

No .

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE REPUBLIC OF CHILE
MINISTERIO DE MINERIA
EMPRESA NACIONAL DE MINERIA

THE STUDY
ON
ENVIRONMENTALLY-FRIENDLY OPERATION
OF MINERAL PROCESSING PLANT
USING BIOTECHNOLOGY
IN
THE REPUBLIC OF CHILE

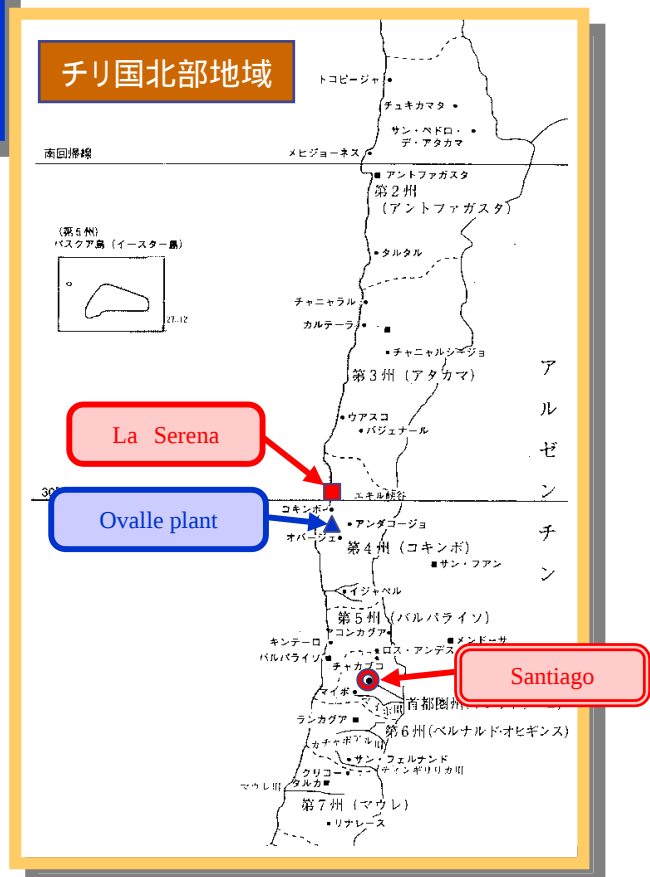
FINAL REPORT
SUMMARY

DECEMBER, 2002

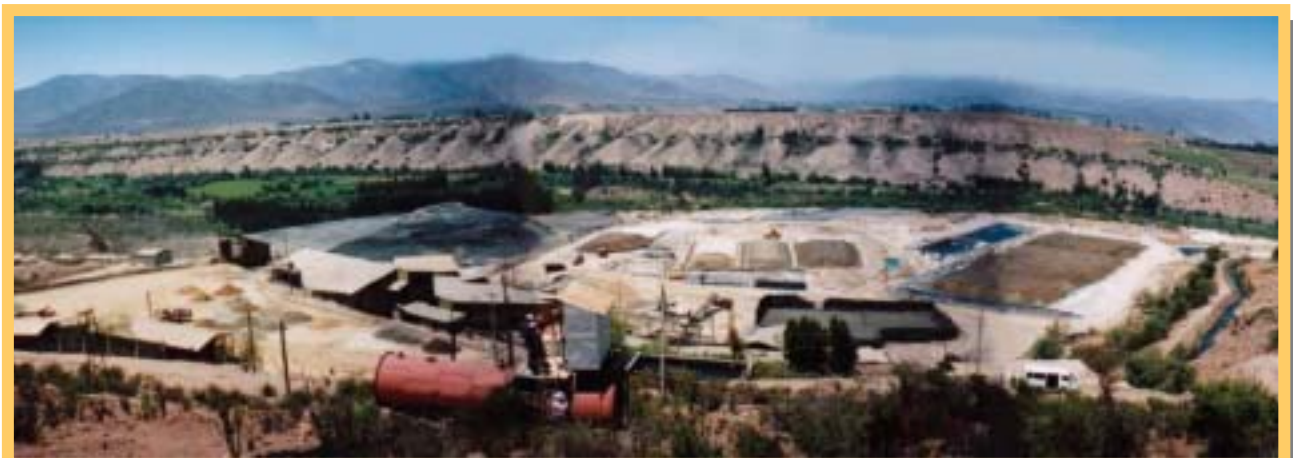
DOWA ENGINEERING CO., LTD.
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MPN
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Position of Chile and Ovalle Plant



Panoramic View at Ovalle Plant



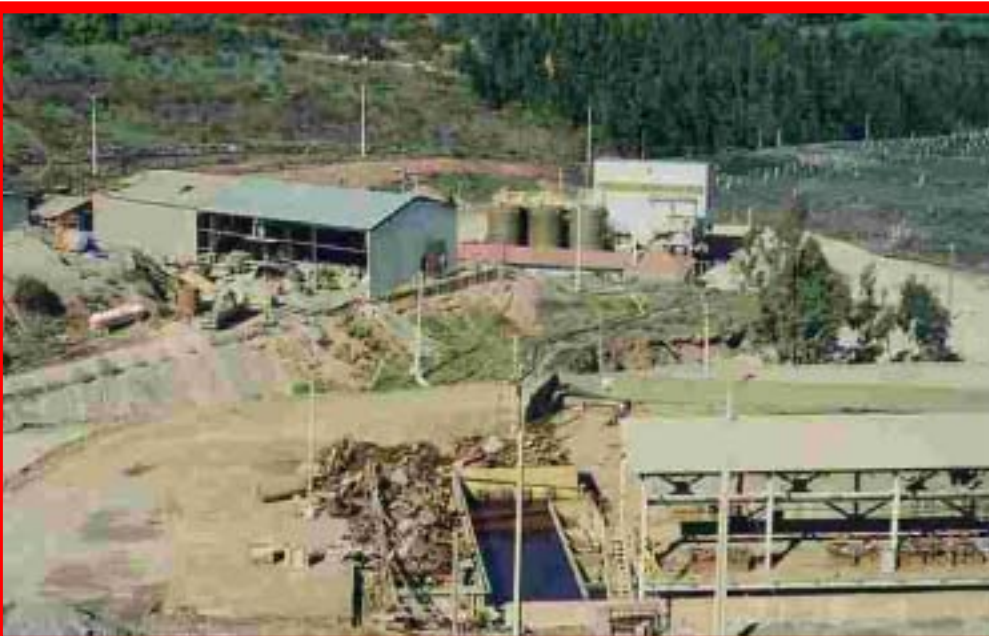
Ovalle Plant (Oxide Ore Process)



Crude Ore



Agglomeration



Precipitate

Pollution Situation around Ovalle Plant



Upstream at Ovalle Plant



Evaporation Pond and Bank Body



Downstream at Ovalle Plant

Model Plant Panoramic View



Demonstration Test Run



Oxidizing Tank



Neutralizing Tank



Flocculation Tank



Filter Press



Bacteria Collector



Dehydrate Cake

Seminar



The First Seminar



The Second Seminar

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Final Report Abbreviation collection and glossary

【Abbreviation and acronym】

1. COCHILCO : Comisión Chilena del Cobre
2. CODELCO : Corporación Nacional del Cobre de Chile
3. CONAMA : Comisión Nacional del Medio Ambiente
4. COREMAS : Comisiones Regionales del Medio Ambiente
5. DCF : Discounted Cash Flow
6. ENAMI : Empresa Nacional de Minería
7. IRR : Internal Rate of Return
8. LME : London Metal Exchange Market
9. LME-spot : Spot transaction price in London Metal Exchange
10. MIDEPLAN : Ministerio de Planificación y Cooperación
11. NPV : Net Present Value
12. RCU : Rate of Capacity Utilization
13. SAG : Servicio Agrícola y Ganadero
14. SEIA : Sistema de Evaluación de Impacto Ambiental
15. SERNAGEOMIN : Servicio Nacional de Geología y Minería
16. SX-EW : Solvent Extraction-Electro winning

【Glossary】

< Processing technology term >

1. Mineral processing : The one to separate, and to gather only object mineral by using difference of physical characteristic of magnetic, grit between minerals, specific gravity, and interfacial wet abilities (hydrophobic property/hydrophilic), interfacial conductivity etc. There is technologies of the classification, the gravity concentration, the flotation, the magnetic concentration, and the electrostatic separation, etc.
2. Oxide ore : The ore which lies mineral which unites with oxygen is originally said. However, the ore which lies to minerals other than sulfides such as the hydroxide, the anglesite thing, the phosphate mineral, the carbonate, halides, and silicate minerals is said additionally in this report. In the copper minerals, chrysocolla ($\text{CuSiO}_3 \cdot n\text{H}_2\text{O}$) and malachite ($\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$), etc. correspond.
3. Sulphide ore : The ore which lies mineral which unites chiefly with sulfur (S) is said. In the copper ore thing, chalcopyrite(CuFeS_2), chalcocite(Cu_2S), and covellite(CuS), etc. correspond.
4. Precipitation (Cementation) process : It is the one in this report for the oxidation copper ore to produce Copper precipitate by the Crushing → Agglomeration → Leaching → substitution precipitation. It is necessary to do the dry smelting and electrolysis refinements of Copper precipitate to produce electrolytic coppers.

5. SX-EW (Solvent Extraction – Electro Winning process) : It is the one in this report for the oxidation copper ore and secondary sulphide copper ore to produce Electrolytic copper by Crushing → Agglomeration → Leaching → solvent extraction → electrolytic winning.
6. Unit consumption : Quantity of material per unit volume of concrete, for example, amount of consumption to ore 1ton
7. Primary sulphide copper ore : What generated during an origin rock formation action or mineralization is called a primary mineral. Copper pyrites etc. correspond in the copper minerals.
8. Secondary sulphide copper ore : After generating Primary sulphide copper ore, the secondary mineral generated by the action of the enrichment of Secondary sulphide copper ore etc. is said. Chalcocite and covellite, etc. correspond in the copper ore thing.
9. Flotation process : It is the one in this report for the chalocite ore to produce Copper concentrate by Crushing → Grinding → flotation. It is necessary to do the dry smelting and electrolysis refinements of Copper precipitate to produce electrolytic coppers.

< Economic term >

10. External economy (benefit) : Economically gain for third parties of the project.
11. External diseconomy : Economically loss for third parties of the project.
12. Environmental liability : Accumulation pollution because of past pollution, payable by the causer.
13. Cash Cost : It is a cost balanced depreciation expense from the sales cost.
14. Net Present Value (NPV) : Future or past effective value adjusted to the present value using discount rate equivalent to capital cost.
15. Internal Rate of Return (IRR) : Discount rate that arises to zero the net present value of project cash flow.
16. Sunk cost : Cost into which amount of money does not change even if which solution is adopted.
17. Discounted Cash Flow (DCF) : Effective cash flow adjusted to present value discounting capital cost rate.

【Units】

1. CH\$: Chilean pesos (Currency of Chile)
2. CH\$/Ha : Chilean pesos / Hectare
3. CH\$/mt : Chilean pesos / ton
4. CH\$/US\$: Chilean pesos/ US\$
5. dmt : dry metric ton
6. dmt/month : dry metric ton / month
7. dmt/year : dry metric ton / year
8. fmt : Content metal ton

9. Ha : Hectare
10. mt : metric ton
11. mt/month : metric ton /month
12. mt/year : metric ton /year
13. US\$/dmt : US\$ / dry metric ton
14. US\$/mt : US\$ / metric ton

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