



MINING PROJECT EXECUTIVE SUMMARY "SEA AND SKY"

Dr.Cs. Antonio Vilches Vera
Mining Engineer
National Service of Geology and Mining of Chile

1 EXECUTIVE SUMMARY

The Sea and Sky Mining project aims exploitation of manganese ore open pit, its concentration in a processing plant and export the resulting Mn concentrate through the port of Arica in two stages, the first stage will start production within six months of receipt capital of ten million dollars, the second phase includes the construction of a concentrator plant, a solar power plant and a railway station which will require an estimated investment of one hundred eighty million dollars.

Studies by Minera Sea and Sky have defined the existence of manganese ore resources exceeding 600 million tonnes (Mt), with an average grade of 47% Mn. Sea and Sky Project has set up a Mining Plan with an extraction rate of the order of 220,000 tonnes of ore per month and export about 1.3 million tons per year (Mt / y) of concentrate Mn. This will mean a life of approximately 22.8 years with current scans that are less than 30% of the mining concession.

The project will be developed over an area nearly 1,200 ha and will comprise three main components: 1) Mining Complex, 2) Railway, and 3) Port Terminal.

1.1 MINING COMPLEX

The Mining Complex, is located in the Region of Arica and Parinacota, 175 km from Arica. Exploration campaigns have established that manganese mineralization is present over a length of 3.0 km, with widths up to 700 meters. The mineralized body surface can be characterized as high-grade tabular body in-situ, which favors exploitation by conventional open pit methods, with depths between 20 and 30 meters. Exploration campaigns in 13% of the total area, have allowed us to estimate potential resources until the order of 60.4 million tonnes, with approximately 40 to 51% Mn.

The main facilities that make up the project are: Rajo Mine Dumps sterile plant processes (crushing and concentration), Dump material rejection, Warehouse lamas, job support infrastructure and facilities for the collection and loading of concentrate in Arica.

The project includes the following main activities:

- Exploitation of minerals by conventional techniques of open pit mining at a rate of about 220,000 tons of ore monthly. The transport of material from the mine (sterile or mineral) will be done by trucks with loading capacity of 50 tons. The overburden will be transported to the waste dumps for disposal, while minerals will be transported to the primary crusher feeder. The average speed of trucks will be 22 km / h, both loaded and unloaded.
- Disposal of waste material in landfills. During project implementation, a total of two landfills for the disposal of waste material will be built. These dumps will have a total storage capacity of up to 30 million tons of waste.
- Mechanical preparation of minerals consisting in the reduction in size by a crushing plant in three stages, operated in closed circuit.
- Concentration of minerals by separation methods for dense media.
- Elimination of the fine fraction by washing. Extra fine particles removed from the process by sifting, be thickened to recover water for reuse, and subsequently stored in a permanent tank of slats.
- Transportation of the finished product by truck to a temporary storage in mine waiting to be shipped via rail to its final destination.

1.2 RAILWAY

The concentrated ore is disposed in a temporary storage site at site and subjected to laboratory tests. The concentrate will be classified and transported by train to the port of Arica. The transport is done using rail Arica La Paz roads passing at a distance of 37 km from the mine, an iron diverted for freight cars will be built, empty wagons locate in station boarding concentrate plant where they will await loading once charging is complete the convoy will be collected by locomotive to bring to port, while a new convoy left for the next load. The Mn will pocket maxi bags which in turn loaded into containers, they are loaded into railroad cars and later ships in the port of Arica.

1.3 PORT TERMINAL

In the port terminal, containers transported by rail Arica - La Paz will be consolidated and subsequently loaded on high tonnage ships for transport to the port of purchase. All port operations will be contracted to

certified service companies operating in the Arica port, in this place retake chemical analysis of product samples according to the protocol of shipment.

1.4 ENERGY AND LABOR

The Sea and Sky Mining project aims exploitation of manganese ore open pit , its concentration in a processing plant and export the resulting Mn concentrate through the port of Arica in two stages, the first stage will start production within six months of receipt of working capital of ten million dollars , the second phase includes the construction of a concentrator plant, a solar power plant and a railway station which will require an estimated investment of one hundred eighty million dollars .

Studies by Minera Sea and Sky have defined the existence of manganese ore resources exceeding 600 million tonnes (Mt), with an average grade of 47 % Mn . Sea and Sky Project has set up a Mining Plan with an extraction rate of the order of 220,000 tonnes of ore per month and export about 1.3 million tons per year (Mt / y) of concentrate Mn . This will mean a life of approximately 22.8 years with current scans that are less than 30 % of the mining concession.

The project will be developed over an area nearly 1,200 ha and will comprise three main components: 1) Mining Complex, 2) Railway, and 3) Port Terminal.

1.5 PROJECT SCHEDULE

The schedule includes: Basic Engineering, Detailed Engineering, Environmental Prior Authorization (AAP). From that date it takes two and a half years to complete the construction of relevant facilities project tasks.

The high grade ore can not concentrate and marketing in this scenario in the first year can start exporting the mineral.

The operation is proposed with a horizon of about 23 years, although this period could eventually be extended depending on the exploration and development of the production process, additional areas of exploitation and market conditions.

1.5 CAPITAL REQUIRED

It is estimated that the capital required to start the project is \$ 10 million, the high grade Manganese allows unconcentrated sale as a first step and does not require EIA only requires permission SERNAGEOMIN DS 95 2001. At this early stage is considered the farm to 60,000 ton / m within six months of receipt of capital in this first stage of basic engineering, environmental impact study and detailed engineering for the second stage will take place.

In a second stage it involves the construction of a plant concentrator, solar power plant and a railway station with an estimated US \$ 180 million investment.

2.0 PROJECT FEATURES

INTRODUCTION

Despite being the most abundant metal in nature after iron, manganese ores, from the economic point of view, are very rare; the main ones are: pyrolusite, and wad the psilomelane. In Chile and Peru has few mineral resources with these characteristics, only in the region of Cajamarca and Tacna found commercially valuable minerals, currently benefiting in a very precarious way, mainly by hand-picked and Chile in the area Arica and Parinacota.

Of these minerals, being metallurgically with adequate and updated techniques, products can be made very popular in the domestic market; being the largest consumer in the steel industry, also in the manufacture of batteries, ceramics, glass paintings and discoloration; concentrate higher law can go directly to the export market or to add more value in the production of chemical reagents, therapeutic uses and fungicides, with economic results that will enhance the quality of life near the production area population.

GENERAL

Manganese ores

Manganese is widely distributed, only some of the minerals they contain are of industrial interest (1): pyrolusite (MnO_2) with gloss black color metal iron, psilomelane ($MnO_2 \cdot H_2O$) with submetallic luster, wad (amorphous masses, can be earthy or compact), manganite ($MnO(OH)$), braunite, rhodonite, rhodochrosite ($MnCO_3$), Hübnerite ($MnWO_4$), marine nodules have a law from 15 to 30% Mn. Manganese (Mn)

The metal is obtained by reduction of the oxides of aluminum and ferromanganese by reduction of oxides of Fe and Mn with carbon.

Applications and uses

Production of manganese steels; aluminum alloys, production of chemical reagents: potassium permanganate with strong oxidizing and corrosive properties; manganese dioxide (MnO_2) which is used as a battery depolarizer, $MnCl_2$, manganese pyrophosphate; as a dye in the textile industry, in agriculture as fertilizer and fungicide; in the diet of humans and small amounts of manganese sulfate and therapeutic uses, for example, in psychiatry in combination with Co-Li-Mg-Mn.

Marketing conditions

Mn, minimum: 40-48%
Fe, maximum: 6.00%
P, maximum: 0.12%
 $SiO_2 + Al_2O_3$, max. 11.00%
Nonferrous max. 1.00%

Products, prices, cost of production and markets

The main countries that produce manganese are South Africa, Soviet Union followed, India, Brazil, Georgia and Ukraine, in Peru there are very few coal reserves, highlighting the highlands of Cajamarca and Tacna.

The manganese price fluctuates with the Mn content and the concentrated with 40% Mn, can contribute between \$ 80 and \$ 140 for TMS, with 47-48% can be sold to an average of \$ 250.00 / TMS; being the cost of production ranges US \$ 40-60 / TMS, depending on the method applied metallurgical treatment.

Manganese dioxide and 74% Mn dioxide is priced from 400 to 500 USD, Ecuador is a potential buyer of manganese concentrates.

Benefit metallurgical methods

- Manual Chosen.
- Desliming-sizing.
- Gravimetry.
- Magnetic Concentration.
- Forward / Reverse Flotation.

Optimizing flotation

By recent research has shown that prolonged high-speed agitation conditioning (flocculation) and time are necessary for optimum flotation of manganese.

The active manganese ores SO_2 adsorption allowing collector more efficiently

Flotation reagents

Fatty acids, oleic acid, dextrin, SO₂, Frother 70, Quebracho, silicate and sodium carbonate, sulfuric acid.

Manganese flotation

- Carbonate gangue minerals; gangue first calcite as fatty acid in alkaline pulp and starch or dextrin is floated to depress the MnO₂, the pulp is acidified and the manganese oxide is floated with oleic acid or high grade oil.
- Mixed gangue minerals calcite and silica, as above.
- Gangue minerals silica-aluminum, manganese is floated directly in acid circuit with the same reagents described above.

The salient features of this project are:

- 1.-The law of Mn present in the project allows direct sale without concentrate at an average price of \$ 250, resources explored until now exceed 600 million tons (Mt) at an average grade of 47% Mn. Under these conditions the project only requires a year to start its operation.
- 2.-The high radiation area allows the construction of solar plants that supply the domestic consumption of the plant and will generate a significant surplus that can be sold to the electrical interconnected incorporating north.
- 3.-Use railroad decrease the cost of transporting ore to the port of Arica by 60% and will not provide traffic flow on the road charging significantly reducing the traffic impact.
- 4.-There is no human population around the mining project within 50 kilometers, or nearby rivers or streams, either downstream areas of agricultural crop that somehow could be impacted.
5. - High demand and low supply of this mineral in the international markets.
6. Can start operation in the first year unconcentrated good considering the Mn ore grade that allows its commercialization in international markets and parallel construction of the concentrate plant.

