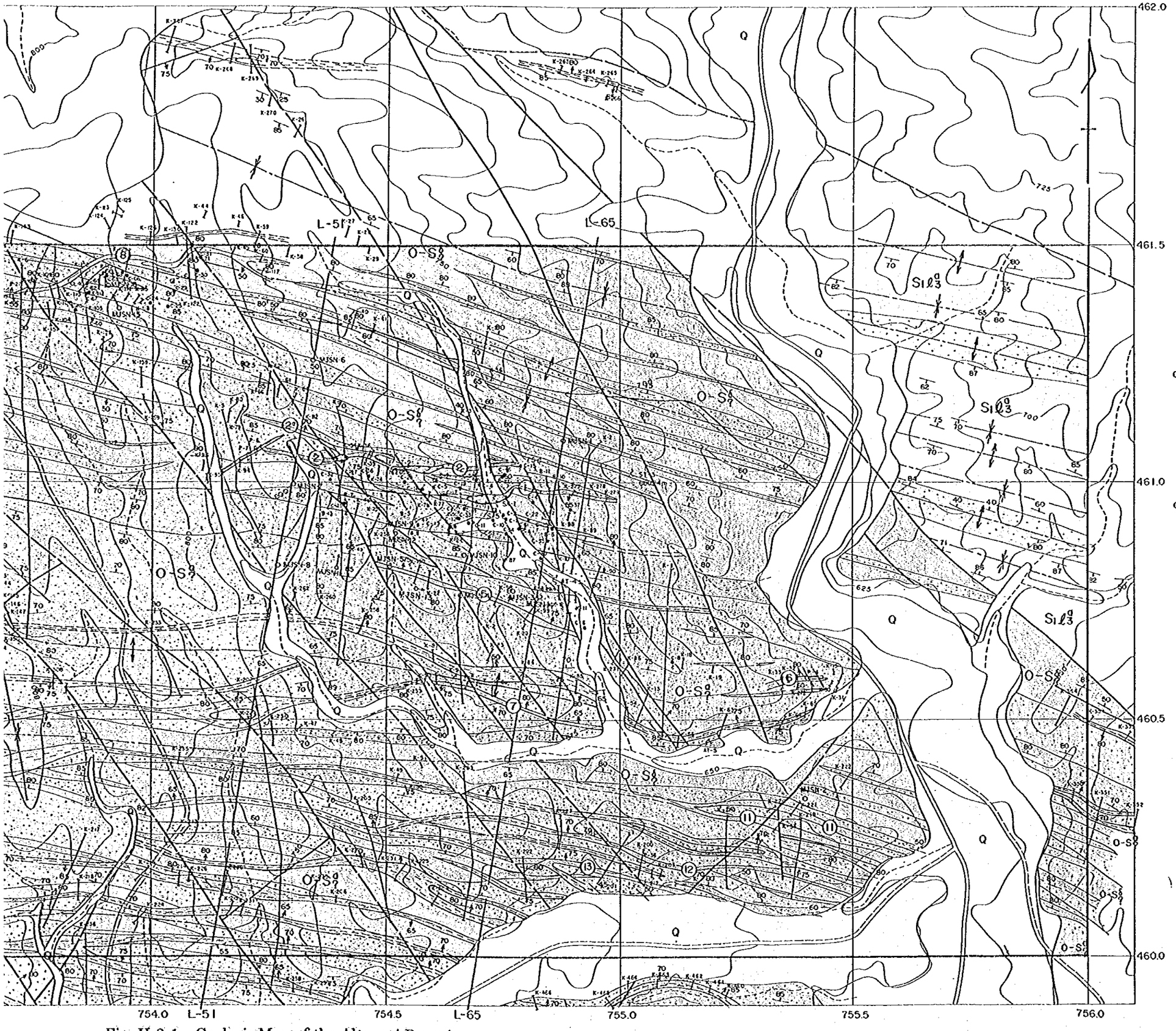
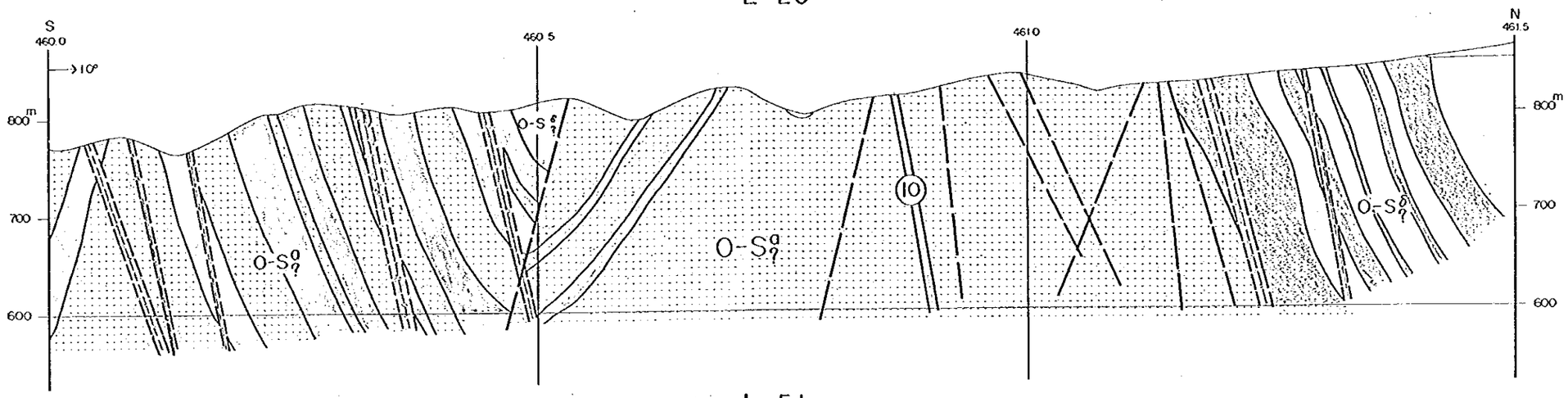


Fig. II-3-1 Geologic Map of the Altynsai Deposit

L-20



L-51

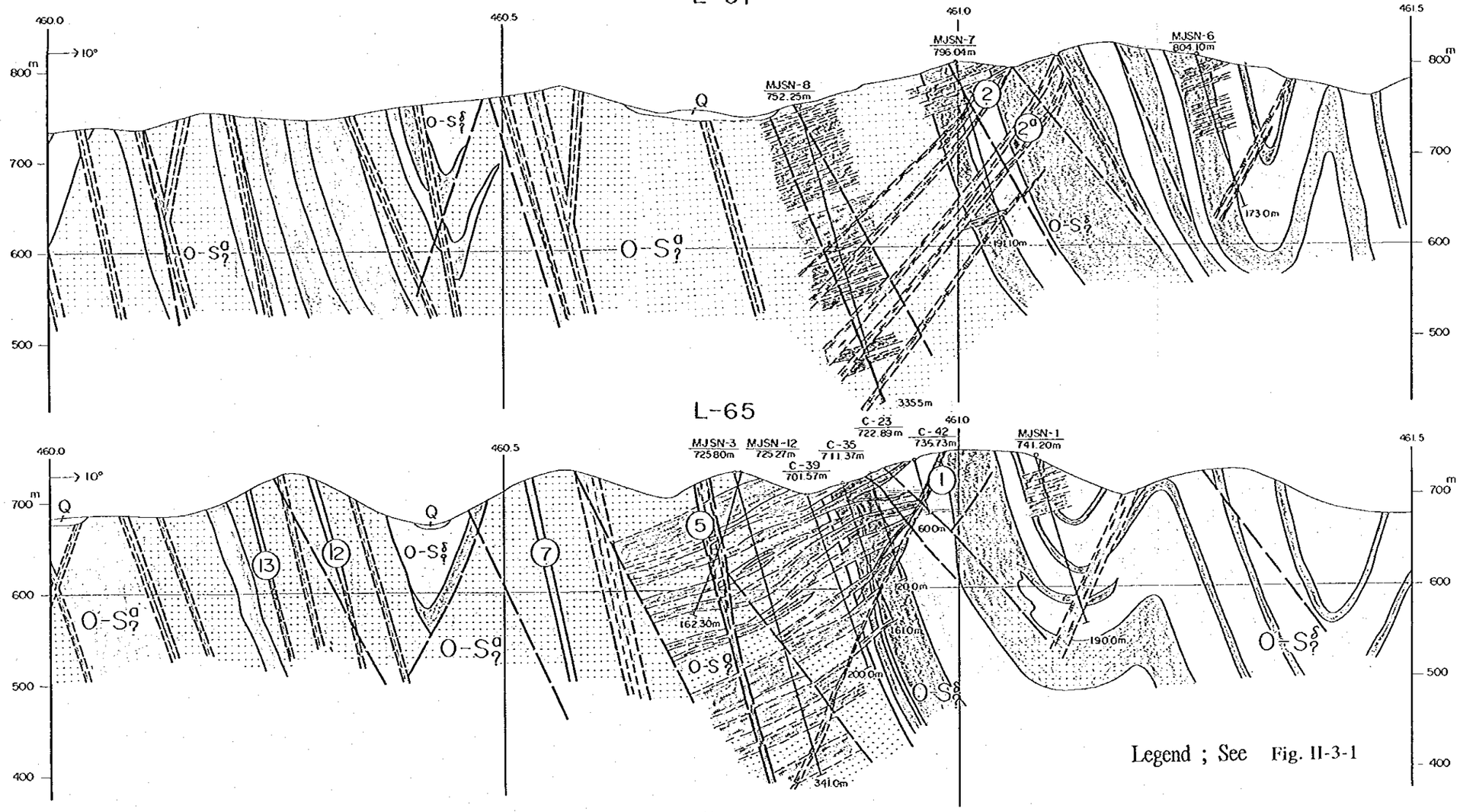


Fig. II-3-2 Geologic Cross Sections of the Altynsai Deposit

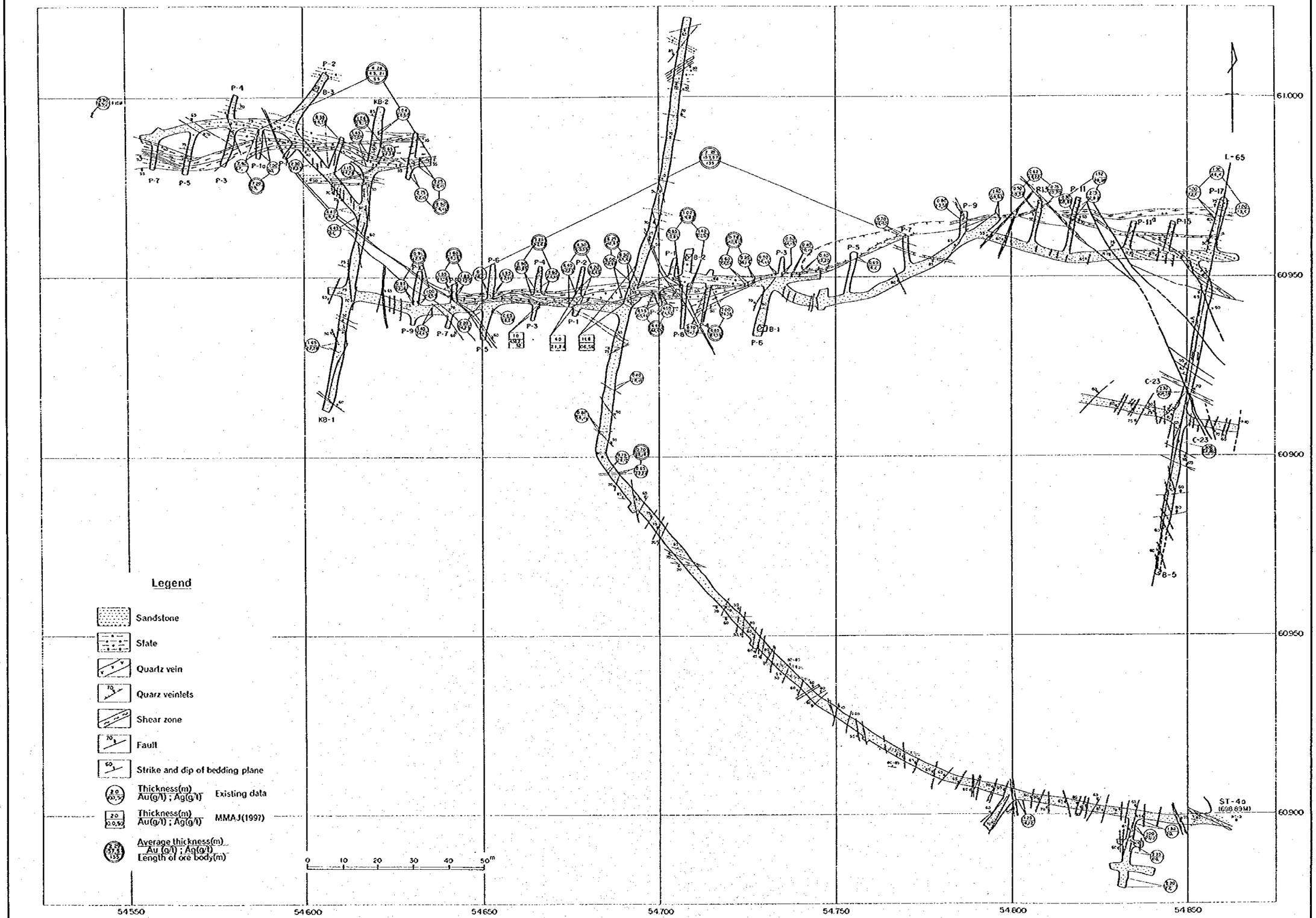


Fig. II-3-3 Geologic Map of the Adit No.4 (+698.89 m Level) of the Altynsai Deposit

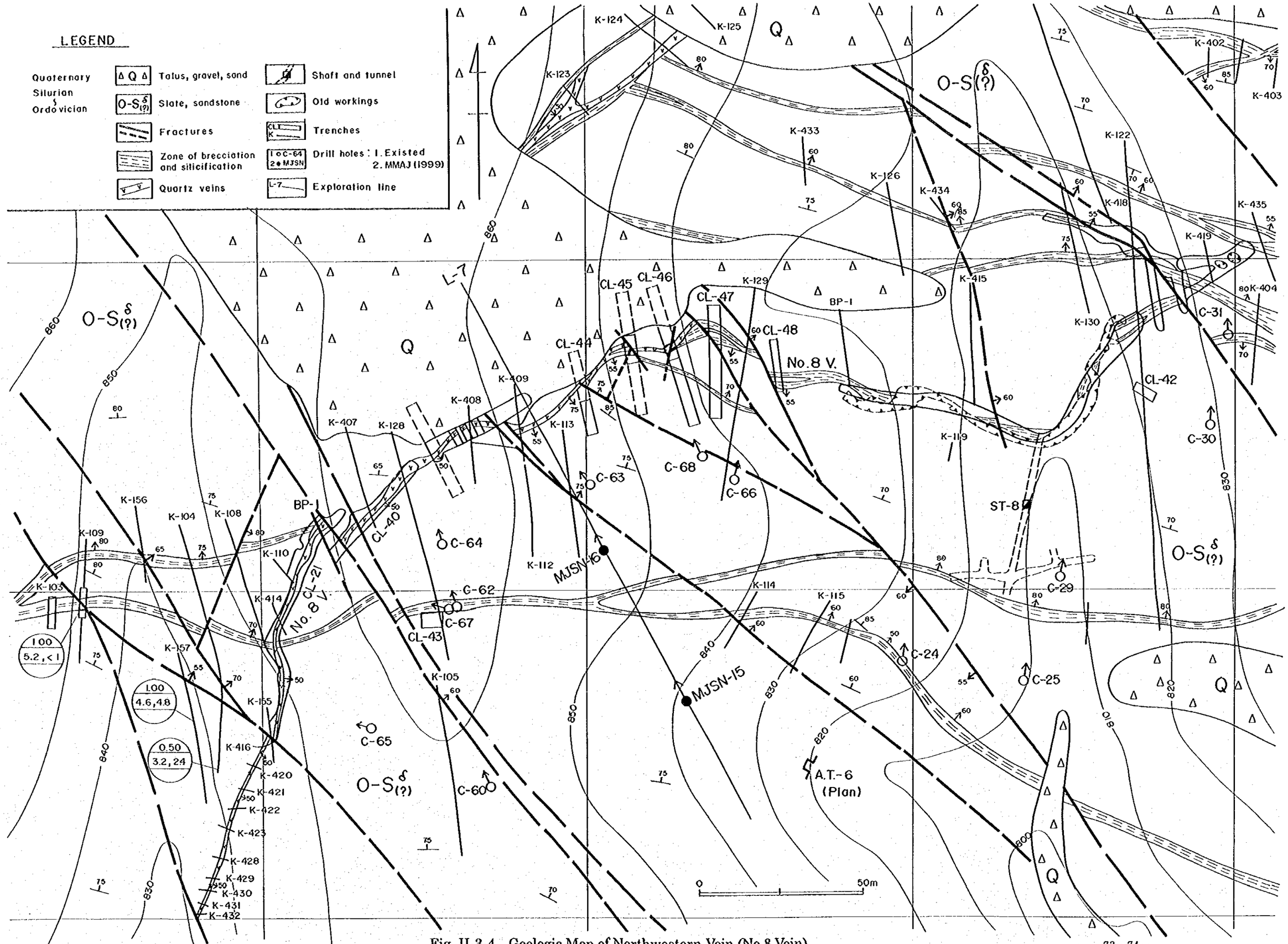


Fig. II-3-4 Geologic Map of Northwestern Vein (No.8 Vein)

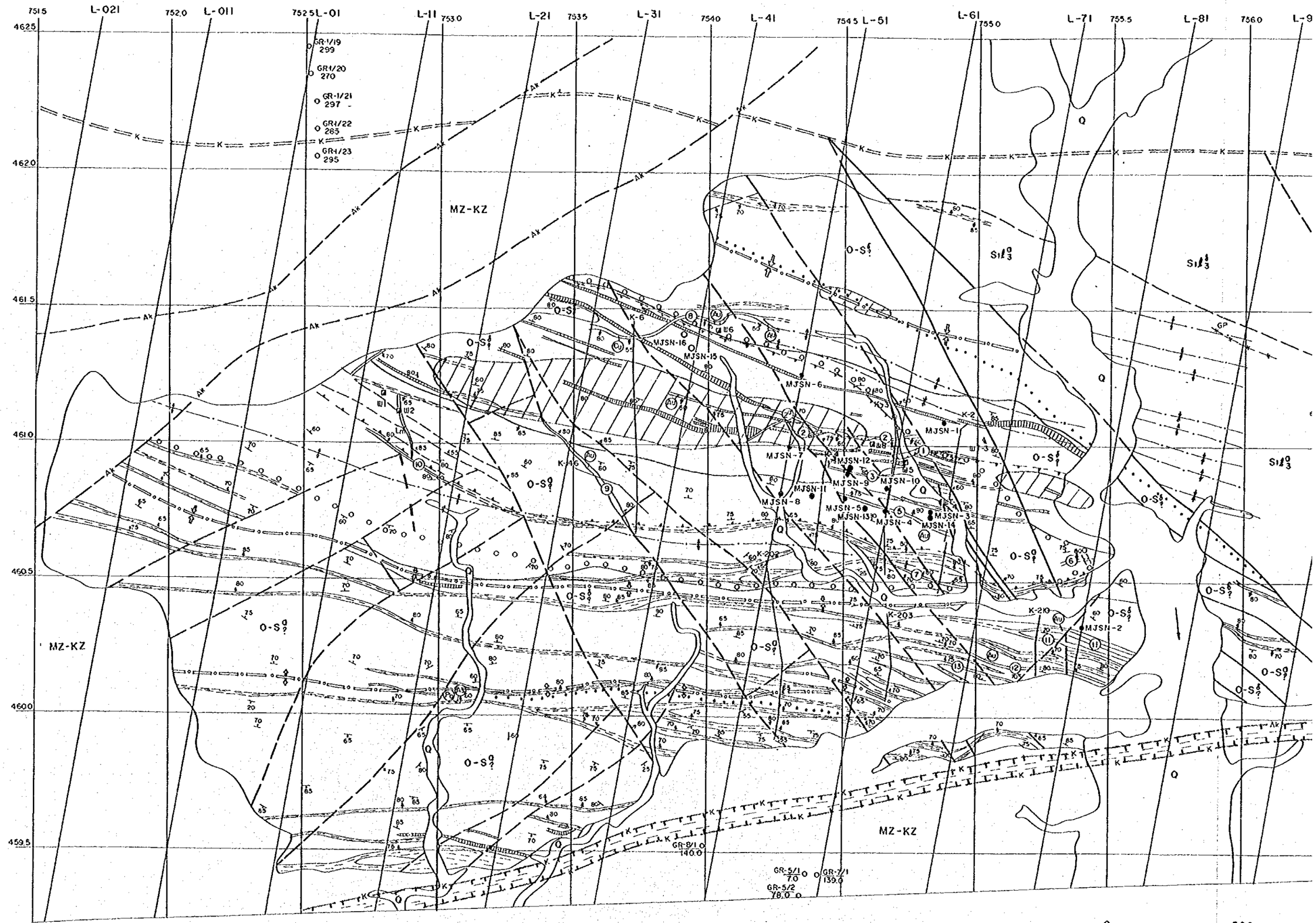
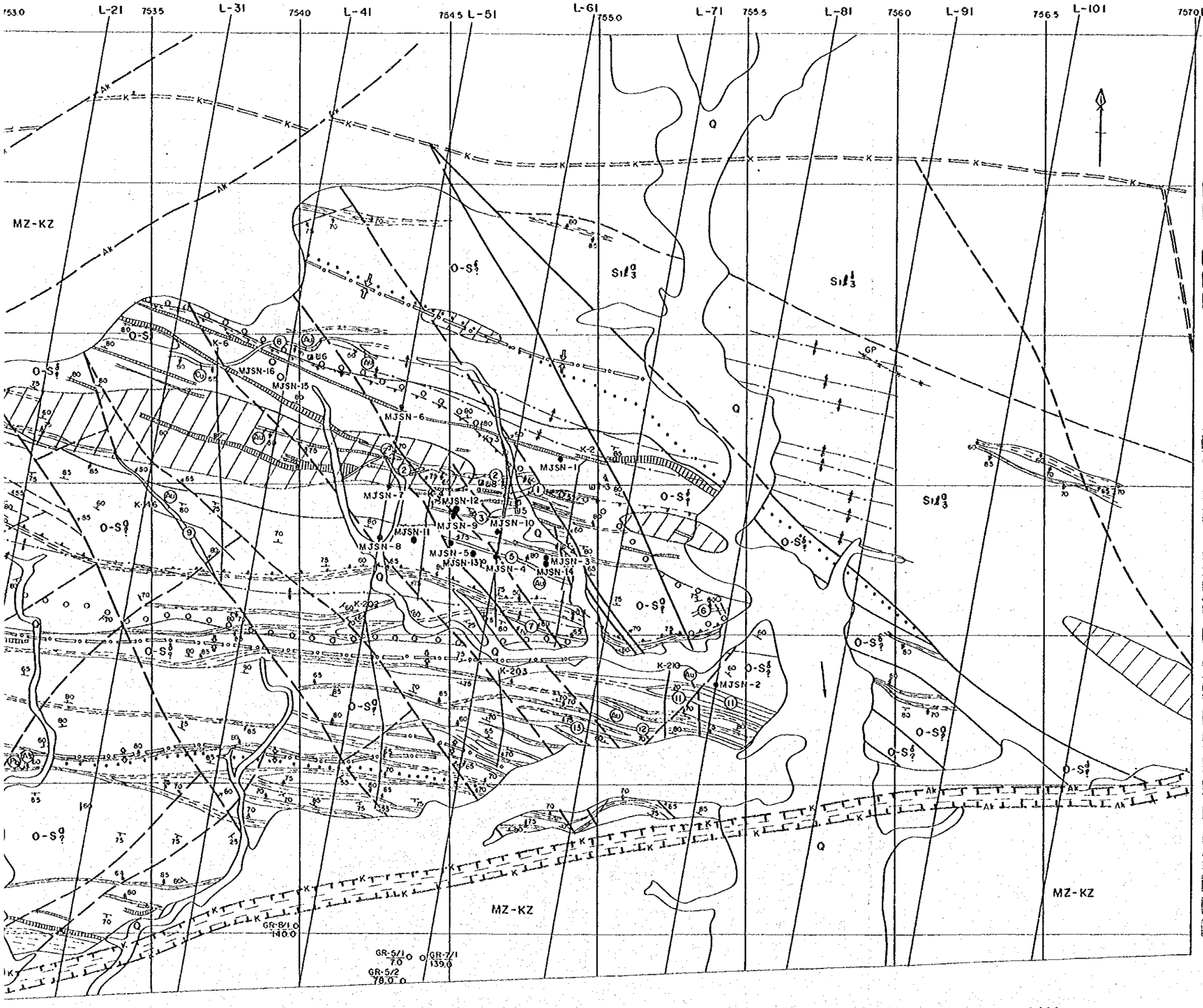


Fig. II-3-5 Integrated Interpretation Map of the Altynsai Deposit

(modified after V.A. Shebchenko; 19



Legend

Mesozoic and Cenozoic Erathem

- Q — Quaternary System ; talus, gravel, sand
- Mz-Kz — Mesozoic and Cenozoic ; non-segmented sediments.

Lower Silurian System ; Lower and middle part of Upper Llando very Series

- Upper formation : quartz sandstones, siltstones, slates
- Lower formation ; slates, siltstones, quartz sandstones

Ordovician - Silurian System

- Middle formation : meta - sandstones, carbonaceous slates, cherty slates
- Lower formation : alternation of meta - sandstones, cherty slates, silicified rocks and phyllites
- Silicified rock

Intrusive rocks

- Granitoids
- Dioritic porphyrites(lamprophyres)
- Granite-porphyries of Middle-Late Carboniferous(?)

Mineralization and metamorphism

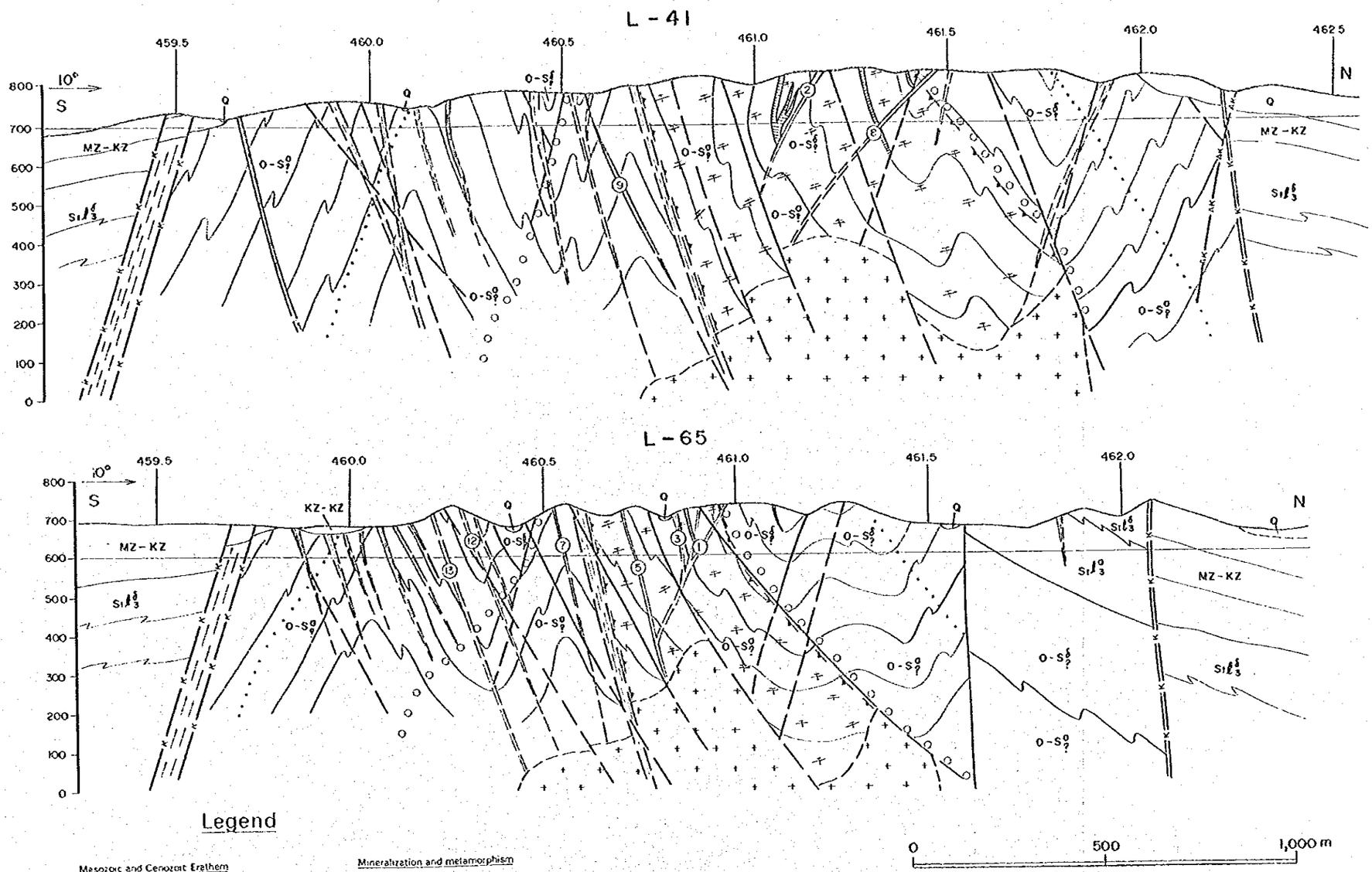
- Mineralization : 1. Gold 2. Galena 3. Arsenopyrite 4. Chalcopyrite and its secondary minerals
- Boundary of muscovite hornfels zone and spotted slate zone
- Boundary of spotty shales zone of muscovite hornfels
- Local positive magnetic anomalies at 20 to 60 gamma of intensity, identified with hidden intrusive bodies (dykes, small stocks)

Fractures

- 1. Traced 2. Supposed
- Fixed : 1. By satellite images 2. By aerial photographs
- Zones of brecciation and silicification
- Ore zone and its number. Intensively silicified with quartz veins and quartzy breccia of 0.2-3.0m thickness and weakly sulphidized zones (more than 1% : pyrite, arsenopyrite, galena, sphalerite, chalcopyrite).
- Submeridional quartz - tourmaline veinlets at thickness from 0.1cm to 20 - 25cm.
- Intensively silicified zone with submeridional quartz-tourmaline veinlets.
- Strike and dip : 1. Rocks 2. Fractures
- Axes of anticlines and direction of their submersion 1. of the first order 2. of the highest order
- Axes of synclines and direction of their submersion 1. of the first order 2. of the highest order
- Trench and its number
- Shaft and its number
- Adit and its number
- Old workings
- Number of hole / Thickness of Mesozoic and Cenozoic sediments
- MMAJ hole and its number
- Prospecting line and its number

Fig. II-3-5 Integrated Interpretation Map of the Altynsai Deposit

(modified after V.A. Shebchenko; 1997)



(modified after V.A. Shebchenko; 1997)

Fig. II-3-6 Integrated Interpretation Cross Sections of the Altynsai Deposit

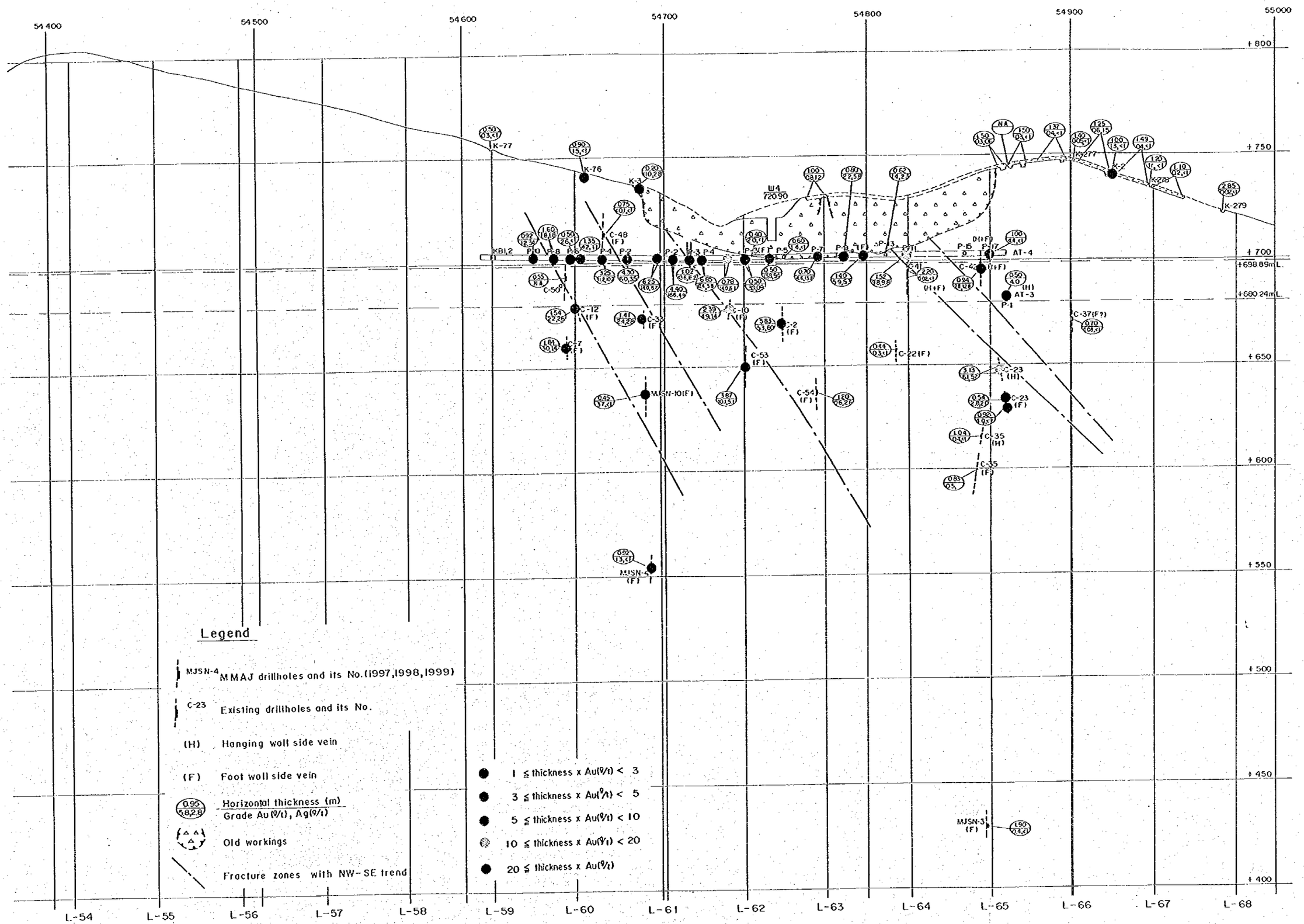


Fig. II-3-7 Perspective Section for Altynsai No.1 Vein

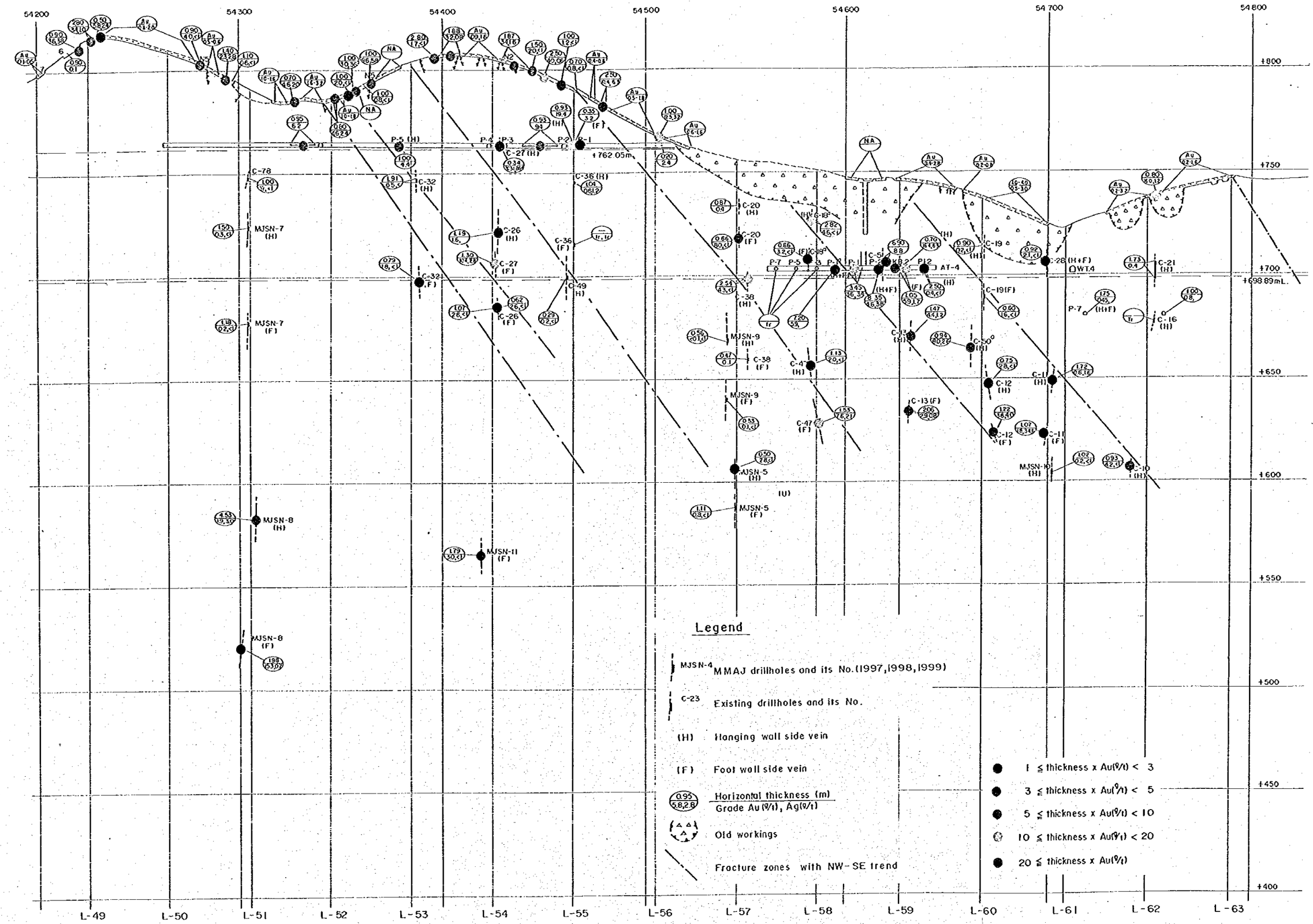
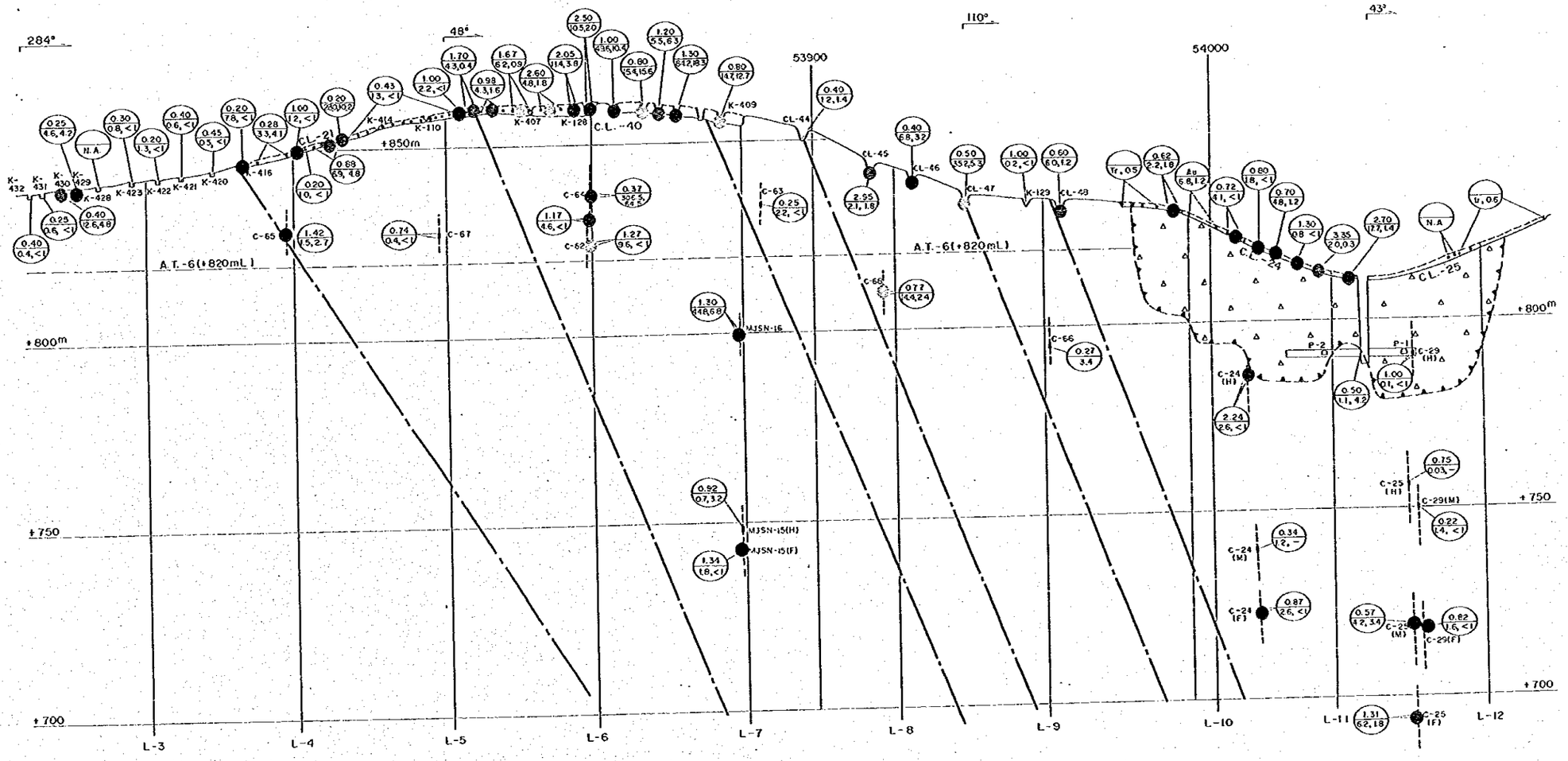


Fig. II-3-8 Perspective Section for Altynsai No.2 Vein



Legend

- MJSN-4 — MMAJ drillholes and its No.(1997,1998,1999)
- C-23 — Existing drillholes and its No.
- (H) — Hanging wall side vein
- (F) — Foot wall side vein
- 0.95 / 582.8 — Horizontal thickness (m) / Grade Au(g/t), Ag(g/t)
- Old workings
- Fracture zones with NW-SE trend

- 1 ≦ thickness x Au(g/t) < 3
- 3 ≦ thickness x Au(g/t) < 5
- 5 ≦ thickness x Au(g/t) < 10
- 10 ≦ thickness x Au(g/t) < 20
- 20 ≦ thickness x Au(g/t)

Fig. II-3-9 Perspective Section for Altynsai No.8 Vein

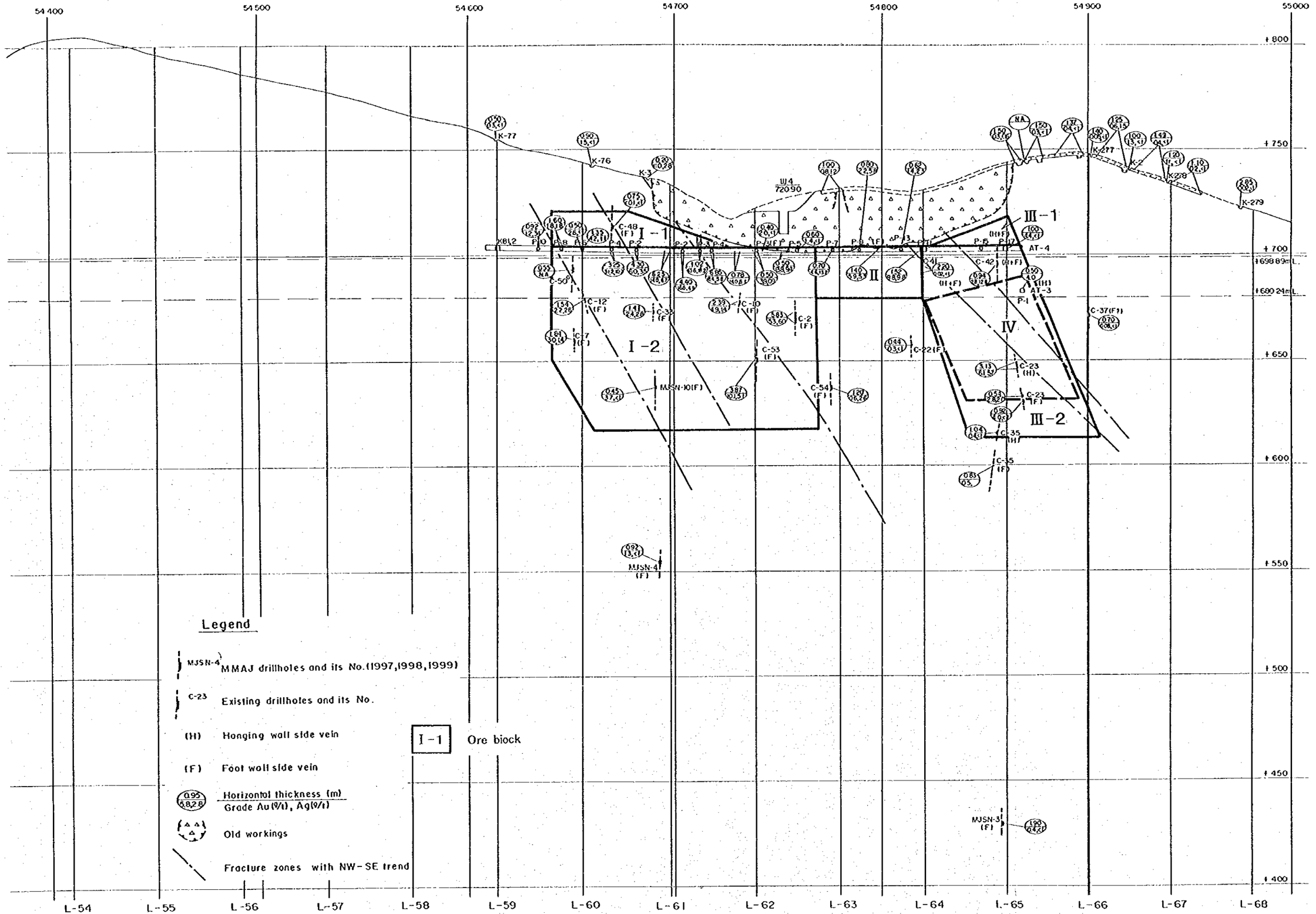


Fig. II-3-10 Perspective Section for Ore Reserves Calculation of Altynsai No.1 Vein

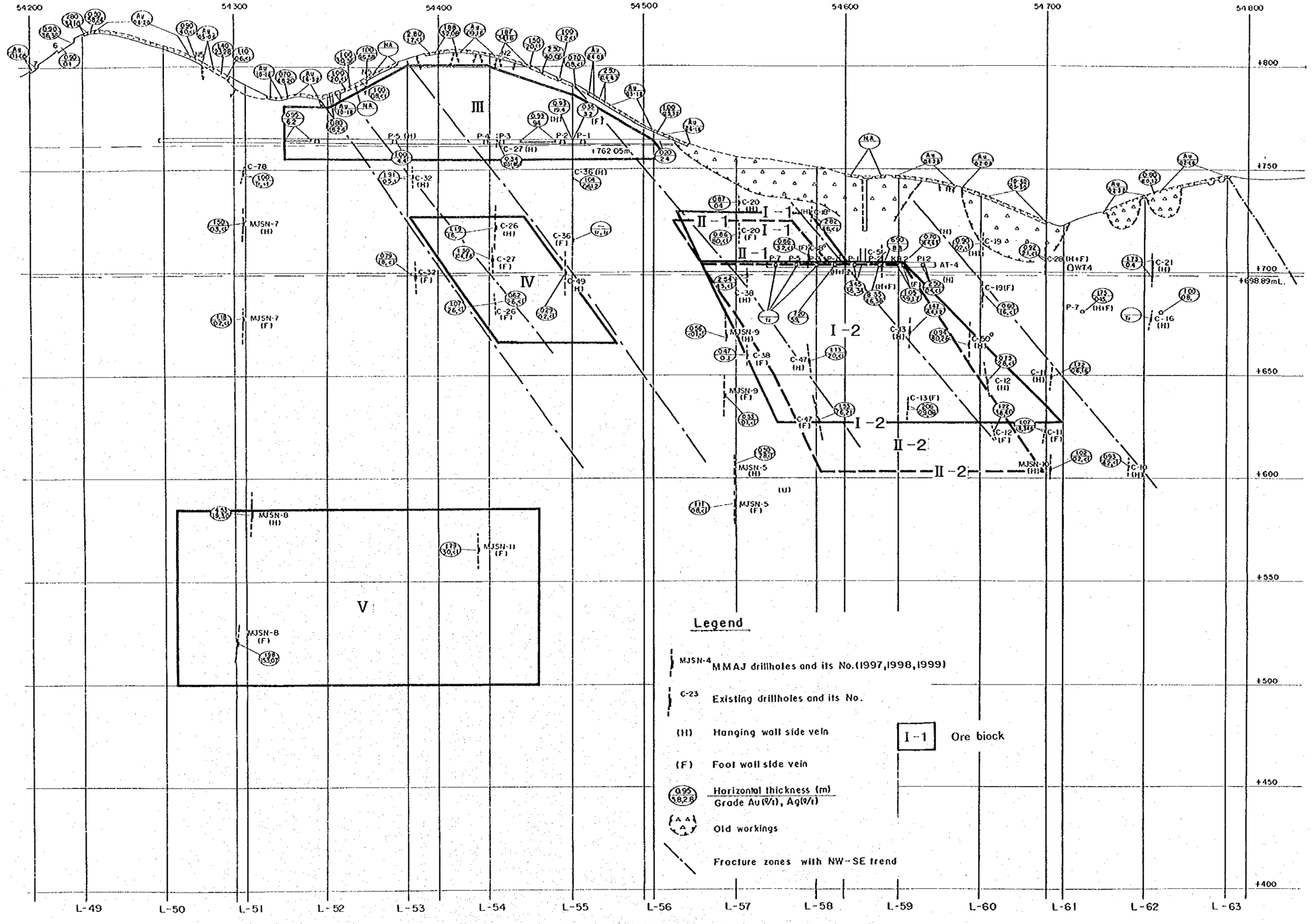


Fig. II-3-11 Perspective Section for Ore Reserves Calculation of Altynsai No.2 Vein

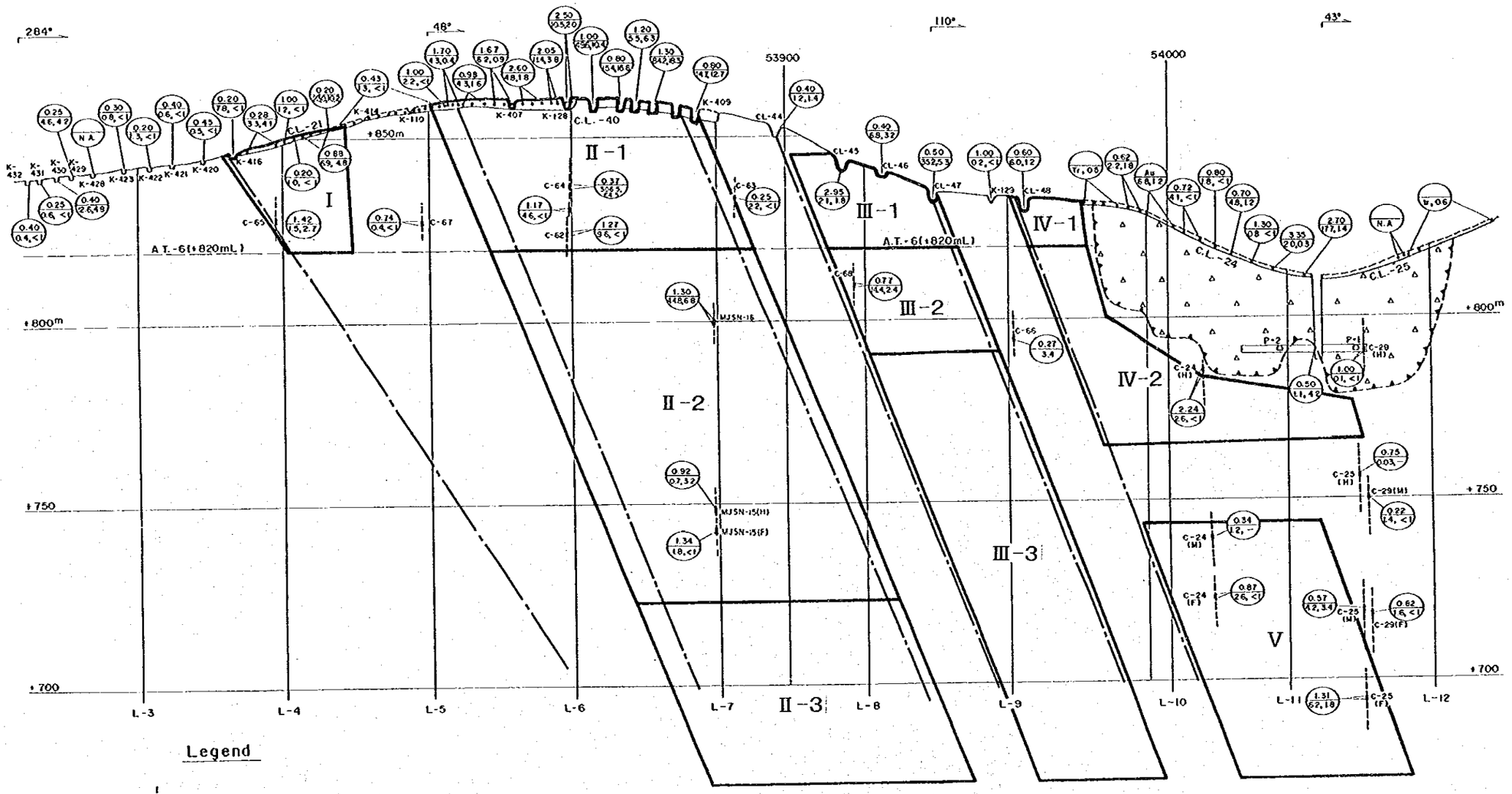


Fig. II-3-12 Perspective Section for Ore Reserves Calculation of Altynsai No.8 Vein