PART Ⅲ

CONCLUSION AND RECOMMENDATION

CHAPTER 1 CONCLUSION

Phase I of the survey involved compilation of previous data combined with analysis of satellite images of the entire survey area. Phase II of the survey included a detailed geological survey of the prospective gold deposit in the Shyraldzhyn area, and a geological reconnaissance survey was conducted in other promising areas of the Kumyshtag and Babahan areas and a geochemical soil survey was simultaneously implemented. Phase III comprised a core drill survey in the Shyraldzhyn area. Generalized results of the survey are summarized in Fig.III-1. The following conclusions are reached on the basis of during these three years.

1-1 Whole area

(1) The survey area is composed of the various geological units from Proterozoic to Cenozoic Era which are intruded by the granite of Kumyshtag and Babahan.

(2) Many types of ore deposits and manifestations of gold, silver, zinc, lead, arsenic, beryllium, copper and tungsten are located in the area. The mineralization has taken place in the limestone and sandstone of the Upper Riphean - the Vendian series, and in the Kumyshtag granite of late Silurian to early Devonian age.

(3) According to the geological structures and characteristics of ore deposits in this area, the mineralization is classified into the following two groups: one is vein-type or massive mineralization related to the Uzunahmat-Kumyshtagsky thrust fault and its subordinate faults, the other is vein, greisen and skarn type mineralization related to the Kumyshtag granite.

(4) Ground confirmation was conducted to check the anomalous zones delineated from the spectral analysis of satellite image. The anomalous zones correspond to limonite disseminated schist of the Riphean series. The ground confirmation revealed that diagenesis alteration, instead of hydrothermal alteration, had produced the anomalous zones.

1-2 Kumyshtag area

(1) Overlapping geochemically anomalous silver, copper, arsenic and antimony zones are widely distributed throughout an area ranging from the Kumyshtag silver deposit to the Uchimcheck arsenic deposit.

(2) Although the Kumyshtag deposit is composed of large-scale silver-bearing manganosiderite veins, gold mineralization is poor. The geochemical gold anomalies are small and scattered.

1-3 Babahan area

A geochemical silver anomaly was detected on the Dzholsay fault near the Kuru-Bakair silver deposit. The small geochemical anomalies and small-scale silver deposits indicate that a large-scale ore deposit should not be expected near the surface.

1-4 Shyraldzhyn area

(1) Shyraldzhyn deposit being only one gold deposit in the Talas area, is composed of quartz-manganosiderite veins in the southeastern part of the Kumyshtag granite.

(2) The absolute age of muscovite, formed by greisenization, as measured by the K-Ar method, is 405±21 Ma, which correspond to late Silurian to early Devonian age. This is the same age as the Kumyshtag granite, which was found to be 406±14 Ma by the U-Pb method.

(3) As the results of the drilling survey, mineralized zones of the vein were confirmed to be embedded about 150m beneath surface at the northern part of the vein, about 80m beneath surface at the central part and at 200m depth at the southern part.

(4) The vein shows echelon arrangement, strikes NNE-SSW and dips 45° W generally. Although elongation of the vein along strike exceeds 1,400m, gold mineralized part extends only 900m. The average true width of the vein is 2.1m at the surface and 2.6m in drill holes. The maximum true width is 3.9m at the outcrops and 10.6m in the hole.

(5) The average gold grades of vein confirmed by drillholes range 2.5 to 11.3 g/t. High gold grade ore exist in the northern and southern part of vein. Native gold is observed as grains ranging from a few μ m to 70 μ m.

(6) It has been pointed out that homogenization temperature shows positive correlation with gold grade. The interpretation suggests that higher temperature zones could exist in depths in the northern and southern parts, and gold mineralized zones could be embedded there.

(7) As the results of a tentative calculation of ore reserves, possible ore reserves are estimated to be 1,043 thousand tons with 5.2 g/t Au and 5.4 tons of gold. Potential ore reserves are expected to be 1,269 thousand tons with 5.0 g/t Au and 6.3 tons of gold. The sum of possible and potential ore reserves are 2,312 thousand tons, average grade 5.1 g/t Au and 11.7 tons of gold.

(8) A mining development program was performed to investigate possible ore reserves. Cut-off grade is determined as 4 g/t Au by operation cost. Crude ore

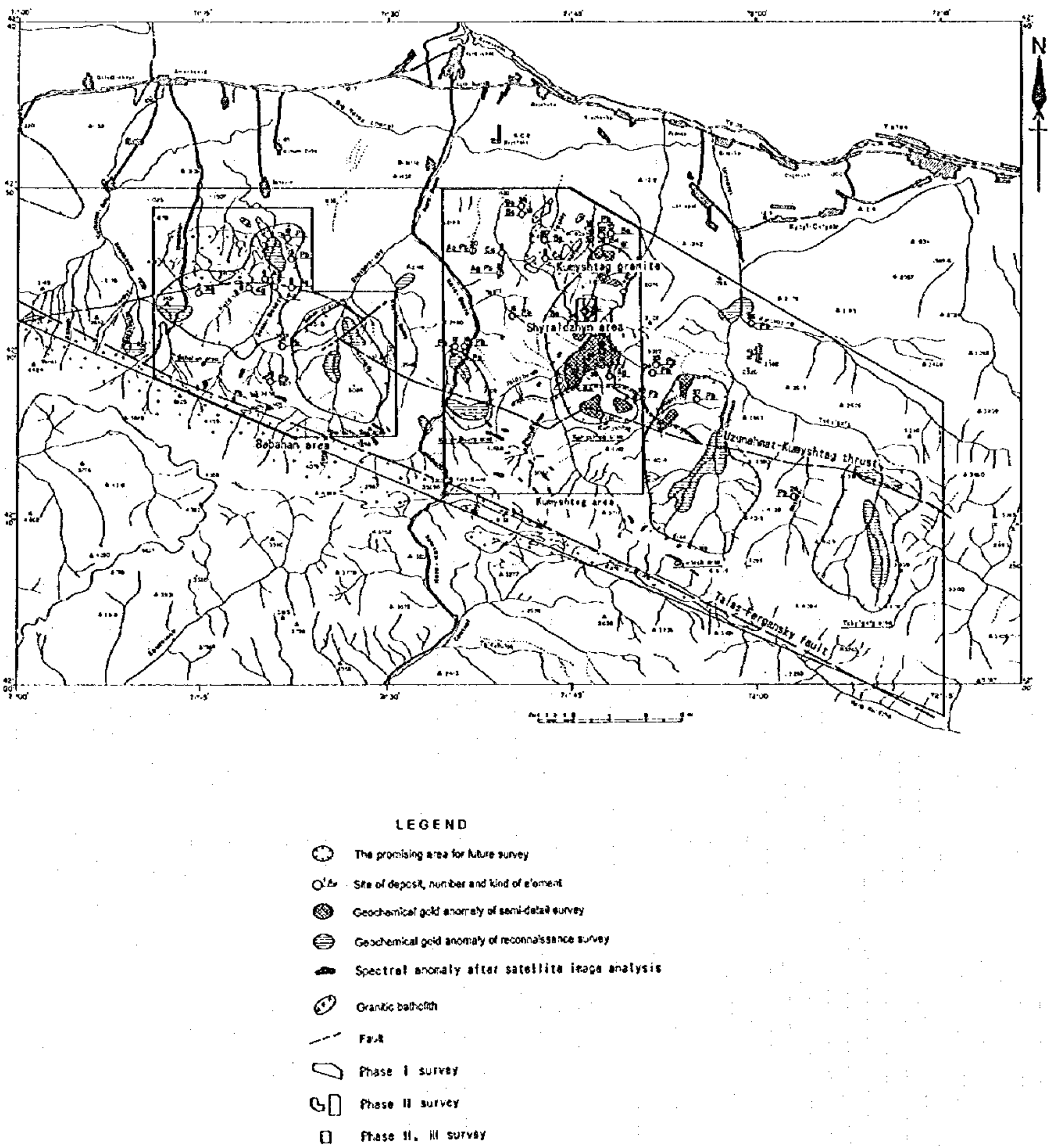


Fig.III-1 Generalized Results of the Survey

reserves are estimated to be 644 thousand tons with 3.3 tons of gold. It is concluded that mining development would be difficult, as things stand.

CHAPTER 2 RECOMMENDATION

A program of mining development at the Shyraldzhyn deposit was studied considering various conditions. Although it is reached that the development would be difficult because a little crude ore reserves and a large initial investment cost, there may be possibility that the deposit could be develop if conditions improve in the future. Lowering of cut-off grade, reduction of operation costs, construction of a cooperating gold refinery and appreciation in gold are listed as conditions influenced revenue and expenses.

Cut-off gold grade was determined by the sum of mining and refining operation costs. If operation costs reduce, the cut-off grade would be low and crude ore reserves would increase. After all, it will be connect with reduction of initial investment cost per ton.

Ore haulage costs occupy about 25% in the operation costs. This program has been investigated considering information of those costs at an operating gold mine in Kyrgyz. Therefore it will be important that the cost reduction at the operating mine is given attention and the costs in this plan are modified to reduce through new eyes.

Gold deposits, such as the Jeruy and the Andash, are located around Talas. The Jeruy deposit estimated 83 tons of gold with 6 g/t Au, has been considering to develop. The Andash deposit calculated 13 tons of gold with 2 g/t Au, has been prospecting. If a gold refinery is built to develop those gold deposits, it would be possibility that gold ore produced from the Shyraldzhyn deposit is sent to a future cooperating refinery.

The price of gold is assumed to be 360 $/TOZ in this plan. If price fluctuates to be 454 $/TOZ, revenue and expenses keep the balance at production of 100 tons per day.

The northern and southern parts of the deposit would be listed as prospective areas if high grade ore can be expected at depth.

REFERENCES

1. Bakirov A. B. and Kiselev V. V. ed (1998) : Precambrian and Lower Paleozoic of Tien-Shan. Ilim press. Furunze. 155p. (in Russian)
2. Bakirov A. B. and Kotov V. V. (1988) : Eclogite-bearing metamorphic formation - Indicators of joining zones of ancient continents. in "Precambrian and Lower Paleozoic of Tien Shan." p.4-24 (in Russian)
3. Bekker A. U., Makarov B. A. and Razboynikov A. G. (1988) : New data on the stratigraphy of Karagainskaya formation in Talas Ala-Too (Northern Tien-Shan). in "Precambrian and Lower Paleozoic of Tien Shan." p.100-126 (in Russian)
4. Geological Department, Kyrgyz SSR (1987) : Schematic geological map of Shyraldzhyn gold deposit. 1:10,000.
5. Hayashi M. (1979) : Quantitative Descriptions of Cores and Cuttings from Geothermal Wells. J. Geothermal Research Soc. of Japan. vol.1 no.2 p.103-116 (in Japanese)
6. Hedenquist J. W. and Henley R. W. (1984) : Effect of CO_2 on freezing point measurements of fluid inclusions-evidence from active geothermal systems and application to epithermal ore deposits. Econ. Geol.
7. Kiselev V. V., Bekker A. U. and Apayarov F. H. (1988) : Epibaikalsky Precambrian of Tien-Shan. in "Precambrian and Lower Paleozoic of Tien Shan." p.127-144 (in Russian)
8. Levingson A. A. (1973) : Introduction to exploration geochemistry. Applied Publishing Ltd. Calgary. 612p.
9. Magakyan I. G. (1979) : Metallogeny. Gendaikougakusha Press 394p. (in Japanese)
10. Mining Encyclopedia (1984) : Sovetskaya Encyclopedia Press (in Russian)
11. Ministry of Geology, USSR (1980) : Geological map of Kyrghyzstan of USSR. 1:500,000.
12. MMAJ (1994) : Circumstance on mineral exploration in the Kyrgyz Republic. 80p. (in Japanese)
13. Ryabko I. I. (1992) : Brief summary of mineral resources in Talas ore area of the Republic of Kyrghyzstan. Northern-Kyrgyzskaya geological expedition. (in Russian)
14. Roedder E. (1984) : Fluid inclusions. Reviews in Mineralogy vol.12, 644p. Min. Soc. Amer., Washington

15. Rossiter A. G. (1980) : Jubilee Plunger Au deposit, Georgetown Inlier, QLD. Jour. Geochemi. Explo. vol.12, no.2/3, p.324-327.
16. Sokolov B. S. (1979) : Vend. Principle of isolation, boundary and time-scale. "Stratigraphy of upper Proterozoic in USSR". Nauka, p.43-61. (in Russian)
17. Sokolov B. S. (1984) : Vendian system, Position on stratigraphic scale. "27th Stratigraphy". Nauka, p.111-127. (in Russian)
18. Togashi Y. (1988) : On visit to gold deposits in the Western America. Chishitsu News (Geological News). vol.411, p.44-59. (in Japanese)

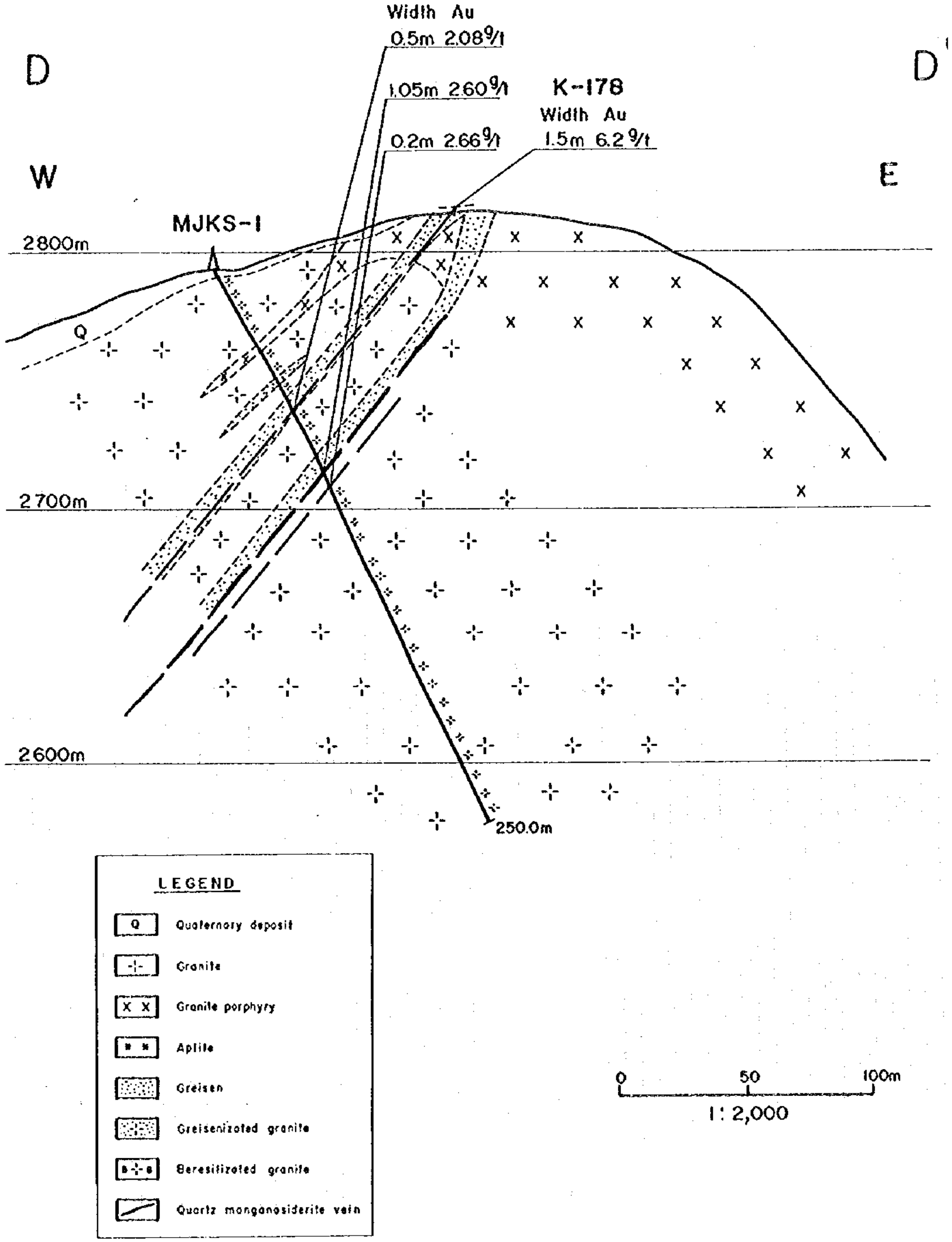
COLLECTED DATA

1. Geological department, Kyrgyz, SSR (1984) : Geological map of Kumyshtagsky ore field 1:10,000.
2. Geological department, Kyrgyz, SSR (1987a) : Schematic geological map of Shyraldzhyn gold deposit. 1:10,000.
3. Geological department, Kyrgyz, SSR (1987b) : Sampling plane of Sterzhnevoyl orebody at Shyraldzhyn gold deposit. 1:1,000.
4. Geological department, Kyrghyz, SSR (1987c) : Lithochemical results map of the Central part of Talas mountain range. 1:50,000.
5. Kyrgyz State Department of Map Making (1977) : Topographic maps. "Talas", "Kirovskoe". 1:200,000.
6. Ministry of Geology, USSR (1963a) : Geological map of USSR. Series of Northern Tien-Shan. "K-42-XVIII". 1:200,000. Explanation 105p. (in Russian)
7. Ministry of Geology, USSR (1963b) : Geological map of USSR. Series of Northern Tien-Shan. "K-42-XIII". 1:200,000. Explanation 85p. (in Russian)
8. Ministry of Geology, USSR (1963c) : Mineral resources map of USSR. Series of Northern Tien-Shan. "K-42-XVIII". 1:200,000.
9. Ministry of Geology, USSR (1963d) : Mineral resources map of USSR. Series of Northern Tien-Shan. "K-42-XIII". 1:200,000.
10. Ministry of Geology, USSR (1980) : Geological map of Kyrghystan of USSR. 1:500,000.
11. Ministry of Geology, USSR (1987) : Geological map and mineral resources map of the Central part of Talas mountain range. 1:50,000.
12. Ministry of Geology, USSR (1988) : Tectonic map of Kyrghystan of USSR. 1:500,000.

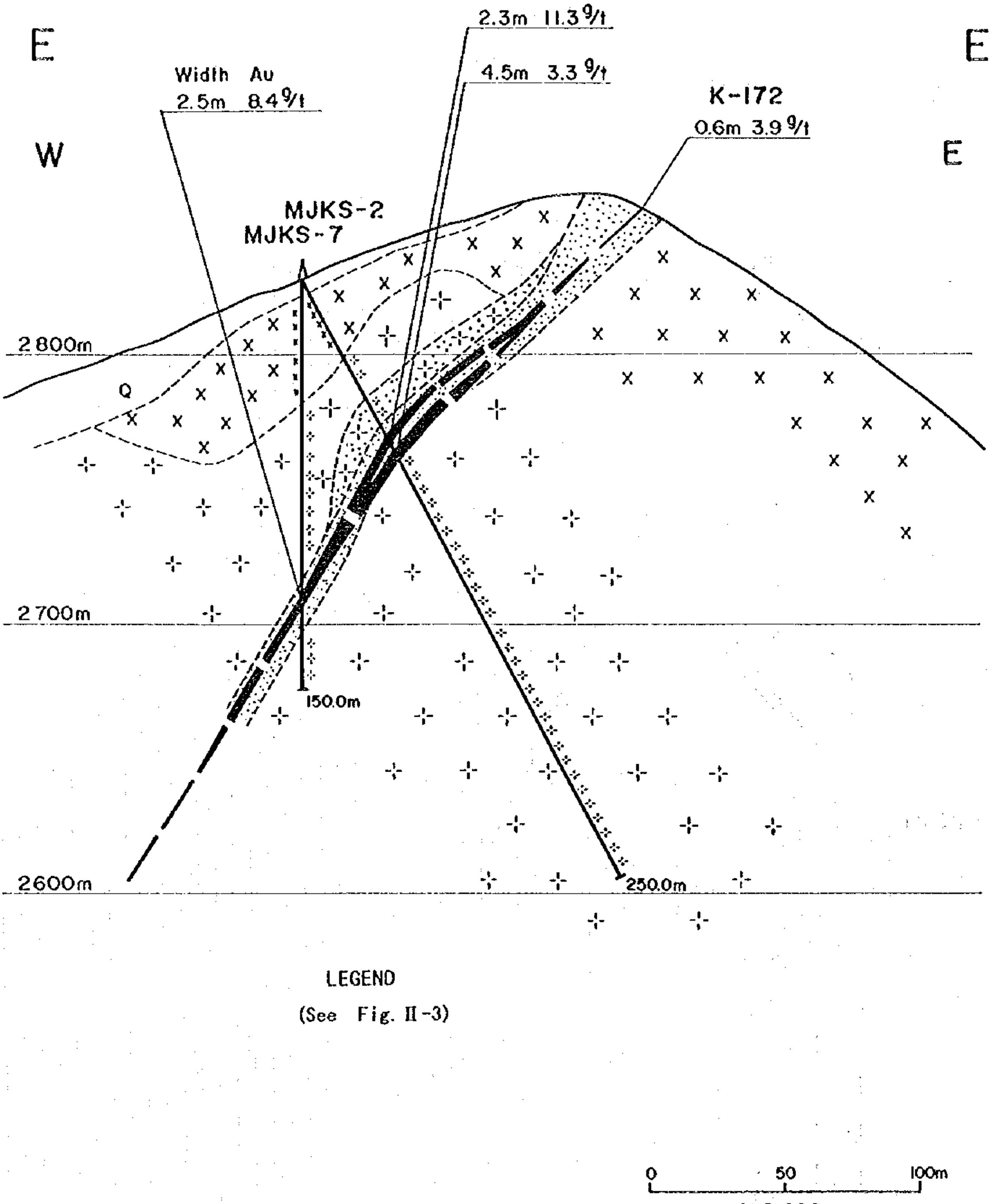
APPENDICES

APPENDIX 1

Geological Cross Section along
Drillings in Shyraldzhyn Area



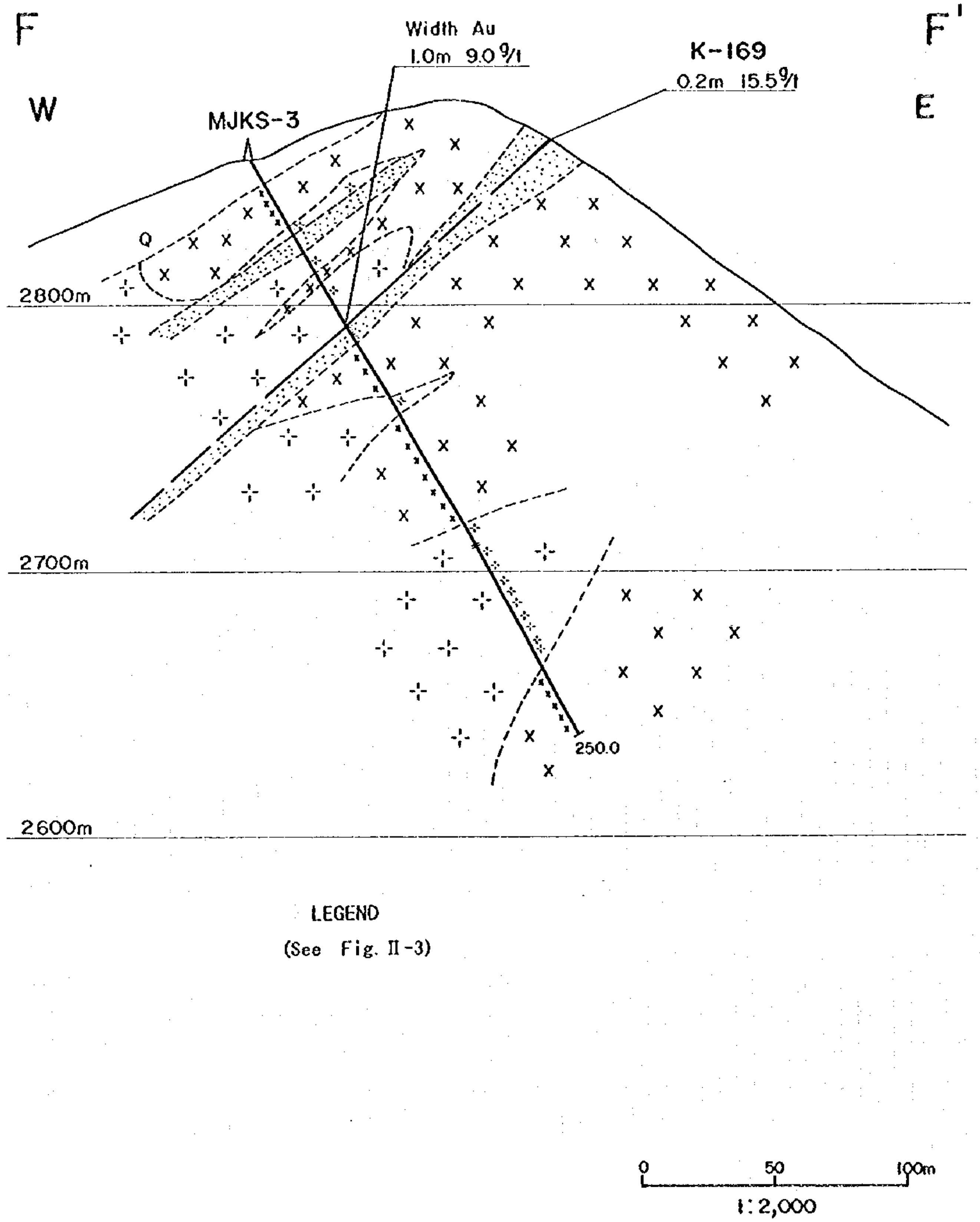
Geological Cross Section along MJKS-1



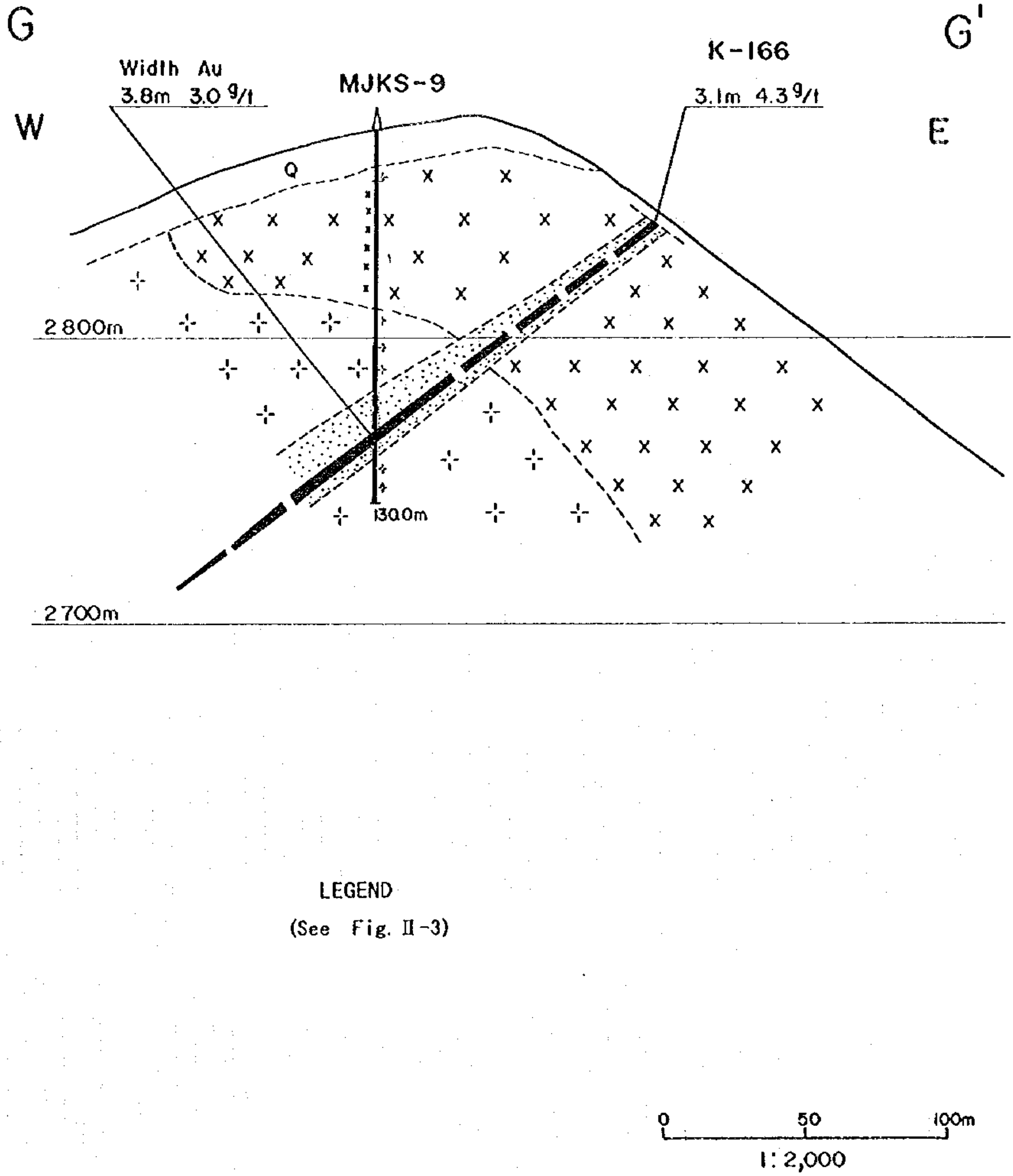
LEGEND

(See Fig. II-3)

Geological Cross Section along MJKS-2 and 7

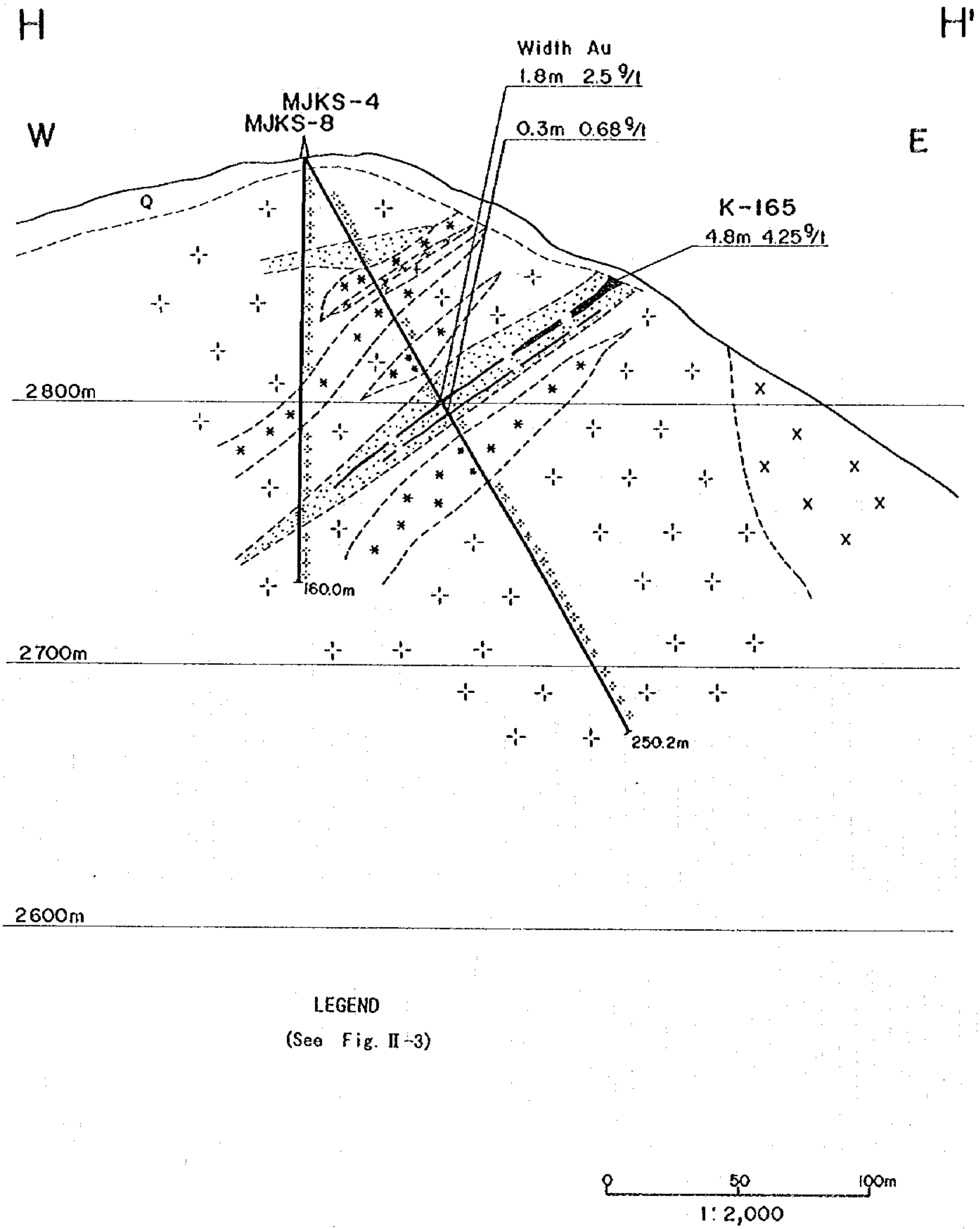


Geological Cross Section along MJKS-3

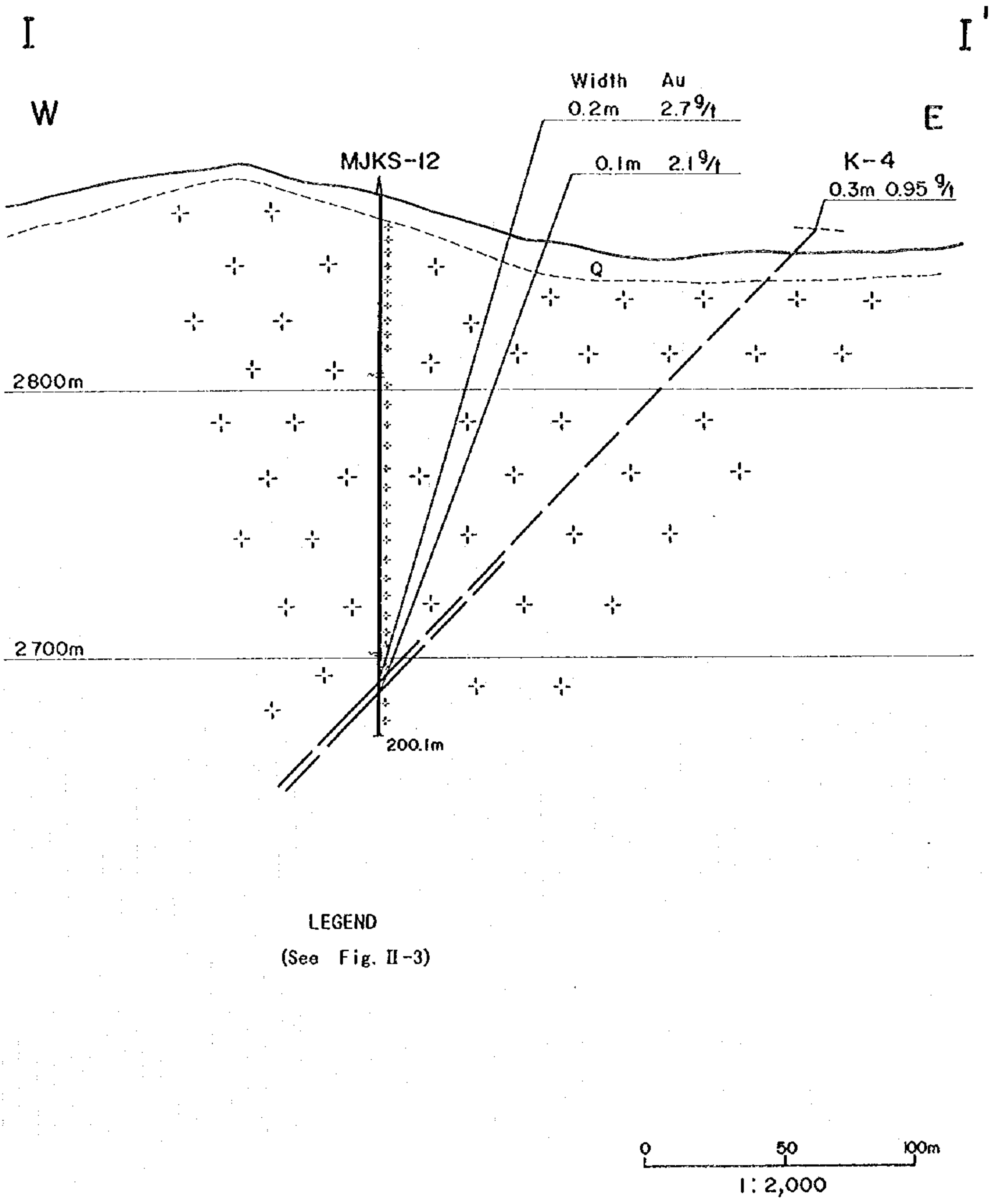


LEGEND
(See Fig. II-3)

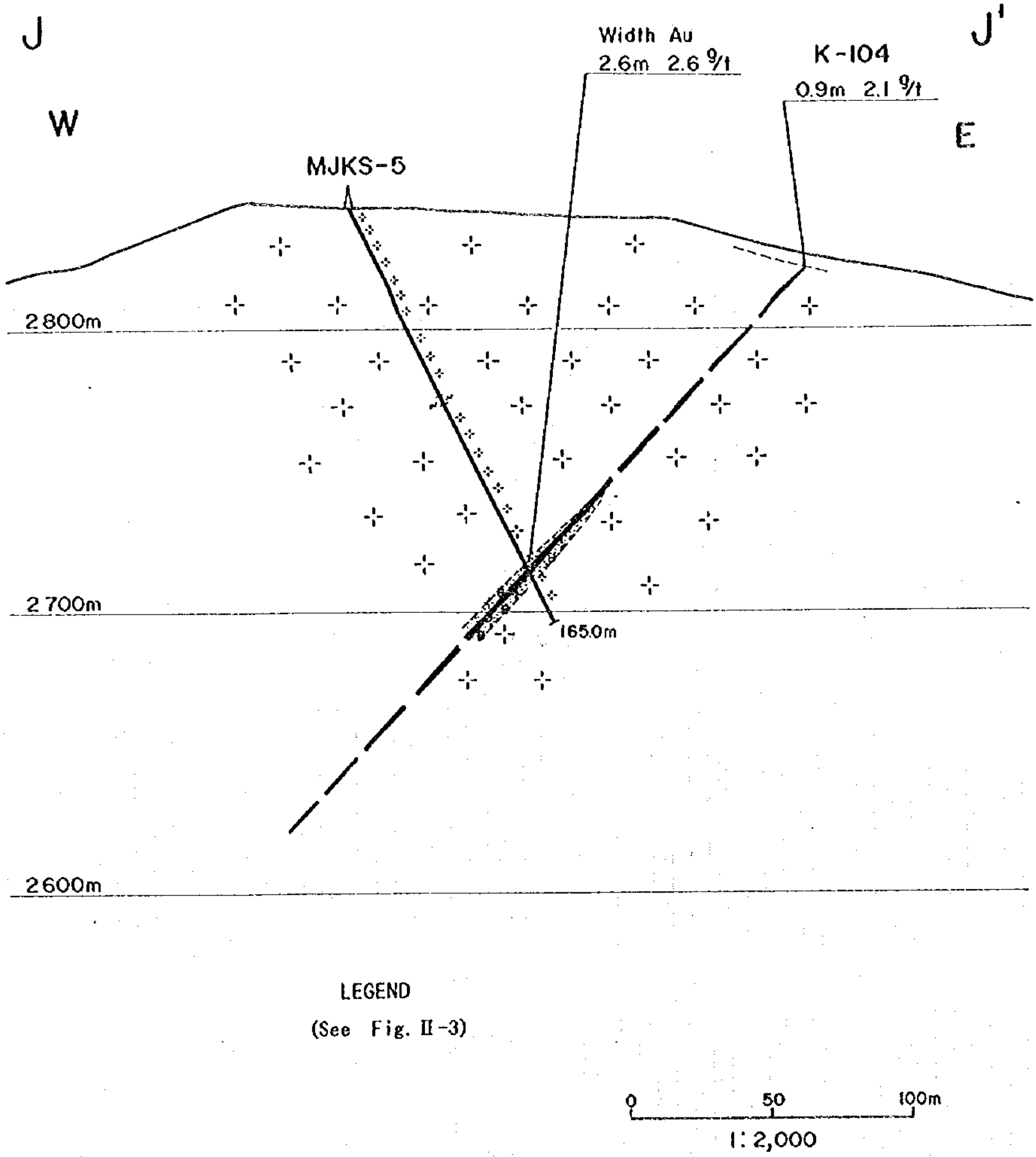
Geological Cross Section along MJKS-9



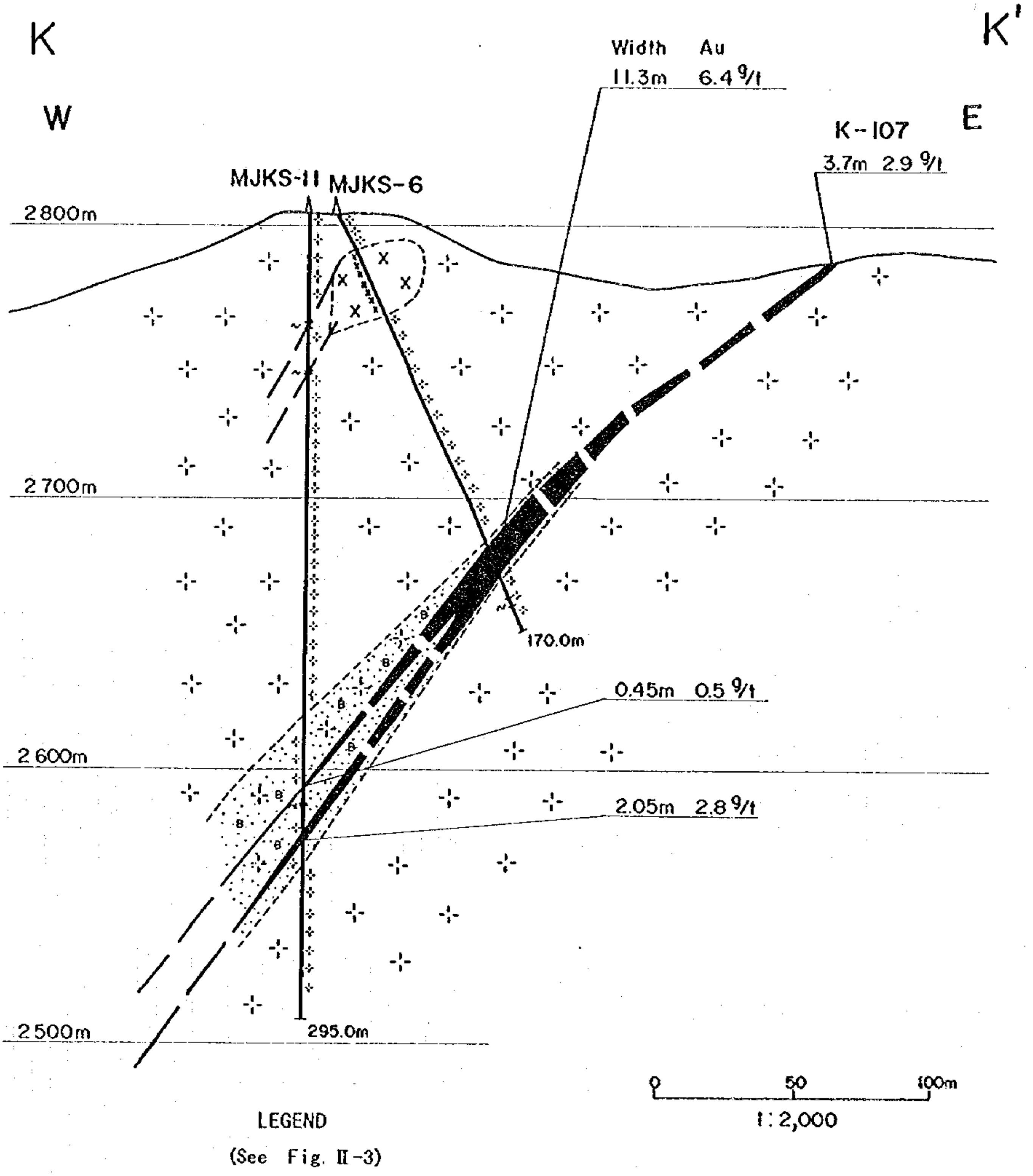
Geological Cross Section along MJKS-4 and 8



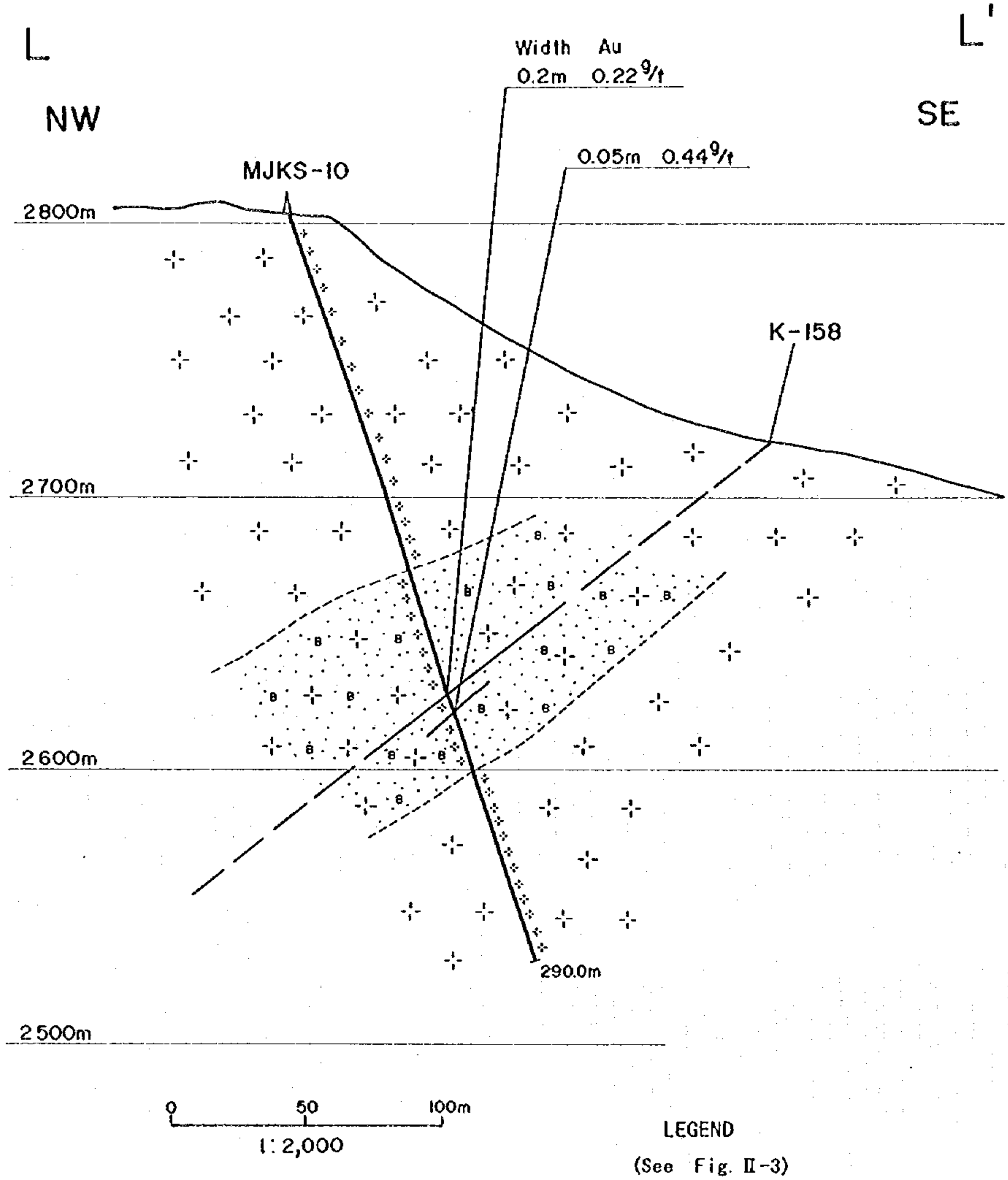
Geological Cross Section along MJKS-12



Geological Cross Section along MJKS-5



Geological Cross Section along MJKS-6 and 11



Geological Cross Section along MJKS-10

APPENDIX 2

Details of Mining Development Program

A-10

Apx.2 Details of Mining Development Program

1. Circumstance around the deposit

The Shyraldzhyn deposit is located near a summit with 2,890m of altitude. The nearest village is the Beisheke situated in 20 km to the northwest of the deposit. There are no infrastructures except a dirt road for transportation of prospecting machines and equipment. The deposit is located 26 km away from a power line. Water is planned to pump up because relative elevation is 400m with 3km of distance between a water source and the deposit.

No operating and developing metal mine is exist in the Talas oblast. Gold mining and refinery complex is also nonexistent there. Electrorefining plant of gold and silver in Kyrgyz have been treated in the Kara-Balta complex based on the national policy. Therefore considering conditions of a mining development, a gold refinery where green gold before an electrorefining process is produced, is adopted to build.

2. Ore reserves to be mined

Base on the results of the drilling survey, it has been known that the gold mineralized zone in the Shyraldzhyn deposit extents over about 1,100m in strike with widths ranging from 1.3 to 4.2m. Possible ore reserves are studied as ore reserves to be mined. The possible ore reserves has been estimated to be 1,043 thousand tons with 5.2 g/t Au. When a cut-off grade is determined to be 4 g/t Au as described later, crude ore reserves are estimated to be 644 thousand tons with 5.1 g/t Au.

3. Development policy

3-1 Mining

Level of ore haulage is designed to be at 2,700m of elevation. Two entrances are opened at both ends of the vein, for an easy transportation of mining machinery, an improvement of working ratio in faces and an ensuring ventilation. The drifts have a gentle ascent to flow out the underground water naturally. Both ore and waste chutes are put a priority to drill because the air is kept fresh and clean. Though local fans are used, no enforced ventilation by large-scale fan is planned.

A productive method of trackless mining is selected. Hand drills are used to mine a small vein. The ore beneath the gallery is to be mined and transported by a downward roadway.

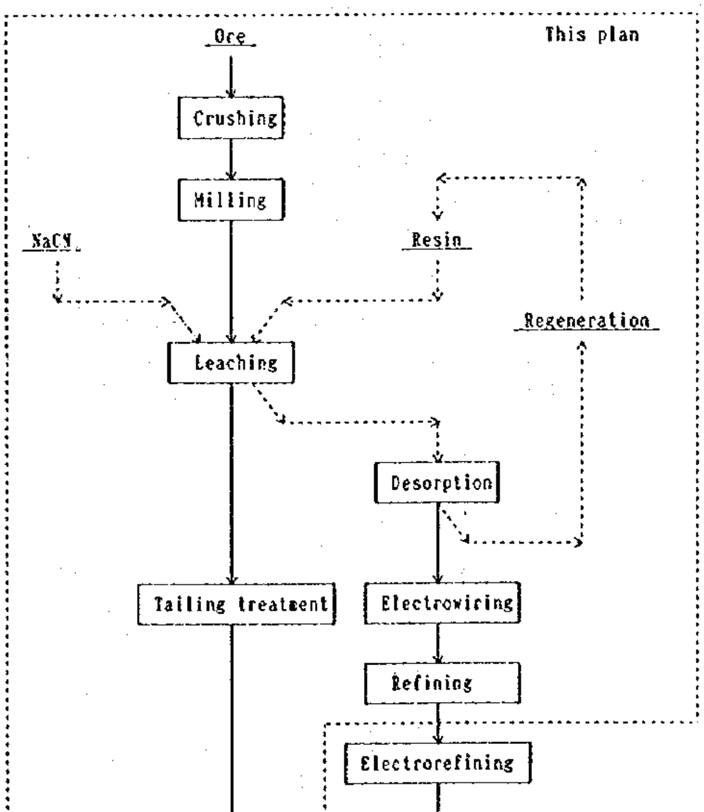
Program is made on the assumptions that the deposit serves as the base and the initial investment is to be minimized. Investment cost per ton is calculated to divide by crude ore. An interest is excluded in this plan.

3-2 Refinery

Considering a gold refinery, a treatment processes are investigated. According to mineral studies on ore minerals in this deposit, gold occurs as native gold of fine particles with a few micro-meter to some tens micro-meter. It associates with quartz and limonite. It is difficult to recover gold by the method of gravity concentration because the grain size is very small. Therefore all slime cyanidation process which is a general technique at a gold and silver refinery, is selected.

All slime cyanidation process is divided into a merrill crowe method and a carbon in pulp (CIP). Resin in pulp method, instead of CIP, are operated at the cyanidation plants in the Commonwealth of Independence States. In this program, the process of a resin in pulp is used. Considering conditions, a gold refinery where green gold before an electrorefining process is produced, is adopted to build.

The generalized flow of a resin in pulp is represented in the following figure.



Flow sheet of Resin in pulp

4. Crude ore reserves

4-1 Cut-off grade of gold

If a value of ore is less than the sum of the mining and refining costs, the ore should not be mined. On the assumption of the metallurgical recovery at 85 %, the electrorefining recovery at 95% and the gold price at 360$/tr-oz, a cut-off grade of gold is calculated to be 3.2 g/t by the following formula:

$X\ (g/t) \times 0.85 \times 0.95 \times 360\$/tr\text{-}oz\ /\ 31.1g/tr\text{-}oz \geqq (18.1+12.2)\ \$/t$

$X \geqq 3.2$

When a dilution is 20%, a cut-off grade of gold is 4.0 g/t in a ore reserve base by the following formula:

$3.2\ g/t\ /\ (1\text{-}0.2) = 4.0\ g/t$

Ore block more than 4.0 g/t Au is reached the following four blocks of No. 1, 2, 3 and 7.

4-2 Crude ore reserves and ore grade

On the assumptions of the mining recovery at 80%, the dilution at 20%, crude ore reserves and ore grade are given in the following table. Crude ore reserves is calculated to be 644 thousand tons with 5.1 g/t Au.

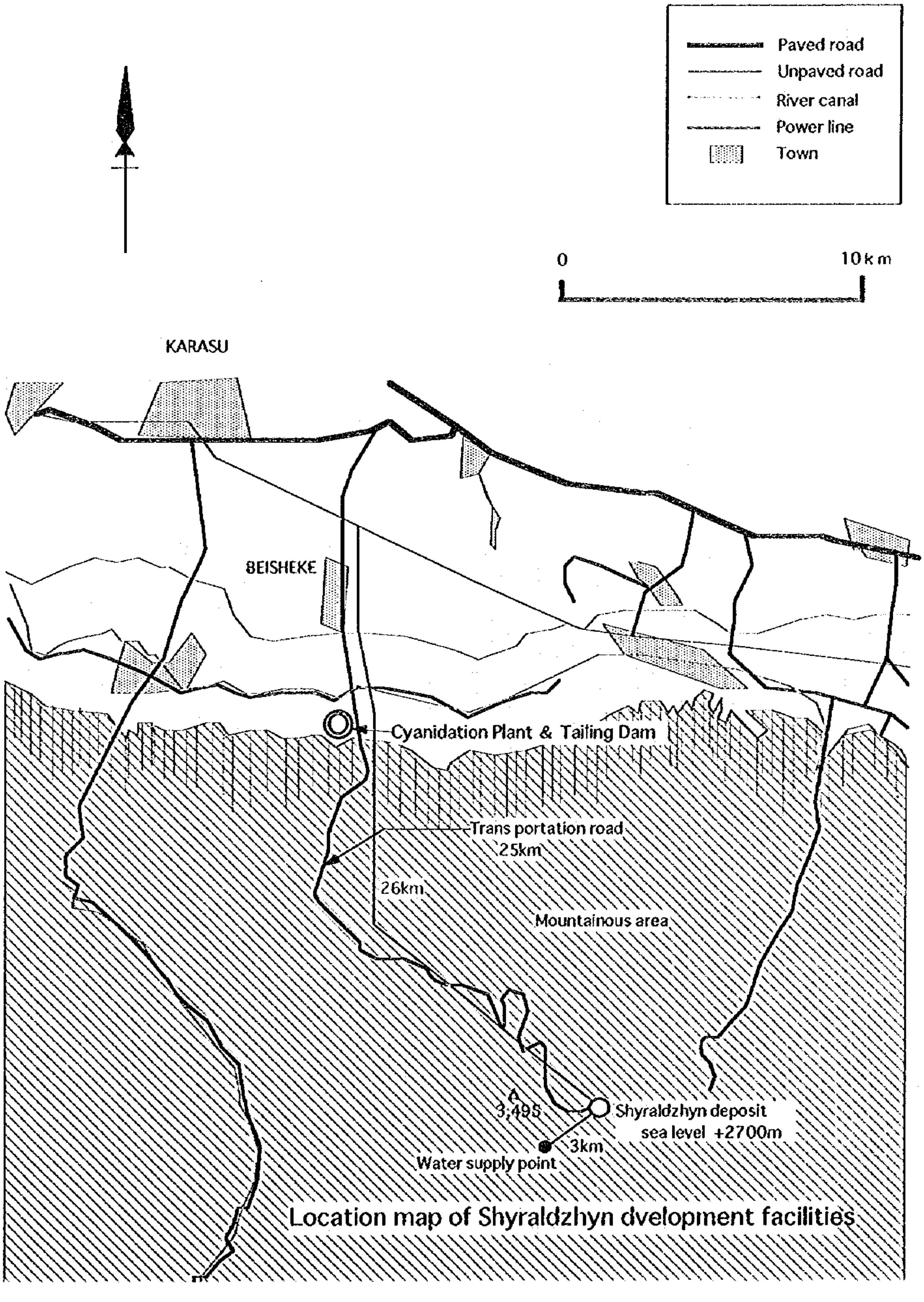
Block No.	True width (m)	Au grade (g/t)	Ore reserve (t)	Au grade of crude ore (g/t)	Crude ore Reserve (t)	Au (kg)
1	1.6	10.5	78,900	8.4	79,000	664
2	2.2	6.0	182,400	4.8	182,000	874
3	1.3	6.4	69,200	5.2	69,000	359
7	4.2	5.5	313,500	4.4	314,000	1,382
Total	2.3	6.4	644,000	5.1	644,000	3,275

5. Mining

5-1 Initial investment

(1) Infrastructure facilities, etc.

This plan is made on the assumption that a refining plant serves to be build at a place of 25km away from the deposit. A 3-km new road is constructed for the ore haulage and a 22-km road is reconstructed. A 26-km temporary power line including transmission is extended to the mine site. A water pipe is laid in 3km length. Surface facilities are built on 2,700m of the same level of the gallery. Miners commute from the Karasu village to the mine by bus. The location of the facilities are shown in the next page.


Paved road
Unpaved road
River canal
Power line
Town
0
10km
KARASU
BEISHEKE
Cyanidation Plant & Tailing Dam
Trans portation road
25km
26km
Mountainous area
3,495
Shyraldzhyn deposit
sea level +2700m
3km
Water supply point
Location map of Shyraldzhyn dvelopment facilities

The infrastructure cost is shown as follows:

① Ore haulage road (new)	250,000 $/km x 3km	=	750,000 $
ditto (reconstruction)	100,000 $/km x 22km	=	2,200,000
② Temporary power line	30,000 $/km x 26km	=	780,000
③ Water pipe (ϕ 100mm)	30,000$/km x 3km	=	90,000
④ Water pump			40,000
⑤ Office			800,000
⑥ Sewerage treatment			100,000
⑦ Environmental preservation	(①+・・・+⑥) x 0.15		714,000
⑧ Temporary construction	(①+・・・+⑥) x 0.05		238,000
Total of infrastructure cost			5,712,000 $

(2) Main galley, incline and chute

On the assumption of the gallery cross section at 4m x 3m, the cross sectional area at 10.8m², the biting efficiency of the 80mm bore at 4m/bit, 51mm at 40m/bit, the volume of explosives at 25kg/m, the detonator at 14.8cap/m, the rock bolt at 9pc/line by 1.2m.

(9pc/line / 1.2m/line = 7.5pc/m) hitting ratio: 50%

·Gallery: 1,600m x 1.1 = 1,760m

·Incline: (170 + 150 + 80)m x 6 x 1.1 = 2,640m (inclination: 1/6)

·Chute: Ore (150 + 120 + 90)m + Waste (150 + 90)m = 600m (diameter of chute:2.5m)

·Total of roadway and chute: 5,000m

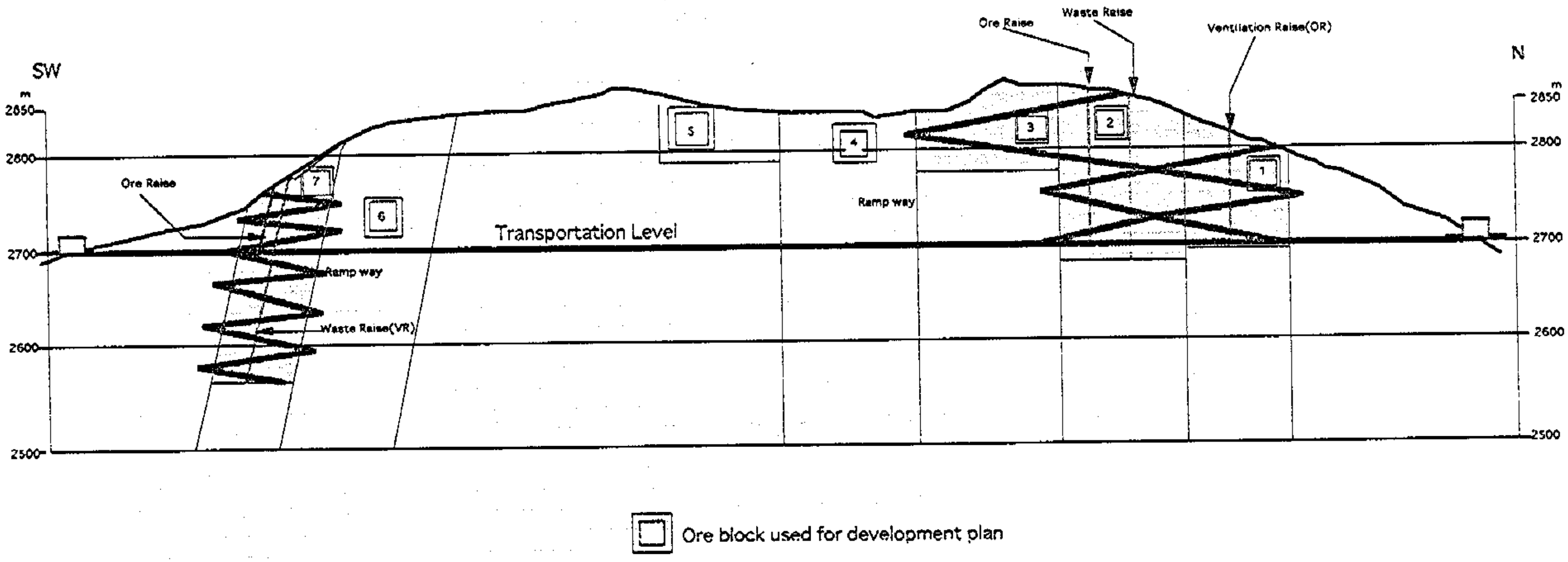
A conception of underground plan is represented in the next page.

·Paving of road: A 1,600m ore haulage gallery is covered with concrete.

① Ore haulage gallery :	1,600m x 900 $/m	=	1,440,000 $
② Main roadway:	2,800m x 700 $/m	=	1,960,000
③ Chute:	600m x 1,600$/m	=	960,000
Total of roadway and chute cost			4,360,000 $

(3) Mining machinery

·Drilling machine (1boom- hydraulic jumbo)	328,000$ x 2	=	656,000 $
·Hand drill	4,000$ x 8	=	32,000
·Loader (bucket cap. 3.8m³)	299,000$ x 3	=	887,000
·Loader(ditto 1.5m³)	188,000$ x 1	=	188,000
·Compressor (900cfm)			105,000
·Fan (150,000cfm)	30,000$ x 2	=	60,000
·Underground transmission			50,000



Conceptual Structure of Underground Development

-Bus	100,000\$ x 2	=	200,000
-Supplemental cars	30,000\$ x 4	=	120,000
Total of mining machinery cost			2,308,000 \$

(4) Initial investment costs

-Infrastructure	5,712,000 \$
-Main roadway and chute	4,360,000
-Mining machinery	2,308,000
Total of initial investment cost	12,380,000 \$

When crude ore reserves is 644 thousand tons, the initial investment costs per ton are estimated to be 19.2 \$.

5-2 Mining operating cost

The mining operation is assumed to be performed for 300 days a year on three-shift basis in 85% of the attendance rate. On the assumption the opening rate at 15m/t, the rate of ore associated with opening at5 %, rock bolt at 1pc/m^2, and the drilling rate at 50%. As the results of tentative calculation of production rate ranging from 100 tons to 600 tons of ore a day, a 100t/d (30,000t/y) is the optimum production. The costs of mining operation on 200t/d are shown as follows:

(1) Labor cost

① Underground worker

-Drilling: 60,000t x 15m/1000t x 4m/m / 52.5m/man = 69men

60,000t x 15m/1000t x 40m/m / 105m/man = 343men

60,000t x 0.95 / 2.86t/m^3 x 1.1m/m^3 / 105m/man = 209men

-Haulage

Haulage on driving: 60,000t x 15m/1000t x 10.8 m^2 x 1.6 = 15,552m^3

Haulage on mining: 60,000t x 0.95 / 2.86t/m^3 x 1.6 = 31,888m^3

Haulage on filling: 60,000t / 2.5t/m^3 = 20,979m^3

Temporary haulage to filling (12% of above total haulage):

68,419m3 x 0.12 = 8,210m^3

Haulage to surface:

(60,000t / 2.86t/m^3 - 60,000 x 13.4m/1000t x 10.8m^2 x 1.6) = 7,397m^3

Ore haulage: 60,000t / 2.86t/m^3 x 1.6 = 33,566m^3

(15,552 + 31,888 + 33,566)m^3 / 76m^3/man = 1,066men

(20,979 + 8,210 + 7,397)m^3 / 152m^3/man = 241men

·Explosives

(60,000t x 15m/1000t x 25kg/m + 60,000t x 0.95 / 2.86t/m³ x 1.89kg/m³) / 200kg/man

= 301men

·Rock bolt

Driving 60,000t x 15m/1000t / 1.2m/line x 9pc/line = 6,750pc

Mining 60,000t x 0.95 / 2.86t/m³ / 4m x 1pc/m² x 1.2 x 0.5 = 2,990pc

(6,750 + 2,990) bolts / 30pc/man = 325men

Total of men for main underground working 2,554men

When a worker increasing ratio on mining of small vein is 20% and main working rate is 70%, a total number of worker is assumed to be 4,379 men.

(2,554 men x 1.2 / 0.7 = 4,379 men)

The personnel arrangement is represented in the following table.

	1st shift	2nd shift	3rd shift	Total
Manager	1			1
Mining engineer	1			1
Geologist	1			1
Mechanician	1			1
Electrician	1			1
Foreman	1	1	1	3
Staff	6	1	1	8
Driller	2	1	2	5
Blaster	1	1		2
L.H.D. man	3	3	3	9
Timber man	1	1	1	3
Repair man	3	2	2	7
Surveyor	2			2
Guard	1	1	1	3
Clerk	1			1
Worker	14	9	9	32
Total	20	10	10	40

② Labor cost

Underground worker: 4,379men x 6 $/man = 26,274 $

Surface worker: 3,315men x 5.3 $/man = 17,570

Underground staff: 3men x 210$/man-month x 12months = 7,560

Surface staff: 3men x 190$/man-month x 12months = 6,840

Manager: 2men x 300$/man-month x 12months = 7,200

Administration cost: (49% of the above total) 32,395

Total of labor cost 97,839$

(2) Explosives cost

On the assumption of the volume of explosives in driving at 25kg/m, the number of detonator at 14.8cap/m, the volume of explosives in mining at 1.89kg/m^3, the number of detonator at 1.11cap/m^3.

-Explosives (900m x 25kg/m + 60,000 x 0.95 / 2.86t/m^3 x 1.89kg/m3) x 0.85$/kg = 51,143$

-Detonator (900 x 14.8cap/m + 60,000t x 0.95 / 2.86t/m^3 x 1.11cap/m^3) x 0.6$/cap = 21,265

・Others (15% of the above total) 10,861

Total of explosives cost 83,269$

(3) Rock tool cost

-80mm-bit: 900m x 4m/m / 300m/pc x 500$/pc = 6,000$

-51mm-bit: (900m x 40m/m + 60,000t x 0.95 / 2.86t/m^3 x 1.1m/m^3) / 700m/pc x 120$/pc
=9,930$

-12ft-rod : (900m x 44m/m + 60,000t x 0.95 / 2.86t/m^3 x 1/1 m/m3) / 2,500m/pc x 350$/pc
=8,613$

-Others: (15% of the above total) 3,681$

Total of rock tool cost 28,224$

(4) Fuel and lubricant cost

-Drilling machinery: 68hp x 0.06L/hp-hr x 1.2hr/d x 300d x 2units = 2,938L

-Loader: 81,006m^3 / 15.2m^3/hr x 1.1 x 185hp x 0.12L/hp-hr = 130,143

36,586m^3 / 30.4m^3/hr x 1.1 x 185hp x 0.12L/hp-hr = 29,389

-Supplemental car: 60hp x 0.06L/hp-hr x 6hr/d x 300d x 4units = 25,920

Total volume of light oil 188,390L

-Fuel cost: 188,390L x 0.2$/L = 37,678$

-Lubricant cost 37,678$ x 0.15 = 5,652

Total of fuel and lubricant coat 43,330$

(5) Tire cost

-Loader: 81,006m³ / 15.2m³/hr x 1.1 / 3,000hr/pc x 4pc x 3,900$/pc = 30,484$

36,586m³ / 30.4m³/hr x 1.1 / 3,000hr/pc x 4pc x 3,900$/pc = 6,884

-Others: (10% of the above total) = 3,737

Total of tire cost 41,105$

(6) Rock bolt cost

(6,750 + 2,990)pc x 10$/pc = 97,400$

(7) Electric power cost

-Drilling machine:	80kw x 0.8 x 0.7 x12hr/d x 300d x 2units	= 322,560kwh
-Fan:	75kw x 0.3 x 0.7 x24hr/d x 300d x 2units	= 226,800
-Compressor:	150kw x 0.7 x 0.6 x 21hr/d x 300d x 1unit	= 396,900
-Others:	(20% of the above total)	= 189,252
Total of electric power cost		1,135,512kwh

-Total electric power cost 1,135,512kwh x 0.025$/khw = 28,388$

(8) Repair cost

-Drilling machine:	2units x 80,000$/unit-year	= 160,000$
-Loader:	3units x 50,000$/unit-year	= 150,000
-Supplemental car:	4units x 10,000$/unit-year	= 40,000
-Others:	(10% of the above total)	35,000
Total of repair cost		385,000$

(9) Ore haulage cost

The distance from the mine to the refining plant is assumed to be 25km. Considering handling, the cost of ore haulage is determined to be 90% of the Makmal gold mine in Kyrgyz.

-Ore haulage cost: 60,000t x 5.23$/t x 0.9 = 282,600$

(10) Total mining operation cost (1)+・・・・・・+(9)

Annual mining operation cost is summed to be 1,087,155$, and the operation cost per ton of crude ore is calculated to be 18.1$.

6. Refinery

6-1 Initial investment cost

The plan is made on the assumption that a refining plant serves to be product at 500t/d on a basis. The initial investment cost at 500t/d is estimated to be 9 million $, of which: 7.2 million $ at facilities, 1.8 million $ at laboring cost. The initial investment cost by respective production is calculated by the following formula This investment cost includes a construction cost of a tailing dam

(Treatment volume t/d / 500t/d)$^{0.65}$ x 9 million $

When a daily production is 200t, it would be 4,961,140$

The initial investment cost per ton is estimated to be 7.7$/t.

4,961,140$ / 644,000t = 7.7$/t

6-2 Refining operation cost

A operation cost of a cyanidation plant is referred to the information of the Makmal mine. The operating cost of the Makmal mine is given at 16.2$/t. A breakdown of it and a presumed cost of Shyraldzhyn are as follows:

	Makmal		Shyraldzhyn
Commodity cost	49%	7.9$/t	6.3$/t
Electric power cost	10	1.6	1.6
Repair cost	25	4.1	3.3
Labor cost	6	1.0	1.0
Administration cost	10	1.6	
Total	100%	16.2$/t	12.2$/t

Although a gravity concentration is operated at the Makmal mine, the above cost can not be divided into details. The administration cost in the Makmal is expensive. In general, it is cheaper than that of Makmal. An administration cost is excluded in the operation cost in the Shyraldzhyn because we have no information about an organization of the administration division. The commodity and repair costs is assumed to be 80% of the Makmal because the plant in this program is new one. As the results, the total operation cost per ton is estimated to be 12.2$.

7. Detailed prospecting

It is necessary to conduct a detailed prospecting when a 644 thousand ton of crude ore is mined. The detailed prospecting is presumed to drill the blocks of No.1, 2, 3 and 7 in a grid of 50m x 50m from the surface. As the results of exploration plan, a total length of drilling exceeds by 2,000m. If the prospecting cost is 300$/m, a prospecting cost per ton is assumed to be 0.9$.

8. Conclusion

8-1 Revenues

Calculation is made on the assumptions of the ore grade at 5.1 g/t Au, the gold price at 360$/tr-oz, the metallurgical recovery at 85 %, and the electrorefining recovery at 95%.

Revenues per ton is estimated to be 47.7$.

5.1 g/t x 0.85 x 0.95 x 360$/tr-oz / 31.1g/tr-oz = 47.7$/t

8-2 Expenditures

Expenditures per ton is calculated as follows in a case of 200t/d.

-Initial investment cost (mining)	19.2$/t
· ditto (refining)	7.7
-Operation cost (mining)	18.1
· ditto (refining)	12.2
-Administration cost (10% of operation cost)	3.0
-Detailed prospecting cost	0.9
Expenditures per ton	61.1$/t

8-3 Conclusion

According to a table of comparison of respective production in the text, a loss per ton of crude ore is estimated to be 13.4$ in a case of 200t/d.

-Revenues per ton of crude ore	47.7$/t
-Expenditures	-61.1$/t
Loss	-13.4$/t

Even if the optimum production of 100 ton per day, a loss is reached to be 12.5$.

JICA