JAPAN’s Metal Mining Policy and the Role of JOGMEC

Hirotoshi KUNITOMO
Director General
Metals Strategy Group

Japan Oil, Gas and Metals National Corporation
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1. Outline of the Japanese Metal Industrial Structure

- History of the Mining Industry in Japan

In the early 20th Century, Japan was one of the world-largest producers of Copper Concentrate along with US and Chile. However, Japanese Domestic potentiality of Mineral Resource has not been competitive in the world market. Therefore, after the peak of copper concentrate Production $121 \times 10^3$ t/y in 1971, it has continuously declined to almost zero because of the exchange rate, environmental issues, increased development cost and low metal price in the world.

[Graph: History of Production of Cu Concentrate in Japan]

- The Days of Japan’s Metal Mining In 1970’s, Japan had over 350 Metal Mines such as Cu, Pb, Zn and Au-Ag.
  - Kuroko-Type 30, Skara-type 60
  - Kies lager-Type 80, Vein-Type 150 etc

- Present operating Metal Mine
  - Toyoha-Mine (Hokkaido) Pb, Zn
  - Nikko 484 $\times 10^3$ t
  - Hishikari-Mine (Kagoshima) Au, Ag
  - Sumitomo 161 $\times 10^3$ t

Source: METI
History of Copper Consumption and Demand in Japan

After World War II, the Japanese Economy has been rapidly progressing and has expanded Domestic Copper consumption constantly. The last 10 years, Japanese Copper Demand has been Saturated. From 2003 to 2004, Japanese Copper Demand increased, because of the progressing IT industry and Export to China. As a breakdown of Japanese Cu Demand, wire & Cables is 48%, Wrought Copper 27% and Export 23%.

<table>
<thead>
<tr>
<th>World Consumption</th>
<th>2002</th>
<th>World Share</th>
<th>2003</th>
<th>World Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 China</td>
<td>2,737</td>
<td>18%</td>
<td>3,065</td>
<td>20%</td>
</tr>
<tr>
<td>2 U.S.A.</td>
<td>2,370</td>
<td>16%</td>
<td>2,300</td>
<td>15%</td>
</tr>
<tr>
<td>3 Japan</td>
<td>1,164</td>
<td>8%</td>
<td>1,202</td>
<td>8%</td>
</tr>
<tr>
<td>4 Germany</td>
<td>1,067</td>
<td>7%</td>
<td>1,099</td>
<td>7%</td>
</tr>
<tr>
<td>5 South Korea</td>
<td>936</td>
<td>6%</td>
<td>901</td>
<td>6%</td>
</tr>
<tr>
<td>Others</td>
<td>6,791</td>
<td>45%</td>
<td>6,980</td>
<td>45%</td>
</tr>
<tr>
<td>World Total</td>
<td>15,065</td>
<td></td>
<td>15,457</td>
<td></td>
</tr>
</tbody>
</table>

Source: World Metal Statistics, WBMS

2004 Cu Consumption Monthly (Jan-Sep)

| 1 China | 2,404.4 | 5.6% UP |
| 2 U.S.A. | 1,867.0 | 9.4% UP |
| 3 Japan | 947.7   | 6.6% UP |
| 4 Germany | 830.0 | 3.0% UP |
| 5 South Korea | 718.1 | 5.8% UP |
| World Total | 12,423.3 | 6.1% UP |

Source: Copper Bulletin, ICSG
History of Metals Smelters and Refineries in Japan

Japan had Metal Mine-site Smelters and refineries for the domestic Metal concentrates produced by domestic Mines. According to the increase of domestic demand of Cu, Pb and Zn, Japanese Industries has been expanding the capacity of Metals Smelters and Refineries, and importing the metal concentrates from overseas countries such as Chile and Indonesia. Therefore, Japanese Smelting Industry has been "custom smelters" to the Domestic Market and Export Needs.
History of Refined Copper Production by Source in Japan

Japan has been Importing Copper Ore from 1950s. Japanese Imported Ore has been increasing constantly. In this situation, it had been a political issue that metal supply from overseas to the Domestic Market should be stabilized and Japanese Metal Producing Industries should be strengthened in terms of Competitiveness in the international market.

Japanese Main Metal Producers, such as Sumitomo, Mitsui, Mitsubishi, Dowa, Nittetsu and Nikko, had been owners of domestic Mines and Minesite Smelters and Refineries. These Companies had Metal Mining Technology and shifted their Mining activities from Domestic to Overseas.
2. Outline of Japan’s Metal Mining Policy

• Background
  - According to the increase of Imported Ore, stable supply from overseas has been needed. Japanese Metal Producing Industries should be activated, as Overseas Exploration and Production has shifted from Domestic Mining.
  - Domestic Metal Mines has been closing because of International Competitiveness and Domestic Mine Pollution Issues have become Social Problems, specifically mine pollution causing serious problems to the human health. For example poisoning waters damaging the rice fields, or Acid Mine drainage polluting the river.
• Basic Policy of Japan’s Metal Mining

- Secure a stable supply of base-Metals (Cu, Pb, Zn etc) and Rare-Metals from overseas to Japan by supporting the private Investment to overseas Exploration and Development for Metal Mineral Resources and National Rare Metals stockpiling.

- Technical Support for the Local Governments to manage the mine pollution control of abundant mine and no-owner’s mines after mine closed.
Roll of JOGMEC in Metal Mining Fields

- Establishment of JOGMEC

  Japan Oil, Gas and Metals National Corporation (JOGMEC) was established on February 29, 2004, integrating Metal Mining Agency of Japan (MMAJ) and Japan National Oil Cooperation (JNOC), with the mission to ensure a stable supply of energy and nonferrous metals for Japan.
Function of JOGMEC in Metals Mining Fields

Strategy Making and Metal Resource Information Center (MRIC)

- Implementation of Geological Survey and Exploration
- Financial Support by low Interest Loan and Guarantees for Development
- National Stockpiling of Rare Metals
  - 7 commodities
  - Ni, Cr, Mn, Co, W, Mo, V
- Release and Selling of stock piled Rare Metals
- Technical Support for mine pollution control by Local Government
- Engineering Service in management of Facility for Local Government

Research and Development (Technical Research Center)
3. Outcome of Japan’s Mining Policy and JOGMEC support project

Japan’s Mining Policy and JOGMEC’s Functions, such as Geological Survey, Financial Support and Subsidy for private company’s Exploration implemented by financial support from Japanese Government, have contributed the 28 Overseas Mining Developments based on the private investment. Accordingly Imported Concentrate from Japanese Invested mines, which is evaluated as stable supply source by Japanese Government, has been increased gradually.

Source of Imported Copper Concentrate by Japan

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Ore Imports from the mine contributed by JOGMEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>43,000t @ 1,206,000t @ 4%</td>
</tr>
<tr>
<td>Zn</td>
<td>108,000t @ 541,000t @ 20%</td>
</tr>
<tr>
<td>Ni</td>
<td>82,000t @ 223,000t @ 37%</td>
</tr>
<tr>
<td>U</td>
<td>1,000t @ 9,500t @ 11%</td>
</tr>
</tbody>
</table>

Source: METI
JOGMEC (MMAJ) contributed Overseas Mines

Contributed Project
GS Overseas Geological Survey
SB Subsidy for Japanese companies that carry out joint exploration with foreign companies
FI Finance, Investment
LG Loan Guarantees
GG Official Development Assistance

Uzbekistan Bulutkan (GG)
Turkey Azan (GG)
Myanmar Monywa (GG)
U.S.A. Greens Creek (FI)
China Anqing (GG)
Philippines Rio Tuba (LG)
Mexico Tizapa (GG-LG)
Rey de plata (SB-LG)
Malaysia Mamut (GS-LG)
Colombia El Roble (GS-LG)
Indonesia Soroako (LG)
Peru Huanzala (GS-LG)
Tintaya (GG)
Iscaycrus (GG)
Gran-bratana (LG)
Australia MacArthur River (SB)
Gunpowder (FI)
Chile Atacama (GS)
Sagasca (LG)
Cerro Colorado (GS)
Argentina Alto de la Blenda (GG)

Niger Akouta (LG)
Oman Rakah (GG)
Congo (Dem Rep) Musoshi (GS-LG)
Brazil Jacobina (GS-LG)
Honduras Vueltas del Rio (GG)
Bolivia San Vicente (GG)
Philippines Rio Tuba (LG)
Colombia El Roble (GS-LG)
Australia MacArthur River (SB)
Gunpowder (FI)
Chile Atacama (GS)
Sagasca (LG)
Cerro Colorado (GS)
Argentina Alto de la Blenda (GG)
Japanese Companies Involvement in Overseas Copper, Lead, Zinc Mines

<table>
<thead>
<tr>
<th>Mine</th>
<th>Major Products</th>
<th>Country</th>
<th>Production or Farm-in</th>
<th>Japanese Equity Interest</th>
<th>Japanese Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huanzala</td>
<td>Pb, Zn</td>
<td>Peru</td>
<td>1968</td>
<td>100%</td>
<td>Mitsui Corp, Mitsui Mining</td>
</tr>
<tr>
<td>Endeavor (Elura)</td>
<td>Pb, Zn</td>
<td>Australia</td>
<td>1983</td>
<td>25%</td>
<td>Toho Zinc</td>
</tr>
<tr>
<td>Morenci</td>
<td>Cu</td>
<td>USA</td>
<td>1986</td>
<td>15%</td>
<td>Sumitomo Metal Mining, Sumitomo Corp.</td>
</tr>
<tr>
<td>Escondida</td>
<td>Cu</td>
<td>Chile</td>
<td>1994</td>
<td>10%</td>
<td>Mitsubishi Corp., Mitsubishi Materials, Nippon Mining, others</td>
</tr>
<tr>
<td>Tizapa</td>
<td>Pb, Zn</td>
<td>Mexico</td>
<td>1994</td>
<td>49%</td>
<td>Dowa Mining, Sumitomo Corp.</td>
</tr>
<tr>
<td>La Candelaria</td>
<td>Cu</td>
<td>Chile</td>
<td>1995</td>
<td>20%</td>
<td>Sumitomo Metal Mining, Sumitomo Corp.</td>
</tr>
<tr>
<td>McArthur River*</td>
<td>Cu</td>
<td>Australia</td>
<td>1995</td>
<td>30%</td>
<td>Nippon Mining</td>
</tr>
<tr>
<td>Northparkes</td>
<td>Cu</td>
<td>Australia</td>
<td>1995</td>
<td>20%</td>
<td>Sumitomo Metal Mining, Sumitomo Corp.</td>
</tr>
<tr>
<td>MacArthur River</td>
<td>Pb, Zn</td>
<td>Australia</td>
<td>1995</td>
<td>25%</td>
<td>Nippon Mining, Mitsui Corp, Marubeni</td>
</tr>
<tr>
<td>Huckleberry</td>
<td>Cu</td>
<td>Canada</td>
<td>1997</td>
<td>40%</td>
<td>Mitsubishi Materials, Furukawa, Dowa Mining, Marubeni</td>
</tr>
<tr>
<td>Collahuashi</td>
<td>Cu</td>
<td>Chile</td>
<td>1999</td>
<td>12%</td>
<td>Mitsui Corp, Nippon Mining, Mitsui Mining</td>
</tr>
<tr>
<td>Batu Hijau</td>
<td>Cu</td>
<td>Indonesia</td>
<td>1999</td>
<td>35%</td>
<td>Sumitomo Metal Mining, Mitsubishi Materials, others</td>
</tr>
<tr>
<td>Los Pelambres</td>
<td>Cu</td>
<td>Chile</td>
<td>2000</td>
<td>40%</td>
<td>Nippon Mining, Mitsubishi Materials, Marubeni, others</td>
</tr>
<tr>
<td>Antamina</td>
<td>Cu, Pb, Zn</td>
<td>Peru</td>
<td>2001</td>
<td>10%</td>
<td>Mitsubishi Corp.</td>
</tr>
<tr>
<td>Atakama Kozan*</td>
<td>Cu</td>
<td>Chile</td>
<td>2003</td>
<td>60%</td>
<td>Nittetsu Mining</td>
</tr>
</tbody>
</table>

*: MMAJ Related Projects
4. JOGMEC’s Present Strategy for Overseas Exploration Project

JOGMEC has been conducting the JICA-JOGMEC government-to-government technical cooperation program in developing countries since 1970. JOGMEC intends to shift its resources from the old technical cooperation program to the operation of the new program. JOGMEC started a new cooperation program for mineral resources development in the 2003 fiscal year, which is referred to as the Joint Basic Exploration Scheme in Developing Countries (JBES).

- **Two Primary Objectives**: Accelerating mineral production and resultant economic growth in developing countries.
  - Contributing to a stable supply of mineral resources to Japan.

- **Major Target**: Copper

- **Target Country**: Asia, Latin America.

- **JV Partner**: Governmental organizations or private companies which hold mineral properties in developing countries.

- **JV Agreement**: Ordinary joint venture exploration agreement (Farm-in agreement), i.e. JOGMEC acquires an option of equity interest of the Property expending exploration fee.
  - An option acquired by JOGMEC will be transferred to a Japanese company with the first priority, if exploration results are positive and a Japanese company wishes a further exploration.

- **Budget**: US$100,000 to $1 million is envisaged

- **Period**: 1 to 5 years
Framework of New JOGMEC Exploration Projects
(Joint Basic Exploration Scheme (JBES))

- **Consignment**
  - METI
  - ODA Budget

- **JV Agreement (Farm-in Agreement)**
  - JOGMEC
    - Operator
    - Exploration Expenditure
      - Acquiring Option of Equity
  - Partner
    - (Governmental organizations · private companies)
    - Providing Property
      - (opportunity to exploration)
    - Receiving exploration results

- Transfer
  - (if exploration results are positive and a Japanese company wishes a further exploration.)

- **Japanese Company**

- **Unincorporated JV**
  - Budget: US$100,000 to US$1 million
  - Period: 1 to 5 years

- **Exploration**

- **Additional and Detailed Exploration**
5. Scheme of Japan’s Policy of Mine Pollution Control

Japanese Government (METI) set up the basic laws in terms of mining safety, environmental protection, and mining pollution control. Based on these laws, METI has decided the basic initiatives concerning the Mine Pollution control works every 5 or 10 years. According to these initiatives, mine equity holders have to implement the proper constructive works for controlling mine pollution. Without mine equity holders, these no-owner’s abandoned mine must be controlled by Local Government in terms of mine-site environmental protection under the financial support by METI’s Subsidy and Technical Support by JOGMEC.

### Number of Abandoned Mines without Responsible Body where preventive measures were applied

<table>
<thead>
<tr>
<th>Number of mines evaluated by JOGMEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st -1</td>
</tr>
<tr>
<td>18</td>
</tr>
</tbody>
</table>

### The basic Initiative of the mining pollution control Budget Plan by Japanese Government

<table>
<thead>
<tr>
<th>1st -1</th>
<th>1st -2</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
</tr>
</thead>
<tbody>
<tr>
<td>330</td>
<td>460</td>
<td>220</td>
<td>228</td>
<td>115</td>
</tr>
</tbody>
</table>
Outline of Mine Pollution Control Work and JOGMEC’s Technical Support Activity

Based on the Local Government’s request for technical Support by JOGMEC, JOGMEC implement the basic planning by research and consultation for pollution control work of the specific abandoned mine. When the Local Government make a decision to carry out the construction work for mine pollution control, JOGMEC accept the trust of design and supervision of constructor.
6. JOGMEC’s Technical Cooperation Projects with Chile and Argentina

6-1. Joint Survey and Demonstration Project of SQUID in Chile

- Teck-Cominco and JOGMEC are carrying out copper exploration in Chile as a JV project.
- JOGMEC has been developing TDEM (time domain electromagnetic method) data acquisition system using SQUID magnetic sensor since 2001.
6-2. Development of Technologies to Recover Valuable Metals from Smelter Flue Dust

- Research of Treatment for Flue Dust from Teniente Converter at Copper Smelter
  - Flue Dust Decontamination = Establishment of Arsenic (As) Immobilization Method
  - Recovery of Valuable Metals (Cu, Zn) = Cost Reduction for Flue Dust Treatment
- Pilot Plant Operation at Las Ventanas Smelter of Chile
  = Estimation for Real Operation and Cost Assessment
- Counter Part : CIMM

Schedule for This Project

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6-3. JICA’s International Technical Cooperation Project between Japan and Chile

**Strengthening Institutional Capacity of Mining Environmental Management (2002-2007)**

- **Counterpart:** National Service of Geology and Mining (SERNAGEOMIN)
- **Objective:** Developing SERNAGEOMIN’s capacities to
  1) grasp the situation of mines including their potential impacts thorough compilation of a database and,
  2) plan for minimizing & monitoring environmental impacts
- **Goal:** Developing Chilean government’s capacity to manage mining environmental issues

*JOGMEC has been contributing a project leader and an environmental expert to this project*

<table>
<thead>
<tr>
<th>Principal Issue</th>
<th>'02</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>'07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abandoned Mine</td>
<td>Field investigation for</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Planning of solution</td>
</tr>
<tr>
<td></td>
<td>screening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Improving database system</td>
</tr>
<tr>
<td>Mine Closure</td>
<td>Planning of closure works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Inspection</td>
<td>Introducing JPN’s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>experiences</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Lab</td>
<td>Installation &amp; training</td>
<td>ISO 17025</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*ICP-MS donated  Field training*
6-4. JV Project in VICUNA of Argentina

**LOCATION**

- **JV Partner**
  Tenke Mining Corp. (Vancouver, Canada)
- **Period**
  2004-2008 (4 years)
- **Interest**
  JOGMEC: 40%
  Tenke Mining: 60%
- **Main Target:**
  Porphyry Copper-Gold
- **Expenditure**
  US$5.0 million
6-5. JICA’s International Technical Cooperation Project between Japan and Argentina

• Name: The Project GEOSAT-AR
• Main Tech: Remote Sensing Technology
• Objective: Transferring program of ASTER advanced satellite technology, applied to geological mapping in the Republic Argentina.
• Goal: The generation of new products for Geologic-mining exploration and for Geo-environmental study
• Term: Mar, 2001-Feb, 2005 (4 Years)
• Counterpart: The Geological and Mining Survey of Argentina-SEGEMAR
• Japanese experts: 4 experts

JOGMEC has been contributing a Project Leader to this project
7. Future Japanese Partnership with Chile and Argentina

Chile is the largest Exporter of Copper to Japan. Chile and Argentina are very important countries in terms of stable Supply of Mineral Resources. JOGMEC wishes to Expand the Exploration and Technological Demonstration Activities in these two Countries.

Table: Export from Chile and Importation of Japan

<table>
<thead>
<tr>
<th>Item</th>
<th>2003</th>
<th>2002</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>955,871</td>
<td>715,884</td>
<td>33.5</td>
<td>42.1</td>
</tr>
<tr>
<td>Other Minerals</td>
<td>149,448</td>
<td>131,868</td>
<td>13.3</td>
<td>6.6</td>
</tr>
<tr>
<td>Seafood</td>
<td>562,024</td>
<td>572,486</td>
<td>-1.8</td>
<td>24.8</td>
</tr>
<tr>
<td>Others</td>
<td>600,553</td>
<td>529,472</td>
<td>13.4</td>
<td>26.5</td>
</tr>
<tr>
<td>Balance</td>
<td>1,633,750</td>
<td>1,407,106</td>
<td>16.1</td>
<td></td>
</tr>
</tbody>
</table>

Graph: Cu Importation of Japan

- Argentina: 2%
- Chile: 50%

Source: METI
8. Conclusion

• JOGMEC invites the Overseas Partner for the Joint Venture Project of Exploration in JBES.

• JOGMEC Santiago Office is a Counter Part of South areas in Latin America such as Chile, Argentine and Brazil, etc.

- JOGMEC Santiago Office:
  Tel : +56-2-228-4025
  Fax : +56-2-228-9722
  e-mail: nakayama-ken@entelchile.net
  feebrey@terra.cl