NORWEGIAN HULL CLUB

Bulk cargo liquefaction

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Introduction:

Shipping is a truly derivative industry, susceptible and constantly required to adapt to the vagaries of the underlying trades which it serves to facilitate. Experience has shown that the regulatory framework, best practices or Codes of Conduct and the law in general tend to develop in a reactionary manner to changes in trade patterns that bring about new safety concerns and incident trends, sometimes with tragic consequences. Further, that enforcement of or imposition of penalties for breaches of such requirements can also be difficult, if at all possible.

The carriage of unrefined, mineral ores in bulk (Iron, Nickel, Bauxite etc.) has long presented difficult practical and safety considerations for the shipping industry concerning cargo liquefaction. It is also characterized by volatile and changing underlying economic and political conditions that have been altering the nature and composition of the trade.

In fine grained moisture laden cargos such as Nickel, Iron and to an extent Bauxite, the spaces between cargo grains are filled with both air and water. Whilst at sea the cargo is subject to forces due to the vibration and rolling of the vessel. These forces cause the inter-grain spaces to contract. The water in the spaces between grains is subject to a compressive force but as it is a liquid it cannot be compressed. This has the effect of reducing the inter-grain frictional force that holds the cargo in a solid state. Where enough moisture is present, often allied to a fine grain particle size, the reduction in inter-grain friction due to the ship's motion and vibration can be sufficient to cause the cargo to flow like a liquid i.e. to liquefy.

Yet, after more than 10 vessel capsizes at sea with the loss of over 100 lives and numerous dangerous list incidents and discoveries of in-hold liquefaction at load ports, incidents still continue to occur, sometimes with devastating consequences.

Whilst a depressed freight rate environment typically imposes additional downward pressures on Owners navigating already difficult and often unpredictable underlying safety issues, such vagaries may now be having the opposite effect and actually serve to improve safety going forwards within this sector of dry bulk shipping. This is good news, since the ability to properly regulate and manage such risks has thus far eluded the industry.

Nickel and Iron ore are key base constituents required for the production of steel. Bauxite is needed for the production of Aluminium. As China underwent its breakneck urbanization and industrial development (and to a lesser degree still continues to do so), consumption of raw materials needed to produce steel and many other refined products increased exponentially and new trades developed accordingly.

Analysis of these 3x key mineral ore trades into China suggests that an increasing trend towards pre-shipment/export refining and even alternative *process* generation is reducing the levels overall of such ores being shipped unrefined and thus reducing the number of liquefaction incidents occurring. It is not all good news though, at least for the time being.

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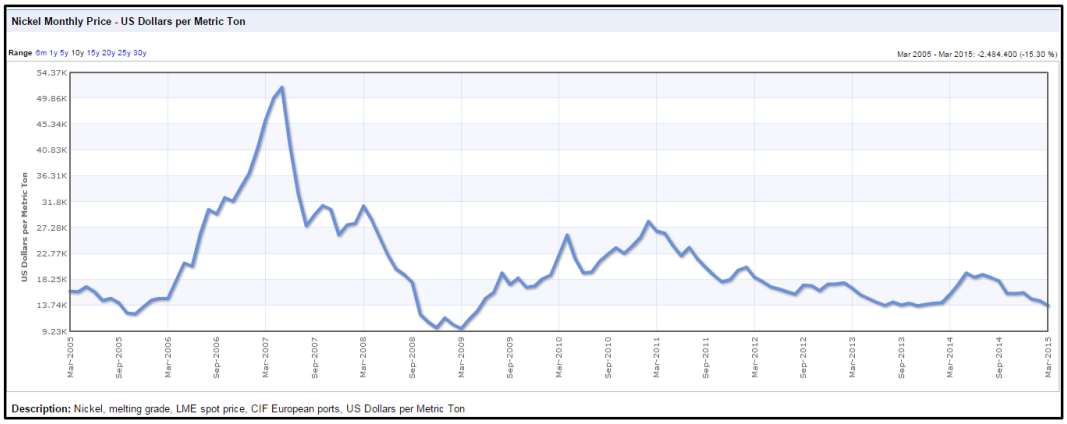
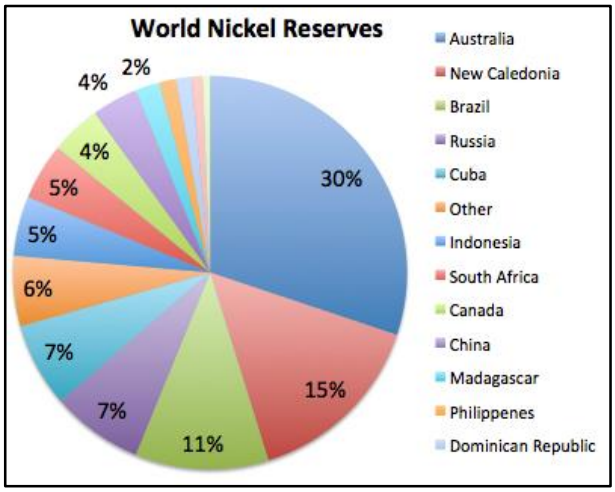
The Nickel Ore trade into China:

The Philippines experienced a rapid development in nickel ore export capacity. As China's hunger for ever increasing volumes stimulated commodity prices, this rendered the shipment of unprocessed nickel ore in bulk from remote islands on long ocean voyages at levels below 2% concentration commercially viable. Chinese nickel pig iron (NPI) smelting capacity increased drastically and cheap close by ores, even in low concentrations became strategically important.

The below chart shows how the USD $/MT price skyrocketed up to in excess of USD $50 000 /MT by early 2007 prior to the collapse of Lehman bank that triggered the global collapse in credit and physical markets.



The other major source of Nickel ore for the Chinese Nickel Pig Iron (NPI) trade that developed to facilitate steel production has been Indonesia, which like the Philippines has a proximity advantage to China over other major source providers such as Australia, New Caledonia and Brazil which have the largest sources of global nickel ore deposits.

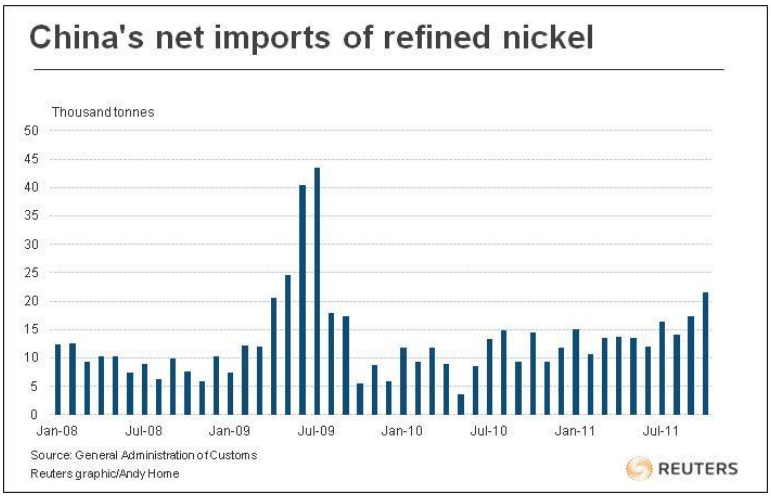


As newly developed low cost mines became profitable backed by a then high nickel price, so they also shut down when the price dropped and shipping costs became too high. By 2008 however, the Philippines had established itself as an alternative low cost provider of base nickel ore for export to China. This below graph shows how the Philippines export of nickel ore developed over 2008 until

2014 when it became the almost exclusive provider of nickel ore to China after the Indonesian government banned all mineral ore exports in January of that year.

As commodity prices reached their low point in 2009, ore export shipments to China reduced drastically from both the Philippines and Indonesia as shipping costs allied to high refining costs associated with low grade ore made the trade increasingly unviable.

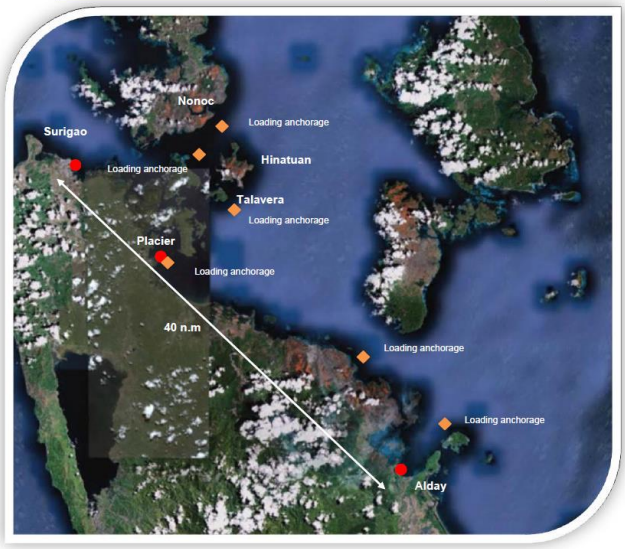
Here though in the below chart you can see how China kept the steel processing supplied by increasing imports of refined nickel products, which peaked by mid 2009 to fill the slack in the ore imports but then dropped off again by early 2010 as unrefined ore producers increased exports again. The new, low cost base sources of nickel ore for the Chinese NPI sector were now firmly established.



As a result, new or additional export capacity developed in very remote and underdeveloped regions in the Philippines where nickel ore was sufficiently widespread, in high enough base concentrations and located near to suitable anchorage loading locations. Mining and distribution locations consequently developed in three primary locations, Santa Cruz, Surigao (the bulk of all trade at this location) and Tubay producing ore in 3x primary qualities:

- Lateritic nickel content 0.9% (low-grade)
- Limonitic nickel content 1% to 1.5% (mid-grade)

- Saprolitic nickel content 1.4% (mid-grade) to 2% (high grade)



The mined nickel ore is stockpiled on the nearest beach to the anchored vessel, where tank landing craft are then loaded by tractor/dump truck. They then proceed out to the ship at anchor and the cargo is loaded via the ships grabs.

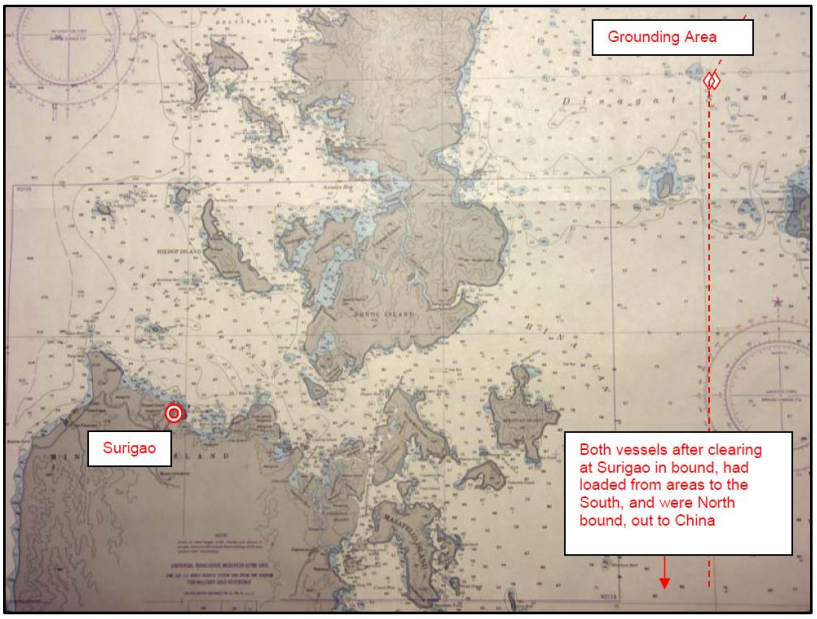
The Lateritic Ore produced is clay like in appearance and reddish while Limonitic and Saprolitic ores are more yellow and granular. Lateritic nickel ore has long been known to liquefy with disastrous results. In 1988 the ***Mega Taurus*** was carrying ore from the Philippines when it capsized with the loss of all 20 crewmen. That same year the ***Sea Prospect*** was shipping nickel ore from Indonesia when it capsized with the loss of 10 lives. Other vessels have been more fortunate. In 1990 the ***Oriental Angel*** developed a list after loading a cargo in New Caledonia; this being repeated in 1999 with the ***Padang Hawk***. The ***Jag Rahul*** also developed a dangerous list in 2005 when carrying nickel ore from Indonesia. Despite this, newly discovered or developed mines were being operated by owners who had little or no experience of the mineral's properties or its shipment requirements in locations proving too remote for the attendance of surveyors coupled with a lack of reliable laboratories for testing. Operating margins were thin and as the nickel price fluctuated activities ebbed and flowed. This in turn limited infrastructural investment in extrapolation, processing and storage facilities - all essential for safe processing of ores for carriage by sea, especially during the rainy season which runs from November to February in any year.

Further, the shippers and mines became very protective of the shipments in response to increased industry/regulatory attempted oversight and access to the mine, stock piles and laboratories was not always granted. Instead the trade was tightly controlled by very powerful local organizations benefitting from revenue of millions of dollars each year. Incidents of Masters and cargo surveyors being physically threatened and intimidated to load cargos quickly, without being given necessary time to carry out independent moisture content tests to verify the shipper's declared moisture content were not uncommon.

As a result, the following cargo conditions in the hold could be created before departure. Liquefaction in the holds typically won't be visible to this extent and thus poses a latent but hidden danger for any crew unaware of the hazards involved.

If the propensity for liquefaction is missed during loading and/or prior to departure, a sudden list can easily develop as cargo in the holds liquefies and suddenly shifts en route assisted by the vibration of the vessels engine and movement at sea.

Additional navigational hazards were also presented by this trade. In 2007 several Handy Max size bulk carriers ran aground on an uncharted reef depth 10m after completion of loading Nickel Ore at Surigao in Mindanao, Southern Philippines. The Masters had chosen on departure to transit Dinagat Sound, an area subject to strong currents and rip-tides particularly during the Monsoon period from September to February. The lack of shipping related infrastructural investment in this area was further evidenced by the fact that charts of the area the coral reefs and shoals in the Dinagat Sound are based on partial surveys from prior to the 1930's and were as such unreliable. The vessels involved had typical laden sailing draughts of 11.8m and 12.5m.



Indonesia, the other major source of nickel ore that developed for the growing Chinese demand, like the Philippines, developed in very remote and underdeveloped regions in Indonesia where nickel ore was sufficiently widespread, in high enough base concentrations and located near to suitable anchorage loading locations. Mining consequently focused within the Halmahera Islands.

Nickel ore mining had been ongoing in Indonesia for several decades already. PT Inco Indonesia a subsidiary of nickel giant Inco operates the Soroako mine on the island of Sulawesi, producing nickel matte for refining by Sumitomo Corp. in Japan. Since the establishment in July 1968, PT Vale has also been operating with the Government of Indonesia to explore, mine, process, and produce nickel from its facilities near Sorowako on the island of Sulawesi.

The other major producer is PT Aneka Tambang (PT Antam), which is listed on the Australian Stock Exchange. PT Antam has mining authorities over parts of the northern part of the eastern provinces of Indonesia, which are highly prospective for lateritic nickel deposits. PT Antam has a mining operation on Gee Island, east of Halmahera Island, which commenced operation in 1979.

As nickel prices rose a number of other projects in the area rapidly developed, including Gee Island, Pakal Island, Tanjung Buli and Obi Island, all within the Halmahera Island area. The Buli deposit has estimated resources containing 41Mt (saprolite) grading 2.5% nickel and 11% iron.

PT Antam also has a joint venture in Gag Island with BHP Billiton. The Gag Island deposit has resources estimated at containing 240 Mt averaging 1.35 % nickel and 0.08% cobalt (including both oxide and silicate laterite zones). At present BHP Billiton has a 75% interest and PT Antam 25%.

PT Weda Bay, a 90% subsidiary of Weda Bay Minerals (the remaining 10% held by PT Antam) is also completing evaluation studies on the Halmahera lateritic nickel deposit located in central Halmahera. Halmahera has indicated and inferred resources of 216 Mt grading 1.37% nickel and 0.12% cobalt.

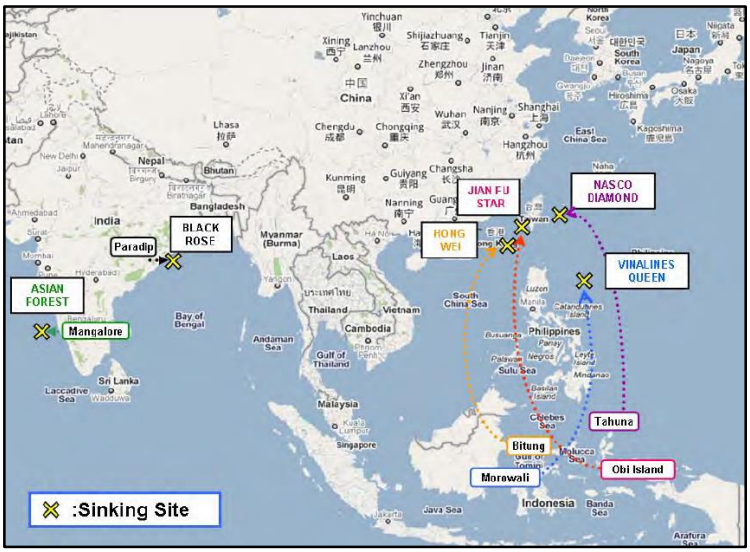
As mentioned above, in 1988 the ***Sea Prospect*** was shipping nickel ore from Indonesia when it capsized with the loss of 10 lives and the ***Jag Rahul*** also developed a dangerous list in 2005 when carrying nickel ore from Indonesia. This led to UK consultants Brookes Bell who were directly involved in some incidents involving nickel ore cargoes loaded at Tanjung Buli, Halmahera Island publishing a special bulletin which stated;

"*Concerns have arisen about the safety of cargoes of nickel ore, loaded at Tanjung Buli. These cargoes originate from open cast mining on the Indonesian island of Halmahera and are presented for loading directly from the mine with little or no processing. The consistency of the material is that of a wet mud of finely-divided particles, interspersed with varying proportions of larger rocks. The declared moisture content of these cargoes is in the region of approximately 25% to 35%. In at least one cargo, pools of free water developed on the cargo surface during loading and during carriage. Because of the method of mining, significant variations in moisture content and physical consistency are likely from cargo to cargo.*"

As with the Philippines, newly discovered or developed mines were being operated by owners who had little or no experience of the mineral's properties or its shipment requirements in locations proving too remote for the attendance of surveyors coupled with a lack of reliable laboratories for testing. Similarly, the shippers and mines became very protective of the shipments in response to increased industry/regulatory attempted oversight and access to the mine, stock piles and laboratories was not always granted. Instead the trade was tightly controlled by very powerful local organizations benefitting from revenue of millions of dollars each year. Incidents of Masters and cargo surveyors being physically threatened and intimidated to load cargos quickly, without being given necessary time to carry out independent moisture content tests to verify the shipper's declared moisture content were not uncommon.

Most notoriously a spate of liquefaction incidents were experienced as a direct result of this between October and November 2010 when the ***Jian Fu Star***, ***Nasco Diamond*** and ***Hong Wei*** sank whilst carrying nickel ore from Indonesia to China with the loss of 44 seafarers.

On 27th October 2010 the ***Jian Fu Star*** capsized off the southern part of Taiwan after departing Obi Islan in Indonesia. On 4th November 2010 the ***Nasco Diamond*** capsized offshore after departing the port of Tahuna in Indonesia and on 3rd December the ***Hong Wei*** capsized, also off the southern part of Taiwan after departing the port of Bitung in Indonesia. Then on 25th December 2011 the ***Vinalines Queen*** capsized and went missing off Luzon Island whilst to China with more than 54,000 tonnes of nickel ore loaded at the port of Morowali in Indonesia. There was 1x sole survivor and 22x fatalities.



Various industry representative interest groups (BIMCO, Intercargo, IG P&I Clubs etc) had already been publishing multiple safety briefings by 2007 warning of the dangers associated with nickel ore liquefaction but by 2011/2012 direct intervention had now appeared in response to these losses. Club's were advising Members not to agree any fixtures with charterparty terms that limited the member's rights to apply fully the IMSBC Code or allows the shipper to avoid his duties as defined within the Code. Express terms were even recommended to be included in the charterparty or freight contract to safeguard the owner's position which included ensuring that proper and accurate moisture content/transportable moisture limit/flow moisture point and cargo descriptions are provided through laboratory testing of load samples prior to loading. Otherwise cover could be prejudiced in the event of an incident.
Changes were also made to the IMSBC Code (which regulates the carriage of cargoes in bulk) via Amendment 02-13 which has been in force since January 2015. This is not the first such amendment to the Code.

Despite this, incidents keep happening. On 16th February 2013 the ***Harita Bauxite*** sank off western Luzon, Philippines, while carrying nickel ore from Indonesia to China with 15 fatalities. More recently, a suspected case of cargo liquefaction may have indirectly claimed the life of one seafarer on July 17th 2015, aboard the 2007-built Supramax ***Alam Manis*** in the northern Philippines, also carrying nickel ore.

If regulation isn't working, what is?

Increased industry regulation and awareness allied to more support from the IG Clubs and other special interest bodies has not been able to effectively manage the risks presented by the Chinese nickel ore trade. What has worked is the trade ceasing entirely as far as Indonesia is concerned after a complete ban on unrefined mineral ore exports was implemented in January 2014. The ban was upheld by Indonesia's Constitutional Court in December 2014 as acceptable to ensure ore supplies to domestic smelters seeking to spur investment in domestic processing and transforming the nation into a producer of high-value metal. Whilst mining interests are still pursuing challenges to the ban via the Supreme Court, investors (now primarily Chinese) are gaining a foothold in the area.

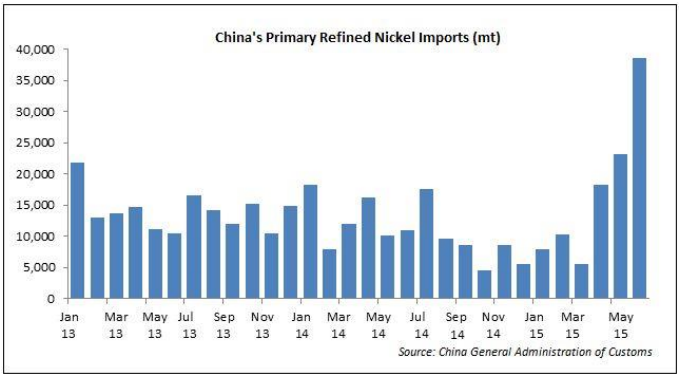
A joint development between PT Central Omega Resources (COR) Industri Indonesia and Chinese Marconing Group is building a smelting facility in the North Morowali regency, Central Sulawesi with a planned annual capacity of 300,000 tons of NPI. Huadi Nickel-Alloy Indonesia, is also building a smelter in Bantaeng, South Sulawesi, which is slated to be the area's first nickel-processing facility. Huadi Nickel is a joint venture between Shanghai Huadi Industrial Co. of China and local firm PT Duta Nikel Sulawesi. The smelter, which may cost a total of $130 million by the final phase of development, will initially produce 50,000 tons of NPI each year.

Sulawesi Mining's partners, Jakarta-based mine owner Bintangdelapan and steelmaker Tsingshan, which used to import ore from the island, are also at work now on $1.8 billion worth of projects in the Morowali Regency, Central Sulawesi province. The first smelter is due for completion by December 2015 or Q1 2016. It is said to cost $672 million and at full capacity should produce 300,000 tons NPI a year. The second plant, a $1.1 billion project backed by Sulawesi Mining and three other investors, will yield the equivalent of 60,000 tons of pure nickel and should be completed by the end of 2015.

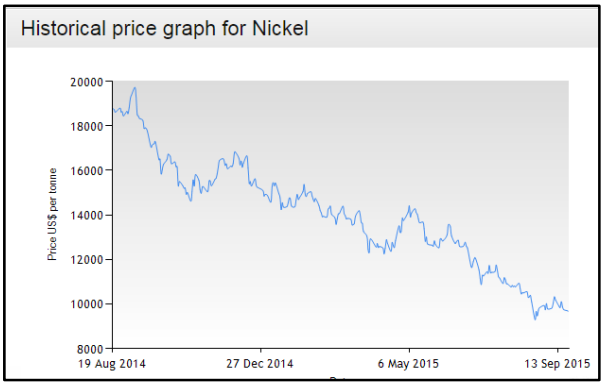
Further south, PT Macika Mineral Industri, a joint venture between PT Macika Mada Madana and China-based Ningbo BrilliMetal Co., is investing $15 million in a blast furnace in Palangga, South Konawe has already been completed and started production.

This trend is taking hold elsewhere as various commodity export based economies try to extract more profit from the supply chain and generate additional local employment by increasing domestic ore refining capacity. In August 2015 the heads of the New Caledonia national and local governments along with mining executives vetoed exports of nickel laterites to China because of New Caledonia's longstanding supply agreements with Australia. New Caledonia has the world's 2nd biggest nickel ore reserves however the ban does not affect refined or ferronickel exports to China.

Whilst China stockpiled as much nickel ore as possible from Indonesia before the ban was implemented, the Philippines has had to almost exclusively fill the gap presented by Indonesia cutting its ore supply availability. China, according to China Customs, imported 14.57 million ton of nickel ore during the first half of 2015 (over 35% down from last year) with over 96% of these imports now originating from the Philippines and less than 1% from Australia, the second-place supplier. Overall, unrefined ore imports are down and the emphasis is now focused on refined ferronickel products instead. This graph shows how China has significantly increased its refined nickel imports since Q4 2014 as the ore stockpiles built up in 2014 have depleted. Nickel ore imports continue to drop.



As the global economy enters the extrapolation phase of the commodity super-cycle, low for longer is becoming the mantra across most major trades, Nickel included.



If such prices persist or continue their decline, it is difficult to see how the existing ore export capacity in the Philippines will remain profitable both locally and for China given the shipping & higher NPI

production costs associated with low grade ores below 2% concentration. Remember it is lateritic ores with high clay content in the Philippines which tend to present the highest liquefaction risks but also constitute the lowest grade ore produced in the region, typically below 1% concentrations.

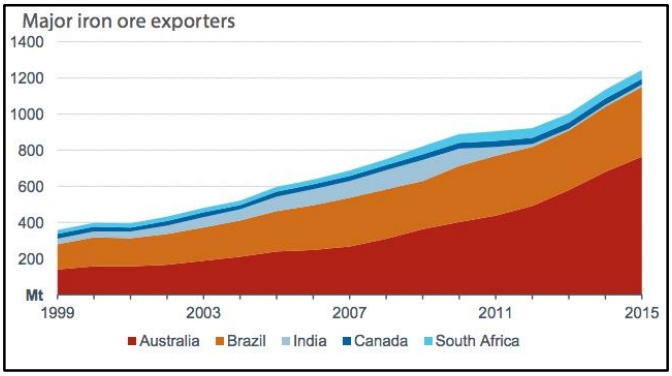
According to Reuters, China's nickel ore imports slumped below 1 million tonnes in February 2015 for the first time since February 2010 and cumulative imports over the first two months of 2015 totalled just 2.1 million tonnes, down from 10.8 million tonnes over the same period of last year. Moreover, as the global outlook worsens and demand both domestically and on an export basis for Chinese steel wanes, so too arguably will the need for high cost, low grade nickel ore.

Also, the trend towards domestic refining prior to export (in order to create more growth locally) allied to developing political resistance could end it altogether. The Philippines, like many other producers has increased its domestic downstream nickel refining capacity and continues to do so in the same way Indonesia has. The Country has not yet taken the step of outright banning unrefined ore exports, like Indonesia and New Caledonia, however the topic is on the legislative radar. In September 2014 the Philippines government released a White Paper to fast-track a Bill aimed at providing for the mandatory domestic processing of all mineral ores, which will amend the Philippine Mining Act of 1995.

If this step is taken, the liquefaction risks associated with the carriage of nickel ore in bulk still prevailing in the industry ought to disappear outright. Absent a Filipino ban on unrefined mineral ore exports, the underlying economic fundamentals should see the trade continue to subside regardless.

The Iron Ore trade into China:

Iron ore, critical for the production of stainless steel has been a stable trade alongside coal for the bulk shipping sector with the major producers being Australia, Brazil, India, Canada and South Africa.



Rather than the trade being driven like the nickel ore trade by then increasing commodity prices, this trade was driven more by simple demand issues stemming from the rapid economic expansion (as well as breakneck urbanisation) China underwent with resultant increases in steel output. Whilst the price of Iron ore continued to diminish post 2011, Chinese import volumes continued to increase.

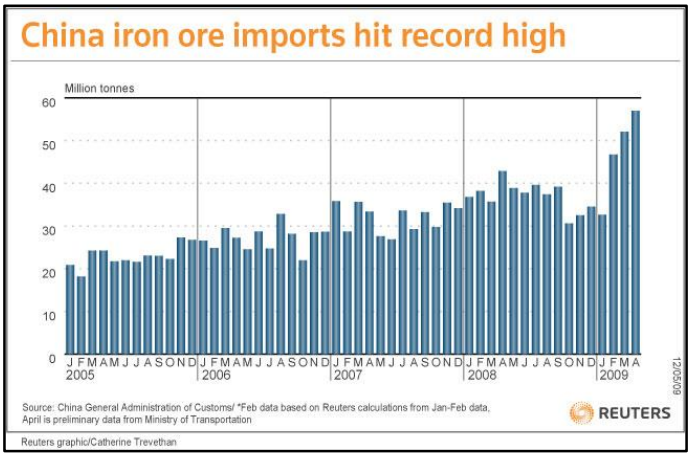
Indian exports of Iron Ore rose from approx. 86m MTs in 2002 to approx. 165m MTs by 2006 of which reportedly some 80% was in the form of 'fines'. The small particle nature of iron ore fines allied to high moisture contents creates a lethal propensity for liquefaction, which is exacerbated by a prevailing monsoon season experienced, similar to that in the Philippines.

As with Nickel Ore, most interested bodies (BIMCO, Intercargo, IG P&I Clubs etc) were already sending out safety briefings by 2007 as export volumes had increased to meet Chinese demand with resultant increases in incidents being witnessed.

3 near misses were experienced in 2007 as follows;

- Vessel 1 sailed Mangalore and developed a list and had to be beached off Tannir Bhavi beach near Mangalore.
- Vessel 2 sailed Haldia and developed list and called Vizag where the cargo, which had overwhelmingly liquefied, was taken off the vessel.
- Vessel 3 sailed Haldia and cargo shifted at sea causing vessel to list 20 degrees to starboard. She was beached off Car – Nicobar Islands.

By 2009, Iron ore imports into China had reached record levels and India had developed itself as a valuable additional low cost source for China to the main exporters Brazil and Australia despite the needs of its domestic steel production capacity.



Another spate of liquefaction incidents were experienced by the industry, this time with more tragic consequences. On 17th July 2009 a vessel loaded with iron ore fines at New Mangalore foundered,

fortunately with no loss of life. There is speculation that the vessel foundered due to liquefaction of the cargo which was reportedly rejected by a previous vessel.

In general iron ore fines produced for shipment from New Mangalore and the West Coast of India are extracted, transported and stockpiled before loading on board ships in the open. With the onset of the South West Monsoon very heavy rain falls on the product during all stages prior to loading and shipment. In 2009 India experienced a particularly bad monsoon season and a succession of 3x liquefaction incidents involving the ***Hodasco 15***, ***Black Rose*** & ***Vinalines Mighty*** again exposed the lack of shore side, cargo related safety procedures being followed in almost every stage of the production and shipment process from mining, to cargo preparation (sieving through bear grill, crushing, solar drying etc), to storage, sampling, testing and issuing of cargo certification.

On 30th August the ***Hodasco 15*** sank off Malaysia whilst carrying iron ore fines from Calcutta to China. On 9th September the ***Black Rose*** sank shortly after departing from Paradip with a cargo of iron ore fines onboard and on 10th September the ***Vinalines Mighty*** developed a list off Paradip after loading fines at that port but made it safely back to port to unload the liquefied cargo.

Typical problems being encountered in the carriage of iron ore fines ex-India as cited by IG Clubs were largely attributed to:

- Lack of understanding of the issues of liquefaction
- Iron ore fines not being declared as a Group A cargo under the IMSBC Code
- No certificates of moisture content and transportable moisture limit issued by the shipper
- Cargos being incorrectly described to avoid being subject to the requirements of the IMSBC Code
- Inaccurate or fraudulent moisture content or transportable moisture limit certificates issued by the shipper
- Only one certificate issued for moisture content and transportable moisture limit even though there may be more than one distinct source of cargo
- Masters under commercial pressure not to delay loading and to accept cargos without sufficient certification
- Moisture content certificates more than seven days old
- Cargo not stockpiled but delivered straight from the mine
- Restrictive charterparty clauses
- Physical threats and intimidation forcing masters and surveyors to accept cargo
- Refusal to provide proper access for surveyors to sample and inspect the cargo before the ship is asked to start loading

In response to these incidents, the Indian Ministry of Shipping issued a Circular dated 1st October 2009 citing heavy rainfall in the Goa and Karnataka regions and setting down additional procedures to be followed when iron ore fines were being loaded during periods of rainfall. On 3rd June 2010 the Goa Port Authority issues another Circular recommending additional steps be taken for loading to include;

1. That cargoes intended for shipment are transported to the load port in trucks covered for rain protection and that barges when used also have hatch covers for rain protection.
2. That stock piles are kept in covered structures (stocks are normally stored in the open).
3. That appropriate test procedures are used to determine safe transportable moisture limits.

4. That in addition to shippers testing and reporting of cargo moisture contents, Owners/Charterers are also to conduct independent sampling and testing as approved by DG shipping.
5. That all moisture test results obtained by Owners/their P&I Club have been obtained, they are submitted to the Mercantile Marine Department for clearance before shipment can proceed.

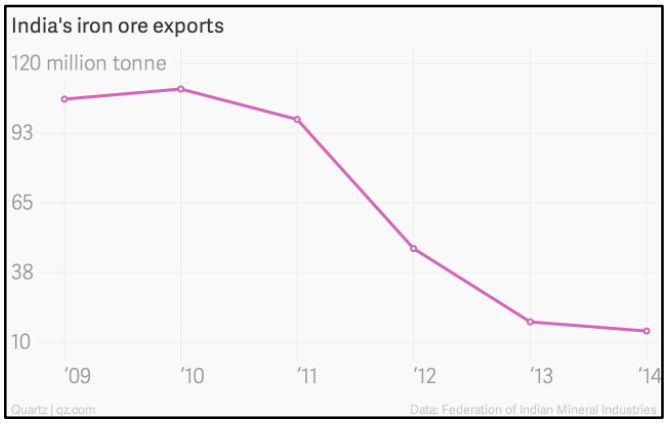
This was followed by a more detailed Circular, 'Merchant Shipping Notice No.9 of 2010' issued on 27th August 2010 titled; 'Safe loading, stowage, carriage and discharging of iron ore fines on ships from Indian Ports in fair and foul season'. Its summary requirements were;

1. The Mercantile Marine Departments shall carry out 100% Port State Control / Flag State Implementation Inspections of all vessels loading cargo of Iron ore fines / Concentrates and similar type of cargoes from Indian Ports during fair / foul weather season.
2. These vessels shall only sail out from Indian ports after obtaining clearance from the concerned Mercantile Marine Departments.
3. In addition, the provisions of this notice shall also be strictly complied with.
4. Laboratory Test Houses conducting test on cargo samples of iron ore fines has the approval of the Competent Authority if accepted by the ship, shipper or their representatives.
5. Non-compliance of the provisions of International Regulations, National Rules and this notice shall be viewed seriously.
6. Legal action for such contraventions shall be taken against the Ship owner, Ship master, Shipper, Port terminal and other concerned Stakeholders under the provisions of Merchant Shipping Act, 1958 and other applicable laws.

Unlike the Philippines and Indonesia which largely lacked the ability or willingness to implement and enforce such requirements domestically, these regulations to the extent they were enforced, provided a relatively effective domestic driven safety net for managing the liquefaction risks posed by cargoes of iron ore fines.

As with nickel ore, by 2011/2012 direct intervention had also appeared in response to these losses. Club's were advising Members not to agree any fixtures with charterparty terms that limited the member's rights to apply fully the IMSBC Code or allows the shipper to avoid his duties as defined within the Code. Express terms were even recommended to be included in the charterparty or freight contract to safeguard the owner's position which included ensuring that proper and accurate moisture content/transportable moisture limit/flow moisture point and cargo descriptions are provided through laboratory testing of load samples prior to loading. Otherwise cover could be prejudiced in the event of an incident.

But by 2010, iron ore exports from India to China were already in rapid decline, but not because of the additional shipping safety procedures and processes that now required implementation before carriage.

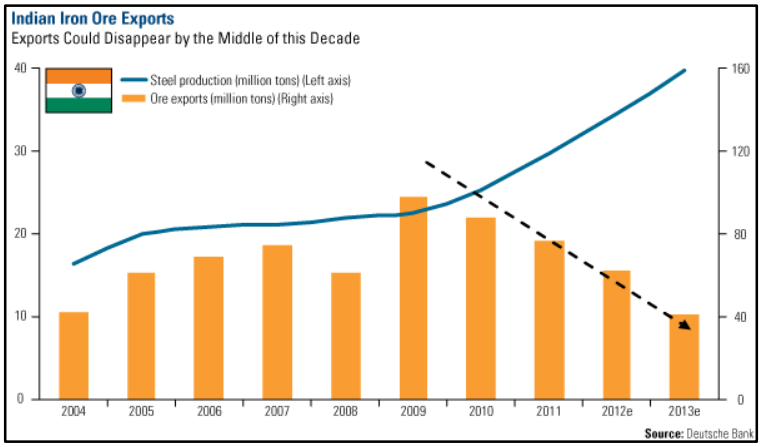


In 2011, troubled by massive illegal mining and its environmental effects, the Indian Supreme Court banned mining of iron ore in Karnataka, followed by a ban in Goa and Odisha following the Shah Commission report on illegal mining which was tabled in Parliament. Jharkhand government also closed 12 of its then 17 iron ore producing mines as their leases had expired.

In January 2012 a 30% export tariff was placed on all iron ore exports up from only 5% as part of an already then growing trend for governments to try and lock in the benefits of their commodity resources within their own borders. It worked. This duty has now been reduced to only 10% for low grade ore exports effective 1st June 2015.

Two years later, in 2013, the court allowed the resumption of iron ore mining in Karnataka, but with a cap of 30 million tonne per year. By 2014, the Supreme Court had lifted the ban on iron ore mining in Goa, but also with a cap, this time at 20 million tonne per year. Iron ore prices have continued to decline though to record lows and it is questionable whether Indian miners could export competitively again as against low cost producers in Australia and Brazil given the current outlook for commodities.

Further, as Indian domestic steel production continues to increase the country has now become a net importer of iron ore. Exports are set to disappear altogether.

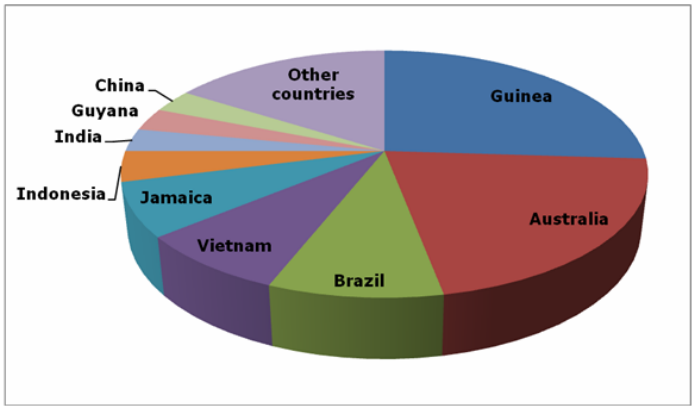


As a result, liquefaction incidents have ceased as the underlying trade responsible has evaporated, but not because of the ability of the industry to properly regulate, enforce and manage the safety issues associated with this trade.

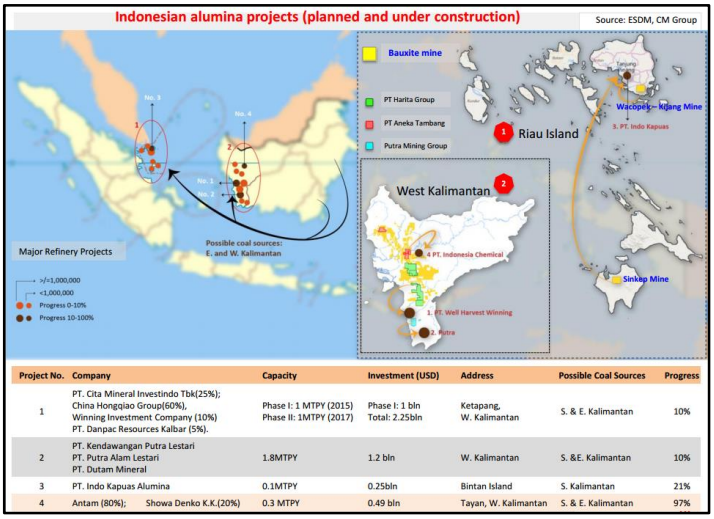
The Bauxite Ore trade into China:

Bauxite is critical for the production of mid-stage alumina and aluminium and China is both the largest consumer and importer of bauxite in the world, accounting for about 75% of global bauxite imports.

More than 90% of the world's bauxite reserves are concentrated in tropical and subtropical regions such as Australia, South-East Asia, South America and India. They are located beneath the surface and are typically extracted through the same open pit mining methods as Nickel and Iron ore.



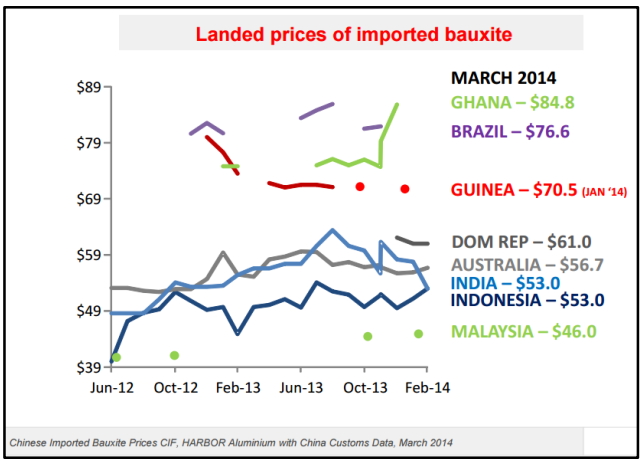
Prior to January 2014, Indonesia was the biggest producer of mined nickel and third-largest bauxite miner. It was also China's top bauxite supplier, accounting for about 80% of the country's bauxite imports, followed by Australia with around 20% and India at 1%. Since the ban, Indonesia has progressed with its own alumina smelting projects. A possible relaxation of the mineral ore ban was under discussion earlier this year as far as bauxite was concerned and only in so far as the licence applicants also had domestic smelting investments 30% completed. It is unclear though to what degree if any bauxite ore will again be exported from Indonesia, especially since an alternative, lower cost ore can now be sourced from Malaysia.



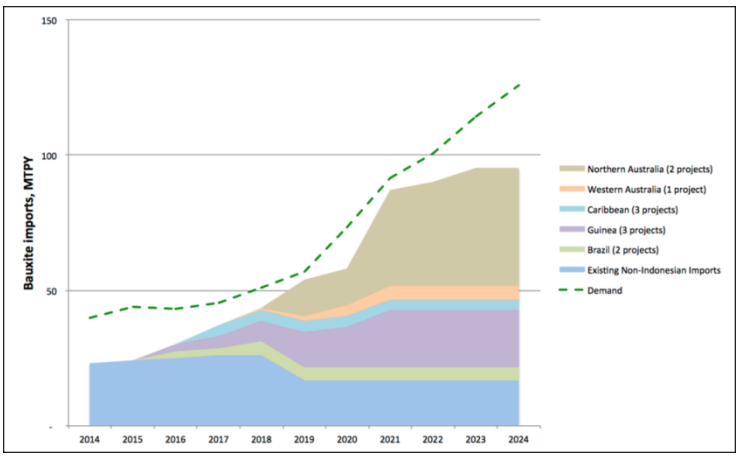
Project No.	Company	Capacity	Investment (USD)	Address	Possible Coal Sources	Progress
1	PT. Cita Mineral Investindo Tbk(25%); China Hongqiao Group(60%), Winning Investment Company (10%) PT. Danpac Resources Kalbar (5%).	Phase I: 1 MTPY (2015) Phase II: 1MTPY (2017)	Phase I: 1 bln Total: 2.25bln	Ketapang, W. Kalimantan	S. & E. Kalimantan	10%
2	PT. Kendawangan Putra Lestari PT. Putra Alam Lestari PT. Dutam Mineral	1.8MTPY	1.2 bln	W. Kalimantan	S. &E. Kalimantan	10%
3	PT. Indo Kapuas Alumina	0.1MTPY	0.25bln	Bintan Island	S. Kalimantan	21%
4	Antam (80%); Showa Denko K.K.(20%)	0.3 MTPY	0.49 bln	Tayan, W. Kalimantan	S. & E. Kalimantan	97%

As the Indonesian mineral ore export ban has remained in place, China has continued to develop new sources from places like Malaysia and now Vietnam in addition to Guinea and Australia (which has

both good and poor quality bauxite supplies). The number of countries now supplying China has increased from a mere 4 in 2011 to 9 in 2014. Additionally, the tonne/mile freight costs can be reduced insofar as Malaysian, and Vietnamese exports to China are concerned, whereas other major Atlantic and Australian based deposits remain at a disadvantage.



Alumina Limited in a presentation to the 2014 World Aluminium Conference held in May highlighted the demand – supply gap likely to persist for the Chinese Aluminium industry if the ban stays in place. Below shows their forecast Chinese bauxite imports to 2024 if the ban stays and the post-stockpile 15 million tonne gap.



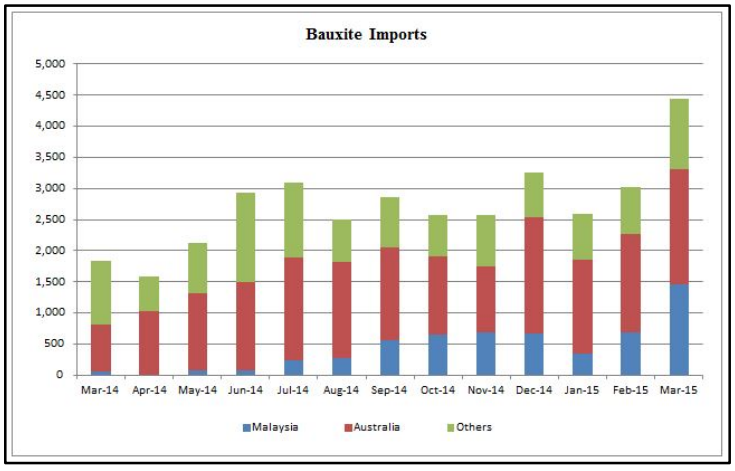
It is promising that Australia will be taking up a lot of the slack in that it has high infrastructural investment levels, good safety systems and testing facilities in place all under the auspices of a tightly regulated legal environment and is not subject to high rainfall seasons.

Australian miners (BHP being a good example) are now trending towards increasing domestic refined Alumina processing facilities which both supports local employment whilst accessing more revenue from the logistics chain, rather than expand existing unrefined bauxite export capacity. This trend will likely continue against the backdrop of higher export volumes from lower cost producers such as Malaysia and Vietnam and is already being replicated elsewhere.

Due to the ban on exports of bauxite from Indonesia, Jamaica is now seeing a similar revival of interest from other countries however; the government will no longer be seeking to enter into deals with any other country solely for the export of Jamaica's bauxite ore. Instead, the government will require that any export investment is matched with similar investments in domestic refining capacity.

Likewise, a draft mining plan for bauxite was approved by the Vietnamese government in 2007 with a strong emphasis on boosting local smelting/processing capacity rather than unrefined ore export mining capacity. Vietnam has some 5.5 billion tonnes of crude ore bauxite reserves (3rd largest after Guinea & Australia), which equals 1.4 billion tonnes of concentrate. The Vietnam National Coal and Mining Industries Group (Vinacomin) recently laid out a plan for six bauxite mining projects covering more than 1800 square kilometres in Vietnam's mountainous Central Highlands. The government is reportedly seeking to attract $15 billion or more of investment to develop bauxite mining and aluminium refining projects by 2025. That said, whilst a large Chinese mining company 'Chalco', has received contracts for the first two processing plants neither are meeting performance standards and both are generating significant losses rendering their futures questionable.

These nationalistic policies restricting the export of unprocessed ores present a difficult conundrum for China which effectively now has an overcapacity of alumina smelting facilities allied to a growing demand for aluminium production both for domestic consumption and export. As a result of the ban in Indonesia, Malaysian exports to China have risen fast. Last year witnessed a 20x fold increase to 3.3 million mt up from 154 000 mt in 2013. This equates to Malaysia now accounting for over 11% of China's total non-Indonesian bauxite imports in 2014 – up from only 0.7% in 2013. Kuantan, a district in eastern Peninsular Malaysia facing the South China Sea, is a hot spot for new bauxite mines with many miners taking advantage of underused infrastructure already put in place by the depressed iron ore sector.



Since early 2012, China also started importing bauxite from Brazil which has historically exported mainly to the Americas and Europe. By March several vessels had experienced cargo liquefaction problems after loading bauxite in the Amazon region in northern Brazil, apparently from terminals in Trombetas and warning Circulars were issued by several of the IG P&I Clubs.

In late 2012, China's first cargoes of African bauxite started to arrive, with imports from Ghana, Guinea and Guyana. Guinea is the only country where production has been achieved in any meaningful manner thus far.

These changing market fundamentals as a result of the Indonesian mineral ore export ban have created new bulk trade patterns and with them come new operational and safety concerns for Owners.

Recognition and proper implementation of International Regulations such as the IMSBC Code that relate to the carriage of ores in bulk requires substantial infrastructural investment, either at a governmental level or via the private mining/shipping interests. This Code is the reference for any ship operator or master when considering whether or not a cargo is likely to liquefy. Group A cargoes such as Nickel and Iron ore fines are those listed as prone to liquefaction, so any cargo listed as Group A should be carried strictly in accordance with the provisions of the IMSBC Code. However, the Code itself warns in Section 1.2.1 that the schedules for individual cargoes are not exhaustive.

While bauxite is listed in the IMSBC Code as a Group C cargo (one that is not known to liquefy or possess a chemical hazard), this characterisation only applies to cargoes that fall within a very narrow scope. According to the Code, bauxite must have a moisture content of 0-10% to be classified as Group C and consist of 70-90% lumps with a size of 2.5-500 mm and 10-30% powder. Conditions which take the cargo outside the Group C specification, such as excessive moisture due to heavy rainfall allied to high fines content may mean the cargo displays the characteristics of a Group A cargo.

Ship operators and Master's should not automatically assume there is no risk of liquefaction simply because a cargo does not appear in the IMSBC Code as a 'Group A' cargo and such concerns are exacerbated when loading may occur during rainy seasons such as those experienced in Malaysia where export capacity is rapidly expanding.

In January 2015 during a record rainy season, the ***Bulk Jupiter*** loaded with a full cargo from Kuantan, Malaysia capsized and sank in minutes whilst en route to China with the loss of all but 1x of the crew. Whilst investigations and litigation continue the exact cause has yet to be confirmed however cargo liquefaction is deemed to be the likely culprit by the vessel's flag state authority (the Bahamas). On the back of this the IMO has now issued a Circular that warns ship Masters not to accept bauxite for carriage unless; a) the moisture limit for the specific cargo is certified as less than the indicative moisture limit of 10% and the particle size distribution as is detailed in the individual schedule for bauxite in the IMSBC Code; or b) the cargo is declared as Group A (cargoes that may liquefy) and the shipper declares the transportable moisture limit (TML) and moisture content; or c) the cargo has been assessed as not presenting Group A properties.

Whilst bauxite ore export capacity in Malaysia is set to grow in the short term, this option provided by the Indonesian ban is widely thought to be opportunistic rather than presenting long term strategic investment possibilities. Similarly with this trade, the trend generally is one towards countries increasing domestic refining capacity, which if witnessed in Malaysia will help to drastically reduce the current risks posed by this trade, especially during the rainy season. That said, given the low costs for extracting and shipping the ore in Malaysia to China combined with relatively small base reserves of the ore (which could be depleted in 3-4 years), it is questionable whether investment in Malaysian bauxite refining will develop at all.

Moreover, alternative alumina generation processes are now taking hold domestically in China. Alumina production technology utilizing the waste product 'fly-ash' from the burning of coal is rapidly developing. The recovery of alumina from coal fly ash was first pioneered by Grzymek in Poland in the 1950s but it is thought that there are now over 100 patents in China for commercially viable extraction

of alumina from fly-ash. According to some research between 500-600 million tons of fly-ash is now produced from coal fired power stations annually in China and constitutes the single largest source of industrial solid waste.

Utilisation of this waste product has been on the agenda for some time now. The Chinese national Development & Reform Commission in 2011 stressed that a level of 75% fly-ash utilisation ought to be achieved by 2015. Traditionally this has only been achieved as an additive in the manufacture of cement and concrete. Now though, raw extraction of alumina is a reality with 2x typical processes now being used, the 'Acid Process' and the 'Base (sintering) Process'. The alumina content of fly-ash varies quite widely though but recent research has shown that the proven coal reserves with high content of aluminium in the Junggar basin, Daqing Shan mountain, and Zhuozi Shan mountain in Inner Mongolia is about 50 billion tonnes. It is expected that 15 billion tonnes of coal fly ash will be generated and 5 billion tonnes of alumina recovered, which is equivalent to 12 billion tonnes of bauxite and 3.2 times the proven bauxite resources in China.
As a result the Inner-Mongolia Melic Sea Ordos Al Co., Ltd. was established in 2006 and the Inner Mongolia Datang International Recycling Resource Development Co., Ltd. was established in 2007. Operations began in 2012 and today, the designed annual production capacity is 240 million tonnes of alumina and 200 million tonnes of active calcium silicate. The third phase of the project is expected to produce 500 million tonnes of alumina and 560 million tonnes of active calcium silicate with invested capital of 13.3 billion yuan. Similar enterprises have also sprung up.

Plants performing alumina recovery from coal fly ash in China.

Plant location	Company	Expected production capacity/million tonnes	Commissioning date	Recovery technologies
Etuoke banner, Erdos city	Inner-Mongolia Melic Sea Ordos Al Co., Ltd.	Alumina 0.4	2013	Lime–sinter followed by low-temperature Bayer process
Tuoketuo county, Hohhot city	Inner Mongolia Datang International Recycling Resource Development Co., Ltd.	Alumina 0.24, active calcium silicate 0.2	2012	Predesilication followed by lime–soda sinter
Tuoketuo county, Hohhot city	Inner Mongolia Datang International Recycling Resource Development Co., Ltd.	Alumina 0.5, active calcium silicate 0.56, zeolite 4A 0.1	2015	Predesilication followed by lime–soda sinter
Zhungeer banner, Erdos city	Inner Mongolia Datang International Recycling Resource Development Co. Ltd.	Alumina 0.5, active calcium silicate 0.469	2015	Predesilication followed by lime–soda sinter
Zhungeer banner, Erdos city	Shenhua Group Co., Ltd.	Alumina 1	2013	Acid leach
Zhungeer banner, Erdos city	Inner Mongolia Kaiyuan Ecological Aluminum Co., Ltd.	First-phase project: alumina 0.4, Si-rich product 0.12, second-phase project: alumina 0.6, Si-rich product 0.18	2015 or later	Ammonium sulfate sinter
Zhungeer banner, Erdos city	Huadian Inner Mongolia Energy Co., Ltd.	Alumina 0.055	2013 or later	Ammonium sulfate sinter
Etuoke banner, Erdos city	Inner Mongolia Erdos Electrical Metallurgical Co., Ltd.	Alumina 1, silica white 0.51, sodium silicate 0.77	2015 or later	Acid leach followed by Bayer process
Qingshuihe county, Hohhot city	Inner Mongolia Tongsheng Electric Power Co., Ltd.	Alumina 1	2015 or later	Activation followed by water leach
Zhungeer banner, Erdos city	Erdos qianhengxing Industrial Co., Ltd.	First-phase project: alumina 1.2	2013 or later	–
Shuozhou city, Shanxi province	China Coal Pingshuo Coal Industry Co., Ltd.	Alumina 0.1, silica white 0.04	2013	Predesilication followed by lime–soda sinter
Baicheng city, Jilin province	–	Alumina 0.2, silica white 0.2	–	Alkali sinter-acid leach

Future considerations

As with Nickel ore and Iron ore fines, changing patterns in the underlying economic fundamentals of these trades are trending towards fewer volumes of the unrefined ores being transported from sensitive regions that typically have long rainy seasons. This is good news as such rainy seasons have become increasingly unpredictable and severe in their impact as a changing climate undermines past historical patterns. The immediate or near time outliers though are Malaysia as far as bauxite exports continue during its rainy season and the Philippines to the extent that low grade lateritic ores are still being shipped, again during its rainy season.

The flag state authority for the ***Bulk Jupiter*** and the IMO, along with many other industry special interest groups and the IG P&I Clubs have now issued warnings and recommendations about future

conduct in the Bauxite ore trade regarding liquefaction. It is questionable though to what degree these recommendations will be heeded given the current industry track record. Unless Malaysia voluntarily adopts (and enforces) domestic practices similar to those witnessed in India before iron ore exports subsided, it is quite possible that another liquefaction incident could occur whilst this trade continues (albeit perhaps only for another 3-4 years).

The same also applies to the Philippines to the extent that low grade nickel ores continue to be exported.

Lastly, another possible future outlier is Vietnam, which unlike Malaysia has the 4th largest bauxite reserves globally but a similar monsoon season. If Vietnamese efforts to develop its domestic alumina smelting capacity continue to stall or cease altogether, it is likely that China will capitalize on its even closer proximity than Malaysia and low extraction costs to stimulate unrefined ore exports to support its vast alumina smelting capacity.