The Republic of the Union of Myanmar
Ministry of Mines

11th INTERNATIONAL CONFERENCE ON MINING AT CHIANG MAI
Session on “ASEAN Mineral Potentials and Mining Law”
(11.11.2013 – 12.11.2013)

“Active Mining Projects in Myanmar”

Zaw Win Than
Director
Department of Mines
11th November 2013
Types of ore in myanmar

Most of the Myanmar Mining Projects extract non-ferrous metals, ferrous metal, precious metal, industrial minerals and also Jade and Gems.

• Copper, Lead, Zinc, Antimony, Manganese, Chromite, Nickel, Chromium.
• Iron.
• Gold, Silver, Tin, Tungsten, Rare Earth.
• Ruby, Sapphire, Jade, Gem, Diamond.
• Dolomite, Limestone, Barites, Gypsum, Granite, Decorative Stone, Quartz for production of silicon.
• Coal.
PRODUCTS SALES

Sales

- natural gas (29%)
- mineral (26%)
- beam and pluses (10%)
- forest products (7%)
- garment (4%)
- fishery products (4%)
- raw rubber (3%)
- agriculture products (3%)
- rice (2%)
- others (12%)
RECENT MINING PROJECTS

2012-2013 fiscal years

- Exploration: 426 no.s
- Small Scale Mining: 1297 no.s
- Large Scale Mining: 148 no.s
- Others: 46 no.s
Graph of Mining Projects increasing rate

- Large Scale Mining Projects
- Small Scale Mining Projects
Land used area of Mining Projects

Land used area (square kilometer)

![Graph showing the land used area of Mining Projects over time. The graph indicates a general increase in land usage from 2003-2004 to 2011-2012.]
# FDI Investment in Myanmar Mining Sector

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Company</th>
<th>Registered Country</th>
<th>Type of Mineral</th>
<th>Type of Permit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conerstone Resource (Myanmar) Ltd</td>
<td>Australia</td>
<td>Zinc Ore</td>
<td>Large Scale Mining Permit</td>
</tr>
<tr>
<td>2.</td>
<td>Myanmar Ponepipet Co., Ltd</td>
<td>Thailand</td>
<td>Tin Concentrate</td>
<td>Large Scale Mining Permit</td>
</tr>
<tr>
<td>3.</td>
<td>Myanmar CNMC Nickel Co., Ltd</td>
<td>China</td>
<td>Ferronickel</td>
<td>Large Scale Mining Permit</td>
</tr>
<tr>
<td>4.</td>
<td>Simco Song Da Joint Stock Co.,</td>
<td>Vietnam</td>
<td>Marble</td>
<td>Large Scale Mining Permit</td>
</tr>
<tr>
<td>5.</td>
<td>Asia Pacific Mining Ltd.</td>
<td>China</td>
<td>Lead, Zinc, Copper, Gold</td>
<td>Exploration Permit</td>
</tr>
<tr>
<td>7.</td>
<td>North Mining Investment Co., Ltd.</td>
<td>China</td>
<td>Ferronickel</td>
<td>Feasibility Study</td>
</tr>
<tr>
<td>9.</td>
<td>Myanmar Yangtze Copper Co., Ltd.</td>
<td>China</td>
<td>Copper</td>
<td>Large Scale Mining Permit</td>
</tr>
<tr>
<td>10.</td>
<td>Myanmar Wanbao Copper Co., Ltd.</td>
<td>China</td>
<td>Copper</td>
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# Large Scale Mining Projects

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Company</th>
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<td>6.</td>
<td>Myanmar Wanbao Copper Co., Ltd.</td>
<td>China</td>
<td>Copper</td>
<td>F D I</td>
</tr>
<tr>
<td>7.</td>
<td>Kyauk Pa Hto Gold Mining Project</td>
<td>Myanmar</td>
<td>Gold</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>8.</td>
<td>Top Ten Star Mining Project</td>
<td>Myanmar</td>
<td>Lead-Zinc</td>
<td>Large Scale Mining</td>
</tr>
</tbody>
</table>
# Large Scale Mining Projects in Myanmar

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<tr>
<th>Sr.</th>
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<th>Registered Country</th>
<th>Type of Mineral</th>
<th>Type of Permit</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td>Myanmar Economic Corporation</td>
<td>Myanmar</td>
<td>Coal</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>10.</td>
<td>May Flower Mining Enterprise Co., Ltd.</td>
<td>Myanmar</td>
<td>Coal</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>11.</td>
<td>May Flower Mining Enterprise Co., Ltd.</td>
<td>Myanmar</td>
<td>Coal</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>12.</td>
<td>May Flower Mining Enterprise Co., Ltd.</td>
<td>Myanmar</td>
<td>Coal</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>13.</td>
<td>Sein Nga Man Mining Co., Ltd.</td>
<td>Myanmar</td>
<td>Tin-Tungsten</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>14.</td>
<td>Good Brother Machinery Co., Ltd.</td>
<td>Myanmar</td>
<td>Lime stone</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>15.</td>
<td>No.3 Heavy Industry</td>
<td>Myanmar</td>
<td>Marble</td>
<td>Large Scale Mining</td>
</tr>
<tr>
<td>16.</td>
<td>No.3 Heavy Industry</td>
<td>Myanmar</td>
<td>Marble</td>
<td>Large Scale Mining</td>
</tr>
</tbody>
</table>
KYAUK PA HTO GOLD MINING PROJECT
<table>
<thead>
<tr>
<th><strong>Location</strong></th>
<th>Ban Bwe Kon Village, Kawlin Township, Sagaing Division.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of ore</strong></td>
<td>Sulphide and oxidized ore</td>
</tr>
<tr>
<td><strong>Au content</strong></td>
<td>2-3 ppm</td>
</tr>
<tr>
<td><strong>Plant Capacity</strong></td>
<td>1000 tons/day</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td>Cyanidation Process</td>
</tr>
<tr>
<td><strong>Main Steps</strong></td>
<td>Comminution, Flotation, Roasting, Cyanidation (Carbon in Pulp &amp; Heap Leach), Electro-winning, Stripping, Refinery</td>
</tr>
<tr>
<td><strong>Product</strong></td>
<td>Refined Gold</td>
</tr>
</tbody>
</table>
Run of Mine Ore

Screening

Crushing

Grinding

Flotation

Mill Tailing

tailing = 29400 tons
Au grade = 1.14 ppm
Au wt. = 33.6 kilograms
Distribution = 40 %

Flotation Concentrate

Conc. wt. = 1008 tons
Au grade = 50 ppm
Au wt. = 50.4 kilograms
Distribution = 60 %

Ore wt. = 30000 tons/month
Au grade = 2.8 ppm
Au wt. = 84 kilograms
Distribution = 100 %
Mill Tailing

Cyanidation CIP II

Loaded Carbon

Flotation Concentrate

Roasting

Calcine

Cyanidation CIP I

Loaded Carbon

Stripping

Electro-winning

Refining & Casting

Refined Gold

Refined gold = 44.13 kilograms
Au grade = 99.9 %
Au wt. = 44.09 kilograms
Distribution = 52.49 %
Flotation Plant
Mill Tailing Cyanidation Plant (CIP II)
Calcine Cyanidation Plant (CIP II)
Mill Tailing Cyanidation Plant (CIP II)
TAKAUNG TAUNG
FERRO-NICKEL PROJECT
## TAGAUNG TAUNG FERRO-NICKEL PROJECTS

<table>
<thead>
<tr>
<th>Location</th>
<th>Tagaung Taung area, Htee Gyaint Township, Mandalay Division and Thabeikkyin Township, Sagaing Division.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of ore</td>
<td>Laterite ore</td>
</tr>
<tr>
<td>Ore assay result</td>
<td>Ni 1.93-2.3%, Fe 12.21-16.50%, SiO$_2$ 38.81-44.39%, MgO 15.14-19.61%</td>
</tr>
<tr>
<td>Plant Capacity</td>
<td>1320000 tons/annum (dry ore)</td>
</tr>
<tr>
<td>Process</td>
<td>Roasting, Smelting and Refining</td>
</tr>
<tr>
<td>Products</td>
<td>Ferronickel (26%Ni) Granules</td>
</tr>
<tr>
<td></td>
<td>85000 tons/annum</td>
</tr>
<tr>
<td>Ferronickel assay</td>
<td>Ni 26-32%, Fe 67-79%, C ≤ 0.03%, Cr ≤ 0.05%, Cu ≤ 0.06%, Co ≤ 0.25%, P ≤ 0.01%, S ≤ 0.03%, Si ≤ 0.05-0.15%</td>
</tr>
</tbody>
</table>
Geological Resources

- **Type**: laterite type nickel silicate
- **Location**: 96° 06'-95° 10'E and 23° 33'-23° 36'N
- **Layers 3 layers**
  - laterite overburden with relatively (low nickel content)
  - nickel bearing limonite layer (secondary ore layer)
  - nickel bearing saprolite (main ore layer)
- **Ore tonnage**: estimated tonnage 22,690,000 tons 1.96% Ni.
- **Metal content**: 444,000 tons (cut-off grade 1.4% Ni)
Nickel Deposits and Mining Method

Nickel Deposits
Mainly includes four ore bodies, No. 1, 2, 3 and 4. No.1 ore body is the largest one and it’s reserve for over 95% of total ore reserve. Remain are considered as potential resources.

Mining Method
- Overburden stripping.
- Cleaning residual overburden on the ore body roof.
- Mining.
- Cleaning residual ore on the ore body floor.
- Backfilling with stripped overburden.
- Land rehabilitation.
- Ecological restoration.
Run of mine ore are screened by grizzly to separate waste rock, size of +300mm.

The under size of ore are crushed to -50mm and sent to ore bin via belt conveyor. Ore Preparation Capacity is 4400 tons per day of dry ore. Waste Rock produced per day is 312 tons/day.
Ore Transportation

- Type of Conveyor: Tubular Belt
- Horizontal Length: 4986.812m
- Max. Inclined Angle: 19° 41’ 24”
- Pipe diameter: Φ 350mm
- Width of Belt: 1300mm
- Speed: 2.0m/sec
- Hauling Capacity: 500t/h
Ore Stock Pile Yard

- Crushed ore sent via Tubular Belt Conveyor piled at Stock Yard and blend to reached average assay of nickel content to round about 2%.

- The composition of the ore to be processed are as follow as:-

<table>
<thead>
<tr>
<th>Element</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ni</td>
<td>1.93% to 2.30%</td>
</tr>
<tr>
<td>Fe</td>
<td>12.12% to 14.44%</td>
</tr>
<tr>
<td>SiO₂</td>
<td>37.91% to 43.38%</td>
</tr>
<tr>
<td>MgO</td>
<td>18.6% to 19.61%</td>
</tr>
</tbody>
</table>
## Main Equipment

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Description</th>
<th>Specification</th>
<th>Unit</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dryer</td>
<td>4.5 dia. x 40 m</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Kiln</td>
<td>6.0 dia. x 135 m</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Electric Arc Furnace</td>
<td>80 MW</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>LF Furnace</td>
<td>50 tons</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Flow sheet of Ferronickel Extraction Process

- Run of Mine Ore
  - Ni: 2.01%
  - Fe: 14.69%
  - SiO2: 41.84%
  - MgO: 18.09%
  - Moisture: 30%
  - 187 tons/hr.
- Rotary Dryer
- Electro-static Precipitator
- Stack
- to fume dust storage bin
- Dry ore Bin
- Fumes: 175 tons/hr.
- Fume dust storage bin
- Electro-static Precipitator
- Stack
- to Fines dust bin
- Coal fines
- Reductance coal fines
- Fume dust storage bin
- Pellets
- Pellets
- Dry ore Bin
- Dried ore + dryer dust
- 175 tons/hr.
- Air
- Reduction Roasting Kiln
- Calcine
- 160 tons/hr
- Air
- Electric Arc Furnace
- Radiation cooler
- Bag House
- Fume dust storage bin
- Nickel Shells
  - Ni 32%
Flue dust prepare for recycling, Pelletizer

Dryer 4.5 mΦ x 40 mL (2 nos.)

Reduction Kiln 6 mΦ x 135 mL (2 nos.)

Electrostatic precipitator
Electric Arc Furnace (2 nos.)

Furnace electrodes (6 no.s for each furnace)

Tap holes

EAF Furnace
Fe-Ni molten metal tapping

Crude Fe-Ni sent to refining stage

Furnace electrodes (6 no.s for each furnace)

Crude Fe-Ni weighing
Ladle refining of crude Fe-Ni
Granulation

Granules weighing and packing unit

Granules (-5mm ~ +2mm)
## Material Balance

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Description</th>
<th>Qty. (tons/day)</th>
<th>Nickel Ni grade (%)</th>
<th>Nickel Ni wt. (ton)</th>
<th>Distribution (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Charge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Laterite ore</td>
<td>4400</td>
<td>2.01</td>
<td>88.44</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Products</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ferronickel</td>
<td>289</td>
<td>26</td>
<td>75.17</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>Slag</td>
<td></td>
<td></td>
<td>13.27</td>
<td>15</td>
</tr>
</tbody>
</table>
Monywa Copper Project
Flow Sheet of Monywa Copper Project

- Open pit
- Ore
  - Crushing
  - Heap Leaching
  - Solvent Extraction
  - Electro-winning
  - Copper

- Produce Grade ‘A’ London Metal Exchange (LME) Copper, and cathode copper purity is above 99.9935%
Schematic Flow Sheet of Monywa
Open-pit Mining
Heap Leaching
Solvent Extraction
Electro-winning
MINING LAW AND MINING PROJECT

• The amendment of existing *Myanmar Mines Law and Related Regulations*, Myanmar Mines Law was drafted for amending with the advice of experts, publics and technical assistance of AusAIDs, World Bank, the comments from the investors of Myanmar’s Mining Industries and experts who have internationally experiences.

• Upcoming Mining Law and Related regulation concern the environmental conservation, socio-economic of the locals and creating the Win-Win situation between the investors and the State. So this new Law set to attract the Foreign Investor which ensure to get more benefits and more reliable to invest in Myanmar’s mining sector.

• The draft of the Myanmar Mines Law is accepted by the Union Attorney General Office and ready to submit to the next parliament which will be held on 1st October 2013. Also the Myanmar Mines Rules is drafted and almost finish enacting within the 90 days after the approval for the Myanmar Mines Law from the Parliament. So, The Myanmar Mines Law and Rules are very ready for you soon.
MINING LAW AND MINING PROJECT

• Regarding to the Foreign Investment Law, there is some incentive for Foreign Investors such as 5 years exemption of commercial tax for exported mineral products.

• The Ministry of Mines tries the best with the appropriate policy and set the regulations. From this we expect to promote the utilization of Myanmar valuable mineral resources for the production to refined products through the contribution of foreign investment with advanced technologies.
Thank you for your attention