

The background features a dark blue gradient with a subtle pattern of white stars. Overlaid on this are several technical diagrams in a lighter blue color. These include circular gauges with numerical scales (e.g., 140, 150, 160, 170, 180, 190, 210, 220, 230, 240, 250, 260), dashed lines, and curved arrows indicating motion or flow. The overall aesthetic is that of a technical or scientific presentation.

LEGISLATING A NATIONAL Ore export ban:  
*Should we?*

- An Ore Export Ban can only really apply to **NICKEL ORE**.
- **COPPER ORE** is not saleable in its raw form and miners already integrate processing in their operations to produce **copper concentrate**.
- **GOLD ORE** is not saleable in its raw form. Miners have to process the ore to produce **dore bars**.

*The proposed ban will therefore primarily impact **nickel ore**. The question now is:*

- Will a ban result in the **construction** of nickel processing plants?
- What **type** of processing plants will an ore export ban bring?
- Will these plants be **competitive** vs. similar plants in the planning/construction stage in Indonesia?

In order to address these, a discussion on the **two types** of ore in a lateritic nickel deposit and how these are processed is necessary.



# HOW IS NICKEL ORE PROCESSED?\*

## ■ Limonite Ore

- By *hydrometallurgical process*, such as a High-Pressure Acid Leach (HPAL) plant. Two HPAL plants exist in the country: *Coral Bay Nickel Corp (Bataraza, Palawan)* and *Taganito HPAL Nickel Corp (Claver, Surigao del Norte)*.
- Both plants are majority owned by Sumitomo Metal Mining (Japan), are affiliated with *Nickel Asia Corp*, and are located in PEZA zones.
- Product: nickel-cobalt sulfide (55% Ni content) for refining in Japan to produce nickel and cobalt metal.

\* This discussion does not cover all of the processing methods, some of which are still in the experimental stage.

# HOW IS NICKEL ORE PROCESSED?



The Taganito HPAL plant in Surigao del Norte was commissioned in 2013 at a cost of US\$1.7B with a capacity of 30,000 tons of contained nickel/year in sulfide form.

While the country has two operating HPAL plants, it is highly unlikely that similar plants can be constructed in the future due to the following factors:

- **Capital Cost:** *HPAL plants are very expensive to build.* The Taganito plant alone was constructed at a cost of \$1.7 billion;
- **Technology:** There are only a handful of similar plants around the world and few companies that can tackle the technology.
- **Requires tie-up with a mine** *(or multiple mines)* that has substantial limonite reserves to ensure ore feed over many years *(the Taganito plant requires over 4.5 million WMT/year).*
- **Lack of incentives:** PEZA incentives have been removed.

# HOW IS NICKEL ORE PROCESSED?

## ■ Limonite Ore

- By *pyrometallurgical process (smelting)*. Limonite ore with iron content of at least 48% was first processed in China mid-2000 using **blast furnaces** to produce a low-grade ferronickel product called **Nickel Pig Iron (NPI)**, used in the production of low-grade (200 series) stainless steel\*\*.



Example of a Chinese blast furnace used for smelting limonite nickel ore,

**The Philippines has no plant of this type.** A ban on the export of unprocessed ore could spur the construction of such plants, but there are certain things to note:

- **Capital cost:** Reasonable, if following China technology, not unless the plant is made to meet world-class environmental standards.
- **These plants are extremely polluting** and have been in disfavor in China in lieu of the more modern electric furnace plants.
- **Coking coal is required** as the fuel source for such plants and reductant. This is not available in the country. It is abundantly available in Indonesia.
- **The permitting requirements and social acceptability of these plants will be difficult**, and it is doubtful that such plant in the Philippines can compete cost-wise with a similar plant in Indonesia.

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\*\*Approx. 60% of world nickel supply, either in metal form or in the form of ferronickel, is used for the production of stainless steel.

# HOW IS NICKEL ORE PROCESSED?\*

## ■ Saprolite Ore

By *pyrometallurgical process* in a ferronickel smelter to produce high-grade ferronickel (Japan) or medium-grade NPI (China), used in the production of 300 series stainless steel. With the introduction of sulphur, can also be treated in a smelter to produce nickel matte, which can be refined to produce nickel metal.



**The Philippines has no plant of this type.** It will be a challenge to construct such plants in the country due to the following:

- **Capital Cost:** Expensive to build if plant is to meet world class environmental standards;
- The higher the **saprolite nickel grade**, the lower the per unit operating cost. Indonesia has an abundant supply of 1.8% + saprolite ore, while *in the Philippines, such ore is in limited supply.*
- **Requires tie-up with a mine** (or multiple mines) that has substantial saprolite reserves to ensure ore feed over many years;
- **Heavy power requirement** coupled with lack of power in the country. A coal fired power plant will have to be constructed to meet the plant's power requirement, adding to cost



# INDONESIA vs. PHILIPPINES: *How do we compare?*

- The ban on exports of ore in Indonesia to spur processing went into effect Jan 12 2014, the result of legislation passed 5 years ago (2009). There are, however, **significant differences** between the two countries that might make such move a success in Indonesia, but not in the Philippines:
- **Indonesia's mineral resources are considerably larger than the Philippines.** Indeed, Indonesia's largest taxpayer is Freeport McMoran's Grasberg copper-gold mine in Papua.
- **Indonesia's mineral resources are also, on average, of higher ore grades than in the Philippines.** This is particularly evident in the case of nickel ore. Volume and type of nickel ore exported to China in 2013 from both countries show the following:

Ore Type	Indonesia	Philippines
	WMT M	WMT M
Saprolite: +/- 1.8%	52	5
Saprolite: +/- 1.5%	5	4
Limonite: +/- 1.0%	2	<b>10</b>
<b>Subtotal for NPI</b>	<b>59</b>	<b>19</b>
Limonite (for carbon steel)	-	<b>25</b>
<b>Total</b>	<b>61</b>	<b>44</b>

The bulk of Philippine ore exports is *low-grade limonite* with higher iron grade, suitable for NPI blast furnaces or to blend with iron ore for non-stainless steel production

## INDONESIA vs. PHILIPPINES: *How do we compare?*

- **The lack of power in the Philippines** is a significant deterrent to the construction of processing plants. In contrast, Indonesia has ample power supply and at cheaper cost. In remote areas in Indonesia that will require an integrated power plant, coal is available in abundance and has a higher calorific value than Philippine coal.
- **It is illogical for the Philippines to make a push towards processing plants without encouraging the growth of the mining industry.** EO 79 has stifled the growth of the industry with a moratorium on new mining permits, now in effect for over two years. The 'no-go' mining zones that now appears to be final will have an even worse long-term effect on the industry.

# CONCLUSION

- It is difficult to imagine that a proposed ban on unprocessed ore in the Philippines will result in the construction of a number of processing plants that can effectively compete with similar plants in Indonesia, for the following reasons:
  - **The generally lower quality of ore in the Philippines** (in relation to the construction of ferronickel or electric arc NPI plants that require saprolite ore) coupled with lower overall ore resources;
  - **The lack of power** and the lower quality of locally produced coal;
  - **The non-availability of local coking coal** (in relation to blast furnaces);
  - **The difficulty in the permitting process and social acceptability** for smelting plants coupled with integrated coal fired power plants;
  - **The environmental issues** associated with blast furnaces;
  - **High capital requirements** (for certain types of plants);
  - **The lack of support** to encourage growth in the mining industry.