3) Benefication Results

It can be estimated on the basis of the results of beneficiation tests made in the present survey in Mexico that mixture processing will result in an increase in Au and Ag recovery rates by 6 to 7% in comparison with those for separate processing of oxidized ore and sulfidized ore.

Consequently, when the modernization plan is carried out, the results obtained for separate processing of cyanidation and bulk flotation (records for January to June, 1989, Table 3.7.2.) are expected to be improved as follows:

Au recovery rate: 25.9% x 1.067 = 27.6%

Ag recovery rate: 62.7% x 1.067 = 66.9%

Table 8.1.2 shows the results expected to be obtained after the system is improved.

4) Rough Estimate of the Construction Cost for Improvement of the Processing System

Figures 8.4.1 and 8.4.2 show the present system and the improved system respectively.

Machines to be installed

Conditioner	1 unit (11 KW)
Flotator	10 cells (30 KW)
Pump	3 units (18 KW)

Estimate of Construction Cost:

Cost of Construction including Piping Work:

18,500,000 pesos

(2) Instrumentation

1) Installation of Constant Mill Feeder

a) Purpose

The amount of ore to be fed to the ball mills is continuously measured, and the exeed of the fine grain bin extraction conveyor is automatically controlled, so that ore is fed to the ball mills at a constant rate.

b) Contents of Construction Work and Rough Estimate of the Construction Cost

Three feeder sets will be installed for No. 1, No. 2 and No. 3 ball mills.

Specifications:

Scale (CS-EC-S1, maximum weighing capacity 90 t/n)

Speed controller EH782

Wide range meter, Converter

VS motor (2.2 KW)

Control panel, Operation panel

Rough Estimate of the Cost:

Installation cost	106,000,000 pesos
Price of three feeder sets in total	318,000,000 pesos

c) Effects:

o Stabilization of the processing rate

o Reduction in the occurrence of operation problems

o Improvement of the operation rate of the facilities

o Reduction in the maintenance cost

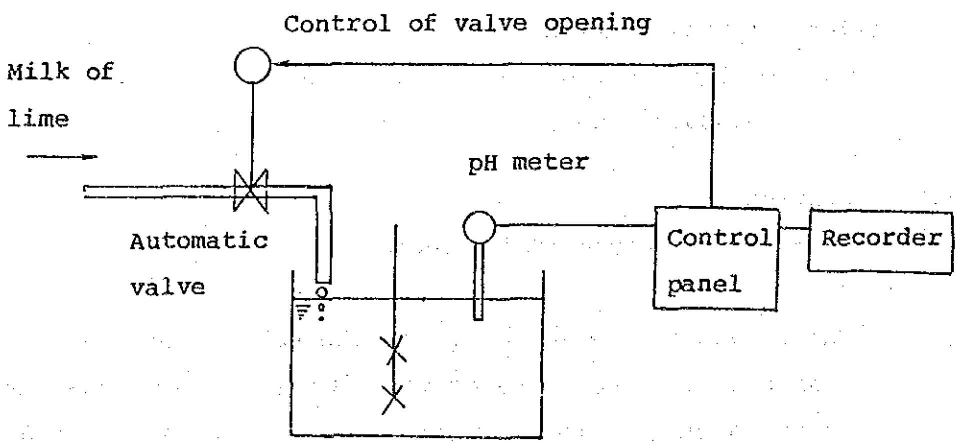
o Improvement of the recovery rates

o Labor saving

2) Automatic pH Control System

a) Purpose: Measurement of cyanidation pH with an electrode and automatic control of the amount of lime to be added.

b) Control Flow:



Cyanidation agitator

c) Specifications and Rough Estimate of the Cost:

pH meter	AC100V, four-wise type
Controller	AC 100V, IN OUT DC 4-20 mA
Recorder	AC 100V, IN DC4-20 mA
Line control valve	

Overal cost including the construction: 34,200,000 pesos

d) Effects:

o Stabilization of cyanidation pH

o Improvement of the recovery rates for Au and Ag

o Reduction in line consumption

3) Problem Alarm System for Mechanical and Electrical Facilities

a) Purpose: To prevent problems due to overload meter relays are installed in the motors of major machinery, so that an alarm is given when the load exceeds a set level, and the machine is automatically shut down when the load reaches a limit value.

b) Specifications and Rough Eximate of the Cost

Meter relays	20
Display panel	
Power supply set	

Total cost including installation: 55,650,000 pesos

c) Effects

o Reduction in the occurrence of failure of a motor or equipment

o Reduction in the maintenance cost

o Improvement of the operation rate of the facilities

o Labor saving

4) Television Camera Monitoring System

a) Purpose: The operation conditions of the mechanical equipment and the systems are monitored with television cameras to detect abnormalities in the early stages.

b) Monitoring Locations

Ball mill feeding ports	3 locations
Flotator floss	2 locations
Cyanidation thickener extract	2 locations
Total	7 locations

c) Specifications and Rough Estimate of the Cost

Monitor	Monochrome	1 unit
Camera	Monochrome	7

Total Cost including installation cost: 79,700,000 pesos

d) Effects:

- o Prevention of problems
- o Reduction in the maintenance cost
- o Improvement of the operation rates of the equipment
- o Improvement of the recovery rates
- o Improvement of the working environment

(3) Personnel Planning

The total number of workers of Barones Beneficiation Plant is 122, and this is thought to be to many for the scale of a plant for beneficiation of about 9,000 tons of ore.

The plant can be operated and managed by 101 workers, the number being reduced by 21, when the ore purchase conditions are improved and the administration section is rationalized, as shown in the modernization plan commion to the three beneficiation plants, and the beneficiation process is improved and instrumentation is completed according to the modernization plan for the existing facilities of Barones Beneficiation Plant.

Since 21 additional workers are required to operate the new plant to be built on the site of Barones Beneficiation Plant according to the improvement plan, all 122 worker can still be employed in Barones Plant.

Personnel Planning Table

Section. Position	Number of Workers		
	Moderniza-tion Plan	State as of September, 19891	Change
Operation section	(27)	(30)	(3)
Three-shift foremen	5	5	
Ore receiving	2	2	
Crushing	6	6	
Grinding	3	6	3
Flotation	3	3	
Cyanidation	6	6	
Concentrate dehydration	2	2	
Maintenance	(20)	(23)	(3)
Mechanical service	15	17	2
Electrical service	5	6	1
Experiments and analysis	12	14	2
Administration	(39)	(52)	(13)
Accounting, supply	11	13	2
Commissioning, ore purchasing	5	9	4
Drivers and others	23	30	7
Staff	3	3	
Total	101	122	21

(4) Economic Evaluation

1) Amount of Facility Investment

	000 pesos
Improvement of the processing system	18,500
Instrumentation	487,550
Constant mill feeder	318,000
Automatic pH control system	34,200
Problem alarm system	55,650
Television camera monitoring system	79,700
Subtotal	506,050
Rationalization of the administration Section	106,000
Total	612,050,000 pesos

2) Balance Improvement

a) Improvement of the recovery rates

The sales of concentrates are estimated as follows on the basis of the beneficiation results which will be achieved after the existing facilities are modernized:

	(US$/month)	(000 pesos/month)
Bulk cocentrate	136,868	362,700
Au, Ag precipitate	17,482	46,327
Total	154,350	409,027

Sales of each kind of metal

	(US$/month)	(000pesos/month)	Beneficiation recovery rate (%)	Sales for 2% in the benficiation recovery rate (000 pesos/ month.%)
Au	10,143	26,879	23.5	1,144
Ag	144,207	382,148	59.9	6,380
Total	154,350	409,027		

When the beneficiation process is improved, the recovery rates of Au and Ag will increase by approximately 1.4% and 2.8%, respectively. When the instrumentation plan is carried out, they will also increase by 0.6% and 1.2%, respectively. Consequently, the Au recovery rate will increase by 2.0%, and the Ag recovery rate will increase by 4.0%.

Sales Increase

Au	1,144,000 pesos/month.% x 2.0% =	2,288,000 pesos/month
Ag	6,380,000 pesos/month.% x 4.0% =	25,520,000 pesos/month
Total		27,808,000 pesos/month
		(3,071 pesos/ton of crude ore)

b) Reduction in Labor Cost

According to the records of Barones Beneficiation Plant from January to June, 1989, the average labor cost per man is estimated as follows:

Wages	539,000 pesos/man.month
Subordinate personnel expenses	154,000 pesos/man.month
Total	703,000 pesos/man.month

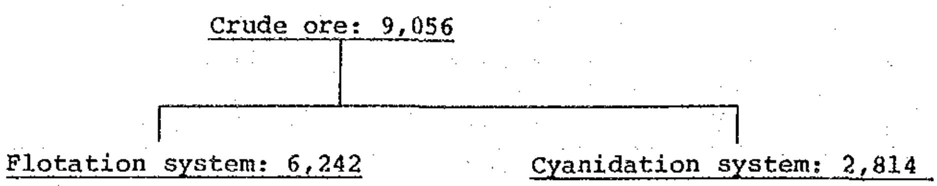
When the number of workers is decreased by 21, the labor cost reduction will be

703,000 pesos/man.month x 21 men = 14,763,000 pesos/month

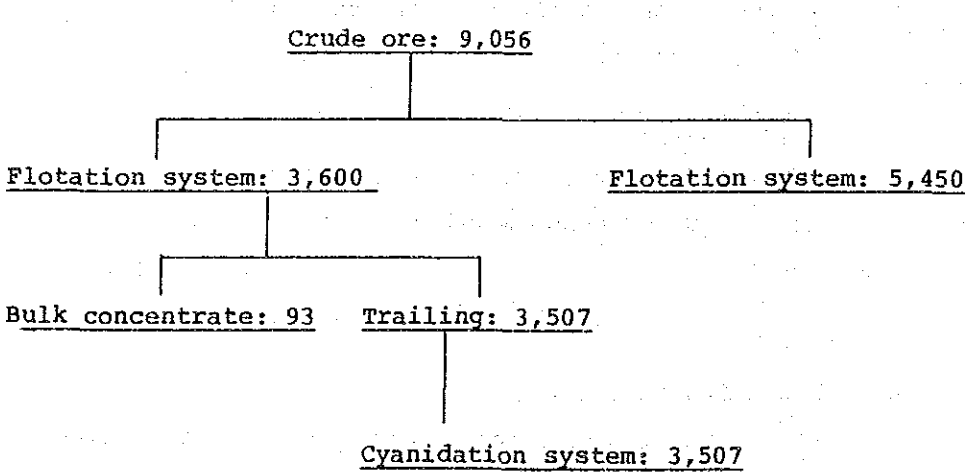
c) Expenses for Consumables Materials

1 Amount of the ore processed in each system (t/month)

Present State (Record for January to June, 1989)



Modernization Plan



2 Expenses for Consumable Materials per Ton of Crude Ore

According to the records for January to June, 1989 the expenses for consumable materials used in the flotation system and the cyanidation system amount to 1,991 pesos/ton of crude ore and 9,703 pesos/ton of crude ore, respectively.

In the modernization plan, the expense for consumable materials used in the flotation system is expected to be 1,991 pesos/ton crude ore, the same amount as that in the actual records. On other hand, the expense for consumable materials used per ton of crude ore in the cyanidation system is expected to be about 70% of the amount in the actual records (6,792 pesos/ton of crude ore), because 70 to 80% of Au and Ag is recovered in the previous stage of flotation, and consumption of reagents such as sodium cyanide in the cyanitation system is decreased.

3 Increase in the Expenses for Consumable Materials

Present state

1,991 pesos/t x 6,242 t/month + 9,730 pesos/t x 2,814 t/month = 39,732,000 pesos/month

Modernization Plan

1,991 pesos/t x (3,600 + 5,456) t/month x 6,792 pesos/t x 3,507 t/month

= 41,851,000 pesos/month

Increase

14,851-39,732 = 2,119,000 pesos/month

d) Increase in the Power Expenses

The additional power required by system modification such as installation of the flotator and other machines is 59 kW, which results in an increase of the power expenses as follows:

59 KW x 52% x 24 HR/day x 26 day/month x 97.0 pesos/KWH

= 1,857,000 pesos/month

e) Overall Balance Improvement:

	000 pesos/month	pesos/ton of crude ore
Improvement of recovery rates	27,808	3,071
Reduction of labor cost	14,763	1,630
Increase of expenses for consumable materials	2,119	234
Increase in power expenses	1,857	205
Total	38,595	4,262

3) Investment Efficiency

Facility Investment 612,050,000 pesos

Depreciation Fund (10 years) 4,845,000 pesos/month

$612,050 \times 0.95 \times 1/10 \times 1/12 = 4,845$

Interest (5% per year) 1,275,000 pesos/month

$612,050 \times 1/2 \times 0.50 \times 1/12 = 1,275$

Balance Improvement 38,595,000 pesos/month

Investment Efficiency

ARR: $$\frac{(38,595-4,845-1,275) \times 12}{612,050} = \frac{389,700}{612,050}$$

$= 63.7\%$

PB: $$\frac{612,050}{389,700} = 1.57 \text{ year (approximately one year and a half)}$$

8.5 Improvement Plan for Developing a New Beneficiation Plant in Barones

(1) Outline of the Improvement Plan

The outline of the improvement plan is summarized as follows:

1) Site: Barones Beneficiation Plant in Zacatecus
2) Processed ore: 150 t/day x 26 day/month = 3,900 t/month
3) Beneficiation method: Pb-Cu-Zn selective flotation
4) Processing systems
   Ore receiving -- crushing -- grinding -- flotation -- concentrate dehydration
5) Estimate of the Construction Cost

Cost of equipment :	US$3,029,000
Contruction cost:	1,569,000
Cost of mechanical and electrical equipment istallment	1,449,000
Total	US$6,047,000
Peso equivalent (2,650 pesos/US$)	16,024,550,000 pesos
Yen equivalent (143 yen/US$)	864,721,000 yen

(2) Estimation on Construction Work

1) Conditions for Design

a) Nominal beneficiation capacity 150 dry-t/day
b) Number of working days 26 days/month
c) Operation hours
   Crushing system 12 hr/day, 2 shifts (12.5 dry-t/hr)
   Grinding and downstream 24 hr/day, 3 shifts (6.25 dry-t/hr)
d) Descriptions of crude ore
   1 Transportation to ore acceptance bin in beneficiation plant
     Dump trucks
   2 Grain size Max. dia. for ore acceptance: -200 mm

3 Moisture 2.65%

4 True specific gravity 3.80 (apparent specific gravity 2.0)

5 Hardness Work index: some 13 - 14 kWh/t

e) Projected construction site

In Barones beneficiation plant, Zacatecas City, United Mexican States.

Altitude: 2,500 m (above sea level)

f) Bearing capacity of projected site 12 t/m2 or more

g) Power source 3 , 60Hz, 13,200V, 440V, 120V

h) Water supply Pumps will be installed at the water source 1 km from the projected site.

2) Conditions for Estimations

a) Basic Policies

1 The estimation was done in such a way that the entire construction work (design, furnishing of machines, appliances and materials, construction work, test run, training of operators, etc.) would be carried out at the site in Mexico.

2 The construction cost was based on the prices as the last of January, 1990, and has not considered price hikes during the construction period (two years in total) and before starting the work.

b) Scope for Estimations

1	Machines, appliances and major facilities	Grouped together
2	Preparation of plant site, foundation work and civil engineering work	One
3	Building work including sheds with steel frames	One
4	Installation of machines and electric facilities	One
5	Facilities for water supply including 1 km long piping	One

c) Items excluded

1 Design cost

2 Wiring work introducing necessary electric power to an incoming panel in the plant (including materials and construction work)

3 Management expenses for construction work and operator training

4 Incidental facilities (offices, repair shops, warehouses, analyzing instruments and tools, etc.)

5 Expenses for temporary facilities (prefabricated houses for construction work, temporary power source and water supply, etc.)

6 Other items not described in the estimation

d) Construction period 24 months from commencement of construction work

Machines and Facilities to be Supplied

Item No.	Name	Specification	Number
	Crushing Facilities US$599,264		
1	Crude Ore Bin	100T capacity 3mW x 5mL x 4mD, H=10m including retaining wall	1
2	Pan Conveyor	12.5t/hr 1.2mW x 10mL x 11kW	1
3	Jaw Crusher	-200mm, 12.5 t/hr, 20"x36"x37kW	1
4	Belt Conveyor	25 t/hr, 600W x 20mL x 3.7kW	1
5	Vibrating Screen	25 t/hr, 4' x 8' x 7.5kW 3/4" openings (mesh), single deck, rubber	1
6	Cone Crusher	15 t/hr, 4' ϕ short-head type x 55kW	1
7	Belt Conveyor	15 t/hr, 600W, 20mL x 2.2kW x 1 5.0m x 1.0kW x 2, 6mL x 1.0kW x 1	1 set
	Grinding Facilities US$733,370		
8	Fine Ore Bin	100T capacity 5.0mϕ x 6.0mH with 4mH stand	2
9	Belt Conveyor	600W x 10mL x 2.2kW x 2	2
10	Belt Conveyor	600W x 30mL x 3.7kW with load cells	1
11	Ball Mill	1.5 t/hr with rubber liner 7' x 7' x 150kW	
12	Pump	5" x 4", SRL-C x 7.5kW, 1,800 rpm	2
13	Cyclone	15B with rubber lining and valve	2
14	Scalp Flotation	Unit type x 11 kW	1

Item No.	Name	Specification	Number
	Flotation Facilities US$193,947		
15	Conditioner	6ø x 6'H x 5.5kW	1
16) 17	Cu. Pb Bulk Rougher and Scavenger	D-R #24 4 cells x 2 motors x 11kW x 1,800 rpm	8
18	Cu Pb Bulk Cleaner	FW 4 cells x 2 motor x 5.5kW	8
19	Pump	SRL-C, 3" x 3" x 3.7kW, 1,800 rpm	1
20	Conditioner	6'ø x 6'H x 5.5kW	1
21	Cu Pb Separator	FW 4 cells x 2 motors x 5.5kW	8
22) 26) 30) 36	Pump	SRL 3" x 3" x 3.7 kW 1,800 rpm	
31	Pump	SRL-C, 4" x 3" x 5.5kW	1
32	Conditioner	6'ø x 6'H x 5.5kW	
33) 35	Zn Rougher Scavenger	D-R #24 4 cells x 2 motors x 11kW x 1,800 rpm	8
34	Zn Cleaner	FW 4 cells x 2 motors x 5.5kW	8
	Concentrate Dehydration Facilities US$373,700		
23) 27) 37	Thickener	20'ø x 10'H x 1.2kW	3
25) 29) 39	Filter Press	Manual press, frame of cast iron 1.0m x 1.0m x 40 chambers Hydraulic pump 0.75kW Centrifugal pump 3.7kW	3
24) 28) 38	Pump	SRL, 3' x 3' x 3.7kW 1,800 rpm	3

Item No.	Name	Specification	Number
	Other Facilities	US$1,129,888	
40	Pump	SRL-C, 4" x 3" x 5.5kW	1
41	Rotary blower	Single-stage compression $20m^3$/min x 1,500mmAq x 11kW x 4P with silencer	2
42	Water tank	L50m^3 steel tank, supply piping 3Dkm x 1 0.3m^3/min x 90mH x 11kW with pump	1
43	Crane	Mill-stage 10t, hoist 10.5 kW, traversing 1.2kW, travelling 15kW, span 10m	1
44	Crane	Floatation stage 3t, hoist 5.0kW traversing 1.2kW, travelling 0.8kW span 12m	2
45	Reagent facility	28 pumps Reagent tanks, lime facility, etc.	1 set
46	Water supply	4^B	1 set
47	pH meter	pH meter (5) pH meter with controller (2)	1 set
48	Load cell	For conveyor	1
49	Power receiving facility	Incoming panel x 1 High voltage panels 150kW, 55kW 1 each Transformers 500kVA x 1.75kVA x 1 Condensers, etc.	1
50	Control center	Control panel in electric distribution room equivalent to 40 motors 440V cables and bus bars	1 set
51	Desk-top X-ray spectrometric analyzer	Analysis equipment for pulp density	1 set
52	Grinding size analyzer	Denver Automatics (On line)	
53	Instrumentation		1 set
54	Valves, etc.	6" --> 3/4" various valves, packing, sealing materials, consumables	1 set
	Total	US$3,030,169	

Civil Engineering Work

No.	Subject Name	Detail	Number	US$
				in thousands of dollars
1	Foundation for water tank	Foundation for 200t water tank Concrete volume	1	
2	Foundation for 100t bin	Foundation for 2 100t bins Concrete volume $182m^3$	1 set	
3	Filter press concrete stand	18mL x 10mW x 5mH stand Concrete volume $216m^3$ Floor concrete $282m^2$	1 set	
4	Ground leveling (Grading)	150m x 80m + 12,000 m^2 Excavation volume (1.5m depth in average) $18,000m^3$ Roads 150m Drainage ditch 460m	1 set	
5	Foundation for crushing mill	Foundation for jaw crusher $120m^3$ Foundation for cone crusher $120m^3$ Foundation for ball mill $44m^3$ $284m^3$	1 set	
6	Floor and foundation for stand in floatation-grinding shop		1 set	
7	Foundation for thickener	Foundation for 3-6m⌀ thickeners Concrete volume $137m^3$	1 set	
8	Pile driving	100 piles for buildings, crushers, thickeners, press stands, water tank, etc.	1 set	
9	Miscellaneous	Fire-hydrant facility	1 set	
	Total		1 set	762

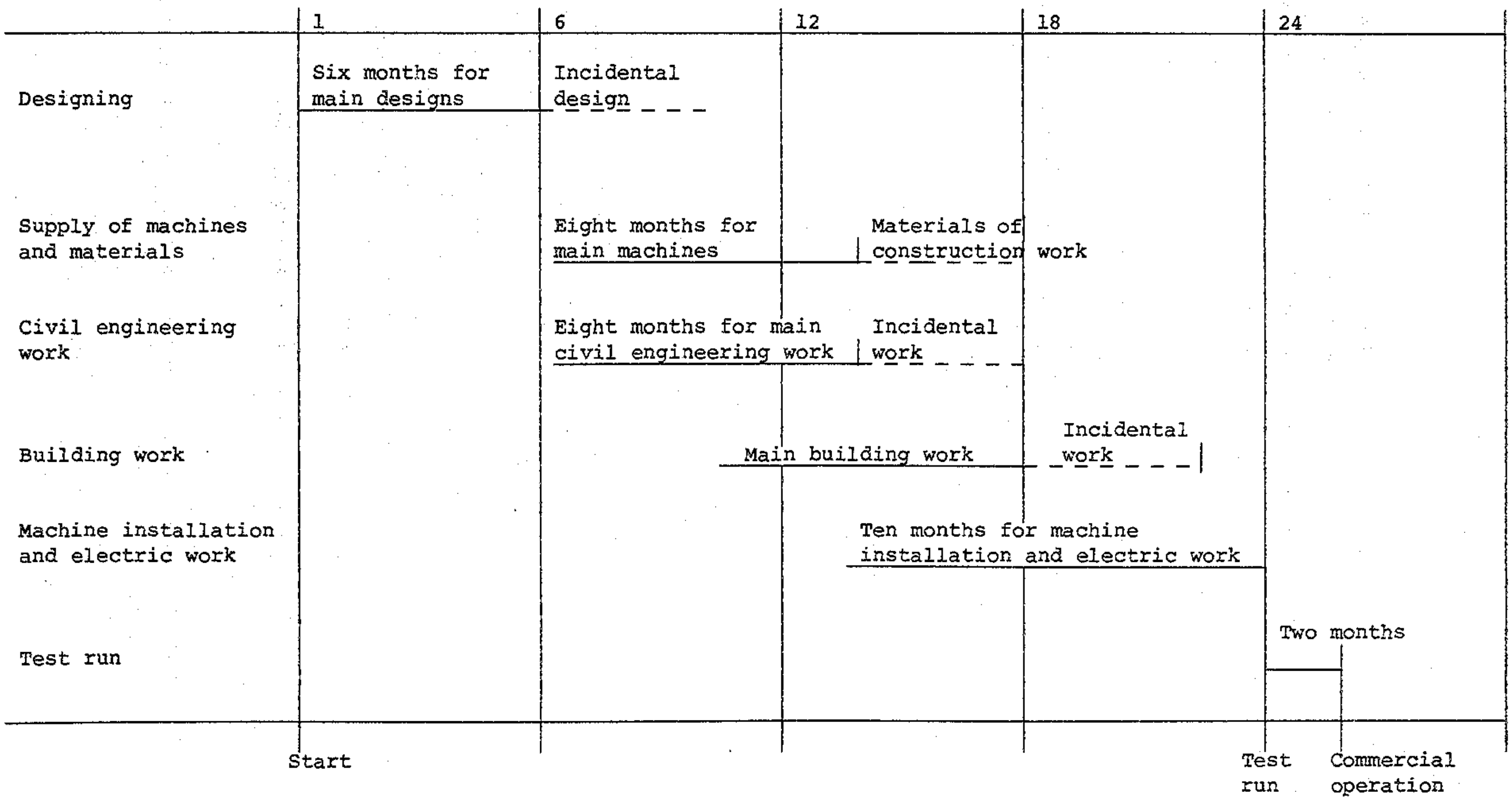
Building Work

No.	Subject Name	Detail	Number	US$
				in thousands of dollars
1	Grinding / floatation shop	Slated steel frame 28m x 30m x 10mH one house 840 m^2	1 set	
2	Crushing shop	Slated steel frame 10mL x 10mW x 10mH 2 houses 100 m^2/1 house	1 set	
3	Electric equipment room	Room space 10m x 10m 1 house	1 set	
	Total			807

Machine Installation Work

No.	Subject Name	Detail	Number	US$
				in thousands of dollars
1	Installation of purchased machines	45 persons x 10 months x 25 days x @	1 set	
2	Floor for stands	Grinding 28x30x0.7=588m^2 Crushing 10mx10mx2x0.7 = 140m^2 Total 728m^2		
3	Corridors, stairs	Thickener, etc.	1 set	
4	Piping	For water supply, pond, blowers, reagents, etc. Preparation of materials and installation of racks, piping, joints	1 set	
5	Miscellaneous		1 set	
	Total			1,136

Time Schedule for Construction Work (Draft)



(3) Production Plan

The income of the new plant was estimated on the basis of the plan for the grade of original ore to be processed and the recovery rates. Table 8.1.2 shows the expected beneficiation results, and Table 8.5.1 shows the calculated sales of concentrates.

1) Grade of Crude Ore

Records for January to June, 1989	Au	Ag	Pb	Zn	Zn	
	0.8 g/t	160 g/t	0.8%	0.4%	1.6%	3,900 t/month
	0.4	126	0.7	0.3	1.2	3,651 "

2) Beneficiation Recovery Rates

Au	Ag	Pb	Cu	Zn
33%	76%	73%	87%	68%

3) Sales of Concentrates

	(US$/month)	(Pesos/ton of crude ore)	(%)
Pb concentrate	53,429	36,304	36.7
Cu concentrate	53,629	36,440	36.9
Zn concentrate	38,438	26,118	26.4
Total	145,496	98,862	100.0

Values after subtraction of 11,154 US$/month for ore production taxes (7% for Au and Ag and 5% for Pb, Cu and Zn).

Calculations were performed on the following conditions:

a) IMMSA smelting conditions

b) I.V.A. not included

c) The average market prices of metals in January to June, 1989

Au: 388.119 US$/TOZ

Aq:	569.281	US cents/TOZ
Pb:	633.944	US$/MT
Cu:	131.951	US cents/LB
Zn:	1819.577	US$/MT

(4) Estimates of Costs

The costs were estimated on the basis of the records from January to June, 1989.

1) Total Beneficiation Cost: 16,265 pesos/ton of crude ore (I.V.A. not included)

a) Labor Cost: 3,785 pesos/ton of crude ore

(Personnel Planning)

Ore receiving and crushing	1 x 2 + 1 = 3
Grinding, flotation, and dehydration	2 x 3 + 1 = 7
Mechanical and electrical equiment	2
Plant supervisor	1
Three-shift foremen	1 x 3 + 1 = 4
Office workers	2
Experiment and analysis staff	2
Total	21

Wages: 549,000 pesos/month x 21   3,900 t/month
= 2,956 pesos/ton of crude ore

Subordinate personnel expenes
154,000 pesos/month x 21   3,900 t/month
= 829 pesos/ton of crude ore
Total 3,785 pesos/ton of crude ore

b) Expenses for Consumable Materials

7077 pesos/ton of crude ore (I.V.A. not included)

Kind of materials	Consumption (g/ton of crude ore)	Unit cost (Pesos/kg)	Cost (pesos/ton of crude ore)
Frother agent	35	3,229	113
Xanthate	60	5,283	317
AF#242	5	9,043	45
NaCN	80	2,935	235
$ZnSO_4$	100	1,026	103
$CuSO_4$	250	1,683	421
$Ca(OH)_2$	1,300	90	117
(Subtotal for chemicals)			(1351)
Ball (3")	1,500	1,006	1510
Liner			609
Lubricating oil			130
Others			3,477
		Total	7,077 pesos/ton of crude ore

c) Power Expenses: 4,015 pesos/ton of crude ore (I.V.A. not included)

Rated power consumption of equipment	(KW)	Operation time (H/day)
Crushing	130	12
Grinding, Flotation, etc.	435	24
Lighting	85	24
Total	650 KW	

Actual Power Consumption

Rated power consumption x 52%

Unit cost: 82.5 pesos/KWH

Power expenses per ton of crude ore:

(30 KW x 12 H + 520 KW x 24 H) x 0.52 150 t/day x 82.5 pesos

= 4,015 pesos/ton of crude ore

c) Cost of Tailings Diposal: 188 pesos/ton of crude ore

Since it is planned that tailings of 3,665.6 t/month are to be piled up for the dam now in use in Barones Beneficiation Plant, the cost of managing and maintaining the dam is estimated at 200 pesos per ton of crude ore.

200 pesos/ton of tailing x 3,665.6 t 3900 t

= 188 pesos/ton of crude ore

d) Expenses for Water: none

It is planned to use fresh water at a rate of 3 m^3/ton of crude ore (0.3 m^3/minute). According to the plan, a pump will be isntalled at the water source 1 km away from the new plant to supply water through a 3" pipe. Since the cost of installing the pump and the pipe is included in the construction cot the expenses for water is estimated to be nil.

e) Assayig Cost: 1,200 pesos/ton of crude ore

Crude ore received will be assayewd in lots of 75 tons of crushing production. A dry assay will be done for Au and Ag, and a wet assay for Pb, Cu and Zn in the assay room of Barones Beneficiation Plant.

Unit Cost of Analysis

Au, Ag	30,000 pesos for each sample
Pb, Cu, Zn	10,000 pesos for each sample
Total	90,000 pesos

Assay cost per ton of crude ore

90,000 pesos + 75 tons = 1,200 pesos/tonof crude ore

It is planned that operation management analysis will be carried out by two persons in the analysis laboratory with a fluorescent X-ray analyzer. The cost of installing the analyzer is not included in the assaying cost but in the construction cost.

f) General Administrative Cost 1,266 pesos/ton of crude ore
(I.V.A. not included)

According to the records of Barones Beneficiation Plant from January to June, 1989,

Processed ore : 9,057 t/month

General management cost: 1,811 pesos/ton of crude ore

When the new plant is put into operation,

Processed ore : 9,057 + 3,900 = 12,957 t/month

General management cost:

1,811 x 9,057   12,957 = 1,266 pesos/ton of crude ore

g) Overall Beneficiation Cost:

The total of the costs of a) to f) is obtained as follows:

Labor cost	3,785 pesos/ton of crude ore
Expenses for consumable materials	7,077
Power Expenses	4,015
Cost of Tailings disposal	188
Expenses for water	0
Assay cost	1,200
General management cost	1,266
Total	16,265 pesos/ton of crude ore

2) Distribution Cost 2,060 pesos/ton of crude ore
(I.V.A. not included)

a) Concentrate Transportation Cost
1,552 pesos/ton of crude ore

Amount of concentrate production (8% moisture included)

Pb concentrate	44.9 t (dry) 0.92	= 40.8 t (wet)/month
Cu concentrate	57.4 t (") 0.92	= 62.4 t (")/month
Zn concentrate	84.8 t (") 0.92	= 92.2 t (")/month

Unit cost of transporting concentrate by truck:
120 pesos/km.ton of crude ore

Transportation distance:
Pb concentrate: Barones - Torreon 400 km
Cu, Zn concentrate: Barones - San Luis Potosi 200 km

Concentrate transportation cost

Pb concentrate:	120 x 400 x 48.8 3900	= 601 pesos/ton of crude ore
Cu concentrate:	120 x 200 x 62.4 3900	= 384 " "
Zn concentrate:	120 x 200 x 92.2 900	= 567 " "
Total		1,552 pesos/ton of crude ore

b) Concentrate Assay Cost: 508 pesos/ton of crude ore
Assay of concentrate of Au, Ag, Pb, Cu and Zn will be requested to be carried out in the assay room of Barones Beneficiation Plant in lots of 10 t.

Unit assay cost: Assay of Au, Ag, Pb, Cu and Zn in total
90,000 pesos/sample
(Refer to the above section of "Assay Cost".

Number of lots

Pb concentrate	48.8	10	5 lots	115 (pesos/ton of
Cu concentrate	62.4	10	7 lots	162 crude ore)
Zn concentrate	92.2	10	10 lots	231
Total	22 lots			508 pesos/ton of crude ore

Concentrate Assay Cost per Ton of Crude Ore

90,000 x 22 3900 = 508 pesos/ton of crude ore

c) Overall Distribution Cost

Concentrate transportation cost	1,552 pesos/to of crude ore
Concentrate assaying cost	508 " "
Total	2,060 pesos/ton of crude ore

3) Depreciation Fund: 29,715 pesos/ton of crude ore

Machinery installation cost:

(3,029 + 1,449) 000 x 2,650 = 11,867,000,000 poesos

Construction cost:

US$ 1,569 x 2,650 = 4,158,000,000 poesos

The depreciation term is set at 10 years for the machinery installation cost and 15 years for the construction cost.

Depreciation fund for machinery installation:

11,867 x 0.95 x 1/10 x 1/12 3,900

= 24,089 pesos/ton of crude ore

Depreciation fund for construction

4,158 x 0.95 x 1/15 x 1/12 3900

= 5,627 pesos/ton of crude ore

Total 29,716 pesos/to of crude ore

4) Interest 8,693 pesos/ton of crude ore

Interest on equipment cost (5% per year)

6,047 x 2,650 x 1/2 x 0.05 x 1/12 3900

= 8,560 pesos/ton of crude ore

Interest on operation cost (5% per year)

Beneficiation cost	Distribution cost	General management cost	Ore expenses	
16,265	2,060	1,266	44,659	= 64,250

64,250 x 1/2 x 0.05 x 1/12 = 133 pesos/ton of crude ore

Total interest 8560 + 133 = 8,693 pesos/ton of crude ore

(5) Crude Ore Purchase Conditions

On the basis of the ore purchase conditions used in Chihuahua Pb Smelting Plant and San Luis Potosi Cu Smelting Plant and Zn Smeling Plant, the crude ore purchase conditions of the beneficiation plant were determined as follows:

1) Standard Crude Ore Grades

The following standard grades were determined:

Au	Ag	Pb	Cu	Zn
0.8 g/t	160 g/t	0.8%	0.4%	1.6%

2) Lower Limits of the Crude Ore Grades

A lower limit grade was set for each metal, and it ws determined that the prices for the elements of a grade lower than the limit grade would not be paid.

Au	Ag	Pb	Cu	Zn
0.5 g/t	100 g/t	0.5%	0.25%	1.0%

3) Setting of the Recovery Rate for Each Metal

On the basis of the beneficiation results in the yearly production plan (Table 8.1.2), the overall recovery rate (beneficiation recovery rate x smelting recovery rate) was set for each metal contained in crude ore. The overall recovery rate does not change depending on the mine.

	Au	Ag	Pb	Cu	Zn
Beneficiation recovery rate (%)	33.0	76.0	73.0	86.0	68.0
Smelting recovery rate (%)	92.0	89.2	80.7	90.0	75.6
Overall recovery rate (%)	30.4	67.8	58.9	77.4	51.4

4) Estimate of the Amount of Concentrate

On the basis of the estimated beneficiation results, the ratio of each kind of concentate to crude ore is determined as follows and is used for the estimation of the amount of concentrate which is poroportional to the grade of crude ore.

a) Setting of the Concentrate Ratios

Pb concentrate	44.9	3900	= 0.0115
Cu concentrate	57.4	3900	= 0.0147
Zn concentrate	84.8	3900	= 0.0217

b) Estimate of the Amount of Concentrate

Pb concentrate: amount of crude ore (t) x 0.0115 x
Pb grade of crude ore (%)

Cu concentrate: amount of crude ore (t) x 0.014 x
Cu grade of crude ore (%)

Zn concentrate: amount of crude ore (t) x 0.0217 x
Zu crude ore (%)

5) Setting of the Beneficiation Cost

17.83 US$/ton of crude ore is substituted in determining the purchase price of ore.

Beneficiation cost	+	General Administrative cost	+	Depreciation fund		
16,265	+	1,266	+	29,716	=	47,247 pesos/ton of crude ore

47,247 / 2650 = 17.83 US$/ton of crude ore

6) Esimtation of the Distribution Cost

On the basis of the concentrate transportation cost ad the assay cost, the distribution cost is determined proportionally to the crude ore grade.

The following equation is used for the estimation of the concentrate distribution cost (US$/ton of crude ore)

(Concentrate transportation cost + Concentrate assay cost)

Standard grade x Crude ore Pb grade (%) ÷ 2,650

Pb concentrate: (601+115) ÷ 0.8 ÷ 2,650 x curde ore Pb grade (%)
= 0.338 x crude ore Pb gade (US$/ton of crude ore)

Cu concentrate: (384+162) ÷ 2.5 ÷ 2650 x crude ore Cu grade (%)
= 0.515 x crude ore Cu grade (%)
(US$/ton of crude ore)

Zn concentrate: (567+231) ÷ 1.6 ÷ 2650 x crude ore Zn grade (%)
= 0.188 x crude ore Zn grade

7) Estimation of T/C (Treatment Charge)

On the basis of the smelting condition, the T/C is determined proportionally to the crude ore grade. The following equation is used for the calculation:

T/C (US$/ton of crude ore) = Smelting T/C x concentrate ratio + standard grade x crude ore Pb grade (%)

Pb concentrate: 77.03 US$ x 0.0115 x 1/0.8 x crude ore Pb grade (%)
= 1.107 x crude ore Pb grade (%) (US$/ton of crude ore)

Cu concentrate: 79.83 US$ x 0.0147 x 1/0.4 crude ore Cu grade (%)
= 2.934 x crude ore Cu grade (/) (US$/ton of crude ore)

Zn concentrate: 266.90 US$ x 0.0217 x 1/26 x crude ore Zn grade(%)
= 3,620 x crude ore Zn grade (%) (US$/ton of crude ore)

T/C is fixed at 266.90 US$/T, the figure for the 2nd marke price of 1819 US$/T. Instead of adopting the sliding scale based on the Zn market price.

8) Estimation of R/C (Refinery Charge)

R/C is determined proportionally to the Pb or Cu grade of crude ore.

Pb concentrate: (109.14 US$ x 0.539 + 602.71 US$ x 0.05)

	Pb content in Pb concentrate	Pb content in Cu concentrate

x crude ore Pb grade (%) = 0.890 x crude ore Pb grade (%)

Cu concentrate: (670.17 US$ x 0.144 + 198.20 US$ x 0.63)

	Pb content in Cu content	Cu content in Cu concentrate

x crude ore Cu grade (%) = 2,214 x crude ore Cu grade (%)

9) Total Costs Relating to Distribution

Since each of the distribution costs, T/C and R/C is proportinal to the crude ore grade, the total cost for each concentrate can be written as follows:

Pb concentrate: (0.338 + 1.107 + 0.890) x crude ore Pb grade (%)
distribution cost T/C R/C
= 2.335 x crude ore Pb grade (%)

Cu concentrate: (0.515 + 2.934 + 2.214) x crude ore Cu grade (%)
distribution cost T/C R/C
= 5.663 x crude ore Cu grade (%)

Zn concentrate: (0.188 + 3.62) x crude ore Zn grade (%)
distribution cost T/C
= 3.808 x crude ore Zn grade (%)

10) Setting of Smelting Penalty

On the basis of the estimated beneficiation results (estimated for the standard grade of crude ore in the production plan), 0.1 US$/ton of crude ore is uniformly subtracted as the smelting panelty.

(Calculation)

	INSOL	S	As	Total	
Pb concentrate	0.018	0.036	0.014	0.068	(US$/ton of
Cu concentrate	0.006		0.009	0.015	crude ore)
Total	0.024	0.036	0.023	0.073	(US$/ton of crude ore)

In consideration of fluctuations in the contents of the penalty elements in crude ore, a penalty of 0.1 US$/ton of crude ore is set.

11) Ore Production Tax

The ore production tax of 3.6% for Au or Ag, or 2.4% for Pb, Cu, or Zu is subracted from the metal price which is determined according to the overall recovery rate.

12) Examples of Calculation of the Crude Ore Purchase Cost in the Production Plan

The purchase cost can be calcualted using the figures for the standard grades shown in 1). The conversion rate of 1US$ = 2,650 pesos is used and the figures in US$ are rounded to two decimal places.

a) Metal Price 49.82 US$

Au: 12.35 US$/g x 0.8 g/t x 0.304 = 3.00 US$

Ag: 183.03 US$/kg x 0.16 kg/t x 0.678 = 19.86 US$

Pb: 633.94 US$/t x 0.008 x 0.589 = 2.99 US$

Cu: 2,909.00 US$/t x 0.004 x 0.774 = 9.01 US$

Zn: 1,819.58 US$/t x 0.016 x 0.514 = 14.96 US$

Total 49.82 US$
(132,023 pesos)

b) Beneficiation Cost: 18.54 US$

c) [Distribution Cost + T/C + R/C]: 10.26 US$

Pb: 233.5 US$ x 0.008 = 1.88 US$

Cu: 566.3 US$ x 0.004 = 2.27 US$

Zn: 380.8 US$ x 0.006 = 6.11 US$

Total 10.26 US$

d) Penalty: 0.1US$

e) Ore Production Tax: 1.49 US$

Au: 3.00 US$ x 0.036 = 0.11 US$

Pb: 2.99 US$ x 0.024 = 0.09 US$

Cu: 9.01 US$ x 0.024 = 0.22

Zn: 14.96 US$ x 0.024 = 0.36

Total 1.49

f) Overall Ore Purchase Price: 19.43 US$

Metal price	49.82	US$
Beneficiation cost	18.54	(The depreciation fund of 11.21 US$ is included)
Distribution cost + T/C + R/C	10.26	
Penalty	0.10	
Total	28.92	
One price before tax	20.92	
Ore production tax	1.49	
Final ore purchase price	19.43	
	(51,490 pesos)	
IVA (15%)	2.91	
Payment	22.34	(59,201 pesos)

8.6 Economic Evaluation of Mill Modernization Plan

8.6.1 Method of economic evaluation

On the plant and equipment investment in both the modernization plan for the existing equipment in all 3 mills and the new plant extension plan for the Barones Mill, an evaluation was made by calculation of the Internal Rate of Return (IRR) by the Discount Cash Flow (DCF) method as a barometer of investment efficiency. IRR is the DR (Discount Rate) that can be determined by the following equation with the operating period:

$$\sum_{n=1}^{m} \frac{NCF}{(1+DR)^{n}} = 0$$

where NCF: Net Cash Flow
m: Operating period

8.6.2 Prerequisite for economic evaluation

(1) Production amount

In each mill, only the overall mineral processing result is calculated, based on the operational result for the period from January to June, 1989, and with ore from all mines and the total processing system combined. Besides, the sales amount when its product (concentrate) is sold to refineries in Mexico is regarded as the current production amount in each mill. This production amount does not always conform to that in the settlement of account. This reason is that in the case of consignment processing, the price for concentrate sales is not included in the production amount of mineral processing, but only the consignment cost (corresponding to the mineral processing cost) becomes the amount of production of the mill. In addition, that is also the case of the ore purchase plan, where the quantity of concentrate to be sold from each mill to refineries does not always conform to the production result in connection with measured measured values of ore in, to measured concentrate out of the total inventory.

(2) Refining Condition

In calculation of the refining condition of each concentrate, that of IMMSA, the major refining company in Mexico, was used as a standard.

(3) Metal official quotation

For the metal official quotation, the following international metal price, the mean value per month for the period from January to June, 1989, was used:

Au: 384.119 US$/T.oz
Ag: 569.291 US$/T.oz
Pb: 633.944 US$/MT
Cu: 161.951 US¢/LB
Zn: 1819.577 US$/MT

(4) Consolidated income and expenditure for the mines and a mill

In order to avoid the variation in evaluation due to the condition on which a mill accepts ore from each mine, that is, the difference in system, consignment or ore purchase plan, the economic evaluation was made by assumed estimation of the mining cost (the mean value in all mines in the district) and by trial calculation of the consolidated income and expenditure of the mines and a mill.

(5) Costs such as mineral processing cost

For the present costs such as mineral processing cost, selling expense, administrative expenses, etc., the actual values for the period from January to June, 1989, was used, and after modernization, these costs were calculated based on those past figures and by using the estimated effects of improvement.

(6) Interest rate

The interest rate for the plant and equipment investment was summed up as one of the non-operating expenses. In this case, this rate was assumed to be 5%, and it was set up on the assumption of financing from the international banking facilities such as IDB (Inter-American Development Bank).

(7) Depreciation expenses

Depreciation expenses were calculated over 10 years for mechanical equipment, 15 years for buildings & other construction and 5 per cent for residual value.

(8) Exchange rate

The foreign exchange rate was calculated as 1US$=2650 pesos.

8.6.3 Conclusion on economic evaluation

For each mill, IRR was calculated for the following three cases: Ag price standard case (the mean value of the actual international prices for the period from January to June, 1989: 569.281 US¢/T.oz), in the case of a 10% increase in the value of silver (630 US¢/T.oz) and in the decrease of silver value of 10%-down case (510 US$/T.oz).

Further, in the extension plan for Barones Mill, IRR was calculated for the four cases, that is, for the two cases where the quantity of ore to be processed in the plant is 150t/day and 200t/day, and in addition, for the 10% increase in Ag value case to the standard Ag price at 150t/day and the 10% decreased value of Ag case to the same also at 200t/day. For each case, the IRR in consolidation with the profit and loss of the existing equipment in Barones was also calculated for the above-mentioned four cases. All of them can be put together as follows:

(1) Modernization of the existing equipment

		Parral existing	Guanacevi existing	Barones existing
Plant & equipment investment (thousand peso)		1,493,275	809,392	612,050
IRR (%)	Case A Ag = 569,281 (US¢/T.oz)	19.9	49.5	52.7
	Case B Ag = 630 (10% up)	21.7	51.5	54.4
	Case C Ag = 510 (10% down)	18.0	47.5	51.0

The results of the calculation are shown in Table 6.8.1 to 6.8.4. The IRRs in Guanacevi and Barones are high in investment efficiency (about 50%) in either case.

(2) Barones extension plan

Q'ty of ore processed	t/day	150	200
	t/month	3900	5200
Plant & equipment investment (thousand peso)		16,025,000	17,628,000
IRR (%)	Case A (Ag price standard)	6.5	9.2
	Case B (10% up)	8.0	(not calculated)
	Case C (10% down)	(not calculated)	7.8

The results of the calculation are shown in Tables 6.8.5 to 6.8.8. In either case, IRR is low (10% or less).

(3) Barones overall evaluation

The overall evaluation on the modernization plan and the extension plan for the existing equipment are as follows:

Q'ty of ore processed (t/month)		12,956	14,256
Plant & equipment invesmtment (thousand peso)		16,637,050	18,240,050
IRR (%)	Case A (Ag price standard)	8.5	10.7
	Case B (10% up)	9.8	(not calculated)
	Case C (10% down)	(not calculated)	9.2

The results of the calculation are shown in Tables 6.8.17 to 6.8.20. In either case, IRR is low (10% or less).

9. CONCLUSION

9.1 Modernization of the Present Equipment in the Three Beneficiation Plants

(1) Parral beneficiation plant

Seen from the viewpoint of mining potential the plant is promising in that there are tremendous ore reserves with the oxide ore still left, the sulfide ore barely exploited while the grade of ores is high as well as unchanging. Mining is being well operated and a steady ore supply will be possible for a long term.

Economically it is important to properly implement depreciation while reappraisal of assets being made and to perform maintenance of equipment and investment for renewal.

Modernization intends to curb deterioration of the equipment, improve production efficiency, stabilize operation, ameliorate working conditions and attain labor saving on the assumption that ore treatment of 6,400 t per month will be attained with the ore grade: Au, 0.74 g/t; Ag, 325 g/t; Pb, 0.2%, Zn, 0.2% and with improvement of beneficiation recovery up to; Au, 67.20%; Ag, 68.25%; Pb, 52.5% and Zn, 47.25%.

An investment in

a) replacement of ball mills,

b) full installation of dust collectors in the crushing processes,

c) some instrumentation of the equipment and

d) rationalization of administrative department

amounts to Mex $1,493 million (US$563 thousand) and this reduces the cost of ore treatment by Mex $3,556 per ton, which results in an profit of Mex $8,844 when added to a present ordinary profit of Mex $5,288 per ton, where IRR is 19.9% (but 18.0% when the market price of silver is lowered by 10% and 21.7% when it is raised by 10%), ARR 18.3% and PB 5.5 yr.

Conditions of investment:

a) The market prices of metals employed are the average values of theinternational market prices from January to June 1989.

b) The smelting and refining conditions on which sales of concentrates are based are in accordance with IMMSA (major mining and smelting companies in Mexico).

c) An interest of 5% was based on the premise of loans from the international monetary institutions such as US State Development Bank.

d) The terms of depreciation employed were 10 years for machinery and 15 years for buildings. The residual value employed was 5% and the depreciation was by straight-line method.

e) The exchange rate between US$ and Mex$ was based on 1$ = Mex$2,650.

f) The income increment (due to improvement in recovery) equivalent to the amount of investment plus the cost decrement (due to cost reduction in beneficiation expenses and administrative expenses) is the sum of gains by improvement, on the basis of which Internal Rate of Return (IRR) was obtained by Discount Cash Flow (DCF) method.

g) Accounting Rate of Return; ARR (%) =
[sum of gains by improvement - (depreciation + interest)] /sum of investment

h) Payback Period: PB = 1/ARR expressed by year.

i) Sensitiveness has some factors such as beneficiation recovery, ore grade, etc. Of them we employed the market price fluctuation of silver, the bands of fluctuation being made to 10% above and below the average value 1). This condition is the same with each beneficiation plant.

(2) Guanacevi beneficiation plant

Seen from the viewpoint of mining potential, ore supply to the plant mainly consists of residual ores and low-grade ores after having thoroughly exploited both oxide and sulfide ores. The ore reserves are being exhausted. Owing to new mining in Santa Cruz mine, the ore supply would be kept for coming two years but in the future it is necessary to further secure the ore quantity through prospecting in cooperation with CRM.

Economically, a decline in the quantity of ore treatment is anticipated and an increase in sales cannot be expected. Rationalization of operation is essential thus to attain drastic cost reduction. A reduction in the sum of labor cost by a third and that in electrical power and material costs by 15% will balance revenue and expense.

Modernization intends to maintain equipment, save energy, stabilize operation, reduce expenses and rationalize office work on the assumption that ore treatment of 7,751 t per month will be attained with the ore grade: Au, 1.45 g/t; Ag, 253 g/t and with enhancement of gold and silver recovery to about 80%, respectively, through modernization.

An investment in

a) installation of filter presses
b) some improvement in grinding processes
c) full preparation of reagents
d) rationalization of floatation processes and
e) rationalization of administrative department

The capital cost amounts to Mex $810 million (US$306 thousand) and this reduces the cost of ore treatment by Mex $5,155 per ton, which results in an profit of Mex $1,340 from current operation after having making up the present deficit of Mex $3,815, where IRR is 49.5% (but 47.5% when the market price of silver is lowered by 10% and 51.5% when it is raised by 10%), ARR 59.2% and PB 1.7 yr.

(3) Barones beneficiation plant

Seen from the viewpoint of mining potential, oxide ores are nearly in the final stage of exploitation while sulfide ores being scarcely exploited. In this region even low-grade ores that are unprofitable in other regions are being mined because of low beneficiation fee. Long-term ore production may be expected but the fluctuation in ore quantity and grade is likely to happen influenced by the construction of private plants.

On January 1989, CMF raised the beneficiation fee, fee being Mex $30 thousand (ore purchase: US$13), but in Barones plant alone fee is suppressed to Mex $16.5 thousand (ore purchase: Mex $17.5 thousand). In the first half year of 1989 the income from current operation was Mex $5,288 per a ton of treated ores in Parral and the loss was Mex $3,815 in Guanacevi and Mex $15,799 in Barones. But if Barones plant was operated at the beneficiation fee similar to that of other plants, the loss would be Mex $1,990.

To make up the deficit not only revising the fee of beneficiation but also operational improvement is necessary. As a means of modernization a plant enlargement with the newest equipment by utilizing effective capital is required to improve recovery as well as greatly reduce operation costs.

The beneficiation plant is not fully operated with mine output suppressed and ore stock in the mine increasing. Ores with a high grade and exploitable in large quantity are being treated in the neighboring CMF El Bote mine at a high beneficiation fee. In the medium-scale mines with large ore reserves, private beneficiation plants and leaching plants and private custom plants are being constructed. Due to such situation and the low beneficiation fee of Barones, low-grade and hard-to treat ores as well as ores of a small lot abound in this region so that the decrease of recovery and operation efficiency and deficit operation result. Amelioration of this condition is quite difficult to perform. There is no choice but to promote plant efficiency and increase recovery.

Modernization of the present plant is to be based on ore treatment of 9.056 t per month and ore grade: Au, 0.47 g/t; Ag, 175 g/t. Beneficiation recovery is assumed to increase to: Au, 2% and Ag, 4%.

An investment in

a) improvement of beneficiation and cyanidation processes by an increased recovery due to treating a mixture of oxide and sulfide ores.
b) some instrumentation and automation

c) rationalization of administrative department

amounts to Mex $612 million (US$211 thousand), thereby reducing the cost of ore treatment by Mex $4,262 per ton. Also number of workers can be cut by 21.

Here, IRR is 52.7% (but 51.0% when market price of silver is lowered by 10% and 54.4% when it is increased by 10%), ARR 63.7% and PB 1.6 yr.

9.2 Construction Plan of New Barones Beneficiation Plant

Next to the existing beneficiation plant a new plant for lead-copper-zinc differential floatation (crushing - grinding - floatation - dehydration) is scheduled to be built. Considering the miner's ore storage, production constraint and the storage capacity of the plant, the optimum amount of ores to be treated is likely to lie between 150 t/d and 200 t/d, these two cases therefore being investigated. The ore grade: Au, 0.8 g/t; Ag, 160 g/t; Pb, 0.8%; Cu, 0.4% and Zn, 1.6% and the beneficiation recovery: Au, 33%; Ag, 76%; Pb, 73%; Cu, 86%; Zn, 68% are assumed, number of workers being 21.

Installation of a) machinery and electrical equipment and b) civil engineering and construction amounts to a sum of Mex $16,025 million (US$6,047 thousand, 150 t/d) or Mex $17,628 million (US$6,651 thousand, 200 t/d), the profit being Mex $2,762 or Mex $11,006 per ton. In combination with the gains from improvement in the present plant, the total gains from modernization of Barones result in Mex R8,451 or 12, 487. The present deficit of Mex $15,799, however, will remain reduced to Mex$7,348 or 3,312 and the difference might inevitably be charged by the revision to the beneficiation feet for medium and small scale mines.

In conclusion, the enforcement of modernization plan and a raise of beneficiation fee from the present Mex $16,500/t to Mex $25,000/t should be done.

IRR in building a new plant is 6.5% at 150 t/d and 9.2% at 200 t/d, while IRR in the case of improvement of the existing plant plus building a new one is 8.5% at the former and 10.7% at the latter. The term of construction assumed is 2 years.

9.3 Recommendations for Modernization of Each Plant in Common

The fundamental means on which improving beneficiation recovery, reducing operation costs, promoting plant efficiency and improving maintenance are based are instrumentation, automation, establishing the system of preventive maintenance and mending and the adoption of all Ore-Purchasing system in place of the current combined system.

Instrumentation and automation are intended for a stabilized plant operation, where controls of beneficiation factors are necessary and accumulation of daily data are required to obtain the optimum conditions, thus the instrumentation such as recording continuous data being also needed. At the same time, training of operators and acquisition of control technology by staff are essential.

Establishment of maintenance and mending systems are intended for optimization of each machine load, reduction of expenses, optimization of parts stock and the resultant betterment of operation efficiency. The following, therefore, are proposed: A daily check and checking with check sheet by more than one person, Introduction of an annual maintenance plan and utilization of maintenance books and Installation failure detectors to lessen watchmen's load and thus prevent human errors.

Present system of Maquila and Ore-Purchasing incurs waste of time and complication of work resulting in a low operation-efficiency.
Conversion to the All Ore-Purchasing system enables the plant improvement and controlled beneficiation. In this system purchase conditions are properly revised monthly according to the past result of recovery

and test result. Then including conditions of smelting and refining and sales expense, the ore purchase system is determined. Based on the classification such as oxide, sulfide, high grade, low grade and hard-to-treat, ores from each mine are mixed and treated separately according to the classes.

In the administrative department the following are proposed: a planned control system on the basis of estimated costs which makes it possible to take measures against abnormality and to prognose the future, and introduction of personal computers for the purpose of simplification, labor-saving and speeding-up of office work.

Summary:

The sum of the investment for modernization of the three beneficiation plants amounts to about Mex $20,543 million (US$7,752 thousand) (increased plan of Barones 200 t/d) and the total output (amount of ores treated) of the three plants increases from the present 23,218 t/month to 28,413 t/month with an increment of 5,200 t/month. Sales output increases roughly from the present Mex $2,000 million/month to Mex $2,600 million/month, an increment being 30%.

A great amount of improvement in revenue of the three plants will be attained, the sum being Mex $165 million/month, and this is a conspicuous contribution to mining production in the three regions.

In order to further promote and Mexican private medium and small scale mines, CFM should promptly take measures for modernization as proposed in the present investigation and also start the new construction in the three plants while necessary financing being made.

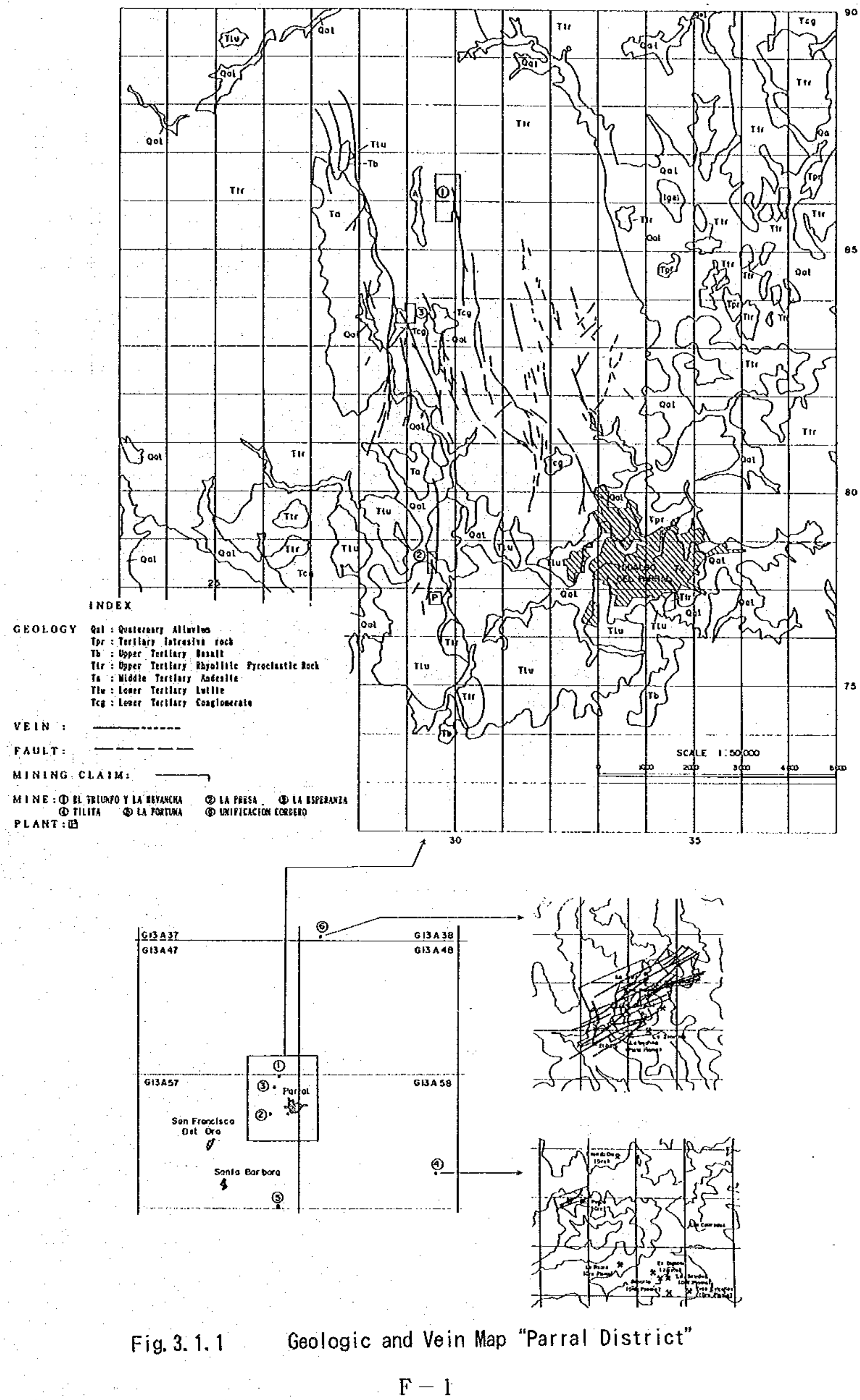


Fig. 3.1.1 Geologic and Vein Map "Parral District"

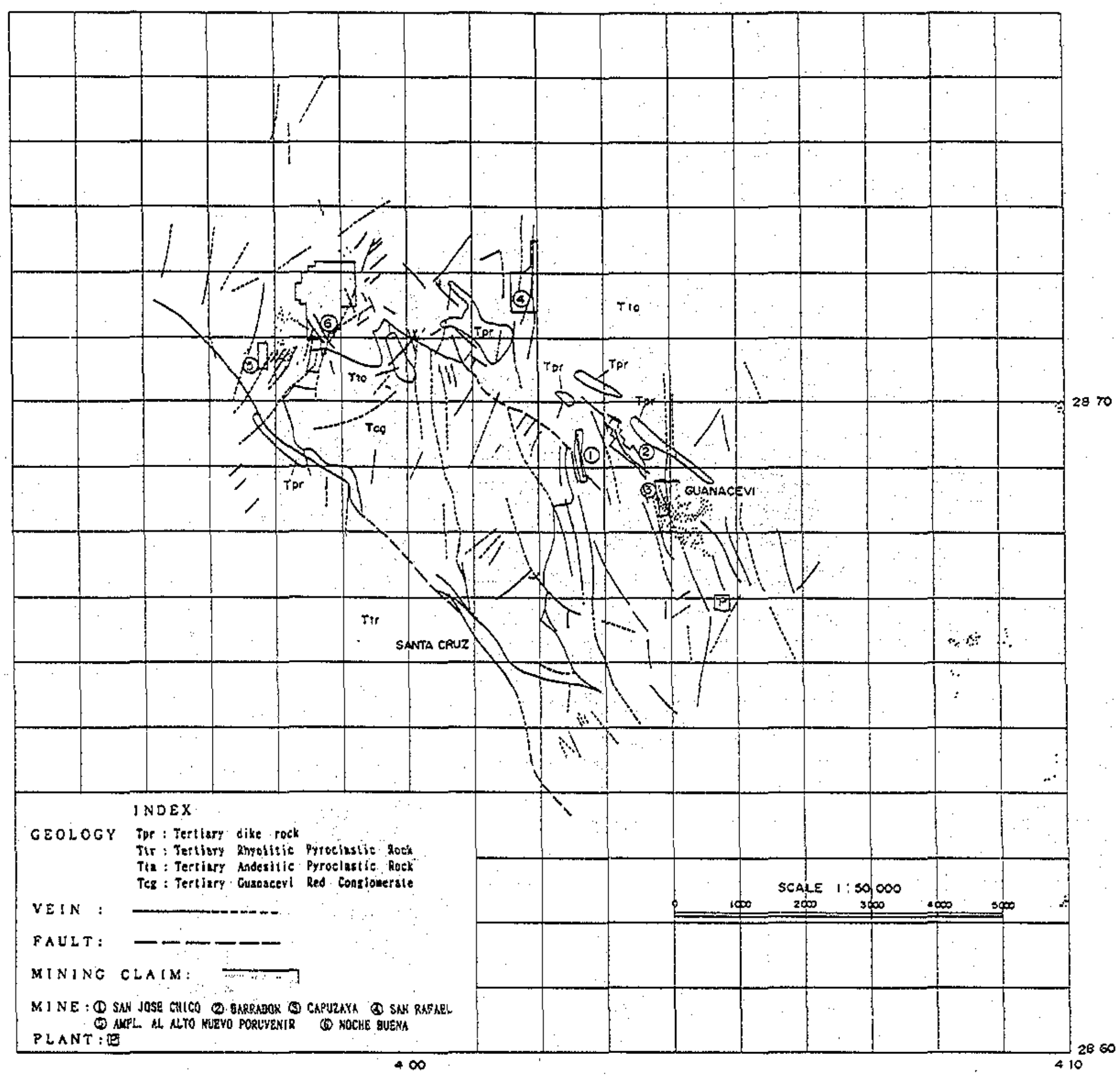


Fig. 3. 1. 2 Geologic and Vein Map "Guancevi District"

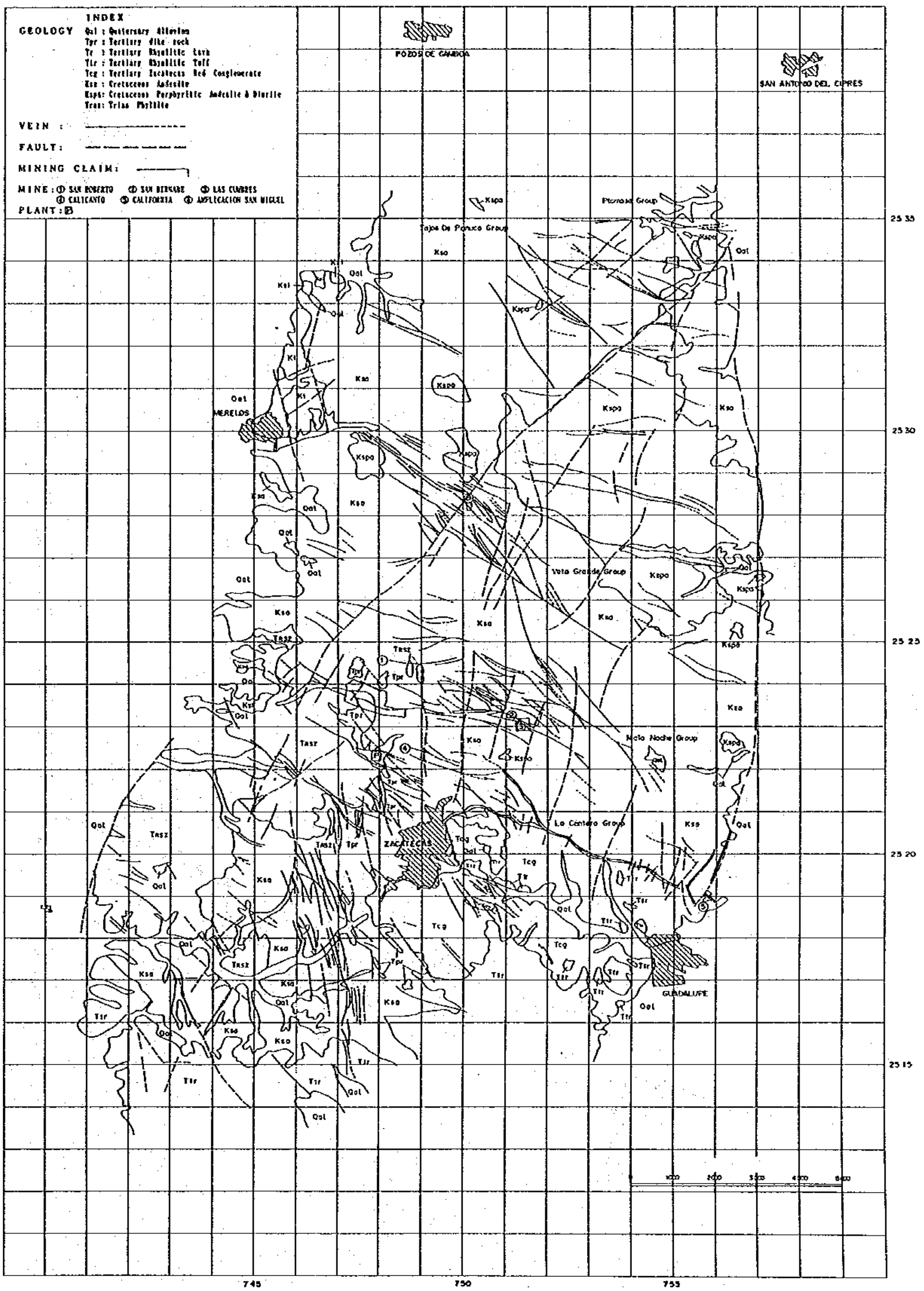


Fig. 3. 1. 3　　Geologic and Vein Map "Barones District"

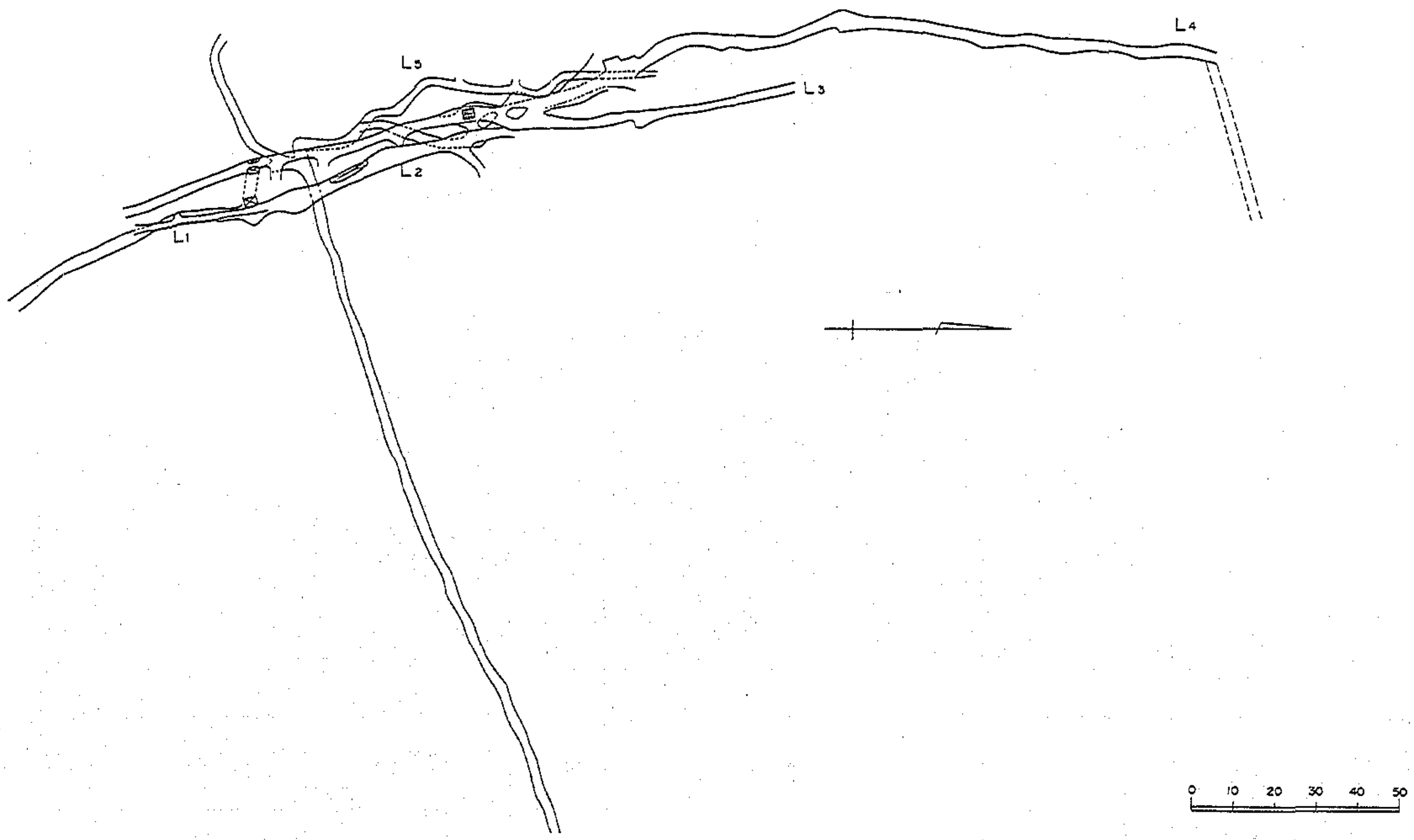


Fig. 3. 3. 1. a　El Triunfo Y La Revancha -Plane-

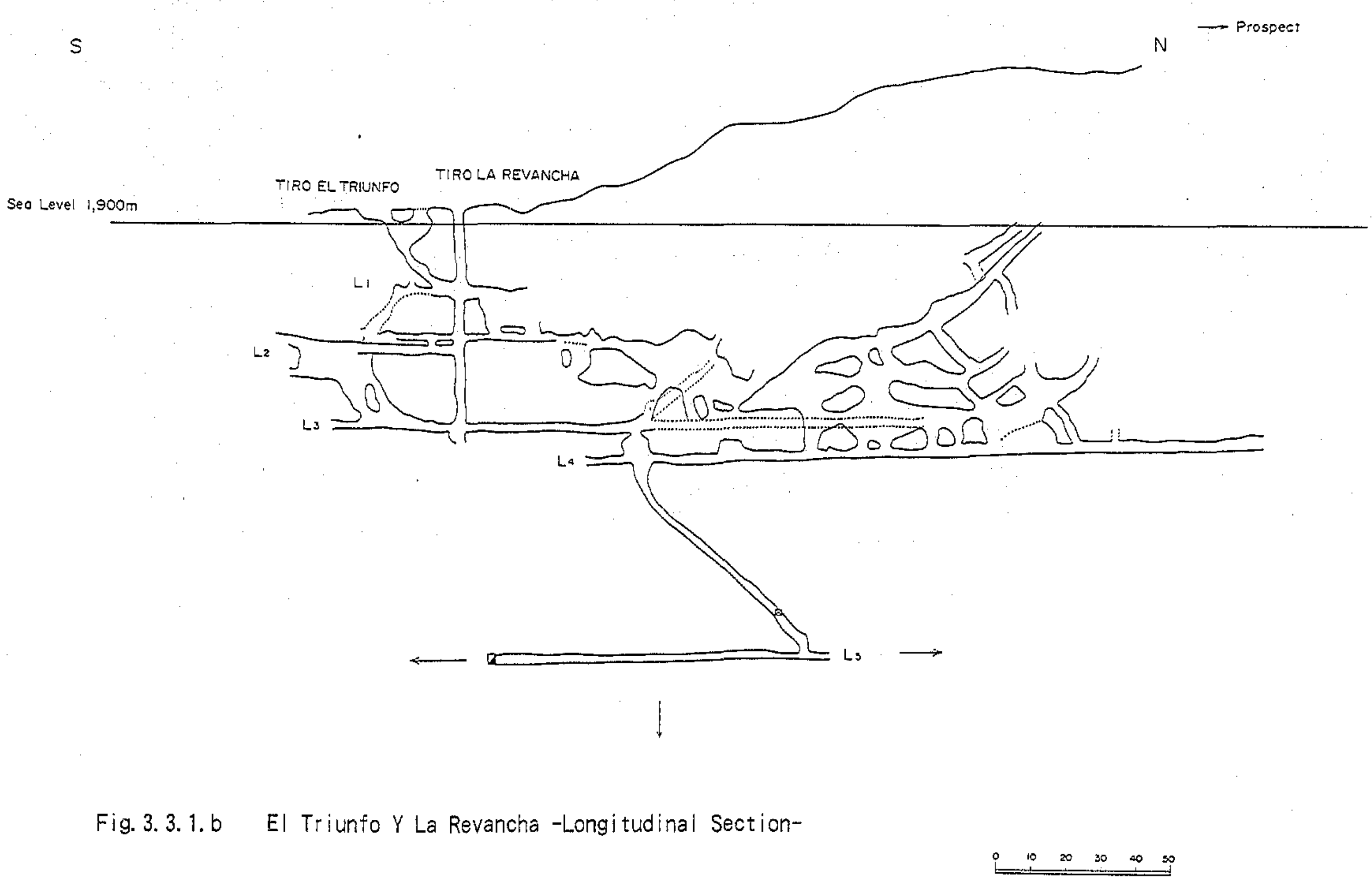


Fig. 3. 3. 1. b　El Triunfo Y La Revancha -Longitudinal Section-

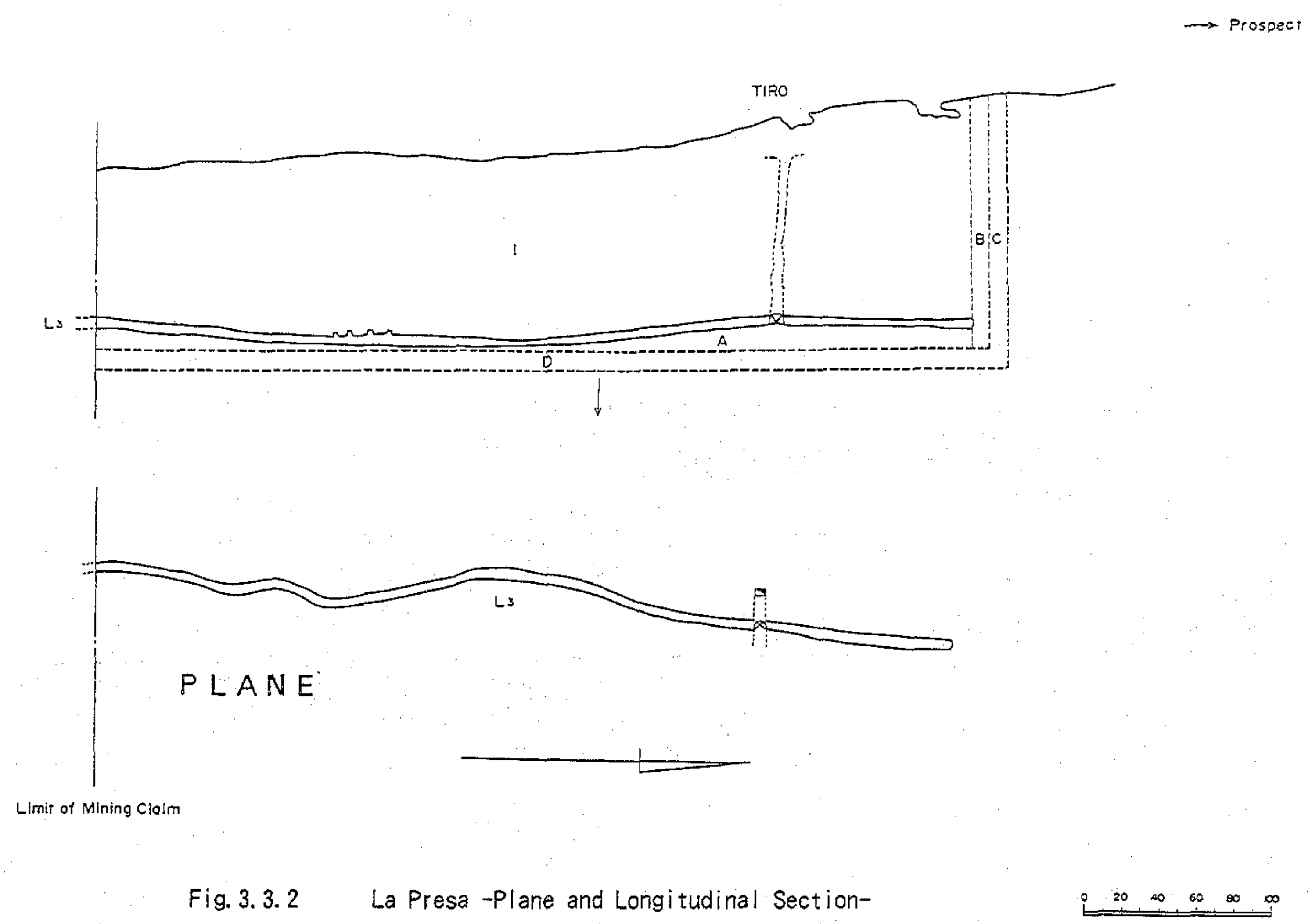


Fig. 3. 3. 2 La Presa -Plane and Longitudinal Section-

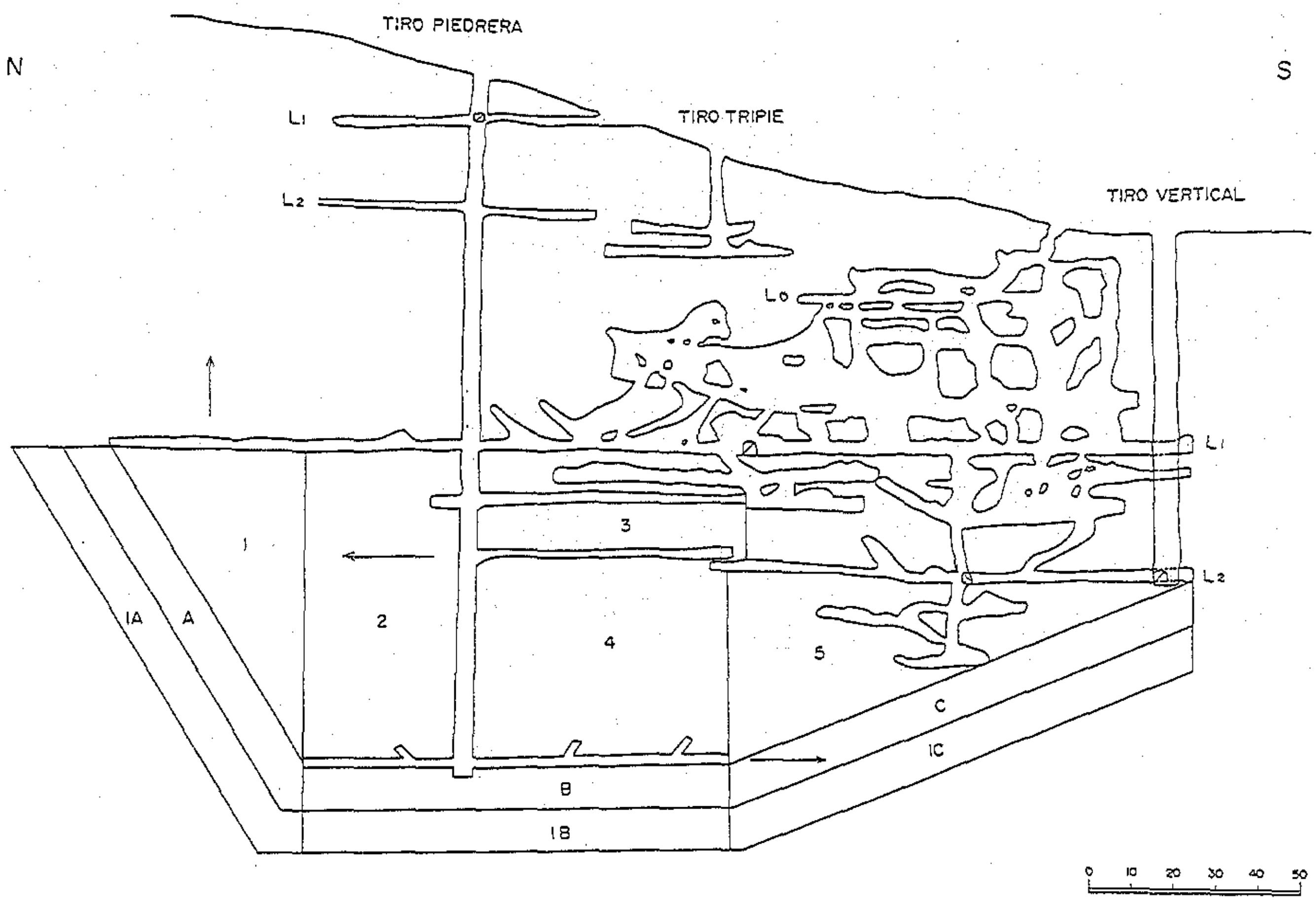


Fig. 3. 3. 3 La Esperanza -Longitudinal Section-

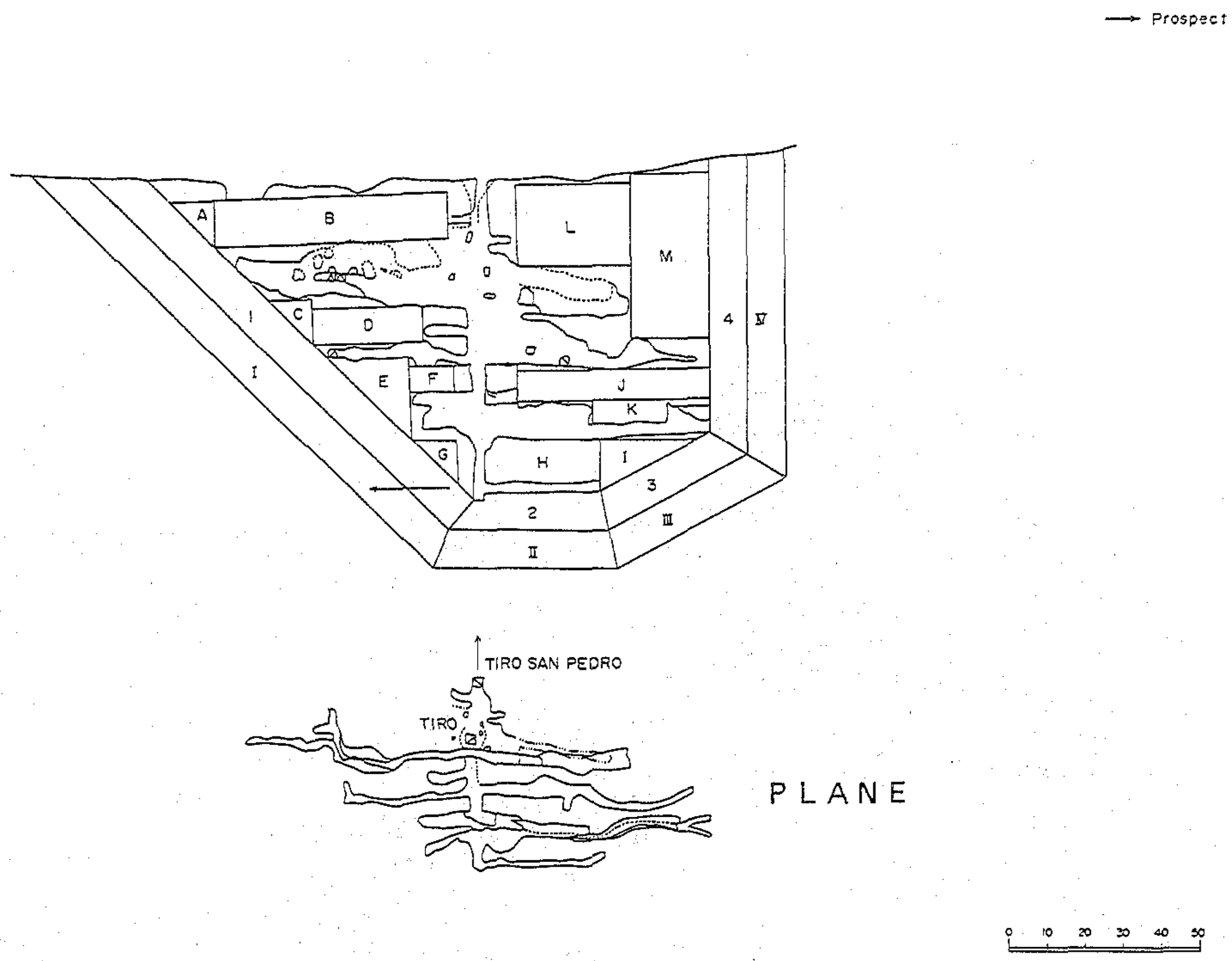


Fig. 3. 3. 4 Tilita -Plane and Longitudinal Section-

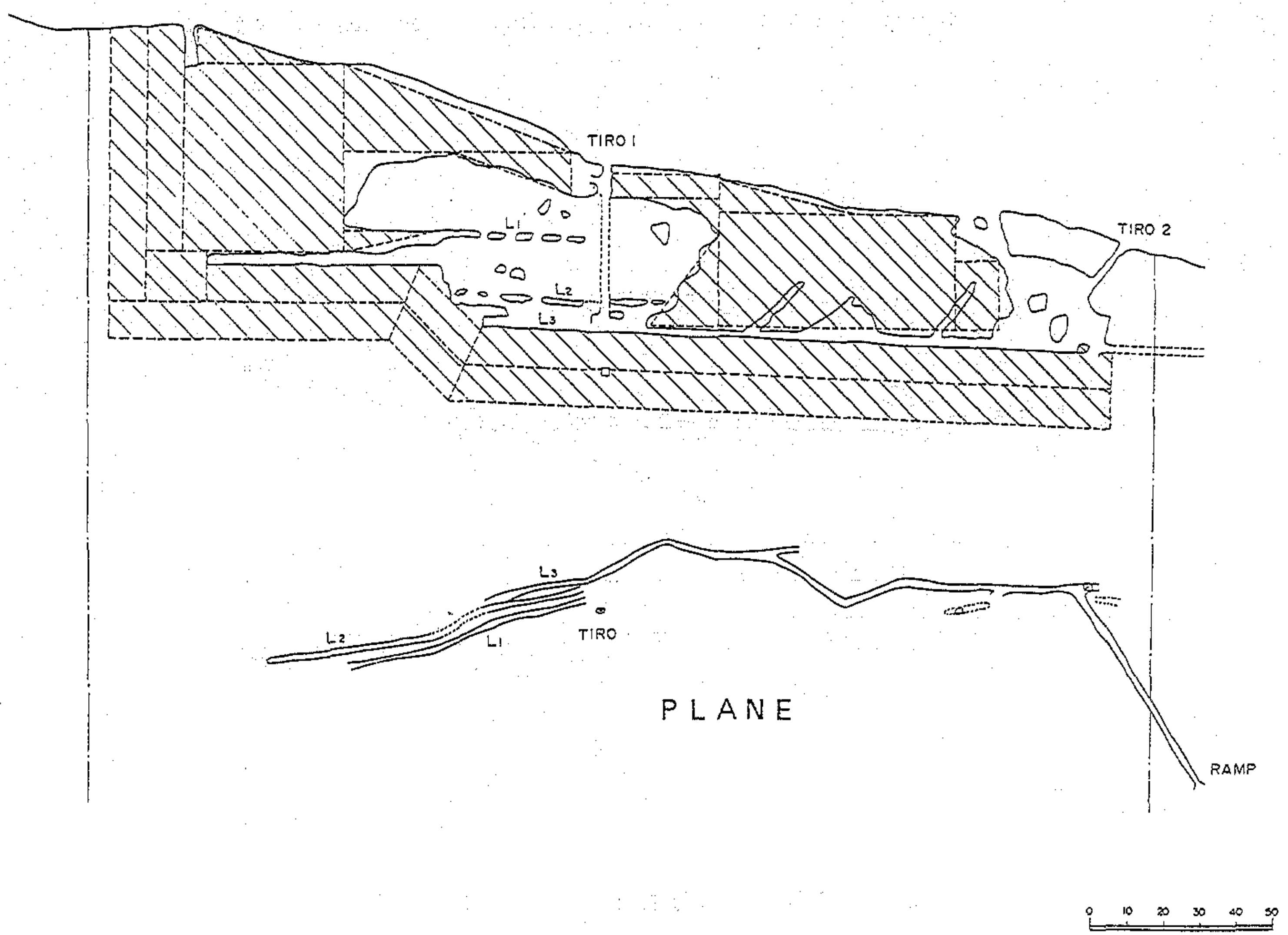


Fig. 3. 3. 5 La Fortuna -Plane and Longitudinal Section-

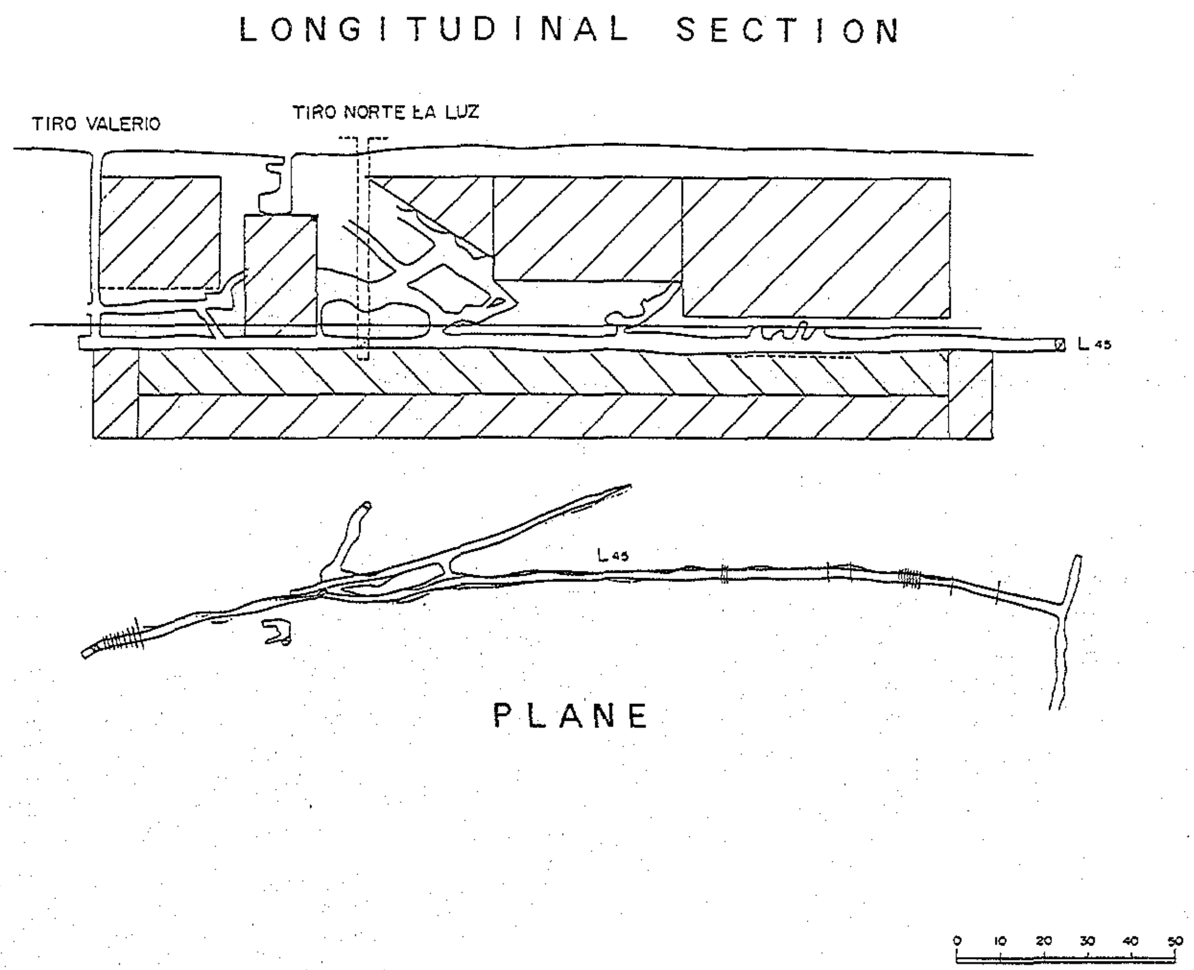


Fig. 3. 3. 6 Unificaction Cordero -Plane and Longitudinal Section-

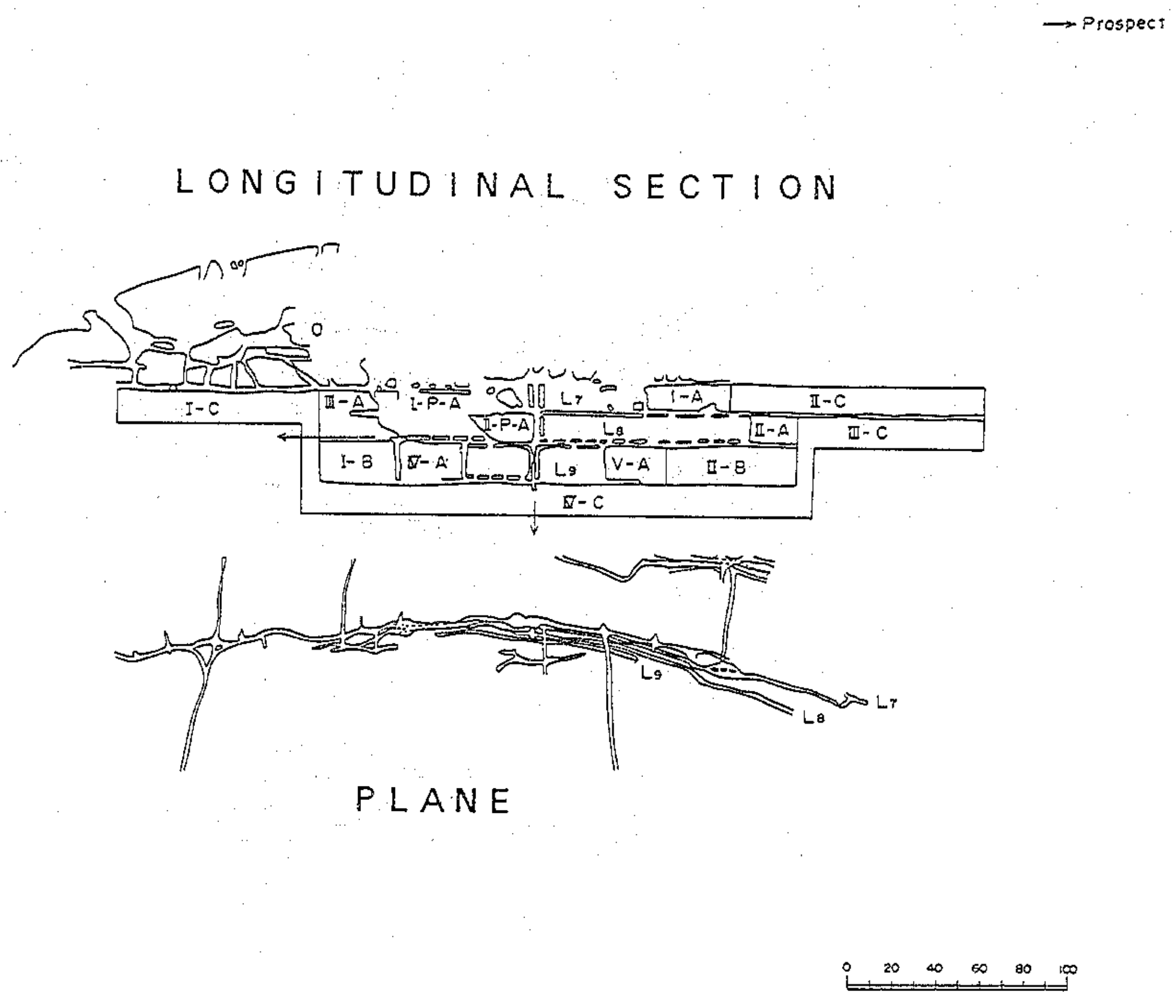


Fig. 3. 3. 7 San Jose Chico -Plane and Longitudinal Section-

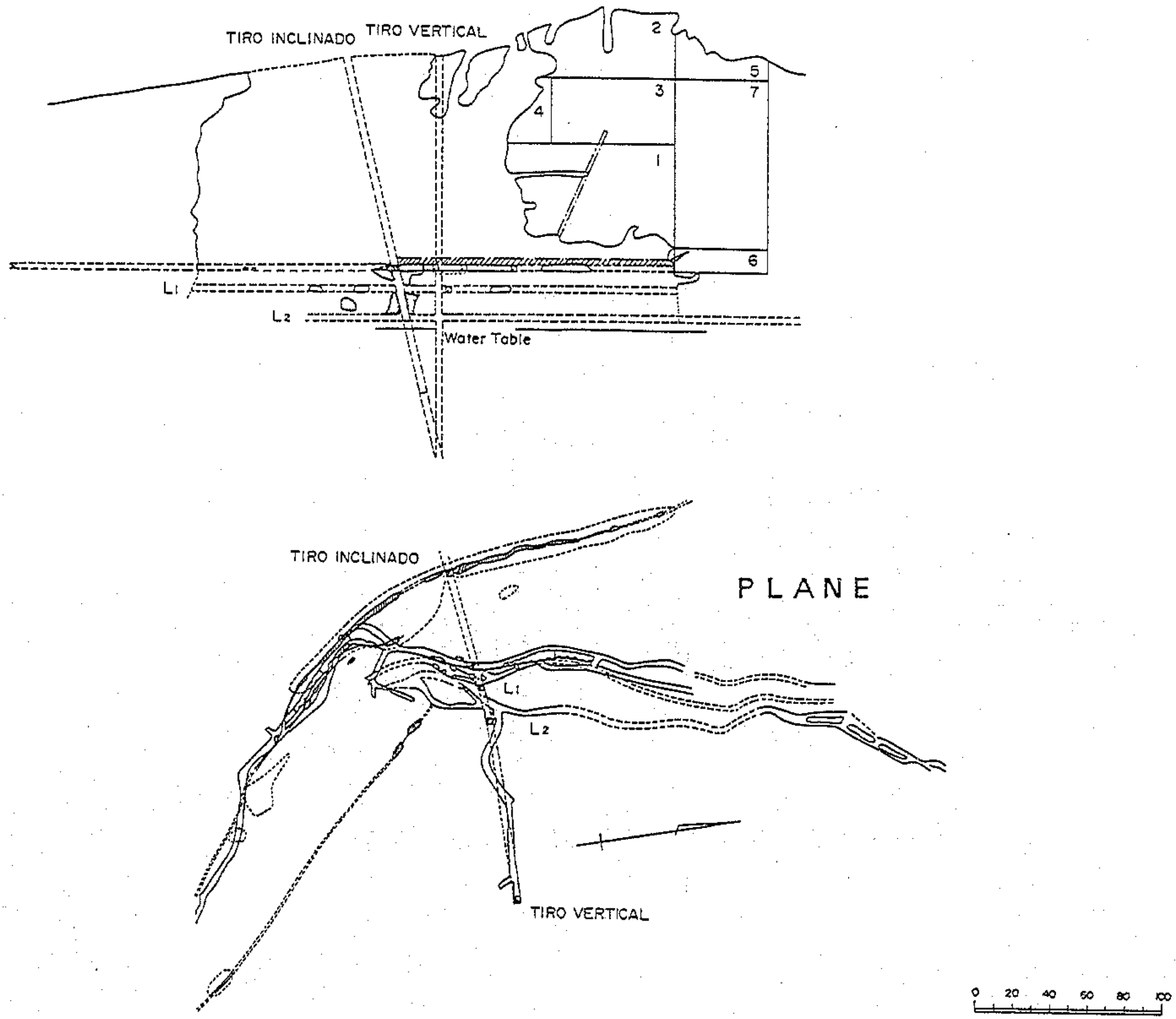


Fig. 3. 3. 8. a   Barradon -Plane and Longitudinal Section-

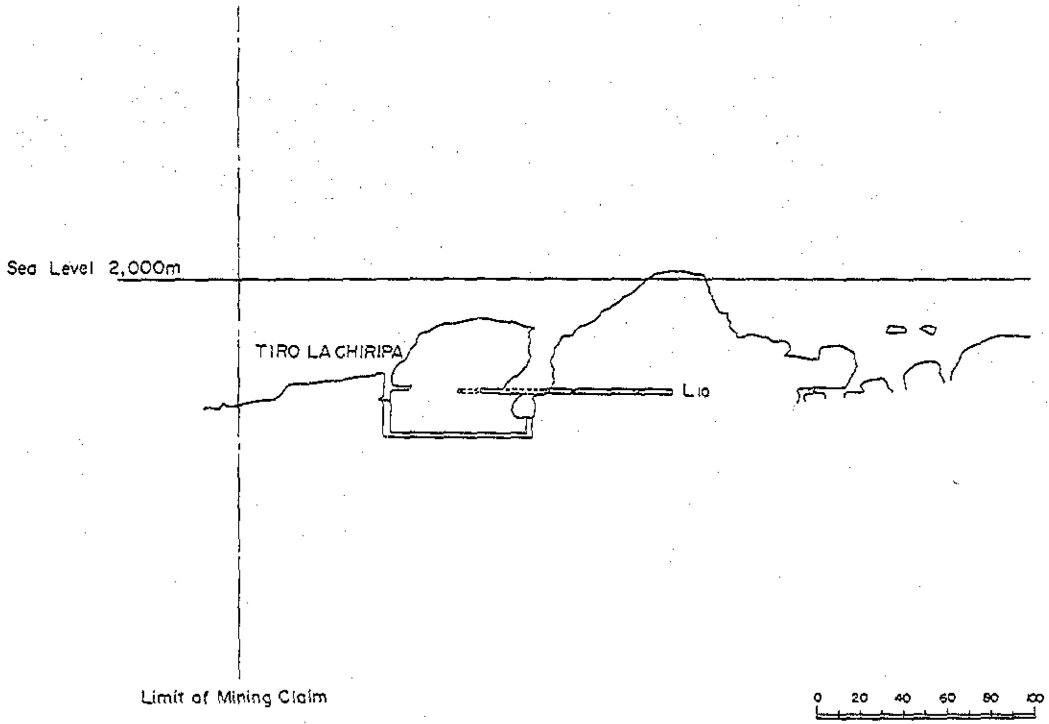


Fig. 3. 3. 8. b Barradon (Chiripa) -Longitudinal Section-

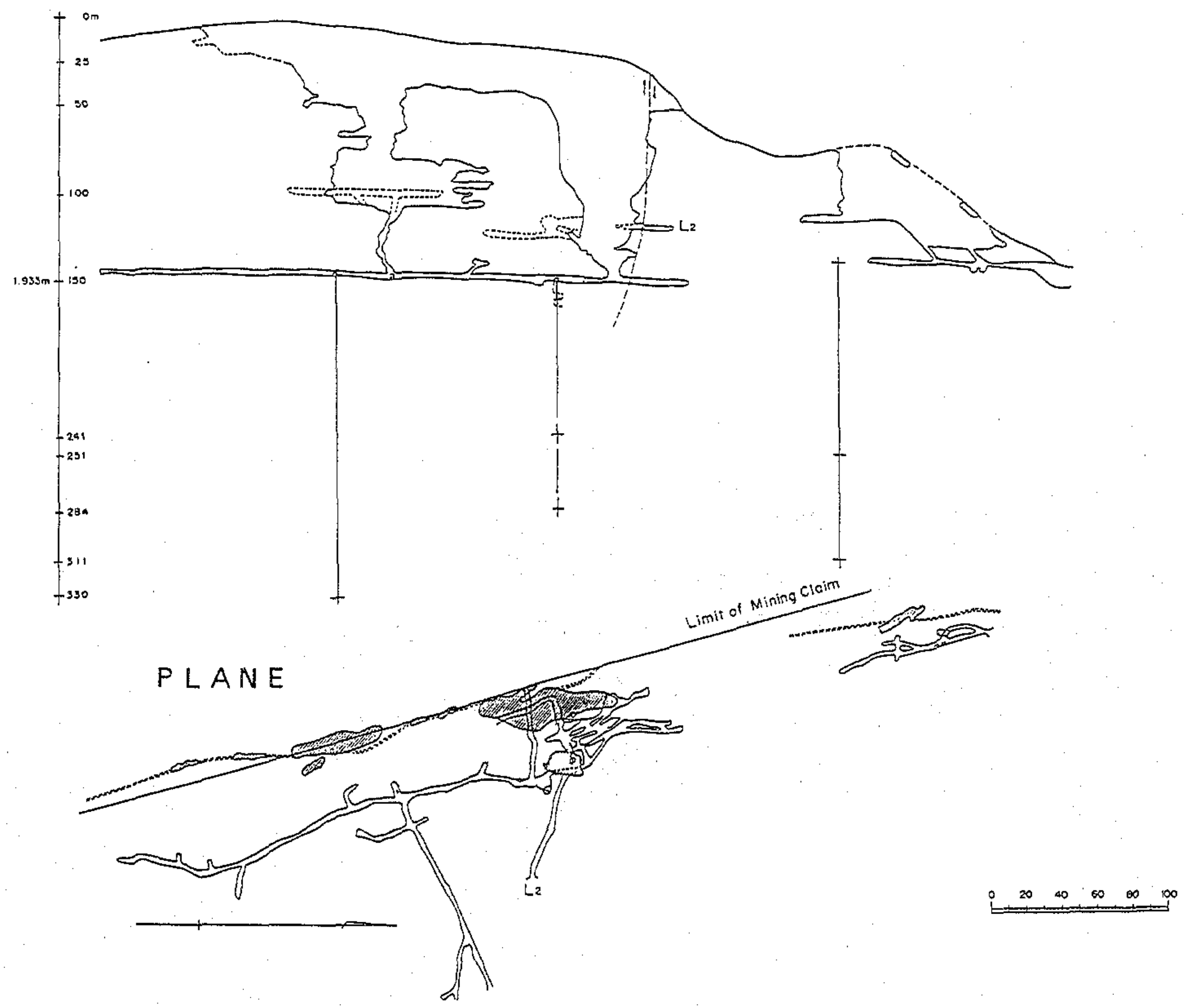


Fig. 3. 3. 9　　Capuzaya -Plane and Longitudinal Section-

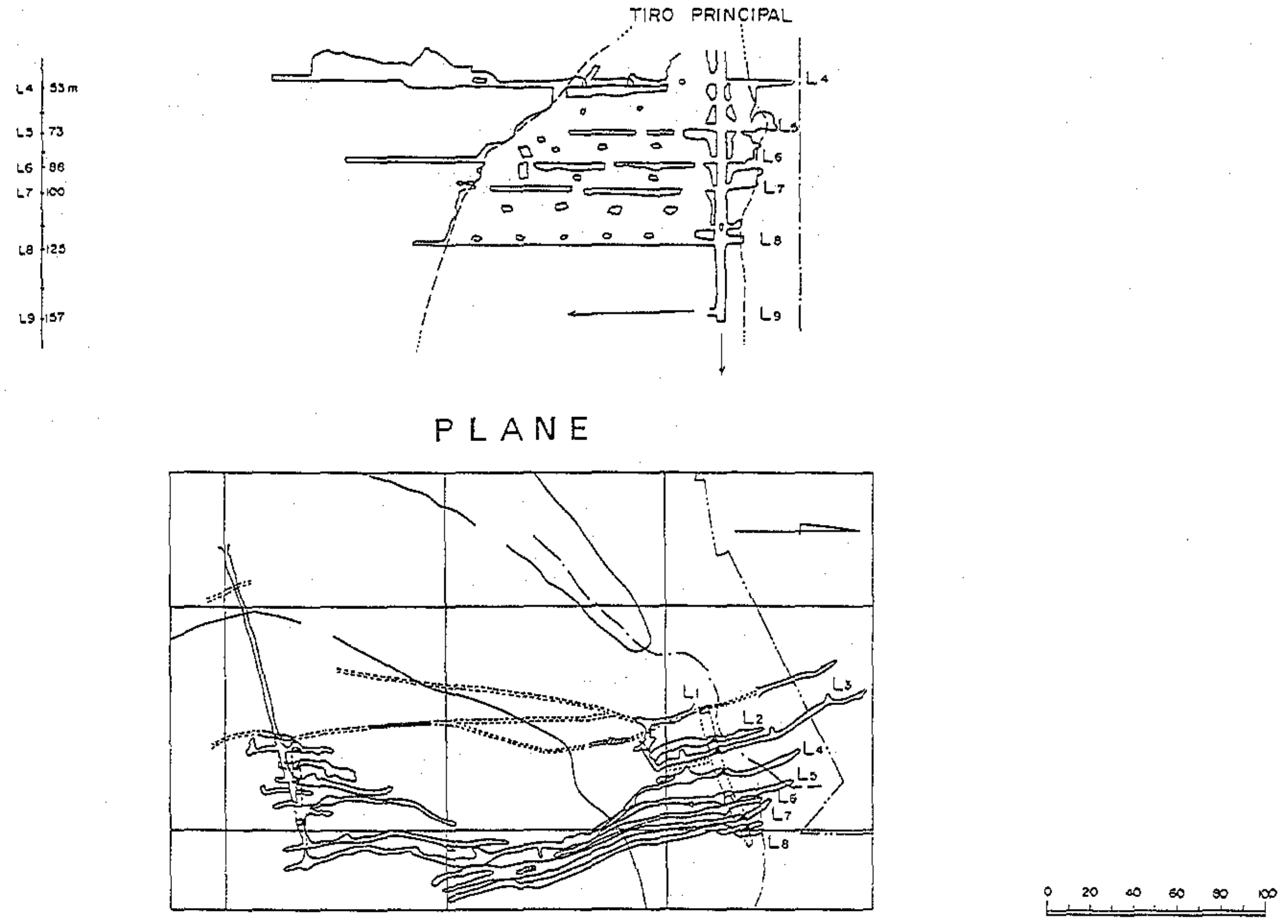


Fig. 3. 3. 10 San Rafael -Plane and Longitudinal Section-

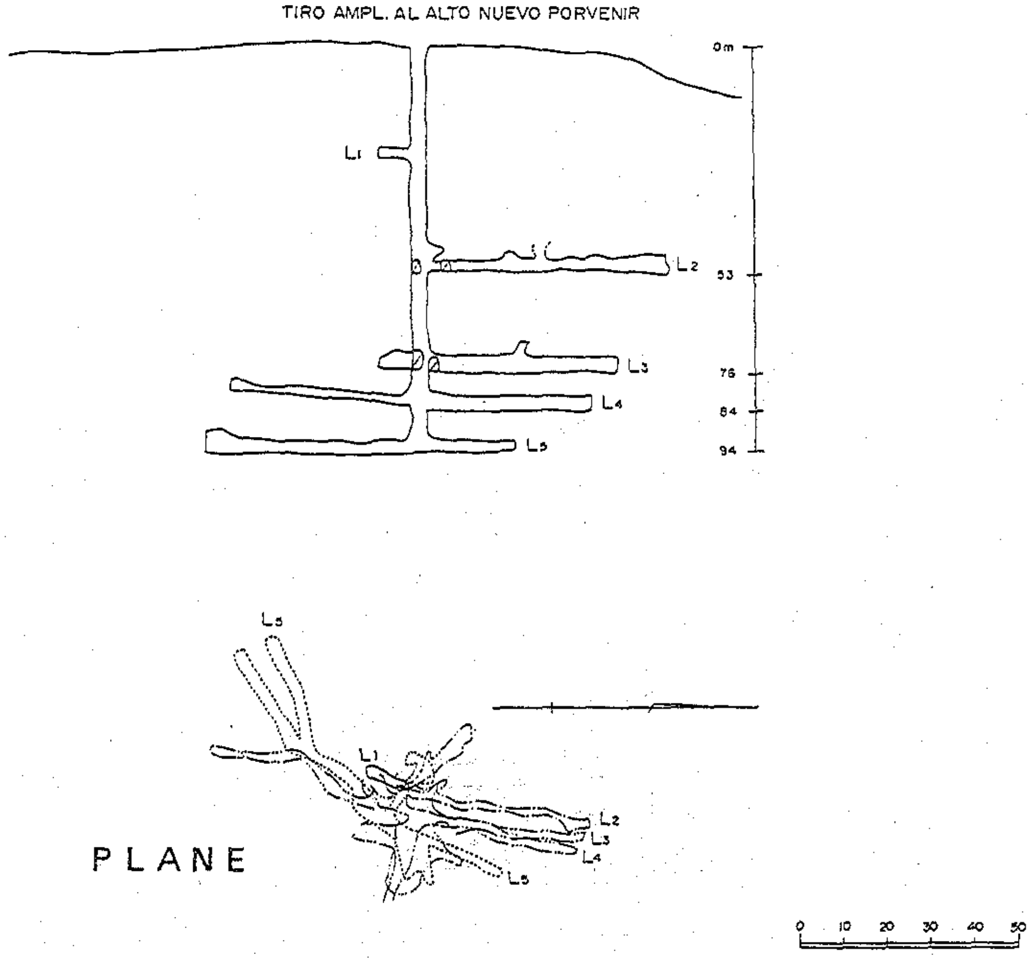
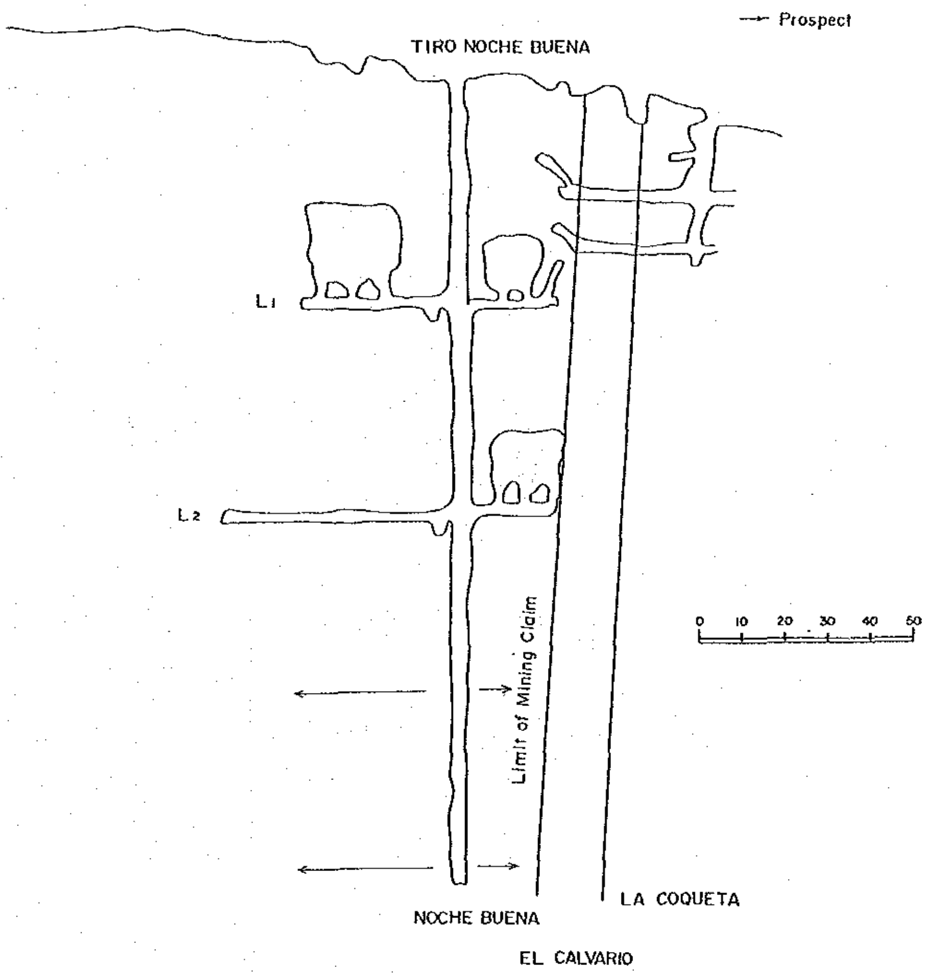


Fig. 3. 3. 11 Ampl. Al Alto Nuevo Porvenir -Plane and Longitudinal Section-



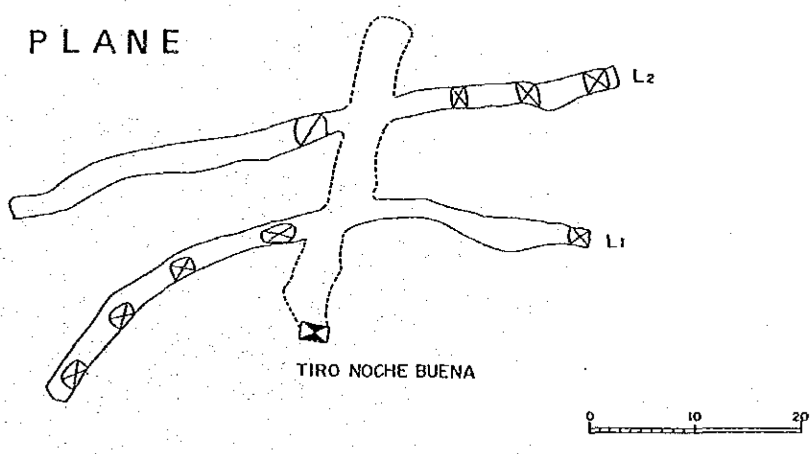


Fig. 3. 3. 12 Noche Buena -Plane and Longitudinal Section-

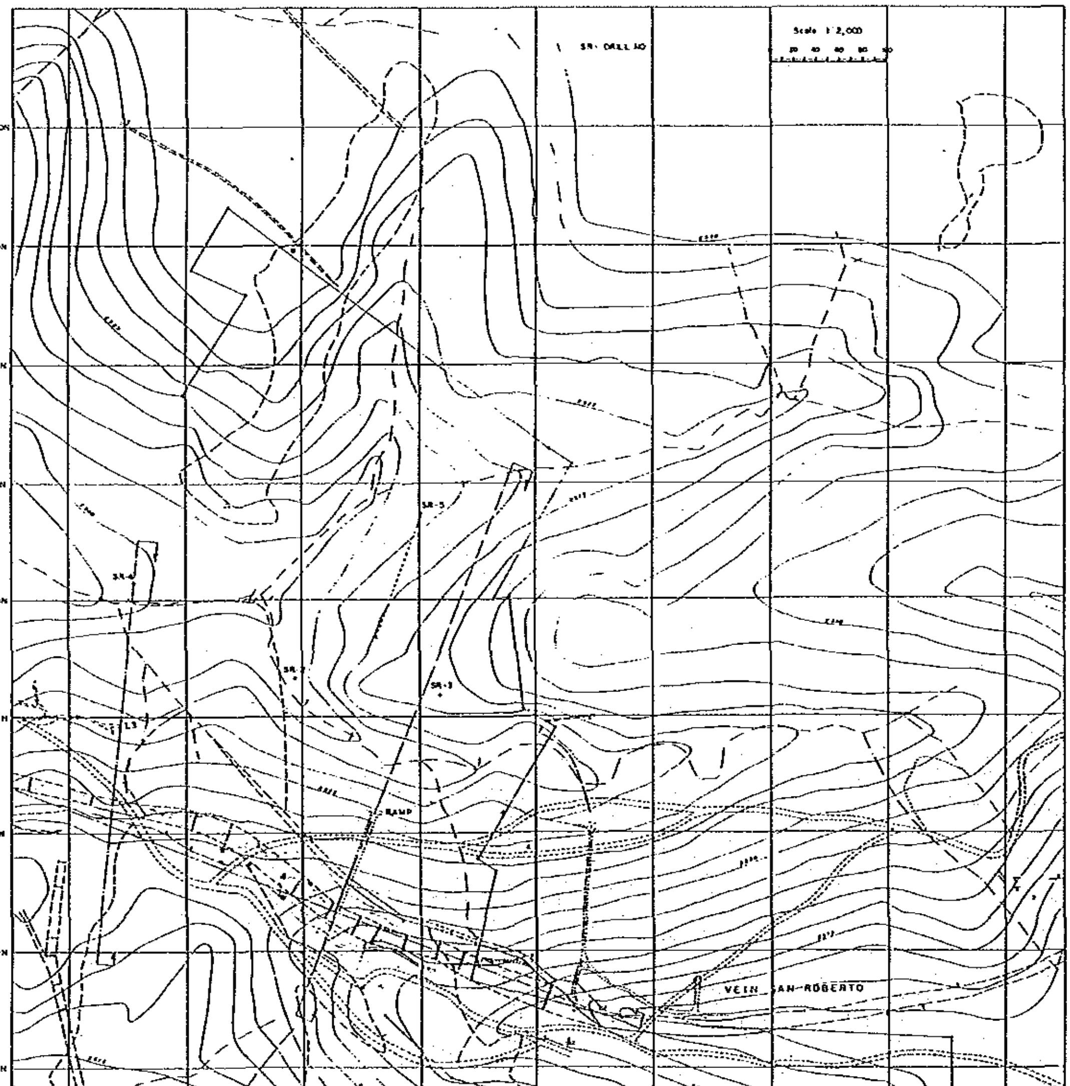


Fig. 3. 3. 13. a San Roberto -Topographic Map-

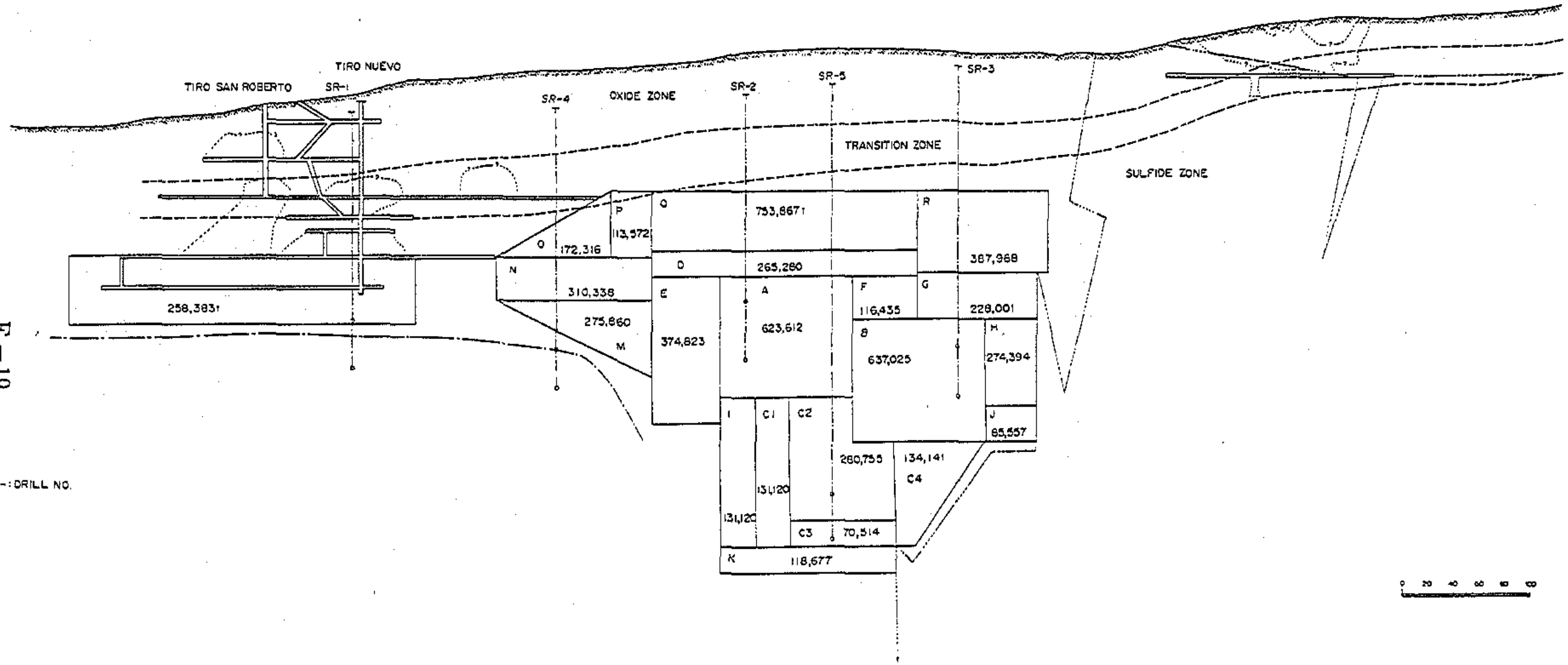


Fig. 3. 3. 13. b San Roberto -Longitudinal Section-

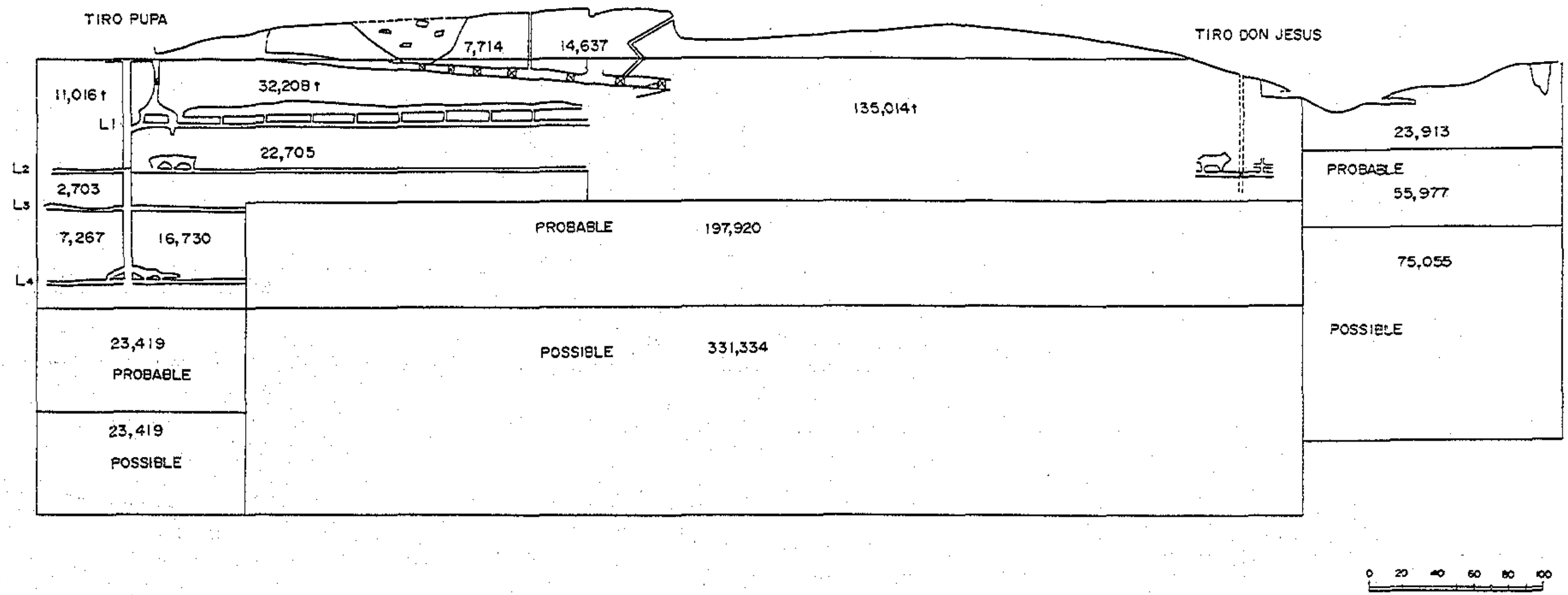


Fig. 3. 3. 14. a San Bernabe y Pupa (Pupa) -Longitudinal section-

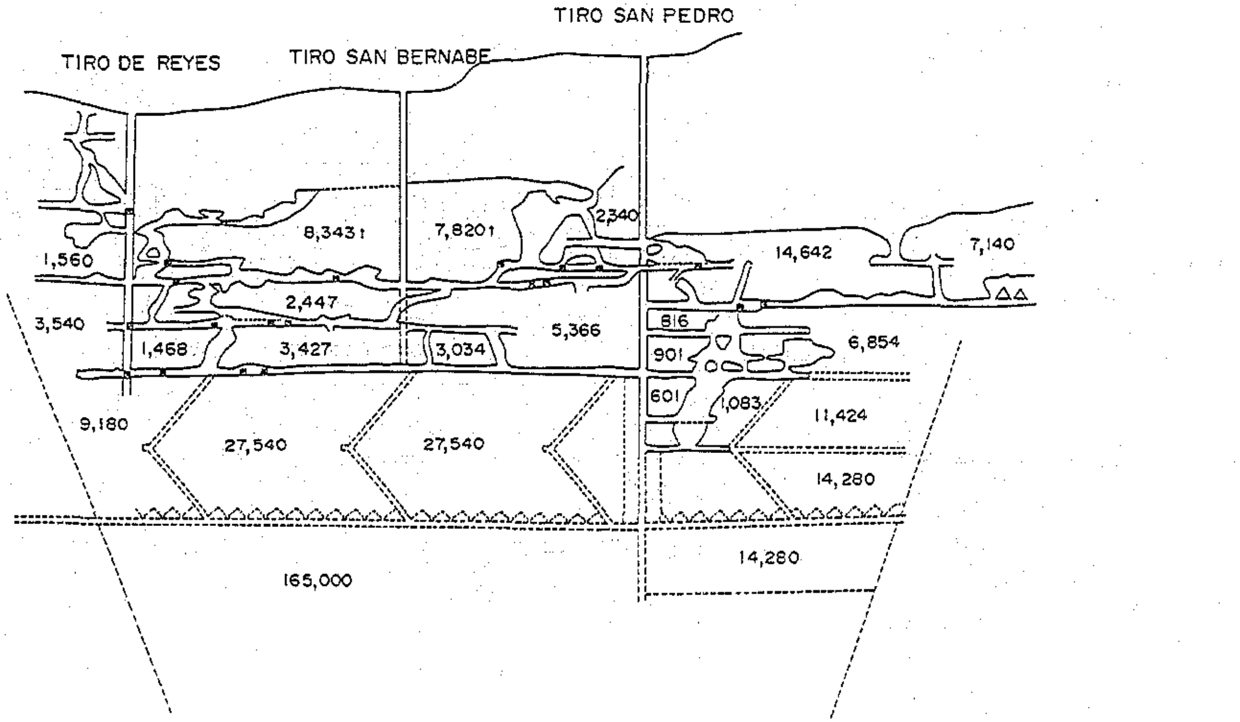


Fig. 3. 3. 14. b San Bernabe y Pupa (San Bernabe) -Longitudinal Section-

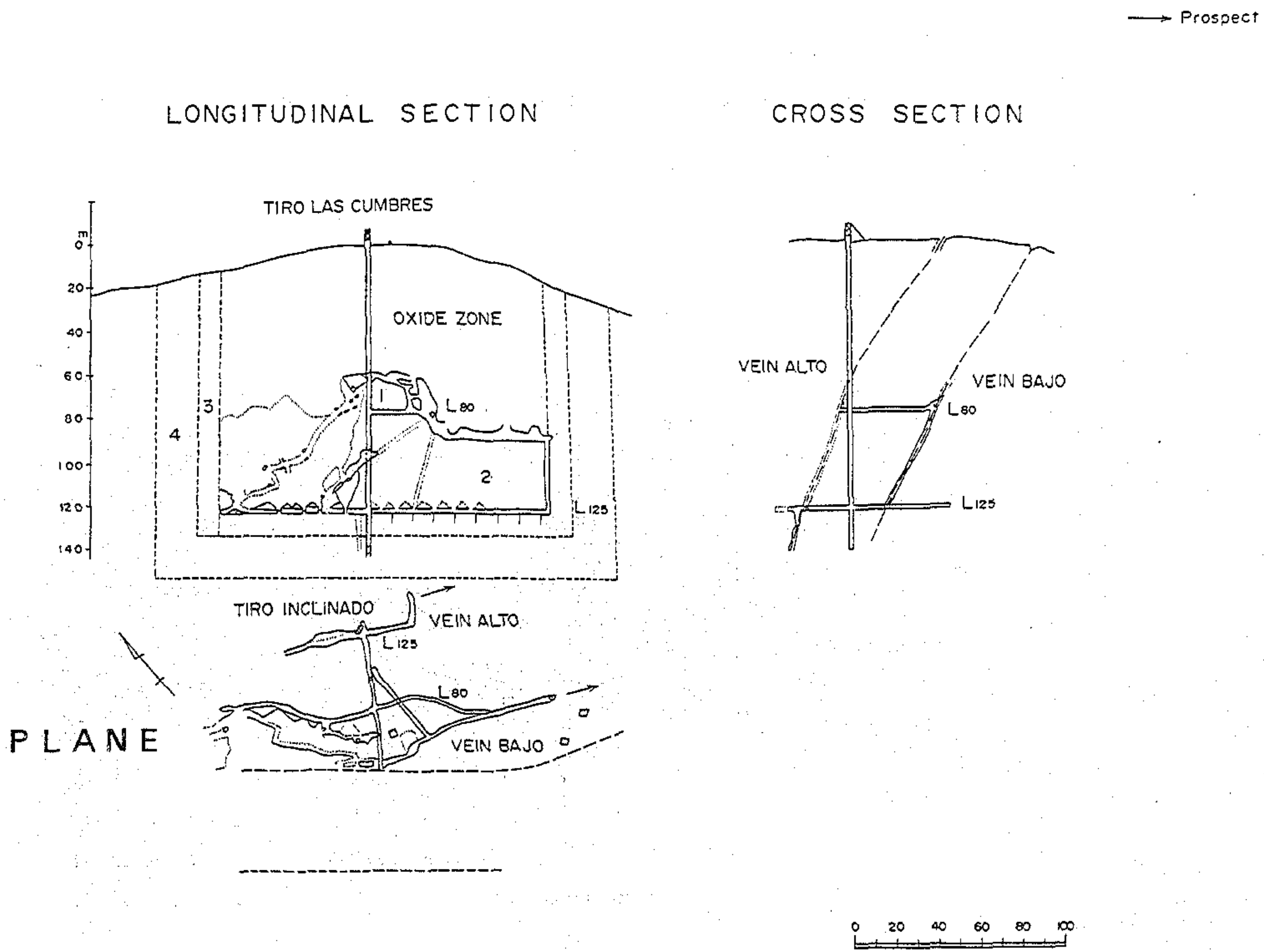


Fig. 3. 3. 15 Las Cumbres -Plane and Section-

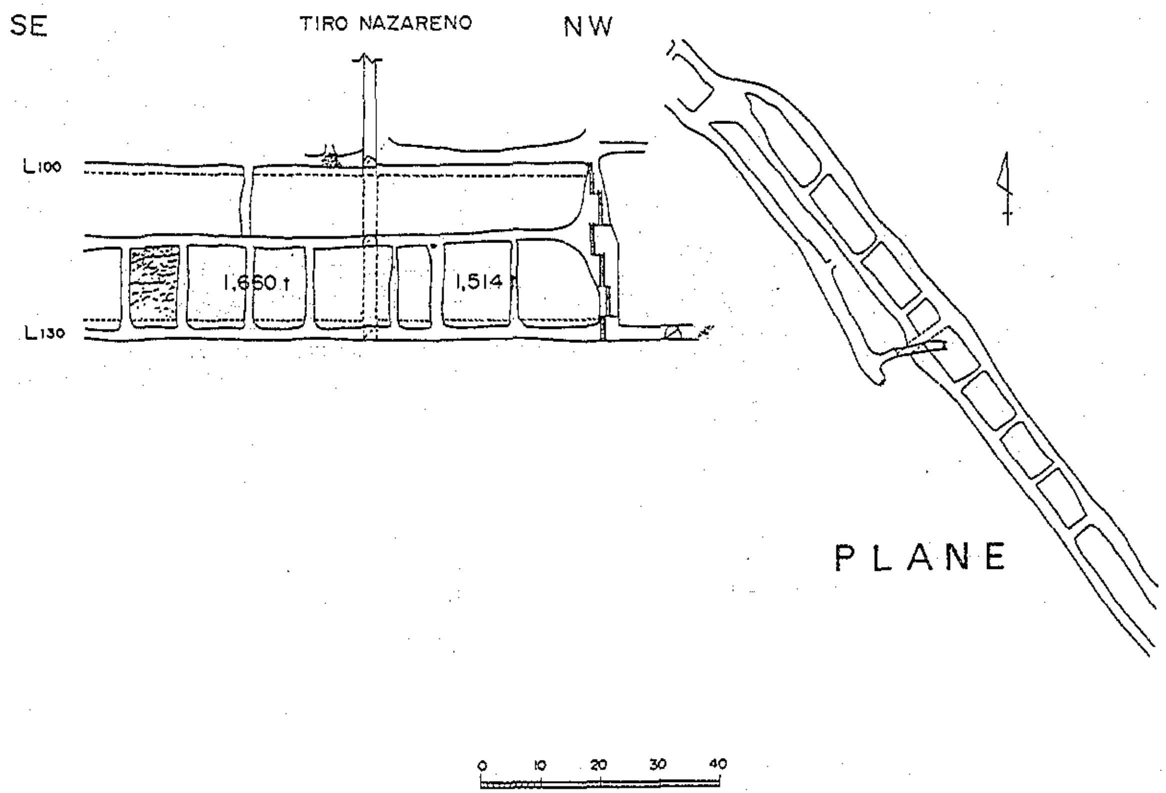


Fig. 3. 3. 16. a　Calicanto -Plane and Longitudinal Section-

LONGITUDINAL SECTION

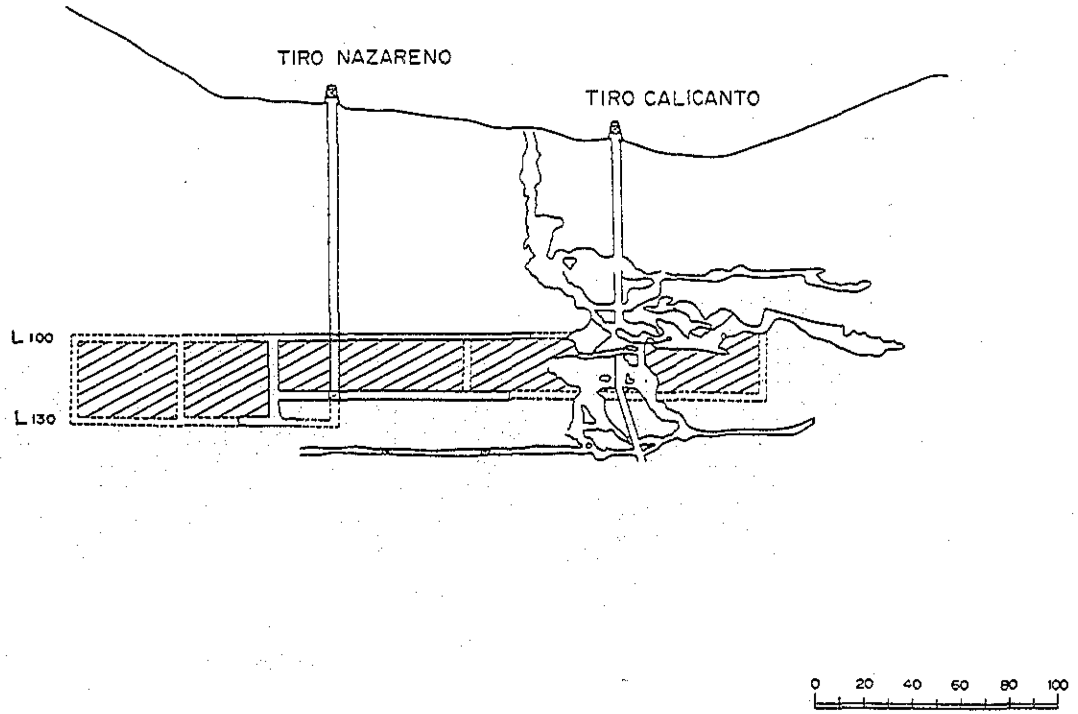


Fig. 3. 3. 16. b Calicanto -Plane and Section-

PLANE

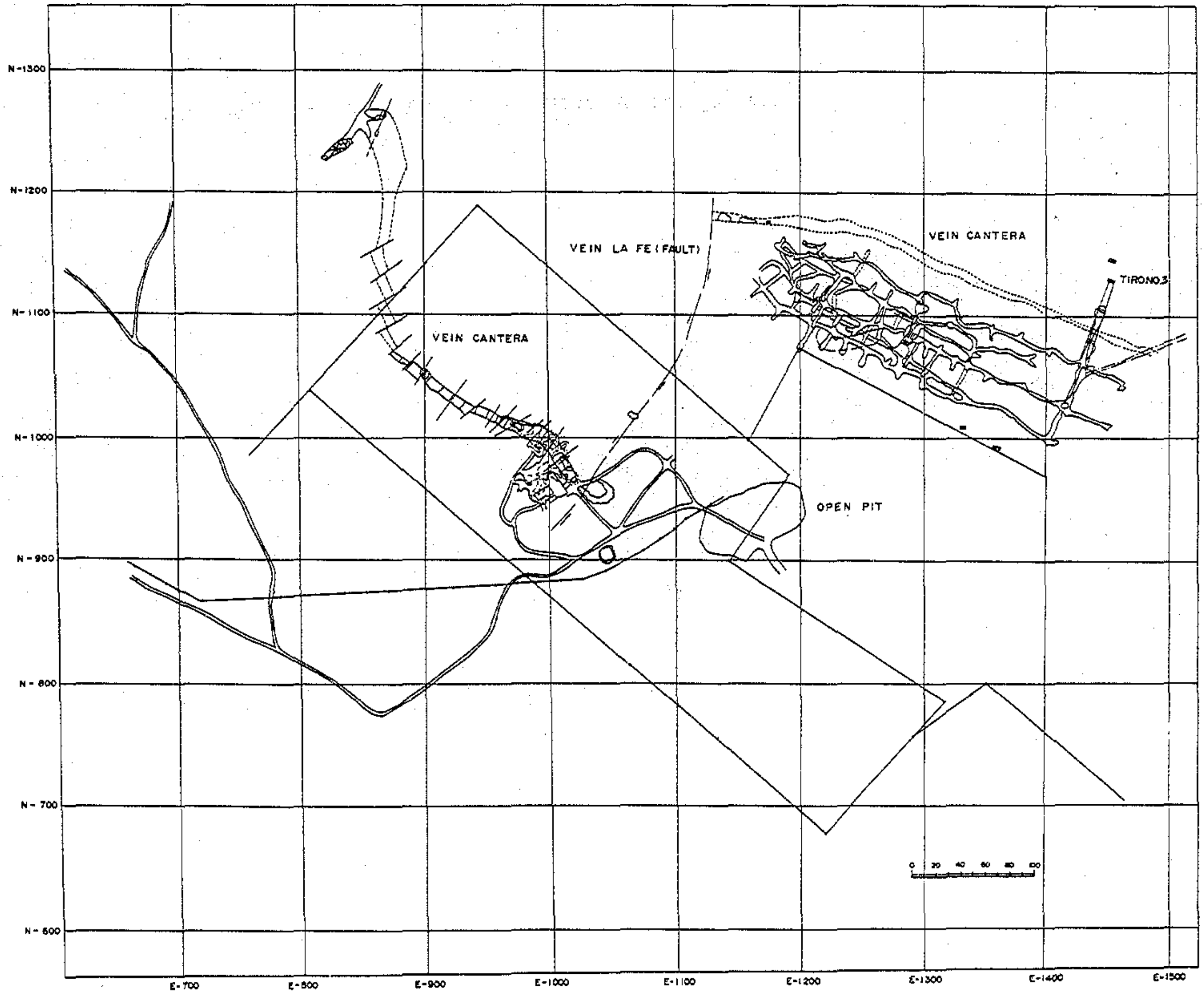


Fig. 3. 3. 17. a California -Plane-

LONGITUDINAL SECTION

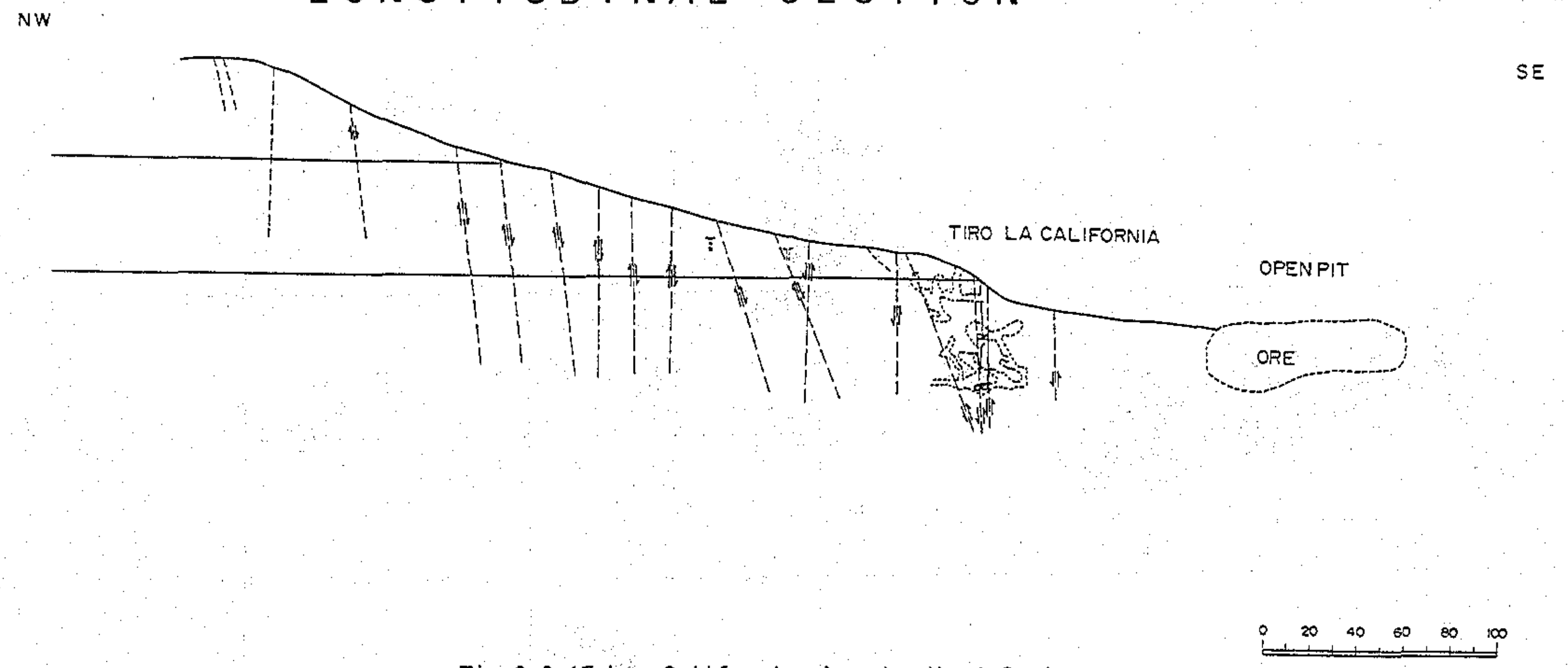


Fig. 3. 3. 17. b　California -Longitudinal Seciton-

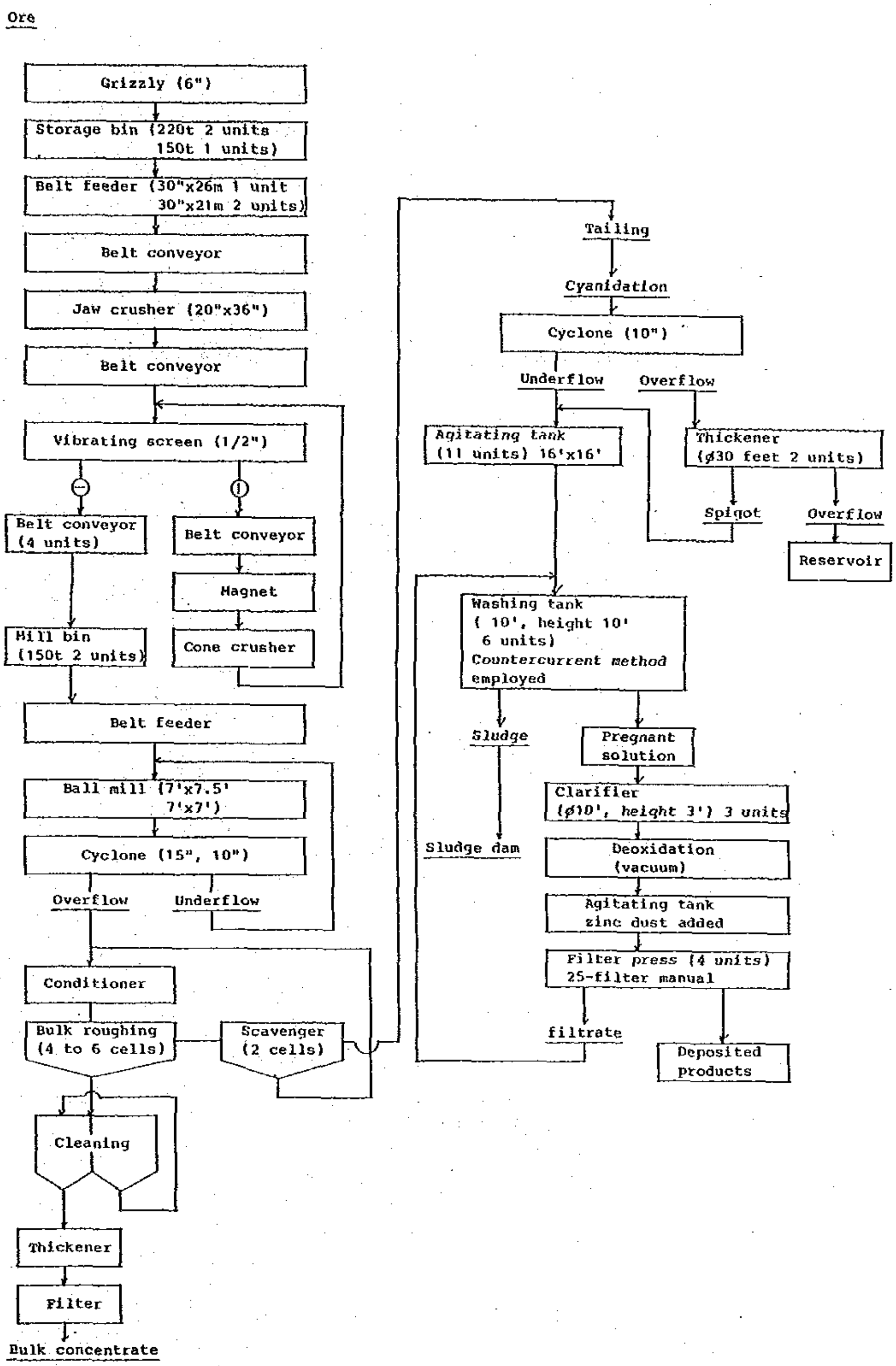


Fig. 3. 6. 1 Flow sheet of Porral Plant

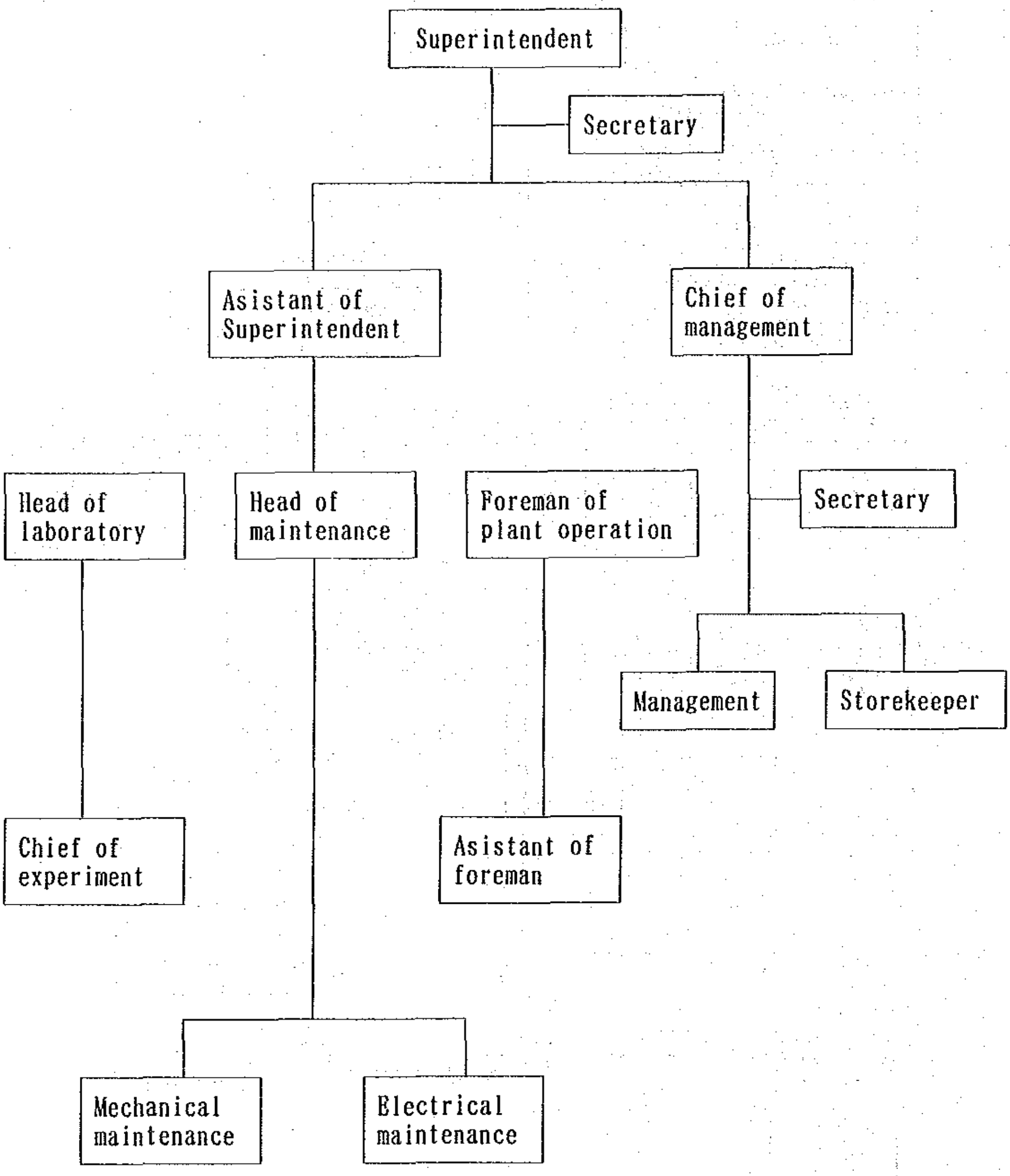


Fig. 3. 6. 2　　Figure of Organization and Personnel

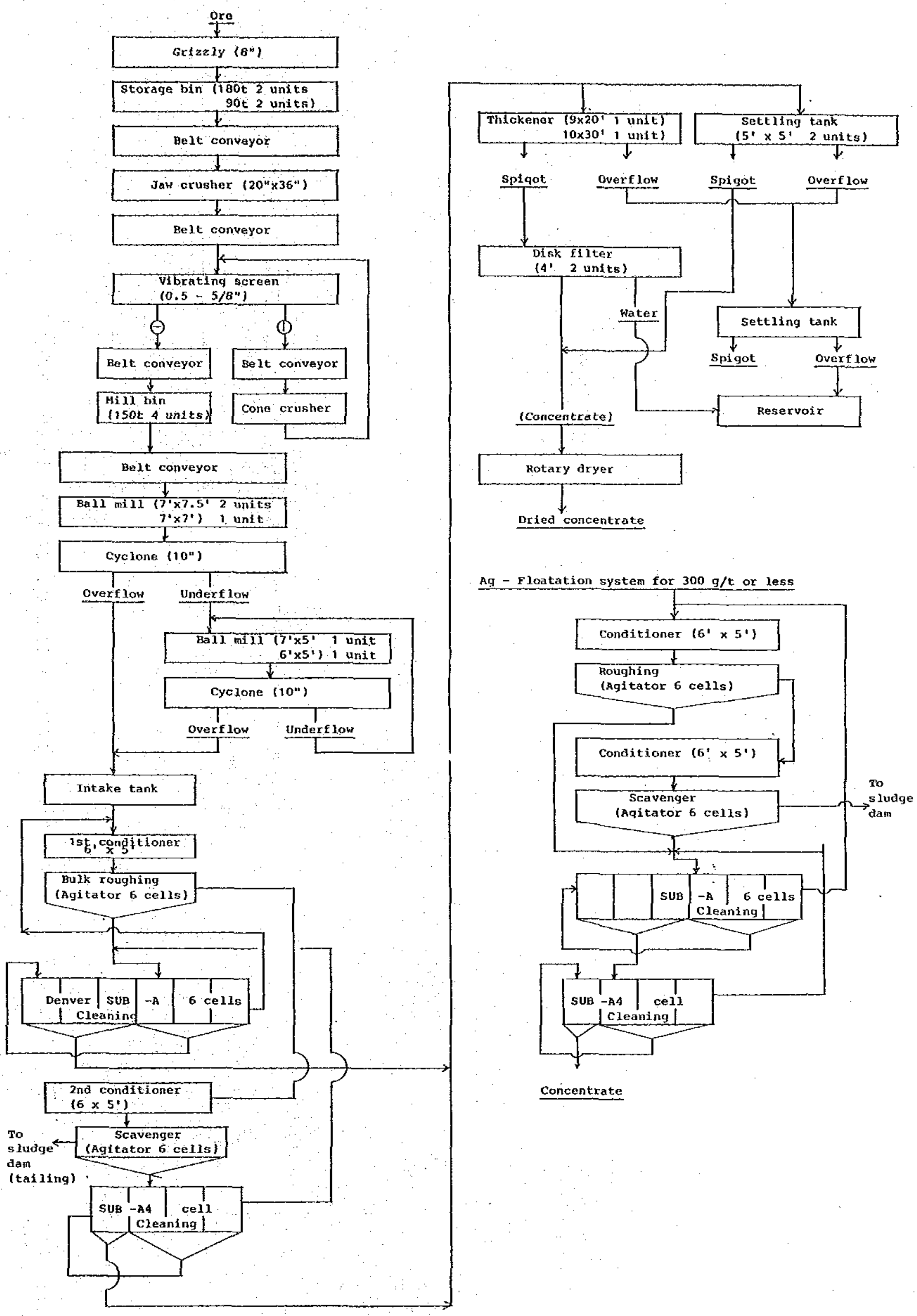


Fig. 3. 6. 3 Flowsheet of Guanacevi Plant

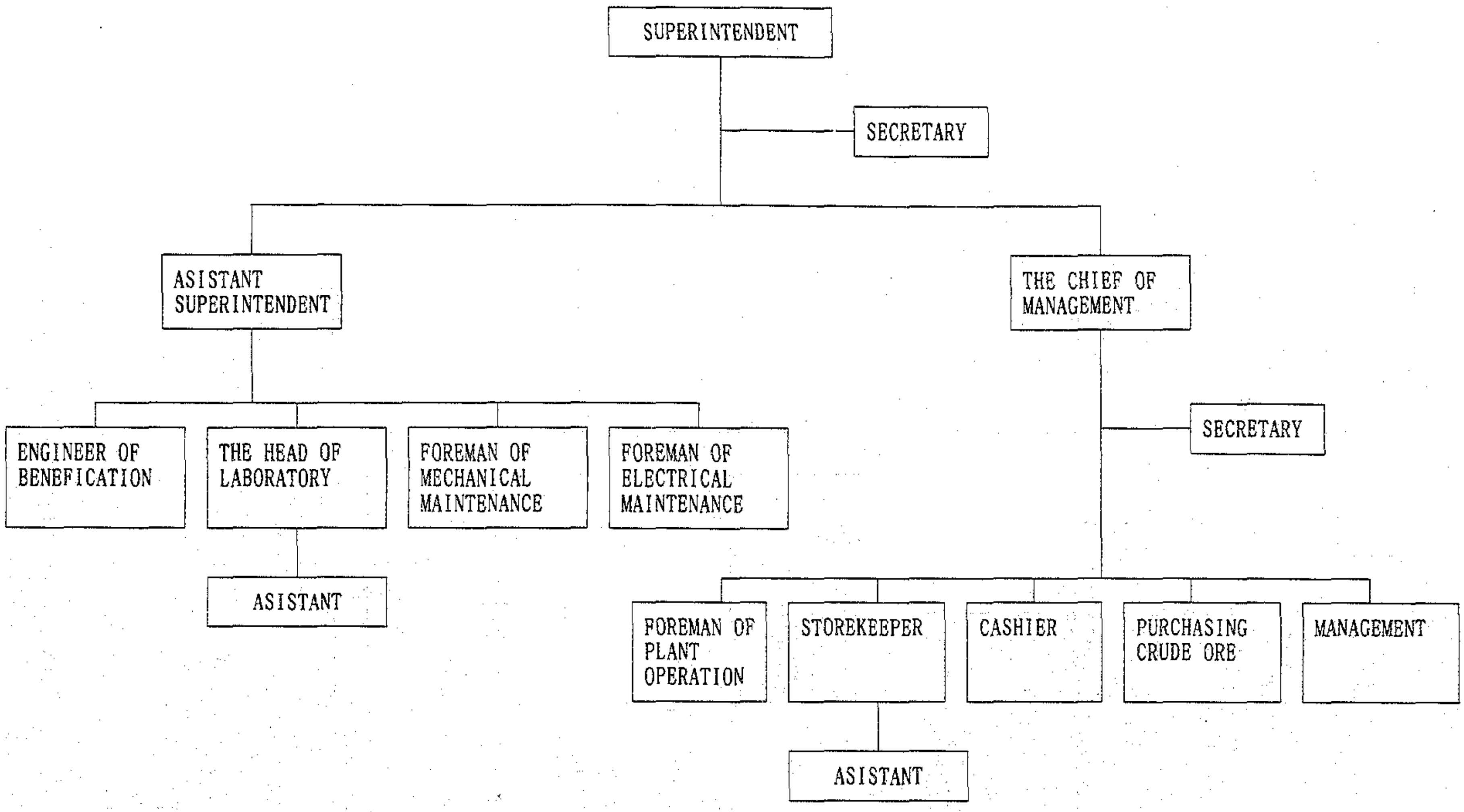


Fig 3.6.4 Figure of organization and personnel Guanacevi

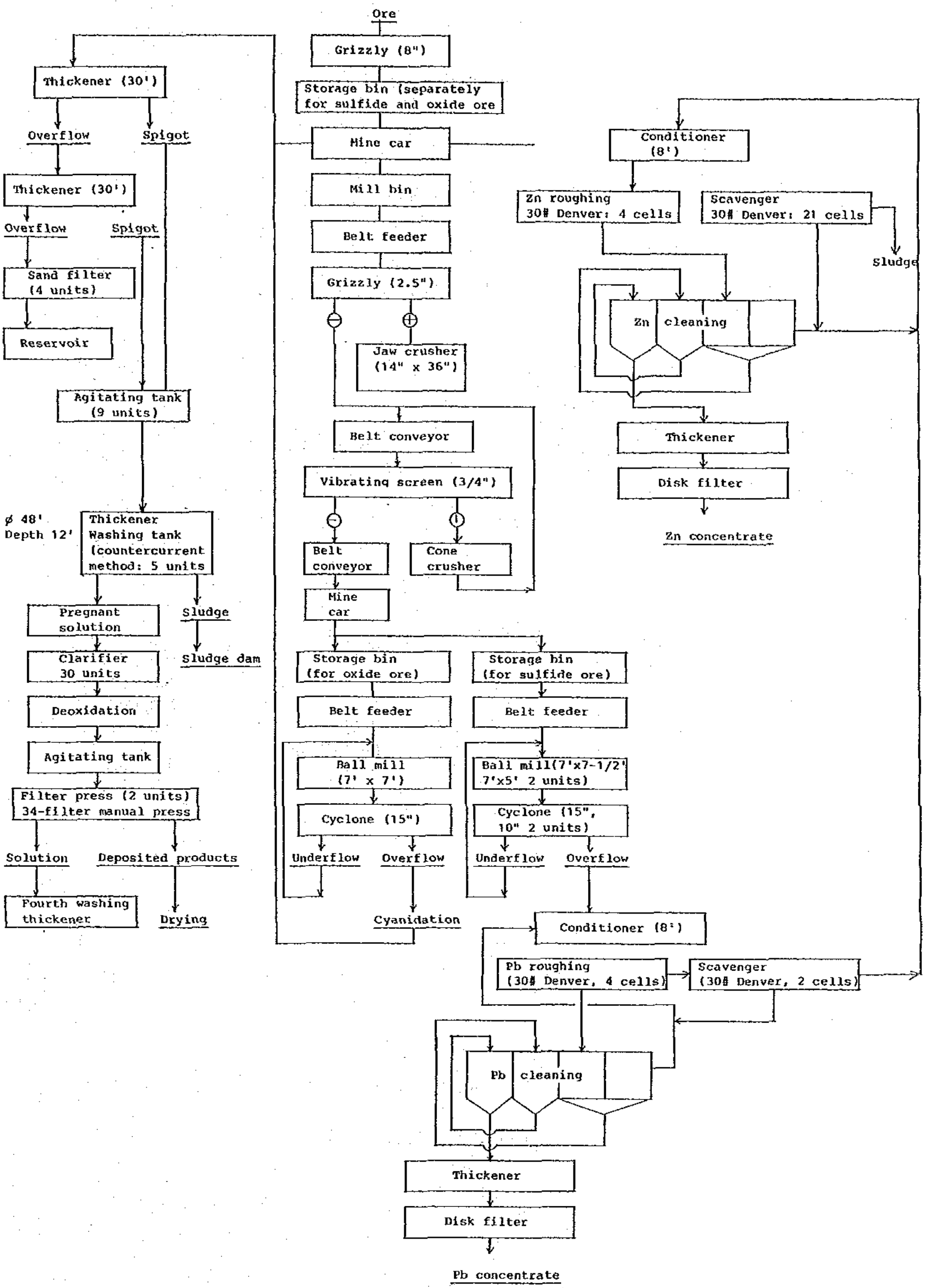
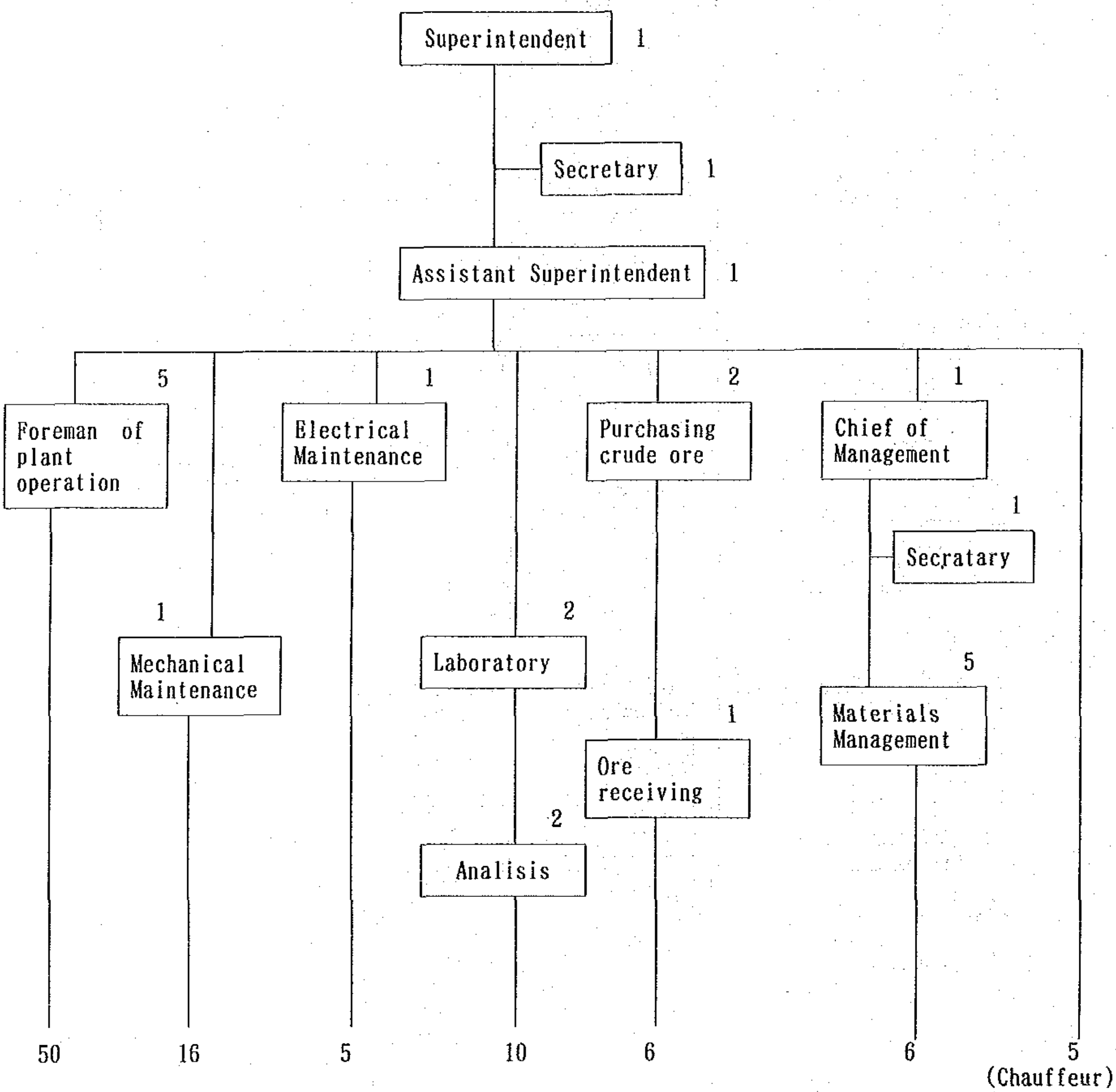


Fig. 3. 6. 5 Flowsheet of Barones plant



Staff ; 24

Worker ; 98

Total personnel ; 122

Fig. 3. 6. 6 Figure of Organization and Personnel

Bulk Flotation-Cyanidation

Example

	Wt	Au	Ag
	tons	g/t	g/t
Distribution	%	%	%

Feed

20,320.0	0.55	378
100.0	100.0	100.0

Pb-Conc

326.4	16.12	11,454
1.6	47.4	48.6

Cyanidation kg/t

1.442	1.4	710
—	18.7	13.4

Tail

19,992.2	0.19	147
98.4	33.9	38.0

Fig. 3.7.1 Metallurgical Balance at Parral Plant 1

Pb Flotation-Cyanidation

Example

	Wt	Au	Ag	Pb
	tons	g/t	g/t	%
Distribution	%	%	%	%

Feed

16,144.0	0.84	286	1.0
100.0	100.0	100.0	100.0

Pb-Conc

337.1	21.32	7,685	19.0
2.1	52.9	56.1	41.1

Cyanidation

Kg/t

0.854	2.1	685	–
–	13.2	12.7	–

Tail

15,806.0	0.29	91	0.6
97.9	33.9	31.3	58.9

Fig. 3.7.2 Metallurgical Balance at Parral Plant 2

Pb/Zn Flotation

Example

	Wt	Au	Ag	Pb	Zn
	tons	g/t	g/t	%	%
Distribution	%	%	%	%	%

Feed

2000.0	1.89	95	3.1	3.1
100.0	100.0	100.0	100.0	100.0

Pb-Conc

77.8	25.79	1,579	59.4
3.9	52.8	64.6	73.8

Zn Conc

76.2	—	370	—	44.4
3.8	—	14.8	—	55.0

Tail

1,846.0	0.97	21	0.9	1.5
92.3	47.2	20.7	26.2	45.0

Fig. 3.7.3 Metallurgical Balance at Parral Plant 3

Buena Fortuna

'89 1-7

Example

	Wt	Au	Ag
	tons	Assay(g/t)	Assay(g/t)
Distribution	%	%	%

Feed

7,498.5	0.86	176
100.0	100.0	100.0

Conc

241.1	17.33	3,319
3.2	64.4	60.7

Tail

7,257.4	0.32	71
96.8	35.6	39.3

Fig. 3.7.4 Metallurgical Balance of Buena Fortuna ore

San Narcos

'89 1-7

Feed

5,207.2	1.55	147
100.0	100.0	100.0

Conc

178.1	33.94	3,020
3.4	74.7	70.1

Tail

5,029.1	0.41	46
96.6	25.3	29.9

Fig. 3.7.5 Metallurgical Balance of San Marcos

San Jose Chico

'89. 7

Example

	Wt	Au	Ag
	tons	Assay(g/t)	Assay(g/t)
Distribution	%	%	%

Feed

1,106.1	2.56	243
100.0	100.0	100.0

Conc

42.4	54.73	5,228
3.8	81.2	81.7

Tail

1,073.7	0.50	46
96.2	18.8	18.3

'89 1-7

Feed

6,015.8	2.78	218
100.0	100.0	100.0

Conc

246.4	57.13	4,473
4.1	84.0	83.9

Tail

5,769.4	0.46	37
95.9	16.0	16.1

Fig. 3.7.6 Metallurgical Balance of Sun Josè Chico

Capuzaya

'89. 7

Example

	Wt	Au	Ag
	tons	Assay(g/t)	Assay(g/t)
Distribution	%	%	%

Feed

769.5	0.99	218
100.0	100.0	100.0

Conc

14.2	31.49	8,140
1.9	59.0	69.0

Tail

755.3	0.41	69
98.1	41.0	31.0

'89 1-7

Feed

4,013.6	0.70	161
100.0	100.0	100.0

Conc

68.7	23.50	5,935
1.7	57.7	63.0

Tail

3,944.9	0.30	61
98.3	42.3	37.0

Fig. 3.7.7 Metallurgical Balance of Capuzaya

El Soto

'89. 7

Example

	Wt	Au	Ag
	tons	Assay(g/t)	Assay(g/t)
Distribution	%	%	%

Feed

70.4	0.36	341
100.0	100.0	100.0

Conc

0.4	11.80	15,782
0.6	57.1	25.9

Tail

70.0	0.30	254
99.4	42.9	74.1

'89 1-7

Feed

2,049.2	0.46	194
100.0	100.0	100.0

Conc

47.4	9.13	4,801
2.3	45.7	57.1

Tail

2,001.8	0.26	85
97.7	54.3	42.9

Fig. 3.7.8 Metallurgical Balance of El Soto

Bulk Flotation

Example

	Wt	Au	Ag	Pb	Zn	Fe
	tons	g/t	g/t	%	%	%
Distribution	%	%	%	%	%	%

Feed

15548.6	0.38	177	0.2	0.2	0.5
100.0	100.0	100.0	100.0	100.0	100.0

Conc

163.3	6.79	9,122	3.8	3.3	12.2
1.1	18.9	54.2	21.7	19.5	2.6

Tail

15385.3	0.31	82	0.1	0.1	4.9
98.9	81.1	45.8	78.3	80.5	97.4

Fig. 3.7.9 Metallurgical Balance of Bulk Flotation at Barones Plant

Pb/Zn Flotation

Feed

8851.8	0.51	165	0.9	1.5	5.7
100.0	100.0	100.0	100.0	100.0	100.0

Pb-Conc

149.2	8.18	3,090	28.8	22.5	9.3
1.7	27.2	31.5	54.0	24.9	2.7

Zn Conc

115.1	1.85	721	2.3	42.1	10.2
1.3	4.8	5.7	3.3	36.0	2.3

Tail

8587.5	0.35	107	0.4	0.6	5.6
97.0	68.0	62.8	42.7	39.1	95.0

Fig. 3.7.10 Metallurgical Balance of Pb/Zn Flotation at Barones Plant

Metallurgical Balancesheet of Barones

Pb/Cu/Ze Flotation

'89 1-6

Example

	Wt	Au	Ag	Pb	Cu	Zn	Fe
Assay	tons	g/t	g/t	%	%	%	%
Distribution	%	%	%	%	%	%	%

Feed

13057.2	0.31	100	0.5	0.5	1.0	6.5
100.0	100.0	100.0	100.0	100.0	100.0	100.0

Pb-Conc

76.5	1.99	2536	32.9	15.2	3.9	10.7
0.6	3.8	14.8	37.4	17.5	2.4	1.0

Cu Conc

239.1	1.79	2284	6.8	18.2	8.4	16.0
1.8	10.7	41.7	24.2	65.6	16.0	4.5

Zn Conc

145.3	0.92	379	0.8	1.1	43.8	8.0
1.1	3.3	4.2	1.6	2.4	50.4	1.4

Tail

12596.3	0.26	41	0.2	0.1	0.3	6.2
96.5	82.3	39.3	36.7	14.5	31.2	93.1

Fig. 3. 7. 11 Metallurgical Balance of Pb/Cu/Zn Flotation at Barones Plant

Cyanidation

	Wt	Au	Ag
Assay	tons	g/t	g/t ·%
Distribution	%	%	%

Feed

16, 882. 7	0. 6	171
100. 0	100. 0	100. 0

Conc Kg %

4, 342	0. 073	47. 10
—	29. 8	70. 8

Tail

16, 878. 3	0. 4	50
—	70. 2	29. 2

Fig. 3. 7. 12 Metallurgical Balance of Cyanidation at Barones Plant

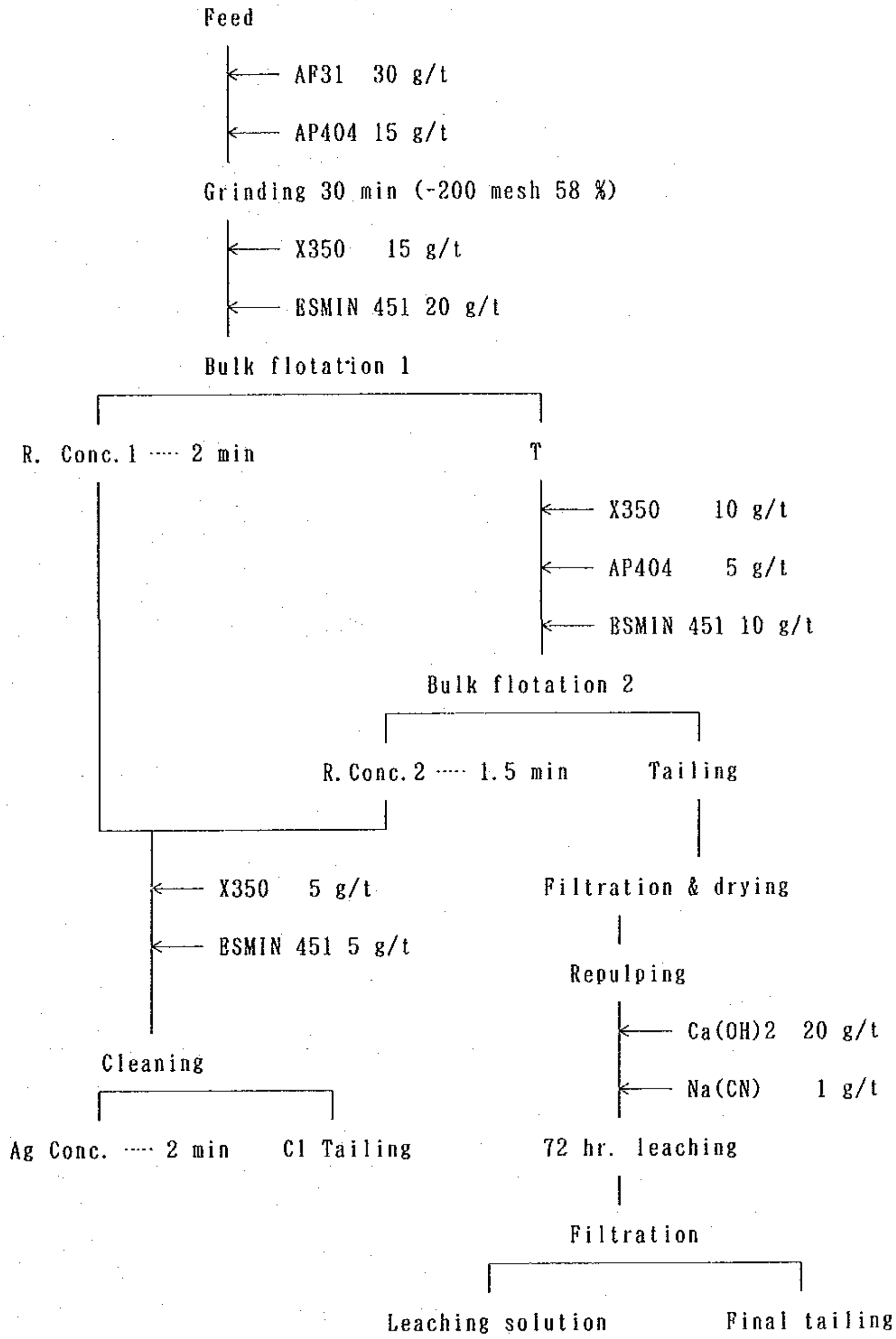


Fig. 4. 1. 1 Flow sheet of Beneficiation test No. 1

Feed

Wt %	assay g/t		Distribution %	
	Au	Ag	Au	Ag
100.0	3.6	122	100.0	100.0

washing and decantation

⊖ Primary slime

Wt %	assay g/t		Distribution %	
	Au	Ag	Au	Ag
15.1	3.1	165	13.1	20.3

⊕

Wt %	assay g/t		Distribution %	
	Au	Ag	Au	Ag
84.9	3.6	115	86.9	79.7

Grinding 30 min.

Decantation (3 times)

⊖ Secondary slime

Wt %	assay g/t		Distribution %	
	Au	Ag	Au	Ag
22.7	4.6	100	29.3	18.5

⊕

Wt %	assay g/t		Distribution %	
	Au	Ag	Au	Ag
62.2	3.3	121	57.6	61.3

Fig. 4.1.2 Result of Washing test of Jose Galindo Ore

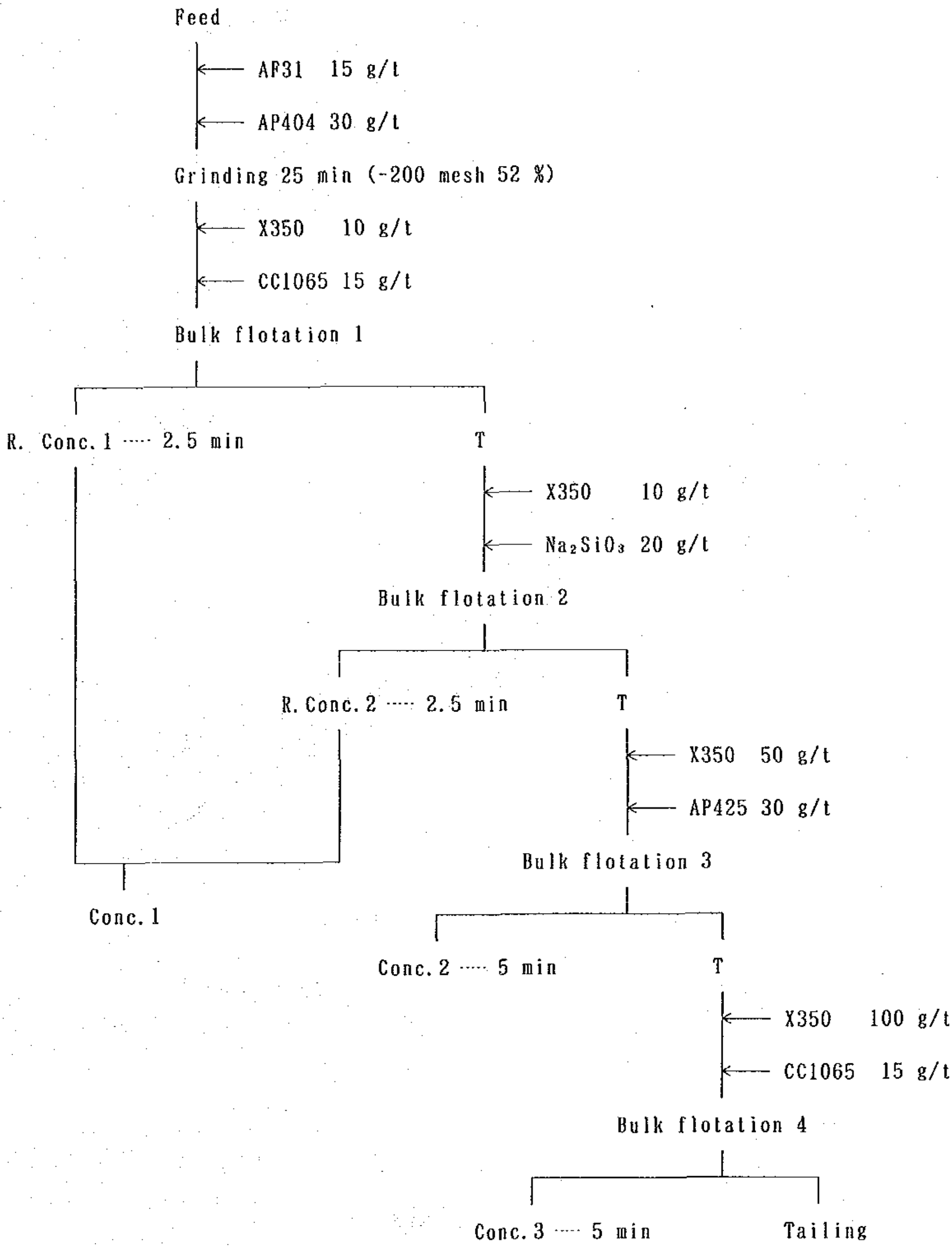


Fig. 4.1.3 Flow sheet of Flotation test for Rosavio Oxide (Test No. 1)

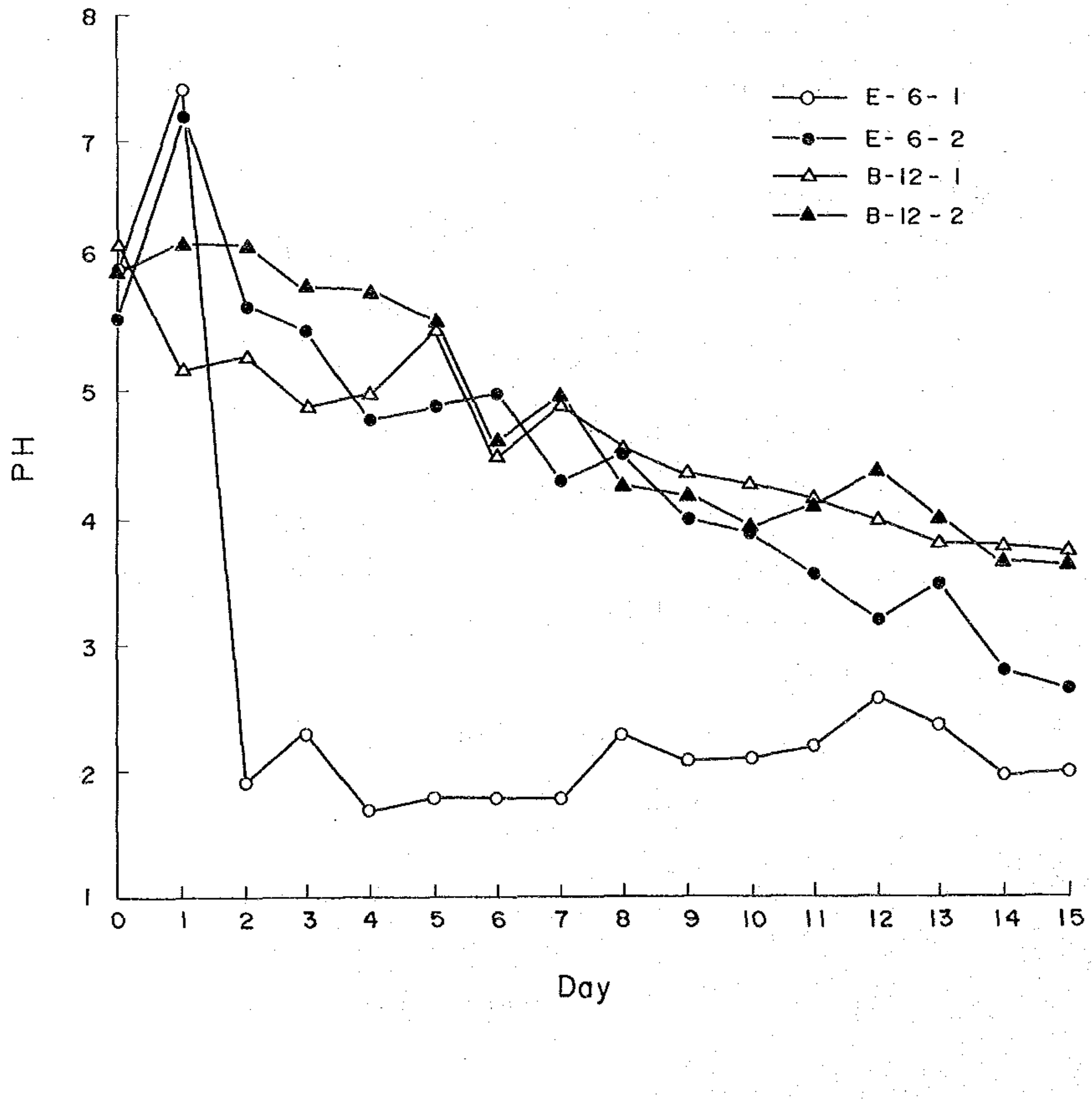


Fig. 4. 2. 1 Relation between pH and Leaching time

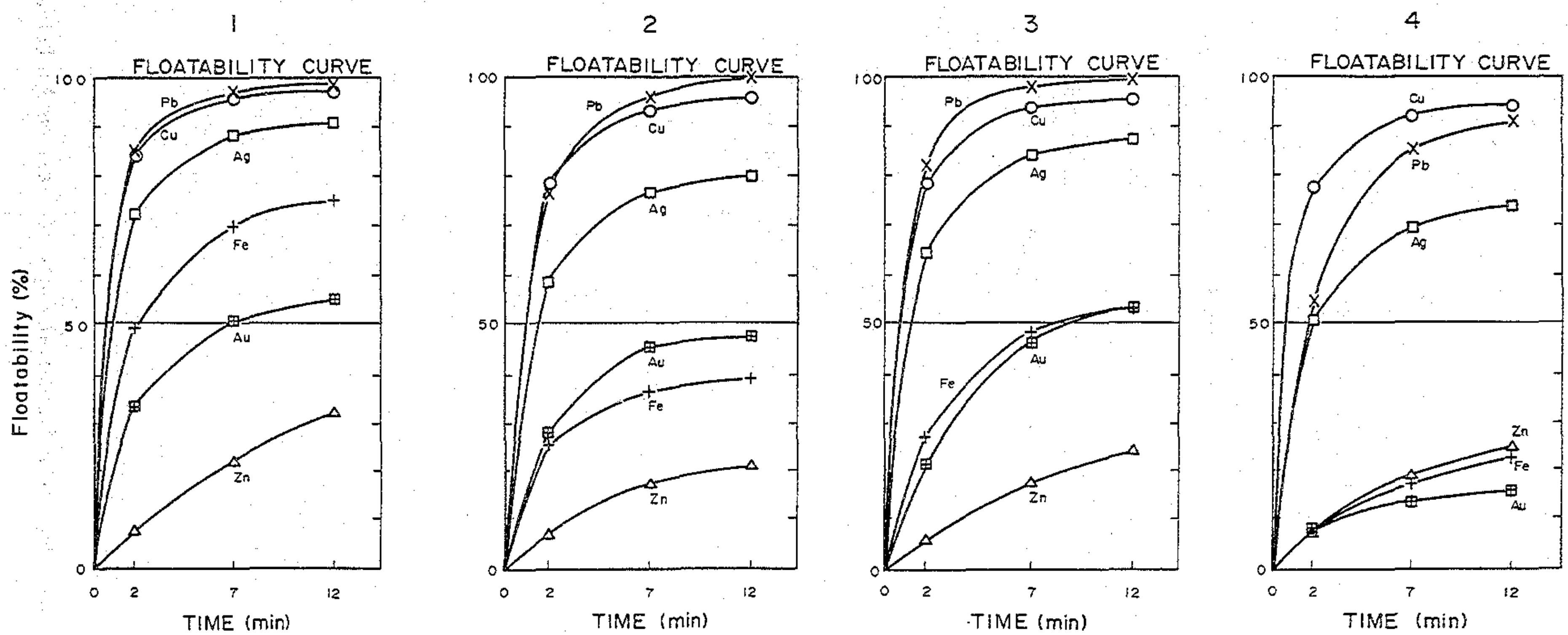


Fig. 4.2.2 Flotablities of Fundamental Flotation test on San Bernabe Ore [a]

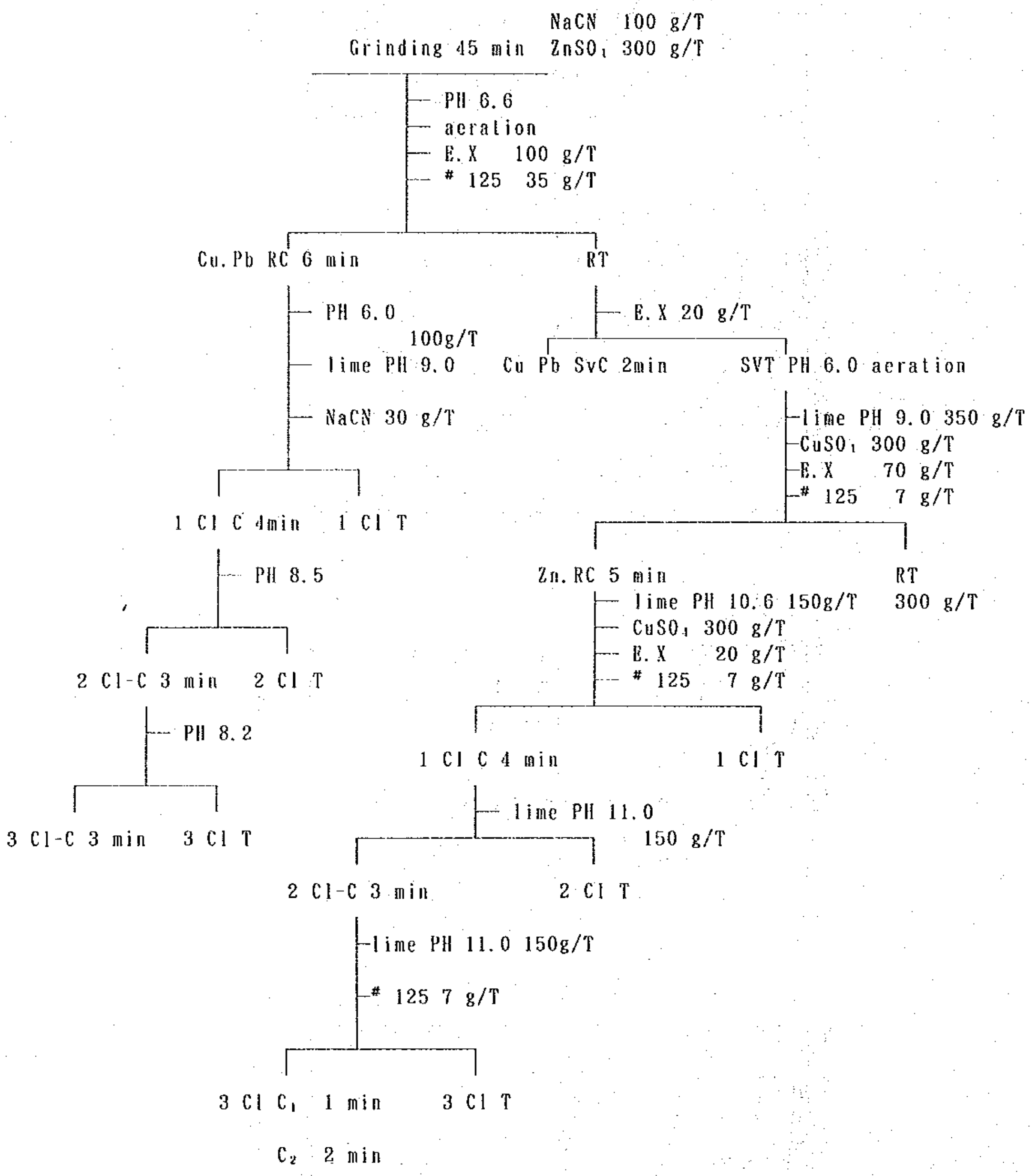


Fig. 4.2.3 Folow sheet on Differential Flotation test on San Bernabe Ore

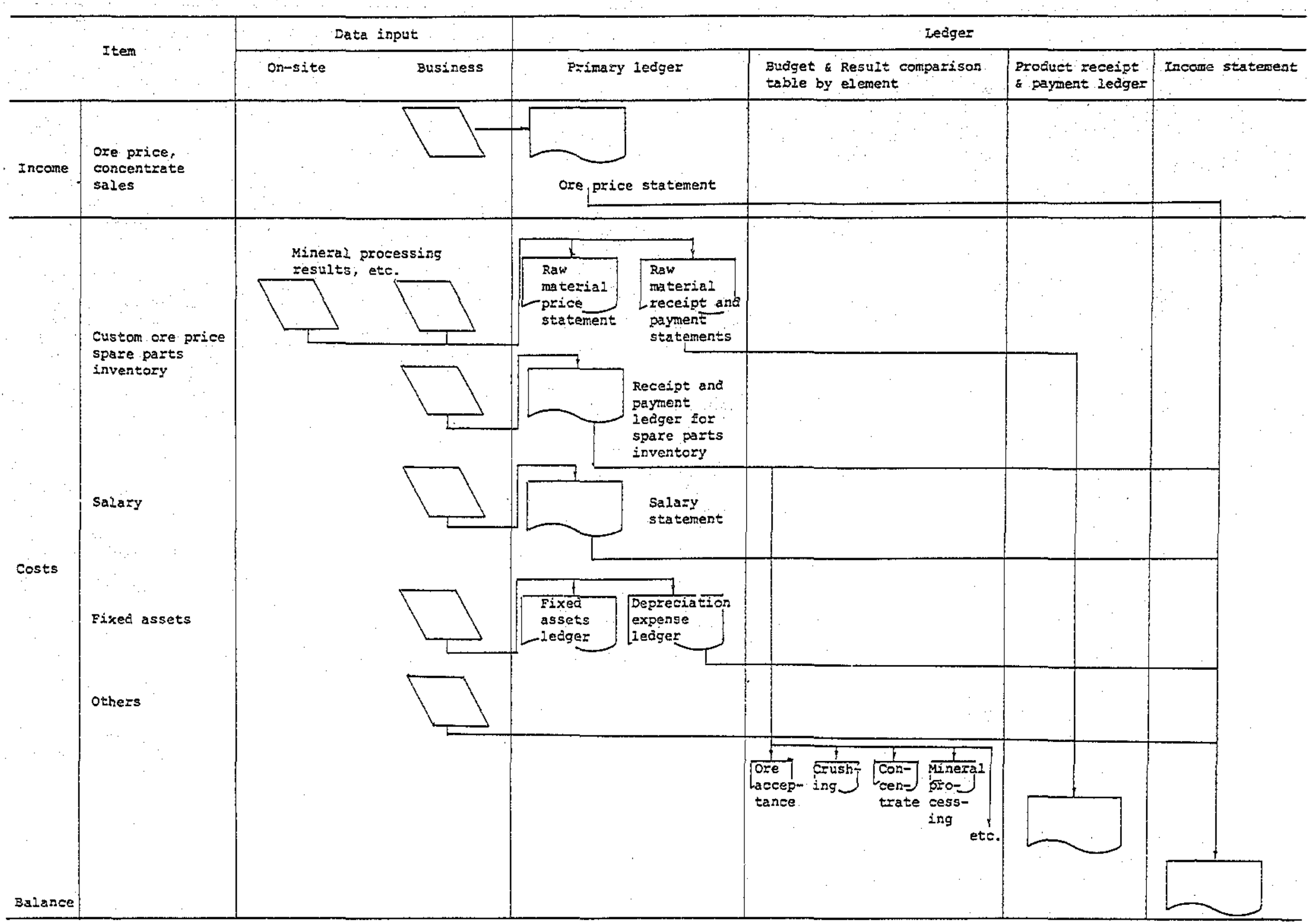


Fig. 6. 6. 1 Flow chart of Rationalized office work

	Item	Data input: On-site	Data input: Business	Ledger: Primary ledger	Ledger: Budget & Result comparison table by element	Ledger: Product receipt & payment ledger	Ledger: Income statement
Income	Ore price, concentrate sales			Ore price statement			
		Mineral processing results, etc.		Raw material price statement; Raw material receipt and payment statements			
	Custom ore price spare parts inventory			Receipt and payment ledger for spare parts inventory			
	Salary			Salary statement			
Costs							
	Fixed assets			Fixed assets ledger; Depreciation expense ledger			
	Others						
					Ore acceptance; Crushing; Concentrate; Mineral processing etc.		
Balance							

Fig. 6. 6. 1 Flow chart of Rationalized office work

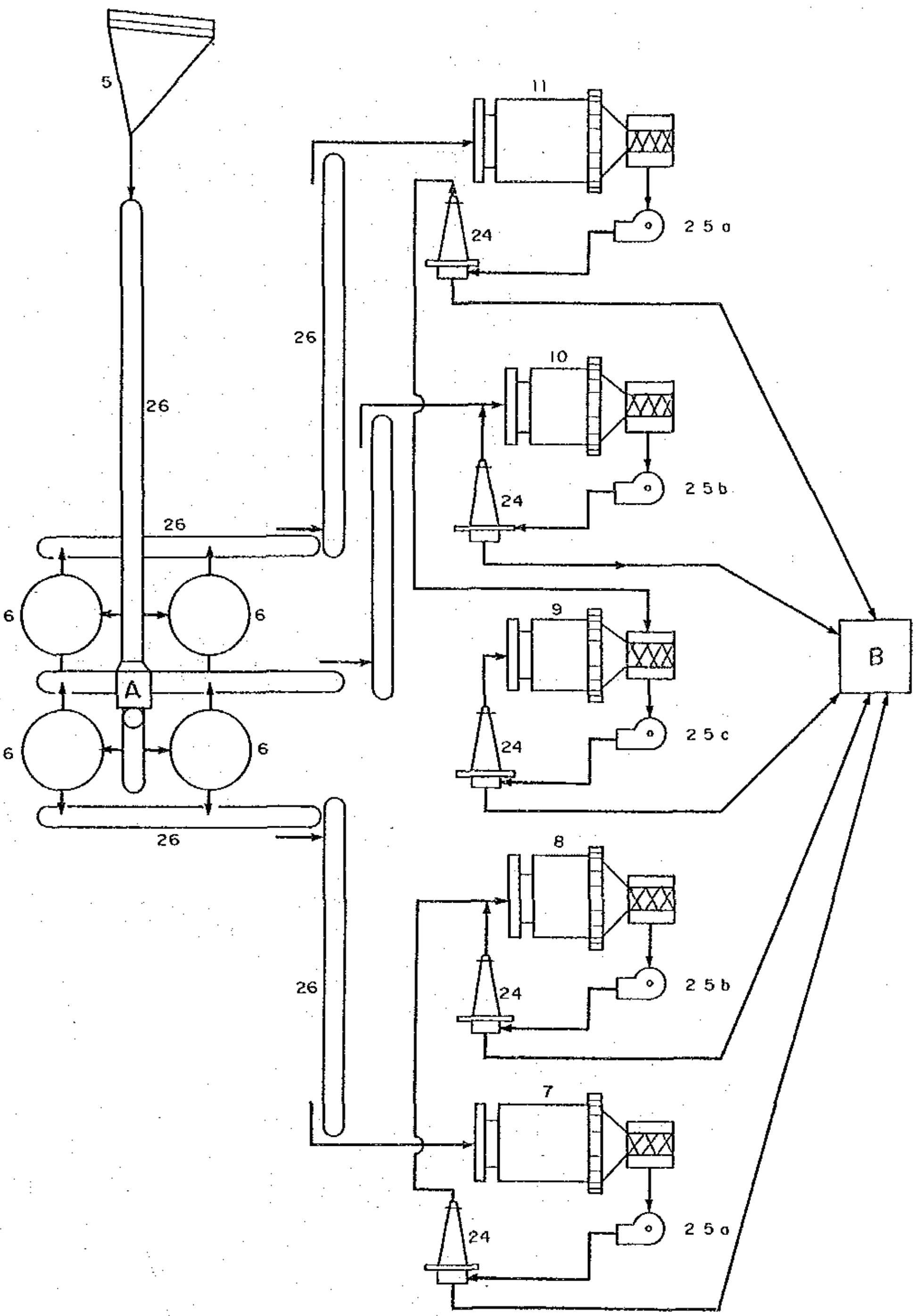


Fig. 8. 3. 1　　Current flow sheet of Grinding Process at Guanacevi Plant

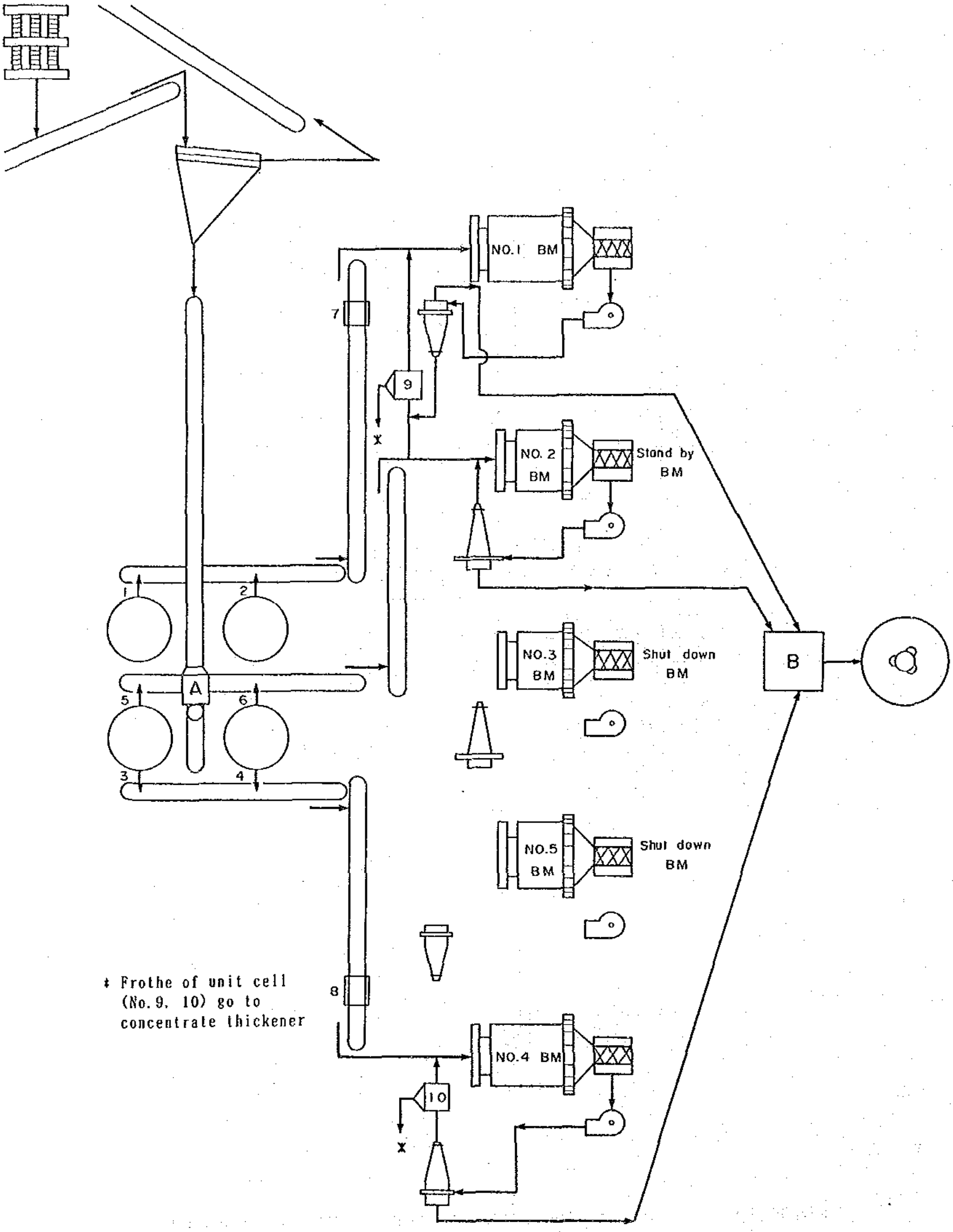


Fig. 8. 3. 2 Flow sheet of Improvement Plant for Grinding Process at Guanacevi Plant

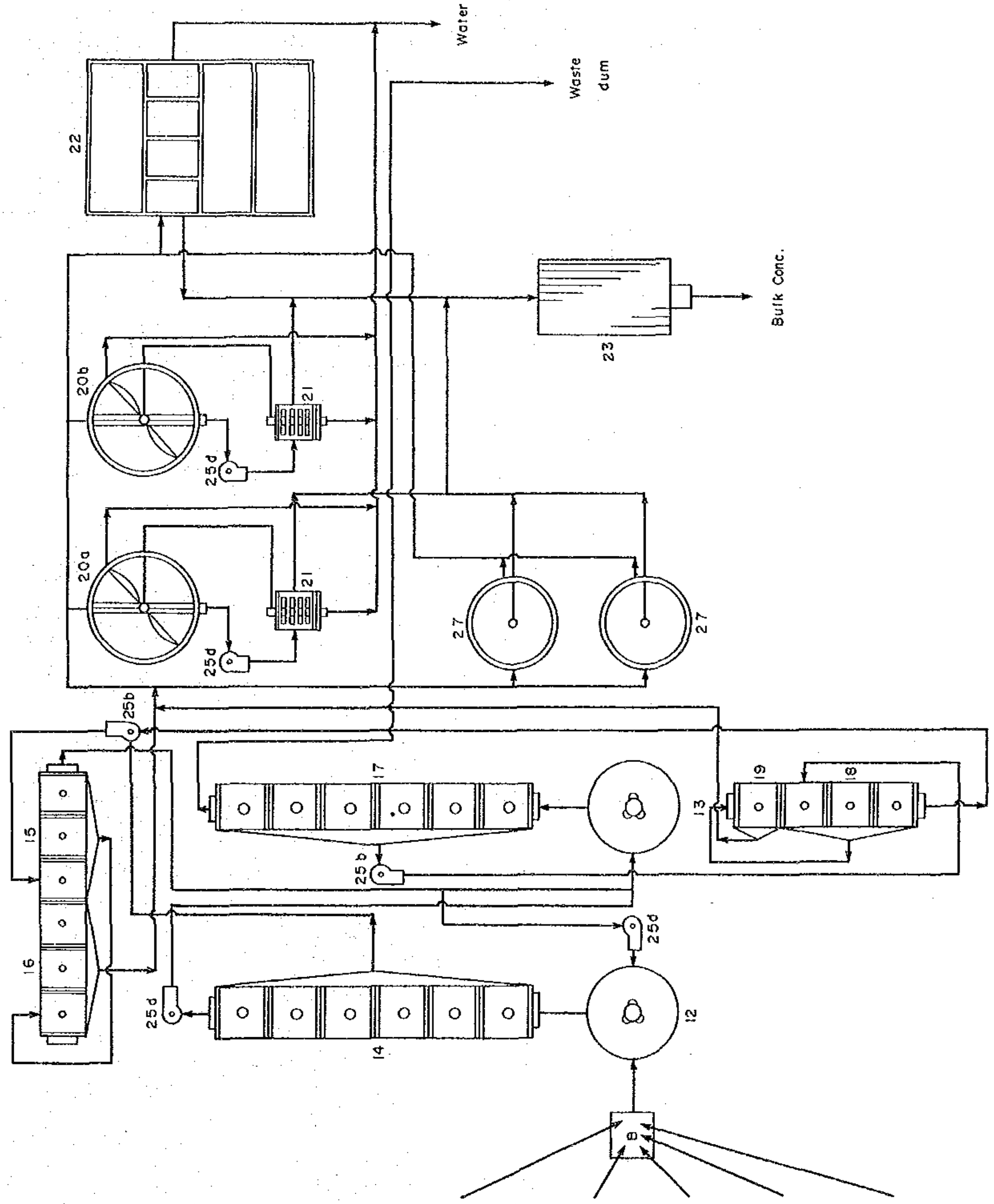


Fig. 8. 3. 3　　Current flow sheet of Flotation and Dewatering Process at Guanacevi Plant

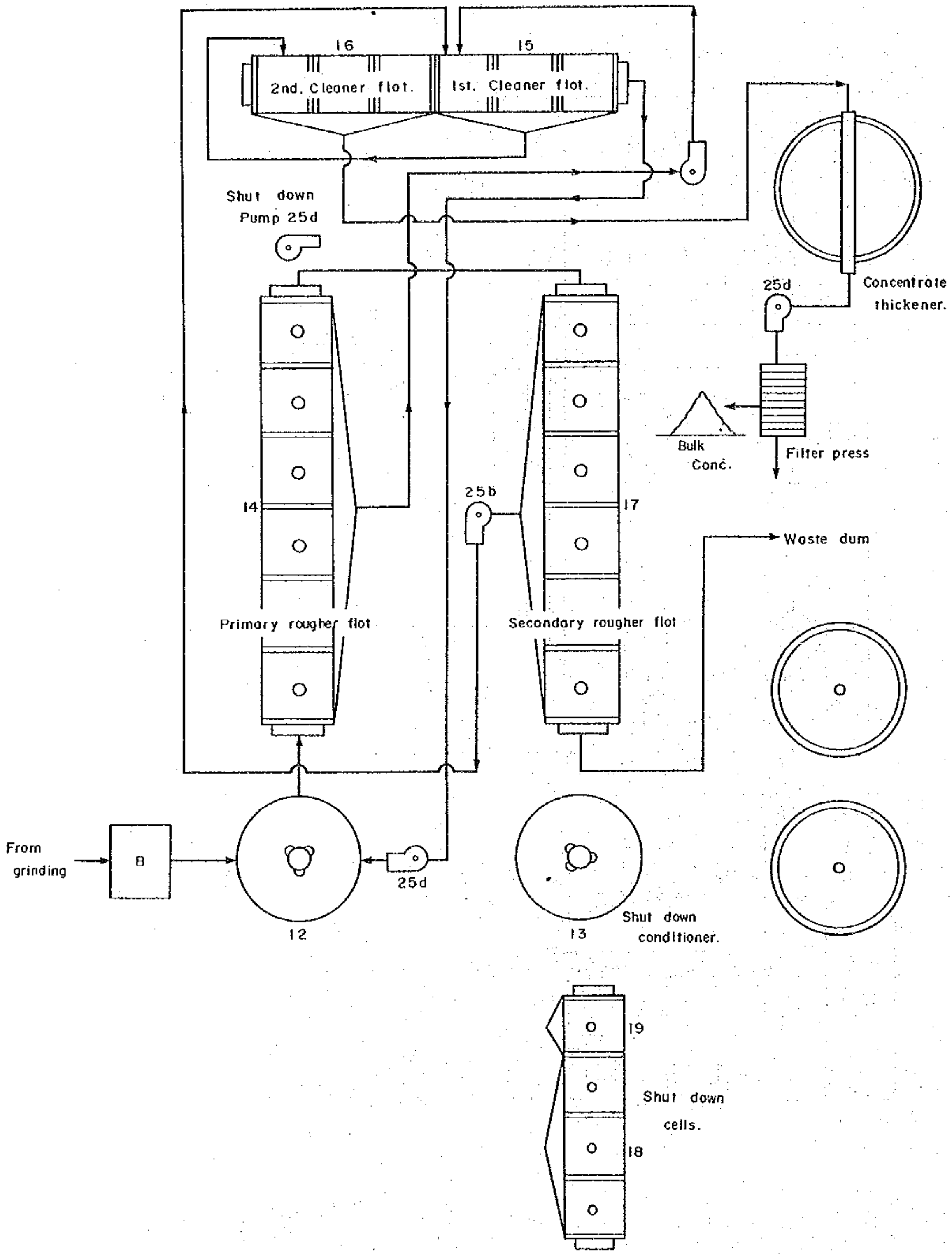


Fig. 8. 3. 4 Flow sheet of Improvement Plan for Flotation and Dewatering Process at Guanacevi Plant

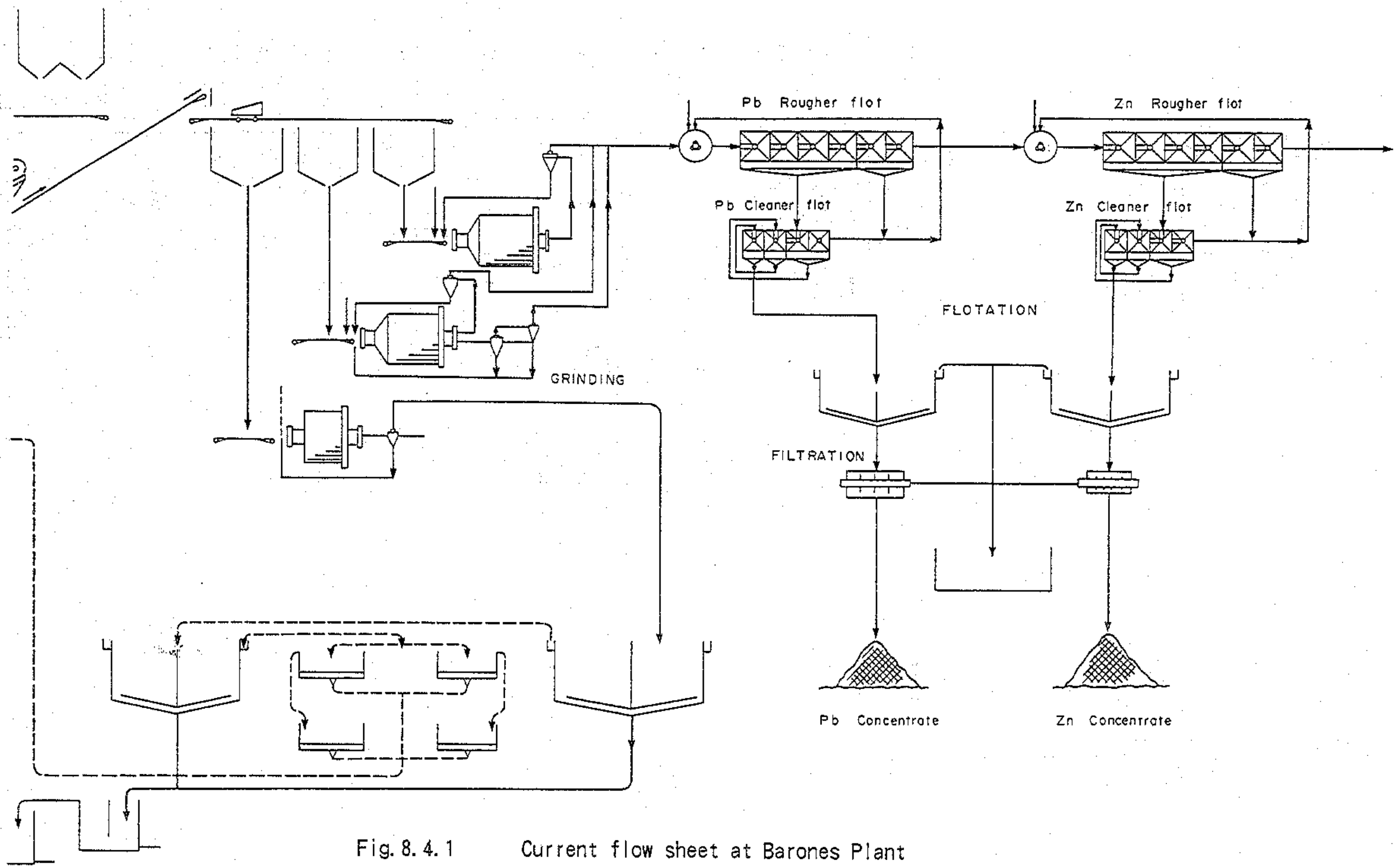


Fig. 8. 4. 1　　Current flow sheet at Barones Plant

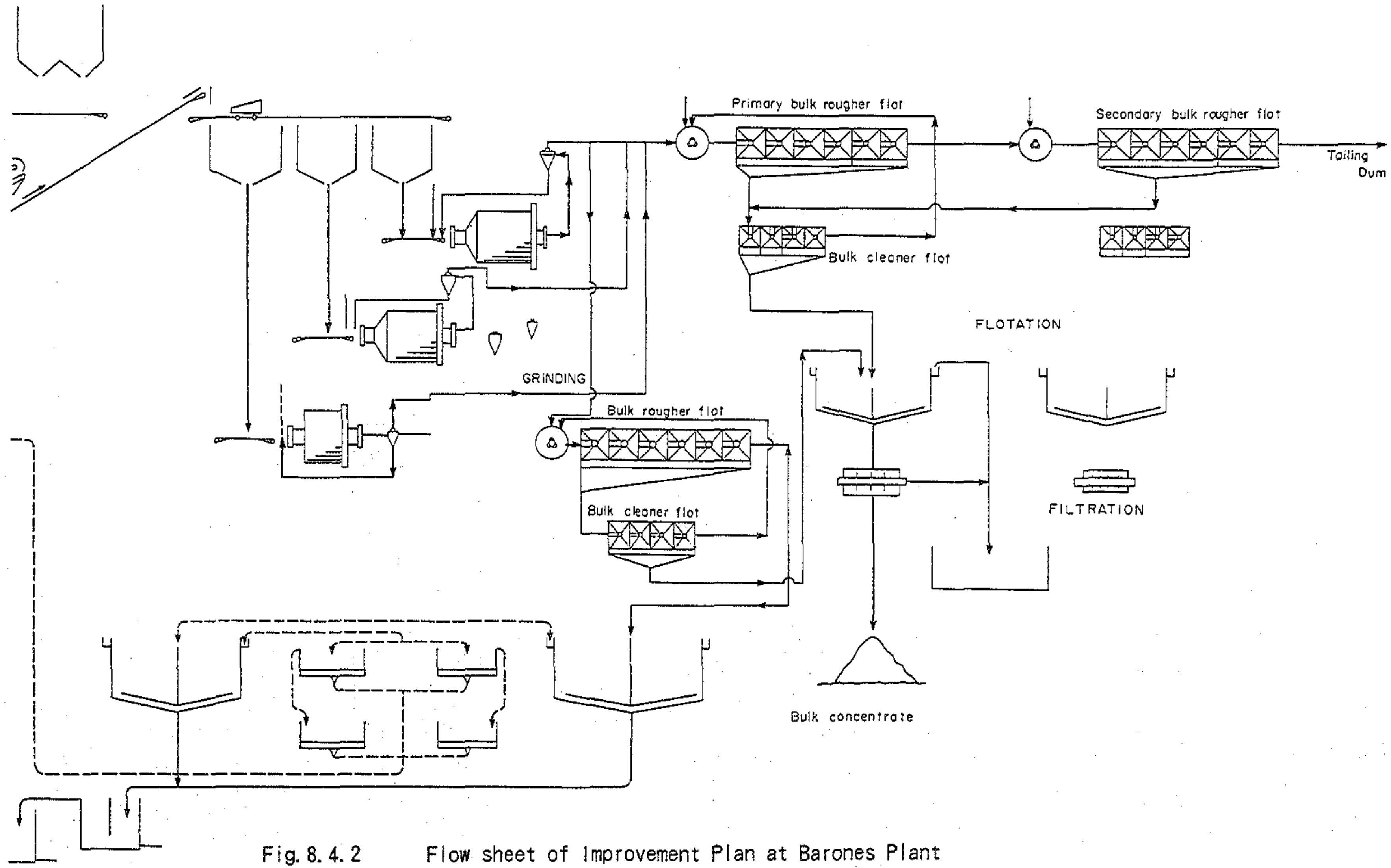


Fig. 8. 4. 2　　Flow sheet of Improvement Plan at Barones Plant

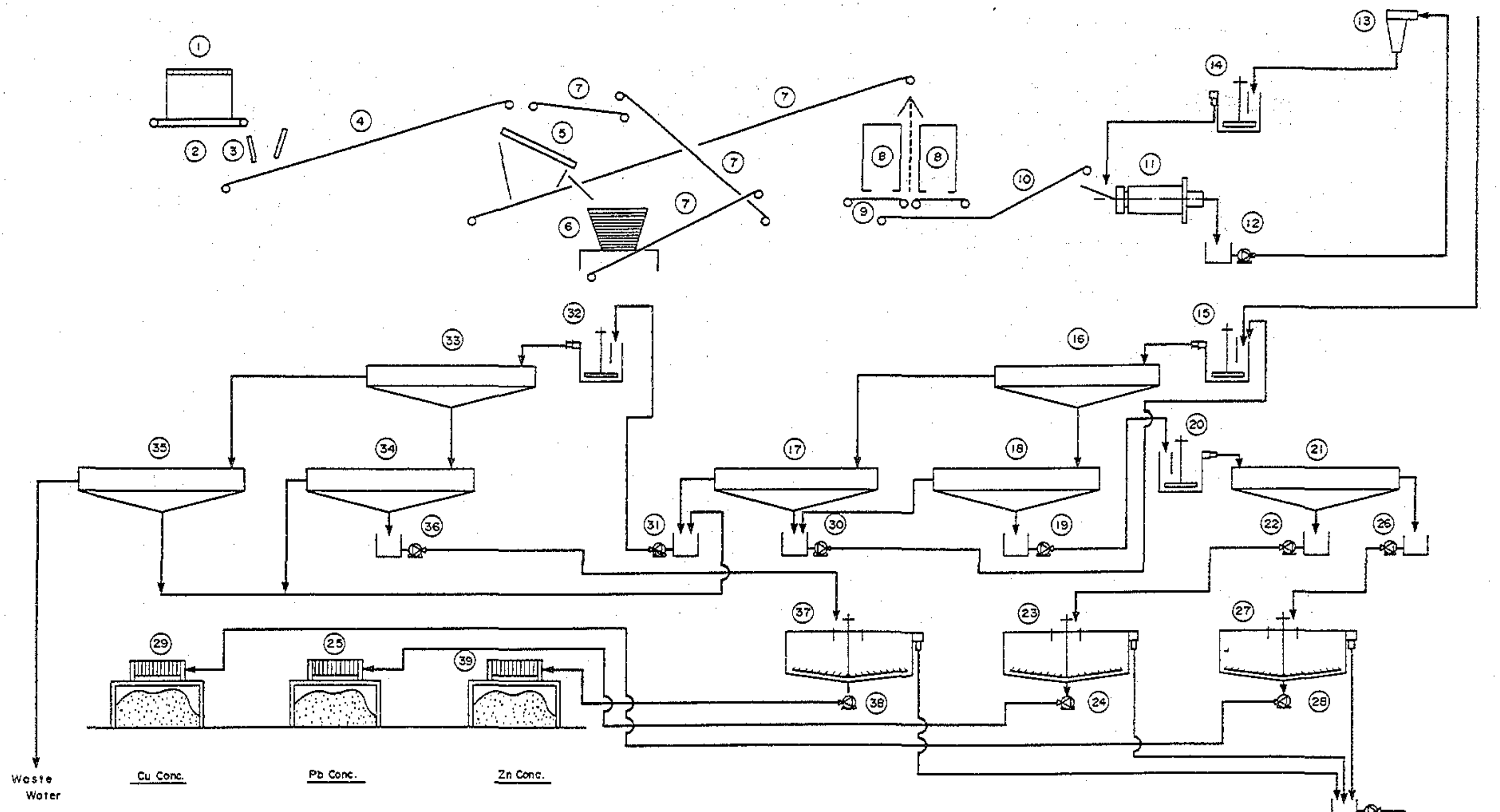


Fig. 8.5.1 150 t/D Plant Flow Diagram

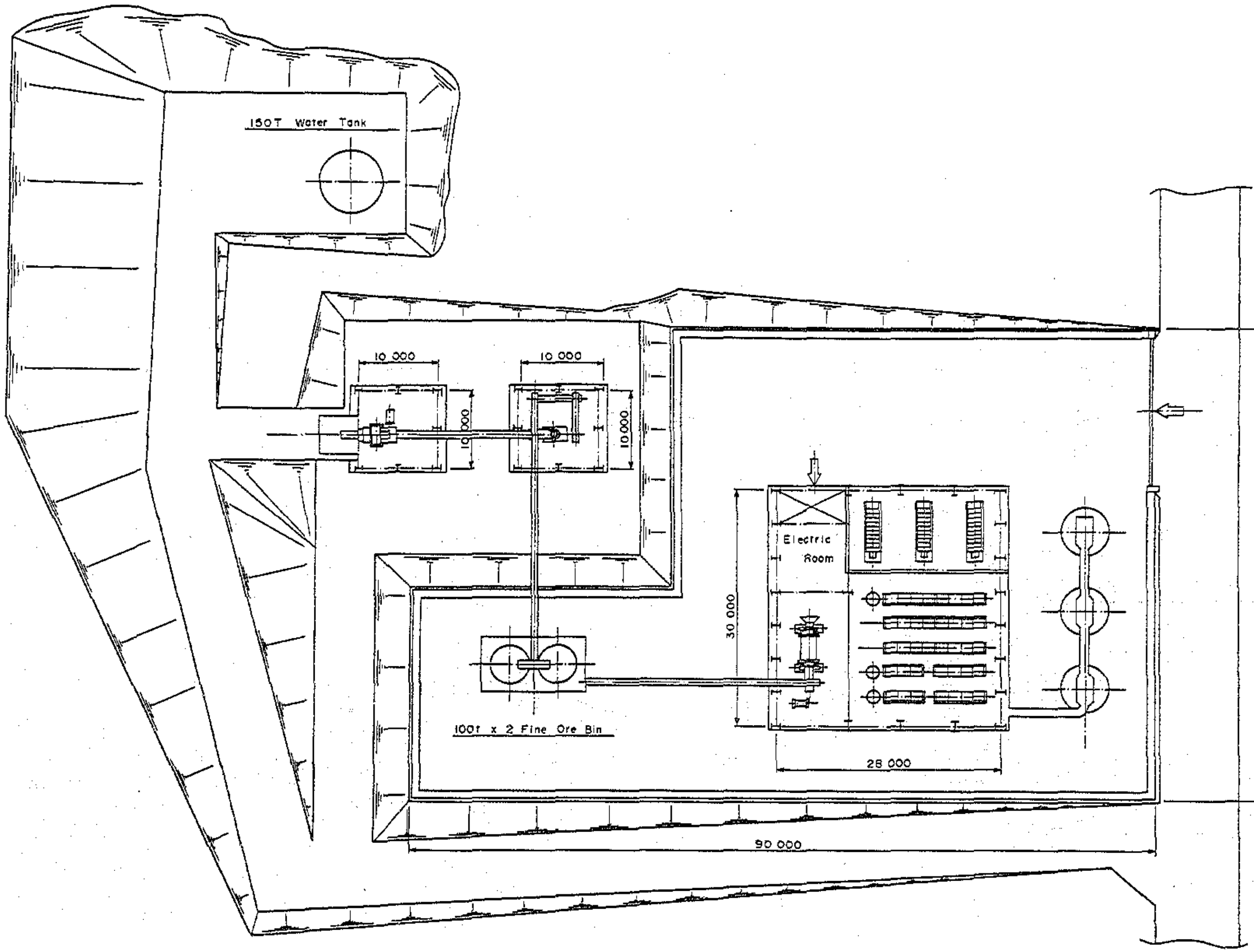


Fig. 8. 5. 2 Lay Out of 150 t/D Plant S=1/500

Table 2.1.1 a) Gross National Production 1983~87

(in millions of Pesos)

Year	Gross National Product (total)	GNP (Industrial and Mining Sector)	GNP (Mining)	Ratio of Mining	
				To GNP	To industrial and Mining Sector
1983	17,141,694	6,737,860	303,769	1.8	4.5
1984	28,748,889	11,790,025	427,472	1.5	3.8
1985	45,419,841	17,672,860	664,756	1.5	3.7
1986	79,353,450	25,833,231	1,734,395	1.7	5.3
1987	195,614,485	67,397,139	3,795,480	1.9	5.6

Source: National Statistics by the Ministry of budget, Bureau of Geographic Data, Bureau of Mines of the Ministry of Energy, Mines and National Corporations, etc.

Table 2.1.1 b) Mexican Mining Production 1983~87

(in millions of Pesos)

Year	Total	Metal	Non-metal
1983	303,769	198,987	104,782
1984	427,472	260,060	167,412
1985	664,756	329,654	335,102
1986	1,374,395	721,203	653,192
1987	3,795,480	1,137,710	1,657,770

Source: Bureau of Mines, Ministry of Energy, Mines and National Corporations

Table 2.1.3 Mexican Export 1983~87 (in Millions of Pesos)
(in Millions of Pesos)

Year	All Sectors	Mining Sector	%
1983	2,571,440	141,713	5.5
1984	4,059,339	182,856	4.5
1985	5,855,065	249,693	4.3
1986	9,916,200	613,796	6.2
1987	26,451,431	1,376,078	5.2

Source: National Statistics by the Ministry of Planning and Budget

Table 3.4.1 Estimation of the Mining cost

Parral

Mine			La Revancha			La Presa		La Esperanza			Tilita			Unificacion Cordero		
Data Source			Survey	Calc 1	Calc 2	Survey	Calc	Survey	Calc 1	Calc 2	Survey	Calc 1	Calc 2	Survey	Calc 1	Calc 2
Underground/Surface			U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G
Daily Tonnage (mt)			70	70	100	50	50	20	20	20	10	10	10	15	15	15
Stoping Width (m)			2	2	3	1.5	1.5	0.7-2	2	1	2.5	3	1	1.2	2	1
Employees (men)			40	37	39		34	14	15	22	13	8	13		13	18
Cost (Peso/mt)	Exploration															
	Mining	Labor (per worker-week)		7,500 (85,000)	5,500 (85,000)		9,600 (85,000)		10,600 (85,000)	15,600 (85,000)		6,400 (50,000)	10,400 (50,000)	41,050	12,300 (85,000)	17,000 (85,000)
		Supplies		21,000	18,700		23,000		23,800	27,400		23,600	29,400		24,500	28,200
		Transportation		5,000	5,000		5,000		5,000	5,000		5,000	5,000	12,000	12,000	12,000
		Drainage												25,000	25,000	25,000
	Total		34,500	33,500	29,200		37,600	30,000	39,400	48,000	28,000	35,000	44,800	78,050	73,800	82,200

Guanacevi

Mine			San Jose Chico		Barradon			Capuzaya		San Rafael		Ample Al Alto Porvenir			Noche Buena	
Data Source			Survey	Calc	Survey	Calc 1	Calc 2	Survey	Calc	Survey	Calc	Survey	Calc 1	Calc 2	Survey	Calc
Underground/Surface			U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G	U/G
Daily Tonnage (mt)			35	35	13	13	13	9	9	50	50	50	50	50	120	120
Stoping Width (m)			1	1	1	1	2	2	2	2	2	2	2	5	0.7-2	2
Employees (men)			36	32	10	16	8		9	30	29	18	29	18		54
Cost (Peso/mt)	Exploration		21,000	21.000												
	Mining	Labor (per worker-week)	19,600	22,900 (150,000)		18,500 (90,000)	9,200 (90,000)		15,000 (90,000)	30,000	14,500 (150,000)		14,500 (150,000)	9,000 (150,000)	25,000	9,000 (120,000)
		Supplies Transportation	29,400 8,500	25,900 8,500		28,600 8,500	18,700 8,500		25,800 8,500	9,000	21,800 9,000		21,800 9,000	18,100 9,000	(8,000)	19,900 8,000
		Drainage														
	Total		78,500	78,300	22,693	55,600	36,400	27,249	49,300	39,000	45,300	21,000	45,300	36,100	25,000	36,900

Table 3.4.1 Estimation of the Mining cost

Barones

Mine	San Roberto & San Bernabe					Las Cumbres			Calicanto				Ampl. San Miguel	
Data Source	Survey			Calc			Survey	Calc	Survey		Calc		Survey	Calc
Underground/Surface	U/G	U/G	Surface	U/G	U/G	Surface	U/G	U/G	U/G	Surface	U/G	Surface	U/G	U/G
Daily Tonnage (mt)	60	80	40	60	80	40	25	25	35	15	35	15	12	12
Stoping Width (m)	3.15	0.2-2.5		5	2		2	2	0.7-2		2		0.7-2.5	2.5
Employees (men)	18	62		21x70%=15	40	4	15	18	45		23	3	10	10
Exploration														
Cost (Peso/mt) – Mining – Labor (per worker-week)				12,500 (300,000)	25,000 (300,000)	2,500 (300,000)		10,100 (98,000)			9,200 (98,000)	2,800 (98,000)		12,500 (90,000)
Supplies				17,800	20,800	9,600		23,300			22,500	14,600		24,000
Transportation				5,000	5,000	5,000		5,000			5,000	5,000		5,000
Drainage														
Total		18,500		35,300	50,800	17,100	35,191	38,400	35,974		36,700	22,400	35,099	41,500
(Average)					(38,100)						(32,410)			

Table 3.4.1 Estimation of the Mining cost

Barones

Mine			California		
Data Source			Survey	Calc 1	Calc 2
Underground/Surface			Surface	Surface	Surface
Daily Tonnage (mt)			120	120	120
Stoping Width (m)					
Employees (men)			40	8	40
Cost (Peso/mt)	Exploration				
	Mining	Labor (per worker-week)		1,000 (90,000)	5,000 (90,000)
		Supplies		6,000	6,000
		Transportation		5,000	5,000
		Drainage			
Total			16,029	12,000	16,000

Table 3.7.1 Metallurgical Balance of each Plant (1988)

(1) Parral ('88. 1~12)

	Weight	Assay				Content				Distribution %			
	(Ton)	Au g/t	Ag g/t	Pb %	Zn %	Au g	Ag Kg	Pb t	Zn t	Au	Ag	Pb	Zn
Feed	85,670.1	0.66	240	0.7	0.2	56,473	20,520	603.1	135.9	100	100	100	100
Bulk conc.	277.0	47.30	7,300	—	—	13,102	2,022	—	—	23	9	—	—
Pb conc.	1,539.5	8.91	6,003	19.9	—	13,722	9,241	306.3	—	24	45	51	—
Zn conc.	179.6	—	178	—	43.3	—	32	—	77.8	—	0.2	—	57
Au・Ag Precip.	3,533 kg	kg/t 2.3	kg/t 690	—	—	8,019	2,438	—	—	14	12	—	—
Tailings	83,670.5	0.26	81	0.4	0.1	21,630	6,787	296.8	58.1	39	33.8	49	43

(2) Guanacevi ('88. 1~12)

	Weight	Assay				Content				Distribution %			
	(Ton)	Au g/t	Ag g/t	Pb %	Zn %	Au g	Ag Kg	Pb t	Zn t	Au	Ag	Pb	Zn
Feed	111,347	1.18	202	—	—	131,147	22,507	—	—	100	100	—	—
Bulk conc.	3,294	28.33	4,739	—	—	93,301	15,610	—	—	71	69	—	—
Tailings	108,053	0.35	64	—	—	37,846	6,897	—	—	29	31	—	—

(3) Barones ('88. 1~12)

	Weight	Assay					Content					Distribution %				
	(Ton)	Au g/t	Ag g/t	Pb %	Cu %	Zn %	Au g	Ag Kg	Pb t	Cu t	Zn t	Au	Ag	Pb	Cu	Zn
Feed	126,806	0.51	145	0.3	0.1	0.4	64,682	18,416	403	124	497	100	100	100	100	100
Au・Ag Precip.	7516Kg	0.16%	40.3%	—	—	—	12,117	3,027	—	—	—	19	16	—	—	—
Bulk conc.	1,037	8.44	4,303	5.5	—	—	8,750	4,462	57	—	—	14	24	14	—	—
Pb conc.	439	11.51	4,440	33.9	3.6	9.8	5,051	1,949	149	16	43	8	11	37	13	8
Cn conc.	472	1.45	1,250	4.9	17.6	9.5	686	590	23	83	45	1	3	6	67	9
Zn conc.	560	1.54	689	2.1	1.1	42.3	864	386	12	6	237	1	2	3	5	48
Tailings	124,300	0.30	64	0.1	—	0.1	37,214	7,954	162	19	172	58	43	40	15	35

Table 3.7.2 Metallurgical Balance of each Plant (1989)

(1) Parral ('89. 1～6)

Products	Weight	Assay				Content				Distribution %			
	(Ton)	Au g/t	Ag g/t	Pb %	Zn %	Au g	Ag Kg	Pb t	Zn t	Au	Ag	Pb	Zn
Feed	38,464	0.74	325	0.6	0.2	28,476	12,500	218.1	61.1	100.0	100.0	100.0	100.0
Bulk conc.	326	16.12	11,454	—	—	5,255	3,734	—	—	18.5	29.9	—	—
Pb conc.	412	22.29	6,582	26.7	—	9,184	2,712	110.0	—	32.3	21.7	50.4	—
Zn conc.	76	—	370	—	44.4	—	28	—	33.6	—	0.2	—	55.0
Au・Ag Precip.	kg 2,296	kg/t 1.7	kg/t 708	—	—	3,867	1,627	—	—	13.6	13.0	—	—
Tailings	37,648	0.30	117	0.3	0.1	11,170	4,399	108.1	27.5	35.6	35.2	49.6	45.0

(2) Guanacevi('88. 1～7)

Products	Weight	Assay		Content		Distribution	
	(Ton)	Au g/t	Ag g/t	Au g	Ag Kg	Au %	Ag %
Feed	54,258	1.45	253	78,447	13,726	100.0	100.0
Bulk conc.	1,724	35.39	6,131	61,029	10,572	77.8	77.0
Tailings	52,534	0.33	60	17,418	3,154	22.2	23.0

Table 3.7.2 Metallurgical Balance of each Plant (1989)

(3) Barones('89. 1〜6)

Products	Weight	Assay						Content						Distribution %					
	(Ton)	Au g/t	Ag g/t	Pb %	Cu %	Zn %	Fe %	Au g	Ag Kg	Pb t	Cu t	Zn t	Fe t	Au	Ag	Pb	Cu	Zn	Fe
Feed	37,458	0.38	145	0.5	0.2	0.8	5.7	14,381	5,516	175.3	66.2	289.0	2,132	100.0	100.0	100.0	100.0	100.0	100.0
Bulk conc	163	6.79	9,122	3.8	—	3.3	12.3	1,109	1,489	6.2	—	5.4	20	7.7	27.0	3.5	—	1.9	0.9
Pb conc	226	6.07	2,898	30.1	5.1	16.2	9.7	1,372	655	68.1	11.6	36.6	22	9.5	11.9	38.8	17.5	12.7	1.0
Cn conc	239	1.79	2,285	6.8	18.2	8.5	15.9	429	546	16.3	43.4	20.2	38	3.0	9.9	9.3	65.6	7.0	1.8
Zn conc	260	1.33	531	1.4	0.6	43.2	8.8	346	138	3.7	1.6	112.2	23	2.4	2.5	2.1	2.4	38.8	1.1
Tailings	36,570	0.30	74	0.3	0.03	0.3	5.5	11,125	2,688	81.0	9.6	114.6	2,029	77.4	48.7	46.3	14.5	39.6	95.2
Cyanidation Feed	16,883	0.6	171					10,602	2,885					100.0	100.0				
Au・Ag Precip	4,342	0.073%	47.1%					3,156	2,044					29.8	70.8				
Tailings	16,878	0.4	50					7,446	841					70.2	29.2				

Table 3.7.3(a) Net sales of concentrates Parral Plant (1989 Jan-June)

BULK-CONC		PARRAL GRADE	CONTENTS	RECOVERY	REC. METAL	VALUE	R/C&T/C	PENALTY	SUB TOTAL	M. P. TAX	SUB TOTAL	I. V. A	US$ TOTAL
DMT T	Pb	0.00 %	0.000 T	1.5UL&90 %	0.000 T	0	0		0	0	0		0
326.000	Au	16.12 G/T	5,255.1 G	100 %	5,255.1 G	59,996			59,996	4,200	55,796		55,796
	Ag	11,454.00 G/T	3,734.004 KG	100 %	3,734.004 KG	642,763			642,763	44,993	597,770		597,770
	Cu	0.50 %	1.630 T	5 KGL	0.000 T	0	0		0	0	0		0
	T/C	77.03 $/DT					25,112		-25,112		-25,112		-25,112
	INSOLUBLE	30.00 %						1,223	-1,223		-1,223		-1,223
	S	20.00 %						815	-815		-815		-815
	As	2.00 %						326	-326		-326		-326
	H2O	%											
	I. V. A.											101,292	101,292
	TOTAL					702,759	25,112	2,364	675,283	49,193	626,090	101,292	727,382

PB-CONC.		PARRAL GRADE	CONTENTS	RECOVERY	REC. METAL	VALUE	R/C	PENALTY	SUB TOTAL	M. P. TAX	SUB TOTAL	I. V. A	US$ TOTAL
DMT T	Pb	26.70 %	110.004 T	1.5UL&90 %	93.412 T	59,237	10,198		49,039	2,452	46,587		46,587
412.000	Au	22.29 G/T	9,183.5 G	100 %	9,183.5 G	104,846			104,846	7,339	97,507		97,507
	Ag	6,582.00 G/T	2,711.784 KG	100 %	2,711.784 KG	466,801			466,801	32,676	434,125		434,125
	Cu	1.00 %	4.120 T	5 KGL	2.060 T	5,993	1,381		4,612	231	4,381		4,381
	T/C	77.03 $/DT					31,736		-31,736		-31,736		-31,736
	INSOLUBLE	27.00 %						1,391	-1,391		-1,391		-1,391
	S	24.00 %						1,030	-1,030		-1,030		-1,030
	As	2.00 %						412	-412		-412		-412
													0
	H2O	%											
	I. V. A.											88,609	88,609
	TOTAL					636,877	43,315	2,833	590,729	42,698	548,031	88,609	636,640

ZN-CONC		PARRAL GRADE	CONTENTS	RECOVERY	REC. METAL	VALUE	R/C	PENALTY	SUB TOTAL	M. P. TAX	SUB TOTAL	I. V. A	US$ TOTAL
DMT T	Zn	44.40 %	33.744 T	8 UL	27.664 T	45,303			45,303	2,265	43,038		43,038
76.000	Ag	370 G/T	28.1 KG	93.3GLES*65%	13.7 KG	2,358			2,358	165	2,193		2,193
	T/C	266.96 $/DT					20,289		-20,289		-20,289		-20,289
	Fe	8.00 %						114	-114				-114
	H2O	%											
	I. V. A.											4,089	4,089
	TOTAL								27,258	2,430	24,942	4,089	28,917

Table 3.7.3(b) Net sales of concentrates Parral Plant (1989 Jan-June)

AU-AG PRECIPITATION PARRAL		GRADE		CONTENTS	RECOVERY	REC. METAL	VALUE	R/C	PENALTY	SUB TOTAL	M.P. TAX	SUB TOTAL	I.V.A	US$ TOTAL
DMT T 2.296	Pb	0.00	%	0.000 T	1.5UL&90 %	0.000 T	0	0		0	0	0		0
	Au	1,700.00	G/T	3,903.2 G	100 %	3,903.2 G	44,562			44,562	3,119	41,443		41,443
	Ag	708,000.00	G/T	1,625.568 KG	100 %	1,625.568 KG	279,822			279,822	19,588	260,234		260,234
	Cu	0.00	%	0.000 T		0.000 T	0	0		0	0	0		0
	T/C	77.03	$/DT					177		-177		-177		-177
	INSOLUBLE	0.00	%						0	0		0		0
	S	0.00	%						0	0		0		0
	As	0.00	%						0	0		0		0
	H2O		%											0
	I.V.A.												48,631	48,631
	TOTAL						324,384	177	0	324,207	22,707	301,500	48,631	350,131

Table 3.7.4 Net sales of concentrates Guanacevi Plant (1989 Jan.-July)

BULK-CONC		GUANACEVI GRADE	CONTENTS	RECOVERY	REC.METAL	VALUE	R/C	PENALTY	SUB TOTAL	M.P.TAX	SUB TOTAL	I.V.A	US$ TOTAL
DMT T	Pb	0.00 %	0.000 T	1.5UL&90 %	0.000 T	0	0		0	0	0		0
1,724.000	Au	35.39 G/T	61,012.4 G	100 %	61,012.4 G	696,566			696,566	48,760	647,806		647,806
	Ag	6,131.00 G/T	10,569.844 KG	100 %	10,569.844 KG	1,819,470			1,819,470	127,363	1,692,107		1,692,107
	Cu	0.50 %	8.620 T	5 KGL	0.000 T	0	0		0	0	0		0
	T/C	77.03 $/DT					132,800		-132,800		-132,800		-132,800
	INSOLUBLE	30.00 %						6,465	-6,465		-6,465		-6,465
	S	20.00 %						4,310	-4,310		-4,310		-4,310
	As	2.00 %						1,724	-1,724		-1,724		-1,724
	H2O	%											0
	I.V.A.											355,611	355,611
	TOTAL					2,516,036	132,800	12,499	2,370,737	176,123	2,194,614	355,611	2,550,225

Table 3.7.5(a) Net sales of concentrates Barones Plant (1989 Jan.-June)

CU-CONC		BARONES GRADE	CONTENTS	RECOVERY	REC. METAL	VALUE	R/C&T/C	PENALTY	SUB TOTAL	M. P. TAX	SUB TOTAL	I. V. A	USS TOTAL
DMT T	Cu	18.20 %	43.498 T	90 %	39.148 T	113,881	7,759		106,122	5,306	100,816		100,816
239.000	Au	1.79 G/T	427.8 G	100 %	427.8 G	4,884			4,884	342	4,542		4,542
	Ag	2,285.00 G/T	546.115 KG	100 %	546.115 KG	94,007			94,007	6,580	87,427		87,427
	Pb	6.80 %	16.252 T	47 %	7.6 T	4,818	4,581		237	12	225		225
	T/C	79.83 $/DT					19,079		-19,079		-19,079		-19,079
	INSOLUBLE	3.00 %						72	-72		-72		-72
	Zn	8.50 %						90	-90		-90		-90
	As	1.00 %						120	-120		-120		-120
	H2O	%											0
	I. V. A.											27,883	27,883
	TOTAL					217,590	31,419	282	185,889	12,240	173,649	27,883	201,532

BULK-CONC		BARONES GRADE	CONTENTS	RECOVERY	REC. METAL	VALUE	R/C&T/C	PENALTY	SUB TOTAL	M. P. TAX	SUB TOTAL	I. V. A	USS TOTAL
DMT T	Pb	3.80 %	6.194 T	1.5UL&90 %	0.000 T	0	0		0	0	0		0
163.000	Au	6.79 G/T	1,106.8 G	100 %	1,106.8 G	12,636			12,636	885	11,751		11,751
	Ag	9,122.00 G/T	1,486.886 KG	100 %	1,486.886 KG	255,949			255,949	17,916	238,033		238,033
	Cu	0.50 %	0.815 T	5 KGL	0.000 T	0	0		0	0	0		0
	T/C	77.03 $/DT					12,556		-12,556		-12,556		-12,556
	INSOLUBLE	30.00 %						611	-611		-611		-611
	S	20.00 %						408	-408		-408		-408
	As	2.00 %						163	-163		-163		-163
	H2O	%											0
	I. V. A.											38,227	38,227
	TOTAL					268,585	12,556	1,182	254,847	18,801	236,046	38,227	274,273

PB-CONC		BARONES GRADE	CONTENTS	RECOVERY	REC. METAL	VALUE	R/C&T/C	PENALTY	SUB TOTAL	M. P. TAX	SUB TOTAL	I. V. A	USS TOTAL
DMT T	Pb	30.10 %	68.026 T	1.5UL&90 %	58.172 T	36,878	6,349		30,529	1,526	29,003		29,003
226.000	Au	6.07 G/T	1,371.8 G	100 %	1,371.8 G	15,662			15,662	1,096	14,566		14,566
	Ag	2,898.00 G/T	654.948 KG	100 %	654.948 KG	112,741			112,741	7,892	104,849		104,849
	Cu	5.10 %	11.526 T	90 %	10.373 T	30,175	6,952		23,223	1,161	22,062		22,062
	T/C	77.03 $/DT					17,409		-17,409		-17,409		-17,409
	INSOLUBLE	27.00 %						763	-763		-763		-763
	S	24.00 %						565	-565		-565		-565
	As	2.00 %						226	-226		-226		-226
	H2O	%											0
	I. V. A.											24,479	24,479
	TOTAL					195,456	30,710	1,554	163,192	11,675	151,517	24,479	175,996

Table 3.7.5(b) Net sales of concentrates Barones Plant (1989 Jan.-June)

ZN-CONC		BARONES GRADE	CONTENTS	RECOVERY	REC.METAL	VALUE	R/C&T/C	PENALTY	SUB TOTAL	M.P.TAX	SUB TOTAL	I.V.A	US$ TOTAL
DMT T	Zn	43.20 %	112.320 T	8 UL	91.520 T	149,875			149,875	7,494	142,381		142,381
260.000	Ag	531 G/T	138.1 KG	93.3CLES*65%	74 KG	12,738			12,738	892	11,846		11,846
	T/C	266.96 $/DT					69,410		-69,410		-69,410		-69,410
	Fe	8.80 %						1,014	-1,014				-1,014
	H2O	%											
	I.V.A.											13,828	13,828
	TOTAL								92,189	8,386	84,817	13,828	97,631

Au-Ag PRECIPITATION		BARONES GRADE	CONTENTS	RECOVERY	REC.METAL	VALUE	R/C&T/C	PENALTY	SUB TOTAL	M.P.TAX	SUB TOTAL	I.V.A	US$ TOTAL
DMT KG	Pb	0.00 %	0.000 T	1.5UL&90 %	0.000 T	0	0		0	0	0		0
4.342	Au	730.00 G/T											
	Ag	471,000.00 G/T	2,045.082 KG	100 %	2,045.082 KG	352,036			352,036	24,643	327,393		327,393
	Cu	0.00 %	0.000 T		0.000 T	0	0		0	0	0		0
	T/C	77.03 $/DT					334		-334		-334		-334
	INSOLUBLE	0.00 %						0	0		0		0
	S	0.00 %						0	0		0		0
	As	0.00 %						0	0		0		0
	H2O	%											0
	I.V.A.											58.233	58.233
	TOTAL					388.223	334	0	388.223	27.176	360.713	58.233	418.946

Table 4.1.1 Main equipment for Beneficiation test

Equipment	Number	Status
Ball mill(8″ ×8″)	1	good
Flotation Machine(WEMCO)	2	good
Ro-Tap sieve shaker	1	good
PH meter	3	out of order
Filter press(12″ ×12″ ,8×12″)	2	good
Agitater for laboratory	2	good

Table 4.1.2 Beneficiation tests at Parral

PROBLEM	OBJECT OF TEST	SAMPLE	CONTENT OF TEST
1. Metallurgical results of Casale • Low revovery of Ag	1. Improvement of metallurgical results 2. Study on the cause of low recovery of Ag	casale	1. Flotation and Cyanidation No. 1 Standard test No. 2 Regrinding for flotation tailing (15 min.) No. 3 Increasing of flotation time No. 4 Increasing of grinding time No. 5 Using AF4037 as collector No. 6 Addition of H_2SO_4 (PH 4.5) No. 7 Addition of H_2SO_4+Na_2S (Na_2S= Rougher 300 g/t, SCAV. 300 g/t) 2. EPMA analysis on Ag minerals tailings of flotation and cyanidation.
1. Dust of crushing plant, suspended solid in lea-ching solution	1. De sliming of crude ore by washing	José Galindo	1. Washing and decantation of crude ore.
1. Treatment of mixed ore	1. Improvement of rate of operation and reduction of operation cost	Nochebuena San luis II La Unión	1. Flotation (1) Individual Sample (2) Mixed Sample

Table 4.1.3 Result of Beneficiation test for Casale Ore

		FLOTATION			CYANIDATION		
Test No.	Product	Assay g/t	Distribution %	Recovery %	assay g/t	Recovery* %	Total Recovery %
		Ag	Ag	Ag	Ag	Ag	Ag
1	Feed	364	100.0	26.5	238	8.5	35.0
	Conc.	5,428	26.5				
	Middling	275	5.6				
	Tailing	272	67.9				
2	Feed	364	100.0	23.3	236	11.5	34.8
	Conc.	6,434	23.3				
	Middling	291	6.0				
	Tailing	282	70.7				
3	Feed	368	100.0	30.3	231	8.5	38.8
	Conc.	2,640	30.4				
	Middling	268	7.8				
	Tailing	268	61.8				
4	Feed	361	100.0	34.2	258	2.8	37.0
	Conc.	6,290	34.2				
	Middling	283	1.8				
	Tailing	270	64.0				
5	Feed	371	100.0	28.2	243	6.9	35.1
	Conc.	4,162	28.2				
	Middling	281	8.9				
	Tailing	273	62.9				
6	Feed	385	100.0	29.6	239	7.2	36.8
	Conc.	9,426	29.6				
	Middling	335	7.3				
	Tailing	270	63.1				
7	Feed	381	100.0	27.9	253	6.9	34.8
	Conc.	2,590	27.9				
	Middling	479	3.5				
	Tailing	281	68.6				

Table 4.1.4 Metallurgical Results of Flotation tests for each Ore

SAN LUIS II

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.2	294	0.44	0.23	0.03	2.25	0.69	83.56	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cl・C	1.4	0.2	11,666	3.80	1.20	0.15	6.00	2.04	68.20	1.5	53.9	11.7	7.0	6.1	3.6	4.0	1.1
Cl・T	13.5	0.1	293	0.54	0.28	0.04	2.80	0.33	80.42	7.2	13.4	16.6	16.2	16.4	16.8	65.0	13.0
RT	85.1	0.2	113	0.37	0.21	0.03	2.10	0.25	84.30	91.3	32.7	71.7	76.8	77.5	79.6	31.0	85.9

NOCHE BUENA

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.1	367	1.14	0.58	0.04	4.23	0.23	64.73	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cl・C	1.6	0.4	11,814	7.20	2.40	0.23	9.20	5.63	50.98	5.5	51.2	10.0	6.6	10.2	3.5	39.1	1.3
Cl・T	10.0	0.2	613	1.45	0.70	0.06	5.50	0.33	59.26	14.5	16.8	12.7	12.1	16.6	13.0	14.5	9.2
RT	88.4	0.1	133	1.00	0.53	0.03	4.00	0.12	65.60	77.0	32.0	77.3	81.3	73.2	83.5	46.4	89.5

LA UNION

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.8	243	0.26	0.17	0.03	4.16	0.10	87.92	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cl・C	0.7	44.8	15,063	1.70	2.00	0.17	11.60	5.47	65.66	36.7	41.6	4.3	7.9	3.6	1.9	35.3	0.5
Cl・T	7.5	2.0	408	0.41	0.24	0.04	5.40	0.16	82.84	18.4	12.7	11.8	10.7	9.5	9.8	11.6	7.1
RT	91.8	0.4	121	0.24	0.15	0.03	4.00	0.06	88.50	44.9	45.7	83.9	81.4	86.9	88.3	53.1	92.4

Calculated result

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.4	301	0.62	0.33	0.03	3.54	0.34	78.70	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cl・C	1.2	0.9	12,350	4.89	1.87	0.19	8.43	4.24	60.16	27.6	49.5	9.6	6.9	6.8	2.9	15.1	0.9
Cl・T	10.4	0.6	424	0.80	0.40	0.05	4.30	1.58	74.18	16.5	14.6	13.5	12.9	14.3	12.6	48.2	9.8
RT	88.4	0.2	122	0.53	0.30	0.03	3.39	0.14	79.50	55.9	35.9	76.9	80.2	78.9	84.5	36.7	89.3

F : Feed, cl・C : Cleaner Concentrate, Cl・T : Cleaner tailing, RT : Rougher tailing

Table 4.1.5 Metallurgical Result of Flotation test for mixed Ore

Mixed ore SAN LUIS Ⅱ : NOCHE BUENA : LA UNION = 1 : 1 : 1

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.4	295	0.55	0.30	0.02	3.68	0.15	78.43	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cl・C	0.4	0.2	406	9.60	3.60	0.38	10.40	8.84	49.30	0.9	1.1	6.4	4.3	6.2	1.0	20.9	0.2
Cl・T	6.2	0.6	390	0.70	0.40	0.04	4.60	0.19	74.22	9.1	16.5	7.8	8.0	11.1	7.7	7.5	5.8
RT	93.4	0.3	129	0.51	0.29	0.02	3.60	0.12	79.90	90.0	82.4	85.8	87.7	87.7	91.3	71.6	94.0

Table 4.1.6 Main Equipment for Beneficiation test

Equipment	Number	Status
Ball mill(9 3/4" ×9 7/8")	1	good
Flotation Machine(WEMCO)	1	good
Ro-Tap sieve shaker	1	good

Table 4.1.7 Beneficiation tests at Guanacevi

PROBLEM	OBJECT OF TEST	SAMPLE	CONTENT OF TEST
1. Metallurgical results of Rosario oxide Low recovery of Ag	1. Improvement of metallurgical results	1. Rosario oxide	1. Flotation test No. 1 Standard test No. 2 Increasing of grinding and addition of collector No. 3 $N_2SO_4+Na_2S$ addition, until I st cleaning No. 4 Decreasing of grinding time
2. Treatment of mixed ore	1. Improvement of rate of operation and reduction of operation cost	1. Rosario oxide and sulfide	2. Flotation (1) Individual sample (2) Mixed sample
Shipping sample to Japan	1. Treatment on refractory silver ore which contains manganese	1. La prieta	1. Bacterial leaching test

Table 4.1.8 Results of Flotation tests for Rosario Oxide

Test No.	Production	Wt %	assay g/t		Distribution %		Flotation Condition
			Au	Ag	Au	Ag	
1	Feed	100.0	1.0	181	100.0	100.0	−200 mesh 52%, pH7.9
	Conc.1	5.4	8.6	1,904	46.9	55.7	Total flotation time 15 min.
	Conc.2	2.7	3.2	744	8.8	10.9	Total AF 31 15 g/t
	Conc.3	3.2	2.6	488	8.5	8.5	AP 404 30 g/t
	Tailing	88.7	0.4	52	35.8	25.9	X-350 170 g/t
							AP-425 30 g/t
2	Feed	100.0	0.9	187	100.0	100.0	−200 mesh 60%, pH4.5 (H_2SO_4)
	Conc.1	6.6	7.2	1,930	54.6	68.1	Total Flotation time 10 min.
	Conc.2	1.8	1.8	432	3.7	4.1	Total AF 31 30 g/t
	Tailing	91.6	0.4	57	41.7	27.8	AP 404 60 %/t
							X-350 140 g/t
3	Feed	100.0	0.9	192	100.0	100.0	−200 mesh 62%, pH4.5 (H_2SO_4)
	Cl.Conc.	3.4	11.8	3,036	45.5	53.9	Total Flotation time 10 min.
	Cl.Tailing	9.2	0.9	256	9.1	12.3	Total Na_2S 400 g/t
	SV.Conc.	1.4	4.7	956	6.8	7.0	AF 31 30 g/t
	Tailing	86.0	0.4	60	38.6	26.8	AP 404 180 g/t
							X-350 40 g/t
							(Cleaner X-350 10 g/t)
4	Feed	100.0	0.6	183	100.0	100.0	−200 mesh 53%, pH7.8
	Conc.1	4.2	3.6	1,766	25.9	40.5	Total Flotation time 15 min.
	Conc.2	1.2	2.9	1,032	5.8	6.8	Total AF 31 15 g/t
	Conc.3	6.2	0.8	356	8.5	12.1	AP 404 30 g/t
	Tailing	88.4	0.4	84	60.8	40.6	X-350 170 g/t
							AP 425 30 g/t

Table 4.1.9 Metallurgical Results of Flotation tests for each Ore

ROSARIO oxide

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.7	181	0.64	0.72	0.35	2.85	0.60	84.83	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
RC	7.1	6.7	1666	5.40	7.69	2.73	6.14	7.49	56.15	72.0	65.5	59.6	75.6	55.1	15.3	89.1	4.7
RT	92.9	0.2	67	0.28	0.19	0.17	2.60	0.07	87.02	28.0	34.5	40.4	24.4	44.9	84.7	10.9	95.3
Cl-C	2.2	19.0	4535	15.20	22.80	7.60	10.00	22.33	7.00	63.1	55.3	52.0	69.5	47.6	7.7	82.4	0.2
Cl-T	4.9	1.2	378	1.00	0.90	0.54	4.40	0.82	78.22	8.9	10.2	7.6	6.1	7.5	7.6	6.7	4.5

ROSARIO sulfide

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.8	248	10.06	7.72	1.52	3.14	6.08	65.45	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
RC	33.5	2.1	690	27.98	22.30	4.30	5.21	17.29	18.54	83.9	93.0	93.2	96.8	95.2	55.5	95.2	9.5
RT	66.5	0.2	26	1.03	0.37	0.11	2.10	0.44	89.08	16.1	7.0	6.8	3.2	4.8	44.5	4.8	90.5
Cl-C	25.5	2.4	804	34.00	27.00	5.20	5.40	20.66	4.56	74.2	82.5	86.2	89.2	87.5	43.8	86.6	1.8
Cl-T	8.0	1.0	326	8.80	7.30	1.45	4.60	6.53	63.12	9.7	10.5	7.0	7.6	7.7	11.7	8.6	7.7

Calculated result

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.8	215	5.35	4.23	0.93	3.01	3.34	75.23	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
RC	20.3	2.9	861	24.01	19.75	4.01	5.39	15.57	25.12	78.7	81.5	91.2	94.9	87.6	36.4	94.6	6.8
RT	79.7	0.2	50	0.59	0.27	0.14	2.40	0.23	87.99	21.3	18.5	8.8	5.1	12.4	63.6	5.4	93.2
Cl-C	13.9	3.8	1100	32.49	26.71	5.42	5.78	20.79	4.77	69.4	71.1	84.2	87.6	80.6	26.6	86.2	0.9
Cl-T	6.4	1.1	346	5.81	4.81	1.01	4.57	4.34	68.84	9.3	10.4	7.0	7.3	7.0	9.8	8.4	5.9

F : Feed, Cl・C : Cleaner concentrate, Cl・T : Cleaner tailing, RC : Rougher concentrate, RT : Rougher tailing

Table 4.1.10 Metallurgical Result of Flotation test for mixed Ore

Mixed ore Oxide≒Sulfide = 1 : 1

	wt	Assay %								Distribution %							
	%	Au g/t	Ag g/t	Pb	Zn	Cu	Fe	S	Insol	Au	Ag	Pb	Zn	Cu	Fe	S	Insol
F	100.0	0.7	222	5.09	1.84	0.93	2.85	3.27	74.97	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sul-C	14.9	3.4	1,165	29.30	10.00	5.00	5.80	19.88	8.04	69.6	78.3	85.7	81.1	80.0	30.0	90.7	1.6
Sul-CIT	4.4	0.9	316	5.20	2.60	1.18	4.80	3.02	72.14	5.4	6.3	4.5	6.2	5.6	7.4	4.1	4.2
OXD-C	1.0	1.4	555	10.00	3.00	1.71	5.60	3.67	63.60	1.9	2.5	2.1	1.6	1.8	2.0	1.1	0.8
OXD-CIT	8.0	0.3	117	1.50	0.65	0.39	3.60	0.60	81.90	3.3	4.2	2.4	2.8	3.4	10.1	1.5	8.7
T	71.7	0.2	27	0.38	0.21	0.12	2.00	0.12	88.40	19.8	8.7	5.3	8.2	9.2	50.2	2.6	84.7
Total-C	15.9	3.3	1,127	28.09	9.56	4.79	5.15	18.86	11.53	71.5	80.8	87.8	82.7	81.8	32.3	91.8	2.4

Table 4.1.11 Main Equipment for Beneficiation test

EQUIPMENT	NUMBER	STATUS
Ball mill (8″ x 8″)	2	good
(12″ x 8″)	1	good
Flotation machine (WEMCO)	2	One is out ot order
(DENVER)	1	Out of order
Ro-Tap sieve shaker	2	good
Filter press (12″ x13″)	2	good
(8″ x 9″)	1	good
pH meter	1	Out of order

Table 4.1.12 Beneficiation test at Barones

PROBLEM	OBJECT OF TEST	SAMPLE	CONTENT OF TEST
1. Metallurgical Result of Veta Linda • Low recovery of Ag	1. Improvement of Metllur-gical result	Veta Linda	Cyanidation Test 1. Grinding time (partide size) 2. Agitation time 3. Addition of Pb $(NO_3)_2$ 4. Pulp heating
2. Dust in crushing plant, suspended solid in leaching solution	2. Desliming of curde ore by washing Influence of secondary slime on sedimentation	Don Jesus AMP. SN Miguel Asturiana Azteca Rayo Veta Linda Mexicapan	1. Washing and decantation of crude ore 2. Sedmentation test for cyanidation tatiling of curde ore with washing and without washing
3. Low Zn recovery of Sta. Marta ore	3. Study of low Zn recovery	Sta Marta	1. EPMA analysis of Zn flot. tailing in Japan
4. Treatmen of mixed ore	4. Improvement of the rate of operation and reduc-tion of operation cost	Calicanto Sulfide Oxide	Flotation + Cyanidation 1. Sulfide flotation 2. Oxide cyanidation 3. Mixed sample flotation + cyanidation
Shipping samples to Japan	Differencial flotation	Sn Bernabé	Execution of differencial flotation test in Japan

Table 4.1.13 Assay of crude Ore

MINE	Assay(g/t, %)					
	Au	Ag	Cu	Pb	Zn	Fe
1. DON JESUS	0.60	191	—	0.16	0.26	3.27
2. AMP. Sn MIGUEL	0.55	226	—	0.11	0.11	3.27
3. ASTURIANA	0.50	126	—	0.16	0.25	3.86
4. AZTECA	0.50	121	0.05	0.15	0.20	5.35
5. RAYO	0.55	151	0.05	0.33	0.44	4.17
6. CALICANTO SULFIDE	1.40	208	—	0.60	1.05	8.30
7. CALICANTO OXIDE	1.30	130	0.05	0.40	0.40	7.10
8. VETA LINDA OXIDE	0.55	169	0.05	0.25	0.35	4.00
9. VETA LINDA SULFIDE	0.58	207	—	0.13	0.14	3.58
10. MEXICAPAN	0.67	168	0.05	0.55	0.42	6.78
11. STA. MARTA	0.60	186	0.10	0.10	2.80	5.40

Table 4.1.14 Effect of Particle size on Au, Ag Dissolution

No.	Grinding time min.	−200 mesh %	Assay, g/t		Dissolution %	
			Au	Ag	Au	Ag
	Feed	−	0.55	170	−	−
1	8′	44	0.30	57	45.5	66.4
2	16′	80	0.28	59	49.1	65.3
3	40′	96	0.28	45	49.1	73.5

CN initial concentration	0.15%
CaO	12kg/t
Agitation time	48hrs
Dilution	3 : 1

Table 4.1.15 Effect of Agitation time on Au, Ag Dissotution

No.	Agitation time hrs.	Assay, g/t		Dissolution %	
		Au	Ag	Au	Ag
	Feed	0.55	170	−	−
4	24	0.30	61	45.5	64.1
1	48	0.30	57	45.5	66.4
5	72	0.25	40	52.8	76.4

CN initial concentration	0.15%
CaO	12kg/t
-200 mesh	43.8%
Dilution	3 : 1

Table 4.1.16 Effect of $Pb(NO_3)_2$ added

No.	$Pb(NO_3)_2$ g/t	Assay, g/t		Dissolution %	
		Au	Ag	Au	Ag
	Feed	0.55	170	—	—
1	0	0.30	57	45.5	66.4
6	200	0.25	45	54.5	73.4

CN initial concentration	0.15%
CaO	12kg/t
-200 mesh	43.8%
Agitation time	48hrs
Dilution	3 : 1

Table 4.1.17 Effect of hot pulp agitation

No.		Assay, g/t		Dissolution %	
		Au	Ag	Au	Ag
	Feed	0.55	169	—	—
7	25℃	0.25	35	54.5	79.3
8	35℃	0.25	37	54.5	78.4

CN initial concentration	0.15%
CaO	12kg/t
-200 mesh	53.6%
agitation time	48hrs
Dilution	3 : 1

Table 4.1.18 Result of Washig and Decantation test

SAMPLE		wt	Assay g/t %					Distribution %				
		%	Au	Ag	Pb	Zn	Fe	Au	Ag	Pb	Zn	Fe
DON JESUS	FINE	9.7	0.6	253	0.30	0.35	5.8	9.7	12.9	17.7	13.1	17.2
	COASE	90.3	0.6	154	0.15	0.25	3.0	90.3	87.1	82.3	86.9	82.8
AMP. SN. MIGUEL	FINE	5.4	0.6	266	0.30	0.35	8.0	5.9	6.3	14.7	16.7	13.2
	COASE	94.6	0.55	224	0.10	0.10	3.0	94.1	93.7	85.3	83.3	86.8
ASTURIANA	FINE	8.9	0.50	106	0.20	0.25	4.5	9.0	7.5	11.6	8.8	10.4
	COASE	91.1	0.50	128	0.15	0.25	3.8	91.0	92.5	88.4	91.2	89.6
AZTECA	FINE	8.3	0.55	141	0.20	0.20	7.1	9.1	9.7	10.8	8.3	11.0
	COASE	91.7	0.50	119	0.15	0.20	5.2	90.9	90.3	89.2	91.7	89.0
RAYO	FINE	11.1	0.50	114	0.20	0.35	5.5	10.3	8.4	6.6	8.9	14.7
	COASE	88.9	0.55	155	0.35	0.45	4.0	89.7	91.6	93.4	91.1	85.3
VETA LINDA OXIDO	FINE	14.4	0.50	136	0.30	0.30	4.1	12.3	9.4	33.3	5.2	16.5
	COASE	85.6	0.60	220	0.10	0.15	3.5	87.7	90.6	66.7	94.8	83.5
MEXICAPAN	FINE	16.3	0.50	57	0.80	0.50	10.6	12.3	5.6	23.7	19.7	25.6
	COASE	83.7	0.70	189	0.50	0.40	6.0	87.7	94.4	76.3	80.3	74.4

Table 4.1.19 Metallurgical Results of Beneficiation tests for each Ore

CALICANTO Sulfide

	wt	Assay %					Distribution %				
	%	Au g/t	Ag g/t	Pb	Zn	Fe	Au	Ag	Pb	Zn	Fe
F	100.0	1.4	223	0.54	0.75	7.3	100.0	100.0	100.0	100.0	100.0
Cl・C	9.8	8.0	1.600	4.40	5.50	25.0	58.0	70.4	80.0	71.6	33.7
Cl・T	14.2	1.2	220	0.20	0.40	11.9	12.6	14.0	5.2	7.6	23.2
SVC	4.6	0.9	120	0.20	0.30	10.8	3.0	2.5	1.7	1.8	6.8
SVT	71.4	0.5	41	0.10	0.20	3.7	26.4	13.1	13.1	19.0	36.3

CALICANTO oxide

	wt	Assay g/t		Distribution %	
	%	Au	Ag	Au	Ag
F	100.0	1.2	229	100.0	100.0
Disol.	-	-	-	100.0	81.2
CNT	100.0	Tr	43	0	18.8

Calculated result

	wt	Assay %					Distribution %				
	%	Au g/t	Ag g/t	Pb	Zn	Fe	Au	Ag	Pb	Zn	Fe
F	100.0	1.3	225	0.27	0.38	3.6	100.0	100.0	100.0	100.0	100.0
Cl・C	4.9	8.0	1,600	4.40	5.50	25.0	30.7	34.7	80.0	71.6	33.7
Cl・T	7.1	1.2	220	0.20	0.40	11.9	6.7	6.9	5.2	7.6	23.2
SVC	2.3	0.9	120	0.20	0.30	10.8	1.6	1.2	1.7	1.8	6.8
SVT	35.7	0.5	41	0.10	0.20	3.7	14.0	6.5	13.1	19.0	36.3
Disol	-	-	-	-	-	-	47.0	41.2	-	-	-
CNT	50.0	Tr	43	-	-	-	-	9.5	-	-	-
Total recovery %							77.7	75.9			

Table 4.1.20 Metallurgical Results Beneficiation tests for mixed Ore

Mixed ore Sulfide : oxide = 5 : 5

	wt	Assay %					Distribution %				
	%	Au g/t	Ag g/t	Pb	Zn	Fe	Au	Ag	Pb	Zn	Fe
F	100.0	1.9	205	0.40	0.51	8.3	100.0	100.0	100.0	100.0	100.0
Cl・C	7.2	17.0	1,741	3.40	4.20	36.0	66.0	61.2	61.7	59.2	31.2
Cl・T	8.2	1.5	276	0.41	0.48	9.8	6.6	11.1	8.6	7.7	9.7
RT	84.6	0.6	67	0.14	0.20	5.8	27.4	27.7	29.7	33.1	59.1
Disol.	-		-				18.2	19.8			
CNT	84.6	0.2	19	-			9.2	7.9			
Total recovery %							84.2	81.0			

Mixed ore Sulfide : Oxide = 3 : 7

	wt	Assay %					Distribution %				
	%	Au g/t	Ag g/t	Pb	Zn	Fe	Au	Ag	Pb	Zn	Fe
F	100.0	1.2	208	0.36	0.43	8.4	100.0	100.0	100.0	100.0	100.0
Cl・C	5.6	13.8	2,130	3.40	4.00	34.5	65.9	57.4	53.1	52.5	23.0
Cl・T	7.6	0.7	242	0.38	0.38	9.8	4.5	8.8	8.1	6.8	8.9
RT	86.8	0.4	81	0.16	0.20	6.6	29.6	33.8	38.8	40.7	68.1
Disol.	-						14.8	22.1			
CNT	86.8	Tr	28				14.8	11.7			
Total recovery %							80.7	79.5			

Table 4.1.21 Sampling data of Cyanidation Plant (Salvador lugo Ore)

SAMPLE	SOLID / LIQUID	pH	P.D.	NaCN g/m³	Cal g/m³	assay, g/t, % Au	Ag	Pb	Zn	Fe
BALL MILL FEED	SOLID					0.55	182			
CYCLONES O.F.	SOLID	12.7	27	0.105	0.125	0.50	133	0.13	0.30	6.20
	LIQUID						50	0.0	0.0	13.0
THIKENER O.F.	LIQUID	12.9		0.115	0.123		45	0.0		14.0
THIKENER SPIGOT	SOLID	12.8	43	0.109	0.125	0.55	137	0.22	0.25	6.10
	LIQUID						49	0.0		13.0
AGITATOR TANK #1	SOLID	12.9	43.5	0.95	0.085	0.40	91	0.22	0.25	7.2
PULP	LIQUID						49	0.0		13.0
AGITATOR TANK #2	SOLID	12.9		0.108	0.085		81	0.15	0.33	4.3
PULP	LIQUID						56	0.0		15.0
AGITATOR TANK #3	SOLID	12.8		0.102	0.078	0.40	76	0.22	0.30	5.7
PULP	LIQUID						56	0.0		16.0
AGITATOR TANK #4	SOLID	12.6		0.107	0.066	0.50	106	0.22	0.25	5.0
PULP	LIQUID						56	0.0		15.0
AGITATOR TANK #5	SOLID			OUT OF ORDER						
	LIQUID									
AGITATOR TANK #6	SOLID	12.6		0.123	0.060	0.40	73	0.23	0.25	6.20
	LIQUID						62	0.0		15.0
AGITATOR TANK #7	SOLID			0.130	0.057	0.30	72	0.24	0.35	5.40
	LIQUID						66	0.0		15.0
AGITATOR TANK #8	SOLID			0.108	0.054	0.40	70	0.22	0.30	4.60
	LIQUID						62	0.0		16.0
AGITATOR TANK #9	SOLID	11.5	38	0.098	0.054	0.55	70			
	LIQUID									
C.C. TANK #1 O.F.	LIQUID	11.8		0.095	0.039		47	0.0		18.0
C.C. TANK #1 SPIGOT	SOLID		44	0.084	0.025	0.25	49	0.22	0.25	5.80
	LIQUID						47	0.0		19.0
C.C. TANK #3 O.F.	LIQUID	11.73		0.086	0.035		28	0.0		17.0
C.C. TANK #3 SPIGOT	SOLID		43.5	0.075	0.023					
	LIQUID						34	0.0		20.00
C.C. TANK #4 O.F.	LIQUID	11.63		0.078	0.024		14	0.0		17.0
C.C. TANK #4 SPIGOT	SOLID		43	0.065	0.023	0.25	50	0.24	0.30	6.10
	LIQUID						15	0.0		19.0
C.C. TANK #5 O.F.	LIQUID	11.24		0.052	0.015		7	0.0		16.0
C.C. TANK #5 SPIGOT	SOLID		47	0.051	0.024	0.40	75	0.22	0.25	6.20
	LIQUID						8	0.0		17.0
BARREN SOLUTION	LIQUID	12.13		0.110	0.045		3.0	0.0		18.0
SEMI PREGNANT SOLUTION	LIQUID	12.11		0.110	0.050		49	0.0		21.0

Table 4.2.1 Complete Analysis

	Sample	Au (ppm)	Ag (ppm)	Cu (%)	Hg (ppm)	As (%)	Cd (%)	Pb (%)	Zn (%)	Bi (%)	Al2O3 (%)	Sb (%)	MnO (%)	S (%)	Fe (%)	F (%)	CaO (%)
PARRAL	1. LA FORTUNA	0.8	1.168	0.11	0.6	1.43	0.017	1.15	2.37	<0.001	1.18	0.270	2.62	6.01	7.42	0.34	8.40
	2. UNFICACION CORDERO	1.6	1,630	0.11	3.2	0.352	0.055	31.07	7.96	0.004	0.93	0.118	0.49	21.92	11.67	0.31	4.95
	3. REVANCHA	0.1	145	0.02	0.2	0.042	0.004	0.04	0.26	<0.001	13.94	0.009	0.46	0.58	4.61	0.30	5.30
	4. LA ESPERANZA	0.8	331	0.15	5.0	0.141	0.091	17.42	16.40	<0.001	1.39	0.030	0.21	12.50	5.65	2.74	6.82
	5. LA PRESA	1.3	92	0.09	0.8	0.049	0.051	7.11	12.26	<0.001	0.24	0.010	0.24	13.12	3.13	15.51	37.73
	6. TILITA	7.5	530	0.20	0.2	1.51	0.003	6.38	1.63	<0.001	0.51	0.119	0.09	7.41	4.86	1.18	2.31
CUANCVI	1. BARRADON	0.3	105	0.12	1.0	0.005	0.002	0.35	0.40	<0.001	4.86	0.009	0.96	0.30	2.08	0.02	0.90
	2. SAN JOSES CHICO	8.5	921	0.58	6.8	0.012	0.122	7.72	18.28	<0.001	2.55	0.010	0.25	11.53	4.08	0.07	0.19
	3. CAPUZAYA	0.2	126	0.13	1.2	0.003	0.003	0.41	0.40	<0.001	4.27	0.012	1.04	0.36	1.83	0.02	0.83
	4. AMPLE DEL ALTO DEL NUEVO PORVEIR	0.7	1.425	0.07	2.2	0.016	0.001	0.15	0.24	<0.001	12.91	0.019	0.17	3.14	3.52	0.03	0.71
	5. SAN RAFAEL	3.4	300	0.13	0.6	0.010	0.002	0.58	0.33	<0.001	5.95	0.007	1.52	2.81	4.13	0.21	0.60
	6. NOCHE BUENA	0.8	216	0.12	0.6	0.013	0.003	0.41	0.63	<0.001	6.25	0.010	1.21	2.36	3.51	0.11	0.75
BARONES	1. AMPL SAN MIGUEL	3.0	138	0.02	2.4	0.027	0.005	0.34	0.99	<0.001	1.09	0.007	0.13	5.74	5.37	0.01	1.15
	2. LAS COMBERES	1.6	105	0.06	0.6	0.031	0.078	16.16	17.02	<0.001	1.29	0.008	0.22	15.56	7.86	0.01	0.87
	3. CALICANTO	2.7	37	0.09	1.8	0.062	0.009	0.90	1.03	<0.001	1.45	0.003	0.47	14.27	12.66	0.04	5.38
	4. CALIFORNIA	0.3	167	0.01	0.2	0.009	<0.001	0.18	0.16	<0.001	0.77	0.005	0.07	0.28	6.35	0.17	0.46
	5. SAN ROBERTO	20.4	33	0.19	0.6	0.039	0.117	0.48	16.11	0.001	1.06	0.004	0.34	11.96	8.97	0.02	0.26
	6. SAN BERNABE	1.4	512	0.05	1.2	0.019	0.016	1.24	2.13	<0.001	4.26	0.007	0.10	10.87	8.91	0.01	0.17

Tabe 4.2.2 a Analytical result by X-ray powder Method

	Mine	Mineral
Parral	La Fortuna	Galena Sphalerite Pyrite Calcite Quartz
	Unificacion Cordero	Galena Sphalerite Pyrite Calcite Quartz
	Revancha	Orthoclase Pyrite Calcite Monmorillonite Quartz
	La Esperanza	Fluorite Galena Sphalerite Pyrite Quartz Calcite

Table 4.2.2 a) Analytical Result by X-ray Powder Method

	Mine	Mineral
Parral	La Presa	Galena Sphalerite Pyrite Fluorite Quartz Calcite
	Tilita	Galena Sphalerite Pyrite Arsenopyrite Fluorite Quartz Calcite
Guanacevi	Barradon	Quartz Chlorite Fluorite
	San Joses Chico	Galena Sphalerite Pyrite Chalcopyrite Quartz Chlorite

Table 4.2.2 a) Analytical Result by X-ray Powder Method

	Mine	Mineral
Guanacevi	Capuzaya	Orthoclase Chlorite Sericite Quartz
	Ample del Alto der Nuevo Porvenir	Pyrite Orthoclase Sericite Quartz
	San Rafael	Pyrite Orthoclase Chlorite (Kaolinite) Quartz
	Noche Buena	Quartz Orthoclase Chlorite Pyrite
Barones	Ample. San Miguel	Pyrite Ankerite Quartz

Table 4.2.2 a) Analytical Result by X-ray Powder Method

	Mine	Mineral
Barones	Las Cumbres	Galena Sphalerite Pyrite Quartz
	Calicanto	Pyrite Galena Calcite Montmorillonite Quartz
	California	Hematite Pyrite Fluorite Quartz
	San Robert	Sphalerite Pyrite Galena Quartz Kaolinite
	San Bernabe	Galena Sphalerite Pyrite

Table 4.2.2 a) Analytical Result by X-ray Powder Method

	Mine	Mineral
Barones	San Bernabe	Quartz

Table 4.2.2 b) Analytical Result by X-ray Powder Method (Refernce)

Mineral	Chemical Composition	Note
Ankerite	$Ca(Fe,Mg,Mn)(CO_3)_2$	Hardness: 3.5-4 Sp.gr.: 2.95-3.1 Trigonal, Fe>Mg
Arsenopyrite	FeAsS	Hardness: 5.5-6 Sp.gr.: 5.9-6.2 Orthorhombic, soluble in HNO_3 generating NO_2 gas
Calcite	$CaCO_3$	Hardness: 3 Sp.gr.: 2.71 Trigonal Streak: white - gray, crystallizes in columnar, plate, rhombohedron or nodule shapes
Chalcopyrite	$CuFeS_2$	Hardness: 3.5-4 Sp.gr.: 4.1-4.3 Tetragonal Streak: black, usually tetrahedron, frequently massive and compact
Chlorite	$(Mg,Fe^2,Al)_{12}SiAl_8O_{18}(OH)_{16}$	Hardness: 2-3 Sp.gr.: 2.6-3.3 Monoclinic formed through hydrothermal alteration
Fluorite	CaF_2	Hardness: 4 Sp.gr.: 3.18 Isometric Cleavage: complete, fluorescent
Galena	PbS	Hardness: 2.5-3 Sp.gr.: 7.4-7.5 Isometric Streak: lead gray, cleavable mass ore column
Hematite	Fe_2O_3	Hardness: 5-6 Sp.gr.: 5.26 Streak: red, trigonal, plate or soil-like form
Kaolinite	$Al_2Si_2O_5(OH)_4$	White powder, hardness: 2-2.5 Sp.gr.: 2.61, formed through hydrothermal alteration
Montmorillonite	$(CaNa)xAl_2(Siy Alx) O_{10}(OH)_2$	Powder, ion exchangeable, extremely swelling, formed through weathering or hydrothermal alteration
Orthoclase	$KAlSi_3O_8$	Hardness: 6-6.5 Sp.gr.: 2.56 Single crystal Cleavage: complete and good

Table 4.2.2 b) Analytical Result by X-ray Powder Method (Refernce)

Mineral	Chemical Composition	Note
Pyrite	FeS_2	Hardness: 6-6.5 Sp.gr.: 4.95-5.10 Isometric Streak: black, crystallizes in hexahedron, octahedron or pentagon dodecahedron forms
Quartz	SiO_2	Hardness: 7 Sp.gr.: 2.65 Hexagonal, semitransparent white mass, characterized by shell-like fracture
Sericite	$K_2Al_4(Si_6Al_2)O_{20}(OH,F)_4$	Phyllosilicate, frequently produced in hexagonal plate form, formed through hydrothermal alteration
Sphalerite	ZnS	Hardness: 3.5-4 Sp.gr.: 3.9-4.1 Isometric Streak: brown- to yellow-tinged, completely cleaves into rhombo-dedecahedron shape

Table 4.2.3

Microscopic observation I

	Mine	Mineral
Parral	La Fortuna	Galena(Pbs), Sphalerite(ZnS), Pyrite(FeS_2)
	Unficacion cordero	Galena, Sphalerite, Pyrite
	Revancha	Galena, Sphalerite,
	La Esperanza	Chalcopyrite($CuFeS_2$), Galena, Sphalerite, Pyrite
	La presa	Sphalerite, Pyrite
	Tilita	Chalcopyrite, Sphalerite, Pyrite
Guanacevi	Barradon	Chalcopyrite, Sphalerite, Marcasite (FeS_2)
	San Joses Chico	Galena, Sphalerite, Pyrite
	Capuzaya	Chalcopyrite, Tetrahedrite ($(Cu,Ag)_{10}(Fe, Zn)_2(As, Sb)_4 S_{13}$) Sphalerite, Pyrite, Marcasite
	Ample del Alto del Nvevo Porvenir	Sphalerite, Pyrite,
	San Rafael	Marcasite, Galena, Sphalerite, Pyrite
	Noche Bvena	Chalcopyrite, Sphalerite, Pyrite
Barones	Ampl. San Miguel	Sphalerite, Pyrite,
	Las Cumbres	Galena, Sphalerite, Pyrite
	Calicanto	Chalcopyrite, Galena, Pyrite
	California	Tetrahedrite
	San Roberto	Chalcopyrite, Galena, Sphalerite, Pyrite
	San bernabe	Chalcopyrite, Sphalerite, Pyrite

Table 4.2.4

Results of E.P.M.A. observation

	Mine	Mineral
Parral	La Fortuna	Ag-Tetrahedrite($(Cu,Ag)_{10}(Fe_2,Zn)_2(As,Sb)_4S_{13}$) Arsenopyrite(Fe, As, S) Stromeyerite, (Cu, AgS)
	Unficacion cordero	Galena(PbS), Ag-Te-(Sb) Manganocalcite($(Ca,Mn)CO_3$)
	Revancha	Ag-Tetrahedrite, Arsenopyrite
	La Esperanza	Ag-Tetrahedrite, Arsenopyrite Cupriangold(Au-Cu)
	La presa	Ag-Tetrahedrite, Chalcopyrite ($CuFeS_2$)
	Tilita	Ag-Tetrahedrite, Galena
Guanaceve	Barradon	Argentite(Ag_2S)
	San Joses Chico	Electrum(Au, Ag), Argentite, Stromeyerite, Chalcopyrite, Galena, Hematite(Fe_2O_3)
	Capuzaya	Ag-Tetrahedrite,
	Ample del Alto Nvevo Porvenir	Polybasite-Antimon pearceite($8(Ag,Cu_2)S \cdot (SbAS)$)
	San Rafael	Electrum
	Noche Bvena	Ag-Tetrahedrite,
Barones	Ampl San Miguel	Polybasite or Antimonpearceite. Argentite Sphalerite
	Las Cumbres	Polybasite-Antimonpearceite, Electrum Argentite, Pyrite (FeS_2)
	Calicanto	Ag-Tetrahedrite, Chaloopyrite
	California	Argentite
	San Roberto	Matildite($AgBiS_2$), Electrum Shalerite
	San bernabe	Stromeyerite, Galena, Sphalerite, Pyrite

Table 4.2.5

Microscopia observation II

Plant	Sample	Mineral
Parral	Casale ——flotation tailing	Pyrite(FeS_2)
	Casale ——cyanidation tailing	Pyrite
Guanaceve	La Prieta ——bacterial leaching feed	Tetrahedrite($(Cu,Ag)_{10}(Fe,Zn)_2(As,Sb)_4S_{13}$)
Barones	Santa Marta ——Zn flotation tailing	Pyrite

Table 4.2.6 Result of Liquid Analysis (mg/l)

			Au	Ag	Cu	Pb	Zn	Mn	Fe^{++}	Fe	As
E-6-1		1 hr	< 0.01	< 0.2	0.25	0.55	1.76	6.28	< 0.02	3.06	< 0.01
		5 days	< 0.01	< 0.2	18.5	2.02	541	969	< 0.01	170	0.33
		10	< 0.01	< 0.2	10.1	0.46	654	1,010	0.01	91.5	0.17
		15	< 0.01	< 0.2	21.2	0.37	768	862	0.01	50.2	0.07
	Na CN	24 hrs	0.01	0.2	0.42	0.76	2.38	0.1	0.02	1.68	< 0.01
		48	0.01	< 0.2	0.06	0.19	0.72	0.1	0.02	0.84	< 0.01
E-6-2		1 hr	< 0.01	< 0.2	0.16	0.18	5.99	237	0.07	1.58	< 0.01
		5 days	< 0.01	< 0.2	0.14	0.18	76.3	252	0.02	1.67	< 0.01
		10	< 0.01	< 0.2	1.25	0.09	286	524	0.03	0.28	< 0.01
		15	< 0.01	< 0.2	10.4	0.28	517	1,510	0.01	12.0	< 0.01
	$CS(NH_2)_2$	24 hrs	< 0.01	5.12	7.50	3.04	868	18,300	0.01	7.42	0.02
		48	0.01	4.19	477	114	398	18,800	0.03	1.61	0.02
B-12-1		1 hr	< 0.01	< 0.2	0.20	0.18	6.18	31.0	0.03	1.88	< 0.01
		5 days	< 0.01	< 0.2	0.48	0.18	66.7	74.9	0.03	1.11	< 0.01
		10	< 0.01	< 0.2	0.13	0.28	40.3	46.5	0.04	0.77	< 0.01
		15	< 0.01	< 0.2	0.11	0.73	4.03	0.28	0.01	1.74	< 0.01
	Na CN	24 hrs	0.02	9.09	0.54	0.76	3.18	18.5	0.02	1.68	0.03
		48	0.05	0.76	0.12	0.66	0.92	56.0	0.02	0.60	< 0.01
B-12-2		1 hr	< 0.01	< 0.2	0.20	0.37	4.37	7.79	0.02	1.06	< 0.01
		5 days	< 0.01	< 0.2	0.17	0.37	15.6	6.94	0.02	0.68	< 0.01
		10	< 0.01	< 0.2	0.34	0.37	117	69	0.02	0.97	< 0.01
		15	< 0.01	< 0.2	0.93	0.37	200	157	0.04	1.26	< 0.01
	$CS(NH_2)_2$	24 hrs	< 0.01	15.5	4.64	1.90	4,200	18,000	0.02	5.98	0.02
		48	0.01	4.78	4.86	1.14	430	19,800	0.1	1.97	< 0.01

Table 4.2.7 Result of Liquid Analysis (mg/l)

		Au	Ag	Cu	Pb	Zn	Mn	Fe^{++}	Fe	As
$Fe_2(SO_4)_3$	1 hr	0.01	0.31	8.80	0.47	821	578	0.01	19.500	2.96
	24	0.01	0.10	13.62	0.75	689	764	0.01	17.000	3.46
H_2SO_4	1 hr	0.01	0.12	12.3	0.1	371	394	0.01	327	0.18
	24	0.01	0.07	8.84	0.1	394	835	0.01	50.3	0.01
Na CN	24 hrs	0.06	37.0	0.06	0.1	1.28	0.99	0.01	0.60	0.01
	48	0.07	18.2	0.12	0.1	1.03	0.44	0.01	0.37	0.01
$CS(NH_2)_2$	24 hrs	0.02	3.63	2.65	0.1	33.0	4.920	0.48	1.51	0.01
	48	0.02	2.76	2.29	0.37	19.8	3.390	0.11	0.39	0.01

Table 4.2.8 Result of Sand Analysis

		Au	Ag	Cu	Pb	Zn	Mn	Fe	S	As
		(g/ton)	(g/ton)	%	%	%	%	%	%	%
B-6-1	5 days	0.2	342	0.03	0.17	0.48	6.52	4.19	9.31	0.015
	10	0.2	346	0.03	0.18	0.47	5.98	4.60	9.37	0.008
	15	0.2	277	0.02	0.18	0.55	3.90	3.02	9.50	0.009
Na CN	24 hrs	0.1	346	0.03	0.21	0.56	6.38	4.61	9.01	0.009
	48	0.1	344	0.02	0.15	0.55	5.35	5.43	10.12	0.007
B-6-2	5 days	0.2	334	0.03	0.17	0.59	6.48	4.67	9.36	0.015
	10	0.2	367	0.03	0.19	0.61	6.42	4.75	7.97	0.008
	15	0.2	323	0.03	0.18	0.58	3.72	3.32	7.50	0.009
$CS(NH_2)_2$	24 hrs	0.1	403	0.03	0.21	0.26	1.08	5.62	10.59	0.008
	48	0.1	367	0.02	0.17	0.36	1.34	5.53	10.41	0.007
B-12-1	5 days	0.2	261	0.02	0.12	0.51	5.34	4.59	12.26	0.01
	10	0.2	270	0.02	0.12	0.49	4.70	5.15	13.01	0.006
	15	0.3	338	0.03	0.18	0.74	4.06	3.48	9.45	0.009
Na CN	24 hrs	0.1	375	0.03	0.20	0.58	6.59	3.67	8.99	0.008
	48	0.1	367	0.03	0.16	0.72	5.50	3.85	9.17	0.007
B-12-2	5 days	0.2	323	0.03	0.15	0.61	6.48	4.67	10.16	0.014
	10	0.2	332	0.03	0.15	0.55	5.90	4.81	9.77	0.006
	15	0.2	312	0.03	0.14	0.64	4.00	3.37	10.08	0.008
$CS(NH_2)_2$	24 hrs	0.1	378	0.03	0.21	0.33	1.46	4.61	10.28	0.006
	48	0.2	364	0.03	0.17	0.46	1.81	5.43	10.52	0.008

Table 4.2.9 Result of Sand Analysis

		Au	Ag	Cu	Pb	Zn	Mn	Fe	As
$Fe_2(SO_4)_3$	1 hr	0.2	388	0.03	0.21	0.91	7.17	5.30	0.018
	24	0.1	377	0.03	0.20	0.71	6.01	5.30	0.105
H_2SO_4	1 hr	0.2	409	0.03	0.22	0.89	7.10	5.48	0.018
	24	0.2	382	0.03	0.20	0.80	6.40	5.48	0.017
Na CN	24 hr	0.1	305	0.03	0.21	0.86	7.30	5.66	0.019
	48 rs	0.1	358	0.04	0.20	0.95	3.91	4.70	
$CS(NH_2)_2$	24 hrs	0.1	419	0.04	0.23	0.89	6.27	5.48	0.020
	48	0.1	382	0.03	0.22	0.79	2.91	5.00	

Table 4.2.10 Extraction Rate of Metals

		Mn	Au	Ag
B-6-1	5 days	3.4	—	—
	10	3.8	—	—
	15	4.9	—	—
Na CN	24 hrs	0	18.9	0.1
	48	0	18.9	0.1
B-6-2	5 days	0.9	—	—
	10	1.9	—	—
	15	8.7	—	—
$CS(NH_2)_2$	24	79.8	0	2.9
	48	76.6	18.9	2.6
B-12-1	5 days	0.3	—	—
	10	0.2	—	—
	15	0	—	—
Na CN	24 hrs	0.1	31.8	5.4
	48	0	53.8	0.5
B-12-2	5 days	0	—	—
	10	0.3	—	—
	15	0.9	—	—
$CS(NH_2)_2$	24 hrs	74.2	0	8.7
	48	71.9	10.4	3.0
$Fe_2(SO_4)_3$	48			
H_2SO_4	48			
Na CN	24	0	58.3	22.0
	48	0	61.5	10.5
$CS(NH_2)_2$	24	15.4	33.3	1.9
	48	21.4	33.3	1.5

Table 4.2.11 Metallurgical Results of Fundamental Flotation test on San Bernabe Ore

Test 1

PRDDUCT	wt	Assay %						Distribution %					
	%	Au g/T	Ag g/T	Cu	Pb	Zn	Fe	Au	Ag	Cu	Pb	Zn	Fe
FEED	100.0	0.1	65.2	0.71	4.49	6.55	15.61	100.0	100.0	100.0	100.0	100.0	100.0
COMC. -1	22.1	0.2	213.0	2.70	17.31	2.32	34.51	33.0	72.2	84.4	85.1	7.8	48.9
COMC. -2	11.8	0.2	88.0	0.69	4.58	7.82	27.48	17.6	15.9	11.5	12.0	14.1	20.8
COMC. -3	5.7	0.1	30.0	0.19	1.09	11.15	13.87	4.3	2.6	1.5	1.4	9.7	5.1
Total	39.6	0.2	149.4	1.74	11.18	5.23	29.14	54.9	90.7	97.4	98.5	31.6	74.7
TAILING	60.4	0.1	10.0	0.03	0.11	7.41	6.54	45.1	9.3	2.6	1.5	68.4	25.3

Test 2

PRDDUCT	wt	Assay %						Distribution %					
	%	Au g/T	Ag g/T	Cu	Pb	Zn	Fe	Au	Ag	Cu	Pb	Zn	Fe
FEED	100.0	0.1	63.8	0.71	4.04	0.72	14.77	100.0	100.0	100.0	100.0	100.0	100.0
COMC. -1	13.4	0.3	281.0	4.14	23.13	3.99	28.31	28.0	59.0	78.6	76.7	7.6	25.7
COMC. -2	8.3	0.3	135.0	1.22	9.26	8.11	18.81	17.4	17.6	14.4	19.0	9.6	10.6
COMC. -3	3.1	0.1	71.0	0.63	5.40	18.54	13.01	2.2	3.4	2.8	4.1	3.8	2.7
Total	24.8	0.3	205.9	2.72	16.27	5.94	23.22	47.6	80.0	95.7	99.8	21.0	39.0
TAILING	75.2	0.1	17.0	0.04	0.01	7.38	11.99	52.4	20.0	4.3	0.2	79.0	61.0

Test 3

PRDDUCT	wt	Assay %						Distribution %					
	%	Au g/T	Ag g/T	Cu	Pb	Zn	Fe	Au	Ag	Cu	Pb	Zn	Fe
FEED	100.0	0.1	63.1	0.72	4.19	6.67	15.30	100.0	100.0	100.0	100.0	100.0	100.0
COMC. -1	16.0	0.2	257.0	3.57	21.62	2.86	27.24	22.2	65.2	78.9	82.6	6.9	28.5
COMC. -2	11.5	0.3	103.0	0.92	5.55	6.06	26.54	23.9	18.8	14.6	15.2	10.4	19.9
COMC. -3	5.2	0.2	39.0	0.25	1.18	19.17	15.43	7.2	3.2	1.8	1.5	7.1	5.2
Total	32.7	0.2	168.2	2.11	12.72	4.99	25.12	53.3	87.2	95.3	99.4	24.5	53.3
TAILING	67.3	0.1	12.0	0.05	0.04	7.49	10.53	46.7	12.8	4.7	0.6	75.5	46.3

Test 4

PRDDUCT	wt	Assay %						Distribution %					
	%	Au g/T	Ag g/T	Cu	Pb	Zn	Fe	Au	Ag	Cu	Pb	Zn	Fe
FEED	100.0	0.2	62.3	0.67	3.74	6.77	15.07	100.0	100.0	100.0	100.0	100.0	100.0
COMC. -1	8.2	0.2	398.0	6.41	25.13	6.29	14.31	8.8	51.1	78.2	55.1	7.6	7.8
COMC. -2	8.5	0.1	134.0	1.10	13.26	8.77	16.81	4.6	18.3	13.9	30.1	11.0	9.5
COMC. -3	4.9	0.1	54.0	0.28	4.05	8.80	17.74	2.6	4.2	2.0	5.3	6.4	5.8
Total	21.6	0.1	212.3	2.93	15.68	7.84	16.07	16.0	73.6	94.2	90.6	25.0	23.0
TAILING	78.4	0.2	21.0	0.05	0.45	6.48	14.79	84.0	26.4	5.8	9.4	75.0	77.0

Table 4.2.12 Result of Differential Flotation test on San Bernabe Ore

PRODUCT	wt	Assay %						Distribution %					
	%	Au g/T	Ag g/T	Cu	Pb	Zn	Fe	Au	Ag	Cu	Pb	Zn	Fe
FEED	100.0	0.2	60.5	0.69	4.10	6.82	14.71	100.0	100.0	100.0	100.0	100.0	100.0
Pb RC	24.6	0.2	196.3	2.63	16.24	6.58	23.87	23.7	79.8	94.1	97.4	23.7	39.9
1 cl C	8.4	0.1	418.5	5.54	45.80	3.37	12.45	5.1	58.1	67.7	93.8	4.1	7.7
1 cl T	16.2	0.2	81.0	1.12	0.91	8.24	29.28	18.6	21.7	26.4	3.6	19.6	32.2
2 cl C	6.6	0.1	502.1	6.74	57.13	1.71	10.50	4.1	54.8	64.7	91.9	1.7	4.7
2 cl T	1.8	0.1	112.0	1.18	4.26	9.45	24.26	1.0	3.3	3.1	1.9	2.5	3.0
3 cl C	6.1	0.1	525.0	7.07	60.84	1.35	8.95	3.5	53.0	62.7	90.4	1.2	3.7
3 cl T	0.5	0.2	223.0	2.65	11.93	6.06	29.40	0.6	1.8	1.9	1.5	0.4	1.0
Pb RT	75.4	0.2	16.2	0.05	0.14	6.90	11.72	76.3	20.2	5.9	2.6	76.3	60.1
Pb Svt C	6.4	0.2	52.0	0.11	0.55	10.27	31.02	7.4	5.5	1.0	0.9	9.6	13.5
Pb Sv T	69.0	0.2	12.9	0.05	0.11	6.59	9.93	68.9	14.7	4.8	1.8	66.7	46.6
Zn RC	19.7	0.1	25.0	0.12	0.25	22.45	15.28	12.3	8.2	3.4	1.2	64.8	20.5
Zn RT	49.3	0.2	8.0	0.02	0.05	0.25	7.79	56.6	6.5	1.4	0.6	1.8	76.1
1 cl C	13.7	0.1	32.1	0.16	0.31	31.91	18.55	8.8	7.3	3.2	1.0	64.1	7.3
1 cl T	6.0	0.1	9.0	0.03	0.11	9.87	7.80	3.4	0.9	0.3	2	0.8	3.2
2 cl C	10.6	0.1	32.1	0.18	0.31	40.30	19.98	7.1	5.6	2.8	0.8	62.6	14.4
2 cl T	3.1	0.1	32.0	0.07	0.32	3.20	13.66	1.8	1.6	0.3	0.2	1.5	2.9
3 cl C1	6.9	0.1	27.0	0.20	0.30	47.30	16.14	4.0	3.1	2.0	.5	47.8	7.6
3 cl C2	2.0	0.1	36.0	0.20	0.37	44.20	17.88	1.1	1.2	0.6	0.2	13.0	2.4
3 cl T	1.7	0.2	48.0	0.10	0.25	7.30	38.05	2.0	1.3	0.2	0.1	1.8	4.4
3 cl C	8.9	0.1	29.0	0.20	0.32	46.60	16.53	5.1	4.3	2.6	0.7	60.8	10.0

Table 4.2.13　Expected Metallurgical Result on San Bernabe Ore

	wt	Assay %						Distribution %					
	%	Au g/T	Ag g/T	Cu	Pb	Zn	Fe	Au	Ag	Cu	Pb	Zn	Fe
FEED	100.0	0.2	60.5	0.69	4.10	6.82	14.71	100.0	100.0	100.0	100.0	100.0	100.0
Pb Conc.	6.6	0.1	502.1	6.74	57.13	1.71	10.50	4.1	54.8	64.7	91.9	1.7	4.7
Zn Conc.	13.1	0.1	61.0	1.01	0.97	46.60	16.73	7.1	13.2	19.1	3.1	89.6	14.9
Tailing.	80.3	0.2	24.1	0.14	0.26	0.74	14.73	88.8	32.0	16.2	5.0	8.7	80.4
Recovery								11.2	68.0	83.8	91.9	89.6	—

Table 5.2.1.a Evaluation of the mines based on ore reserved Parral

Parral

Mine			LA REVANCHA	LA PRESA	LA ESPERANZA	TILITA	UNIF.CORDERO
Ore Value	Head Grade (g/t, %)	Au				0.90	
		Ag	374	120	100	519	304
		Pb		4.36	4.00		6.50
		Zn		3.88	5.00		4.30
	Mill Recovery (%)	Au				60	
		Ag	60	65	65	80	65
		Pb		50	35		50
		Zn		55	55		55
	Smelter Recovery (%)	Au	92	92	92	92	92
		Ag	89	89	89	89	89
		Pb	81	81	81	81	81
		Zn	76	76	76	76	76
	Recoverable Metals Value (Peso/t)	Au	0	0	0	15,972	0
		Ag	83,473	29,015	24,179	154,448	73,504
		Pb	0	30,902	19,845	0	46,069
		Zn	0	56,764	73,150	0	62,909
	Total (Peso/t)		83,473	116,681	117,174	170,420	182,482
Operating Cost (Peso/t)	Mining		33,500	37,600	39,400	35,000	82,200
	Milling		31,902	31,902	31,902	31,902	31,902
	Smelter Charges		8,347	23,336	23,435	17,042	36,496
	Total		73,749	92,838	94,737	83,944	150,598
Operating	Cash Flow (Peso/t)		9,724	23,843	22,437	86,476	31,883

Metal Prices	
Au (US$/oz)	400
Ag (US$/oz)	5.2
Pb (US$/t)	700
Zn (US$/t)	1400
g/oz	31.1035
Peso/US$	2500

Table 5.2.1.b Evaluation of the mines based on ore reserved Guaracevi

Guanacevi

Mine			S.JOSE CHICO	BARRADON	CAPUZAYA	SAN RAFAEL	A.PORVENIR	NOCHE BUENA
Ore Value	Head Grade (g/t, %)	Au	2.50	1.55	0.48	4.10	0.63	0.30
		Ag	260	183	205	396	579	160
		Pb						
		Zn						
	Mill Recovery (%)	Au	80	75	60	80	70	80
		Ag	80	70	60	80	60	80
		Pb						
		Zn						
	Smelter Recovery (%)	Au	92	92	92	92	92	92
		Ag	89	89	89	89	89	89
		Pb	81	81	81	81	81	81
		Zn	76	76	76	76	76	76
	Recoverable Metals Value (Peso/t)	Au	59,157	34,385	8,519	97,018	13,044	7,099
		Ag	77,373	47,651	45,754	117,844	129,227	47,614
		Pb	0	0	0	0	0	0
		Zn	0	0	0	0	0	0
	Total (Peso/t)		136,530	82,036	54,273	214,863	142,271	54,713
Operating Cost (Peso/t)	Mining		78,300	36,400	49,300	45,300	45,300	36,900
	Milling		30,000	30,000	30,000	30,000	30,000	30,000
	Smelter Charges		13,653	8,204	5,427	21,486	14,227	5,471
	Total		121,953	74,604	84,727	96,786	89,527	72,371
Operating Cash Flow (Peso/t)			14,577	7,433	-30,455	118,076	52,744	-17,658

Metal Prices	
Au (US$/oz)	400
Ag (US$/oz)	5.2
Pb (US$/t)	700
Zn (US$/t)	1400
g/oz	31.1035
Peso/US$	2500

Table 5.2.1.c Evaluation of the mines based on ore reserved Barones

Barones

Mine			SAN ROBERTO	SAN BERNABE	LAS CUMBRES	CALICANTO	A.S.MIGUEL	CALIFORNIA
Ore Value	Head Grade (g/t, %)	Au	0.50	0.56	0.45	1.10	0.70	0.58
		Ag	109	170	185	175	303	300
		Pb	0.93	1.17	1.00	0.51		
		Zn	1.88	1.42	1.84			
		Cu	2.86					
	Mill Recovery (%)	Au	20	20	40	50	60	20
		Ag	60	60	60	60	70	55
		Pb	50	50	55	50		
		Zn	45	45	50			
		Cu	60					
	Smelter Recovery (%)	Au	92	92	92	92	92	92
		Ag	89	89	89	89	89	89
		Pb	81	81	81	81	81	81
		Zn	76	76	76	76	76	76
		Cu	90	90	90	90	90	90
	Recoverable Metals Value (Peso/t)	Au	2,958	3,313	5,324	16,268	12,423	3,431
		Ag	24,328	37,942	41,290	39,058	78,898	61,377
		Pb	6,591	8,292	7,796	3,615	0	0
		Zn	22,504	16,997	24,472	0	0	0
		Cu	81,081	0	0	0	0	0
	Total (Peso/t)		137,462	66,545	78,883	58,941	91,321	64,808
Operating Cost (Peso/t)	Mining		38,100	38,100	38,400	32,410	41,500	16,000
	Milling		16,500	16,500	16,500	20,375	16,500	16,500
	Smelter Charges		27,492	13,309	15,777	5,894	9,132	6,481
	Total		82,092	67,909	70,677	58,679	67,132	38,981
Operating Cash Flow (Peso/t)			55,369	-1,364	8,206	262	24,189	25,828

Metal Prices	
Au (US$/oz)	400
Ag (US$/oz)	5.2
Pb (US$/t)	700
Zn (US$/t)	1400
Cu (US$/t)	2100
g/oz	31.1035
Peso/US$	2500

Table 6.4.1 Schedule of anual maintenance

Section	Equip	Detail	Replacement of parts Cycle of ovethaul	Expected date of replacement of parts	N o t e
Crushing	Jaw Crusher Vibrating Screen	eccentric shaft toggle bearing unbalance Weight	'86.5 ～'88.5	'90.5	Need to replace
Grinding	No.1 Ball Mill	trunnion liner feed side discharge side scoop feeder			
Flotation	Blower	bearings			
Filtration	Disk Fiter	inside tubes			

Table 6.4.2 Schedule of anual maintenance

<table>
<tr><td colspan="6">Machine Register No.</td></tr>
<tr><td colspan="6">Name :</td></tr>
<tr><td>Date of Acquisition</td><td colspan="2"></td><td>Plice</td><td colspan="2"></td></tr>
<tr><td rowspan="4">Production</td><td>Maker</td><td colspan="4"></td></tr>
<tr><td>Date</td><td colspan="2"></td><td>No.</td><td></td></tr>
<tr><td>Type</td><td colspan="2"></td><td>Material</td><td></td></tr>
<tr><td>Size</td><td colspan="2"></td><td>Weight</td><td></td></tr>
<tr><td>Function</td><td colspan="5"></td></tr>
</table>

Date	Contents of Repairment	expense

Table 6.4.3 Schedule of anual maintenance

Daily Report of Grinding

Date . .

Name :	1st.	2nd.	3rd.
Treatment t/h			
P.D. (%)			
No. 1 B.M.			
No. 2 B.M.			
Presure of Cyclone (p.s.i)			
No. 1			
No. 2			
Current (A)			
No. 1 B.M.			
Pump			
No. 2 B.M.			
Pump			
Statement			
No. 1 B.M.			
Pump			
No. 2 B.M.			
Pump			
Other equips Notes			

Table 6.4.4 Schedule of anual maintenance

Daily Report of Flotation		Date . .	
Name	1st.	2nd.	3rd.
P. D.			
Zn RF			
Zn RT			
Zn Cl. T			
Reagent			
Zn R EX			
$Cu\ SO_4$			
PH			
Temperature of Blower			
Notes			

Table 6.6.1 Example form of the copmarison between budget and results

Item			Budget (A)	Oct.	Nov.	Dec.	Jan.	Feb.	March	Total budget (C)	Total actual result (D)	Increase/ decrease (D)-(C)
Work quantity												
Personnel expenses	Salary	Number	3	3	3			3		6	6	
		Amount	942,000	989,921	969,019			979,470	27,019	1,884,000	1,958,940	74,940
	Sum		1,534,000	1,584,807	1,606,276			1,595,542	72,276	3,068,000	3,191,083	123,083
Labor related expenses			724,000	724,000	721,000			722,500	-3,000	1,448,000	1,445,000	-3,000
Commodity expense	Oils			25,620				12,810			25,620	25,620
	Metal product											
	Medicines				18,950			9,475	18,950		18,950	18,950
	Chemicals Rubber & leather goods			1,880	4,760			3,320	4,760		6,640	6,640
	Machines			24,560	21,000			22,680	21,000		45,360	45,360
	Tools											
	Misc. goods & others		150,000	29,750				14,875	-150,000	300,000	29,750	-270,250
	Total		150,000	54,320	238,874			390,597	88,874	300,000	781,194	481,196
Simple expenses	Repair cost payable		100,000						-100,000	200,000		-200,000
	Power rates payable											
	Freight rates payable											
	Contract expenses											
	Traveling and transportation expenses											

Table 6.6.1 Example form of the copmarison between budget and results

Item			Budget (A)	Oct.	Nov.	Dec.	Jan.	Feb.	March	Total budget (C)	Total actual result (D)	Increase/ decrease (D)-(C)
Simple expenses	Communication expenses											
	Rent											
	Expense accounts											
	Misc. expenses and others											
	Total		100,000	662,961				331.481	-100,000	200,000	662,961	462,961
Compound expenses	Power electricity expenses	KWH										
		Amount										
	Electricity expenses	KWH										
		Amount										
	Analysis expenses	Number	192						-192	384		-384
		Amount	50,000						-50,000	100,000		-100,000
	Water expenses	m^3										
		Amount										
	Total		50,000						-50,000	100,000		-100,000
Total expenses			150,000	662,961				331,481	-150,000	300,000	662,961	362,961
Depreciation expenses			456,000						-456,000	912,000		-912,000
Total			3,514,088	3,514,088	2,566,150			3,040,119	-447,850	6,028,000	6,080,238	52,238
Original unit price												

Table 7.1.1 Statement of Profits and Losses, Parral plant (Jan. 1, 1988- Dec. 31, 1988)

Unit: Peso

Sales	7,302,555,902	(85,241 peso/ton)
Sales costs	6,720,536,159	
Sales profit	582,019,743	
General administrative expenses	214,377,505	
Selling expenses	159,915,032	
Operating profit	207,727,206	
Non-operating income	50,853,275	
Non-operating expenses	2,905,860	
Ordinary profit	255,647,621	

Table 7.1.2 Total Revenues, Parral plant (Jan. 1, 1988-Dec. 31, 1988)

Unit: Peso

Lead concentrate	5,879,251,334	80.51%
Zinc concentrate	198,114,133	2.71%
Cyanided deposit	1,195,438,234	16.37%
High grade non-treatment ore	29,752,201	0.41%
Total	7,302,555,902	100%

Table 7.1.3 Total Costs of Revenues, Parral plant (Jan. 1, 1988-Dec. 31, 1988)

Unit: Peso

Sales costs	Treated ore prices		4,914,625,734 (57,367 peso/ton)	
	Operating cost	Direct costs	1,594,634,908 (28,614 peso/ton)	2 peso discrepancy
		Indirect costs	188,992,226	
		Depreciation expense	22,283,291	
		Subtotal	1,805,910,425 (21,080 peso/ton)	
	Total		6,720,536,159	

Treated ore volume : 85,670 t

Treated ore prices = Expense for purchasing treated ore + Expense for purchasing high grade non-treatment ore - Concentrate stock price (Concentrate stock price = Term beginning stock concentrate + During-term purchased concentrate - Term-end stock concentrate)

Table 7.1.4 Detailed Operation Costs, Parroal plant (Jan. 1, 1988-Dec. 31, 1988)

Unit: Peso

	Personnel expenses	Material costs	Others	Cost of electric power	Cost of water	Total
Ore receiving	36,609,631 (509,071)	27,719,755 (14,911,767)	106,750	-	-	64,436,136 (15,420,838)
Crushing	51,412,396 (4,988,206)	18,071,198 (4,876,794)	-	28,450,695	- -	97,934,289 (9,875,000)
Grinding	33,616,848 (6,553,779)	149,790,245 (10,095,595)	1,682	112,565,794	-	295,974,569 (16,649,374)
Flotation	55,840,897 (6,812,818)	101,080,474 (1,584,060)	17,823	27,930,163	-	234,869,357 (8,396,878)
Cyanidation (Primary agitation and washing)	72,265,371 (16,151,140)	335,259,684 (48,172,339)	-	72,157,560	-	479,682,615 (64,323,479)
Cyanidation (Filtration and settle-ment)	31,396,555 (2,107,641)	28,031,021 (11,868,981)	426,280	21,441,103	-	81,294,959 (13,976,622)
Drying (Including can packing and shipment)	-	1,300,234	163,620	-	-	1,463,854
Cyanidation (Compr. air)	792,304 (785,560)	5,675,861 (4,656,865)	-	14,019,183	-	20,487,348 (5,472,425)
Sludge	2,135,628 (2,102,791)	8,850,535	100,171	13,606,856	-	24,693,190 (2,102,791)
Water supply	275,009 (273,105)	1,037,815	53,325	21,853,433	83,845	23,303,427 (273,105)
Stockyard	78,813,181 (1,287,336)	1,649,093	1,049,144	7,834,250	-	89,345,668 (1,287,336)
Electrical maintenance	15,626,311	401,503	3,225,960	2,350,274	-	21,604,048
Mechanical maintenance	33,857,942	801,362	6,173,107	20,451,157	-	61,283,568
Laboratory	66,042,551 (778,153)	23,139,527	8,564	9,071,236	-	98,261,878 (778,153)
Total	478,684,624 (42,359,600)	702,808,307 (96,166,401)	11,326,426 (25.19%)	401,731,704	83,845	1,594,634,906 (138,556,001)
30%	8.85%	13.68%				8.69%

44.1%

Treated ore volume: 85,670 t

( ) = Maintenance [included]