

CHAPTER 2 DRILLING SURVEY

2-1 Outline of drilling survey

In Phase III, underground drilling survey was conducted in the 1850m-level adit, where three drill chambers were prepared. The drilling work was performed at five boreholes, totaling 828.9m. Thanks to the solid rock conditions with little cracks and fractures, the average drilling efficiency substantially surpassed the planned rate of 8.8mpd, reaching 15.1mpd. The average core recovery was also as high as 99.5%

The MJKA-14 and 15, inclined drilling from the drill chamber No.1, and the MJKA-16 and 17, inclined drilling from the drill chamber No.2, ascertained marble on the hanging side of the ore deposit, the skarn zone where the deposit occurs and granodiorite on the footwall of the deposit. The MJKA-18, horizontal drilling from the drill chamber No.3, started from granodiorite on the footwall, passing through the skarn zone, and ascertained marble on the hanging side.

Details of the drilling operations are indicated in Table II-2-1

Table II-2-1 Result of the Drilling Survey

Drilling Chamber	No.1		No.2		No.3	Total
	MJKA14	MJKA15	MJKA16	MJKA17	MJKA18	
Direction	-	300 °	-	300 °	109 °	
Inclination	-90 °	-70 °	-90 °	-60 °	0 °	
Length (m)	181.0	150.5	206.0	161.0	130.4	828.9
Core Recovery(%)	99.3	99.8	99.4	99.8	98.9	99.5(Avg)
Efficiency(m/day)	20.1	15.5	21.3	11.8	10.0	15.1(Avg)

The survey period was 74 days from 15 June, 1999 (date of departure from Japan) till 27 August, 1999 (date of return to Japan), of which 61 days from 21 June to 20 August, 1999 were spent for the site survey.

The drilling work progress is tabulated in Table II-2-2

The drilling operation was performed with L-38 type drilling machines, mud pumps BG-10C and mud mixers furnished by the Kyrghyz side. Sets of spindles and motors which are highly damageable, as well as repair parts and main consumables such as bits, were procured in Japan and transferred in containers to the site. For the drilling machines, mud pumps and mud mixers,

Table II -2-2 Progress Record of the Drilling Survey

Contents of Study	June	July	August	September
Trip to Kyrgyz	15 - 20			
Receive the Equipment	21			
Preparation	21 - 2			
Drilling	23		17	
Reparation			18 - 20	
Trip to Japan			21 - 27	

proper maintenance and repair were done while their engine units were replaced with motors for underground use. In Phase III, however, the mud mixers were eventually dispensed with as drilling was done with clear water, without cementing. Power for the drilling operation was supplied with cables connected with a generator installed on the surface.

Major equipment and machinery are listed in Table II-2-3

Table II-2-3 List of the Used Equipment of the Drilling Survey

Item	Model	Quantity	Capacity, type and Specification
Drilling Machine	L-38	2	φ 76mm:565m, 22kw, 380V, 50Hz
Mud Pump	BG-10C	2	120liter/min, 11kw, 380V, 50Hz, Piston φ 80mm
Mud Mixer	M1e-200	2	3.7kwh, 100rpm, 3.7kw, 380V, 50Hz
Generator	SP-200	1	200KVA, 265PS

The wireline method was employed for the drilling operation to ensure high drilling efficiency. For the initial drilling, the 116mm bits were used, which were later replaced by the HQ and finally by the NQ. The drilling operation was performed by two units in three 8-hour shifts, with a foreman and four operators per unit-shift. For drilling water, the underground water obtained in the 1850m-level adit was utilized.

Results of the drilling work are compiled in Table II -2-4 , whereas Appendices 23 thru 27 indicate the work progress, consumption of drilling articles and diamond bits, drilling meter of diamond bits, work details and deviation measurement.

Table II-2-4 General Results of the Drilling Works

Item		MJKA14	MJKA15	MJKA16	MJKA17	MJKA18	Subtotal
Drilling chamber		No.1	No.1	No.2	No.2	No.3	
Period		15 July. '99 } 28 July. '99	3 July. '99 } 15 July. '99	29 June '99 } 10 July '99	11 July. '99 } 31 July. '99	1 Aug. '99 } 20 Aug. '99	
Total days		14.0	12.3	12.0	21.0	20.0	
Direction		-	300°	-	300°	109°	
Inclination		-90°	-70°	-90°	-60°	0°	
Length of drilling (m)		181.0	150.5	206.0	161.0	130.4	828.9
Length of core (m)		179.7	150.2	204.8	160.7	129.0	824.4
Core recovery (%)		99.3	99.8	99.4	99.8	98.9	99.5
Bit	φ 116mm	4.0m	4.0m	4.0m	4.0m	1.0m	
	HQ	106.6m	71.7m	104.5m	66.6m	40.6m	
	NQ	70.4m	74.8m	97.5m	90.4m	88.8m	
Casing	HW	4.0m	4.0m	4.0m	4.0m	1.0m	
	NW	110.6m	75.7m	108.5m	70.6m	41.6m	
	BW					129m	
Drilling (day)*		8.0	9.7	9.7	10.3	12.0	49.7
Drilling (day)**		9.0	9.7	9.7	13.7	13.0	55.0
Efficiency (m/day)*		22.6	15.5	21.3	15.6	10.9	16.7
Efficiency (m/day)**		20.1	15.5	21.3	11.8	10.0	15.1

* working days

** including out of working days

2-2 Drilling operations of each hole

Details of the drilling operation by boreholes are given in the following paragraphs:

(1) MJKA-14 (Inclination -90° ; length 181.0m)

The drilling started on 15 July and ended on 22 July, 1999.

From the mouth of the borehole to 4.0m, drilling was done with a 116mm bit which was replaced by an HQ for drilling from there to 110.6m, where NW casing pipes were inserted and drilling was continued with an NQ until reaching 181.0m.

From around 35m, began loose return which grew to a complete loss of circulation at around 80m. To ensure return of drilling water, the NW casing pipes were inserted. A complete loss of circulation took place again at around 150m, which however caused little harm to the drilling operation thanks to the high water level in the drillhole. The drilling efficiency at the borehole was as high as 20.1mpd while the core recovery at a rate of 99.3% was attained.

As regards rocks, marble continued from the mouth to 102.4m, where the skarn zone appeared and continued up to 131.0m. At this point, it changed to granodiorite on the footwall side. The drilling was continued up to 181.0m in pursuit of the arsenopyrite veins.

(2) MJKA-15 (Direction 300° ; inclination -70° ; length 150.5m)

The drilling started on 5 July and ended on 14 July, 1999.

From the mouth to 4.0m, drilling was done with a 116mm bit, which was then replaced with an HQ. At 75.7m, NW casing pipes were inserted and the bit was changed to an NQ for further drilling up to 150.5m.

A complete loss of circulation took place at around 40m, which however caused no serious harm to the drilling work; the drilling efficiency of 14.1mpd and core recovery at 99.8% were attained.

As regards the rocks, marble continued from the mouth to 72.3m, from where to 110.2m observed was the skarn zone. From 110.2m, it changed into granodiorite on the footwall side. The drilling was continued up to 150.5m in pursuit of arsenopyrite veins.

(3) MJKA-16 (Inclination -90° ; length 206.0m)

The drilling started on 30 June and ended on 09 July, 1999.

From the mouth to 4.0m, drilling was done with a 116mm bit, then replaced

with an HQ. At 108.5m, NW casing pipes were inserted while the bit was changed to an NQ for further drilling up to 206.0m

Water began flowing at 26m and increased at around 40m, which later turned to circulation loss coming to a complete loss at around 160m. Nevertheless, the drilling efficiency reached 19.3mpd, while the core recovery was 99.4%.

Marble continued from the mouth to 104.8m where the skarn zone appeared and lasted till 118.6m. At this point, the rock changed to granodiorite on the footwall. The drilling was continued up to 206.0m in pursuit of arsenopyrite veins.

(4) MJKA-17 (Direction 300° ; inclination -60° ; length 161.0m)

The drilling started on 11 July and ended on 20 July, 1999.

From the mouth to 4.0m, drilling was done with an 116m bit, then replaced with an HQ. At 66.4m, NW casing pipes were inserted and the bit was replaced with an NQ for further drilling up to 161m.

Although some circulation loss was experienced near the boundary between skarnized granodiorite and granodiorite at around 85m, the drilling was continued without troubles. The drilling efficiency was 14.2 mpd while the core recovery was 99.8%.

Marble continued over 66.4m from the mouth; then, the skarn zone appeared and continued up to 85.1m. At this point it changed to granodiorite on the footwall. The drilling was continued up to 161.0m in pursuit of arsenopyrite veins.

(5) MJKA-18 (Direction 109° ; inclination 0° ; length 130.4m)

The drilling started on 03 Aug and ended 13 Aug, 1999.

The drilling was done in the regular method with a 116mm bit from the mouth to 1.0m, which was then replaced with an HQ for further drilling up to 41.6m. At this point, NW casing pipes were inserted and the drilling method was shifted to the wireline method for further drilling up to 130.4m.

From around the 50m point, water began flowing at a rate of 10 to 20 litres per min., which however caused no trouble to the drilling work. Thanks to the solid rock condition with little cracks, the drilling efficiency was 10.0 mpd and the core recovery was 98.9%.

Granodiorite continued from the mouth to 23.8m, followed by gabbro up to 109.9m and the skarn zone up to 118.4m. After the point, the drilling was continued up to 130.4m passing through the marble on the hanging side.