



**CSA Global**  
Mining Industry Consultants

# Unlocking ASEAN Mineral Potential

learning from the past, looking to the future

Neal Reynolds

Director, CSA Global Pty Ltd

APMREC 2016, Kuala Lumpur





# About CSA Global



## CSA Global

Mining Industry Consultants



EXPLORATION



RESOURCES



MINING



TECHNOLOGY



CORPORATE

CSA Global is a leading mining, geological, technology and management consulting company providing strategic services and advice to companies in the international mining industry.

Our team of specialists include geologists, mining engineers, project managers, data management professionals, and technology (IT) personnel.



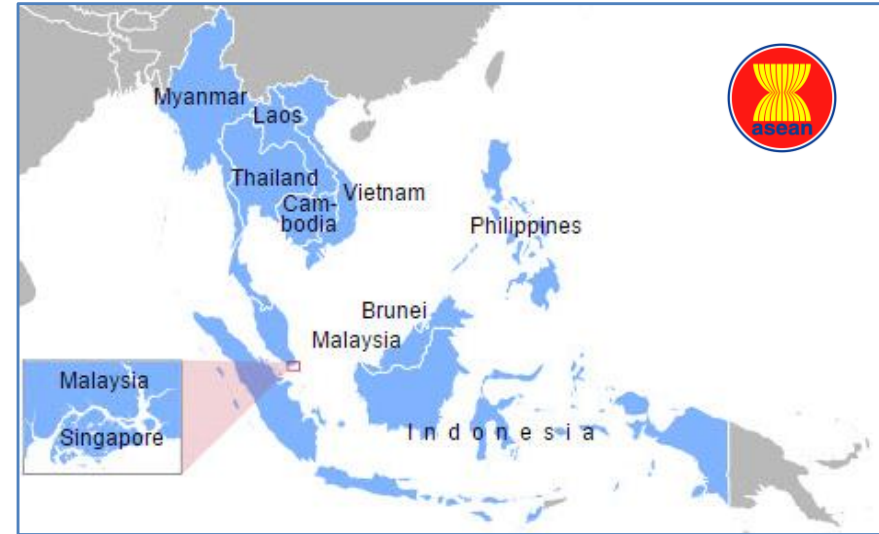


- 1984** : CSA Group was founded in Ireland.
- 1986** : Australian branch setup in Perth, later incorporated as CSA Australia.
- 1990** : Lisheen discovery, first international growth phase.
- 2000** : Diversification strategy – commodities, services, regions.
- 2006** : Acquisition of Finore P/L, CSA Consulting International established.
- 2008** : CSA Australia renamed as CSA Global, CSA Global UK office opened.
- 2009** : Additional Australian branch office opened in Darwin, Northern Territory.
- 2010** : Indonesian office opened, new headquarters in West Perth, Western Australia.
- 2011** : Third Australia branch office opened in Brisbane, Queensland.
- 2012** : Opened an office in Johannesburg, South Africa and a branch office in South Australia. Acquired Revelation Geoscience Ltd in Vancouver, Canada.
- 2013** : Established CSA Global Rus in Moscow to service the CIS region.
- 2014** : CSA Global Singapore office established.
- 2016** : CSA Global Toronto and Dubai offices established.





- More than 20 years experience throughout Southeast Asia
- CSA Global subsidiaries in Singapore & Jakarta, associates throughout the region
- Projects undertaken from regional targeting to exploration to production
- Independent consultancy role – provides investor, government & community perspective
- CSA Global history and global exposure provides a unique view to ‘benchmark’ the mining industry in Southeast Asia



Lisheen Zn-Pb-Ag Discovery, Ireland, 1992; managed by CSA Global



Cho Don Zn-Pb-Ag Project, Vietnam, 1994; managed by CSA Global





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# History of Mining in Southeast Asia



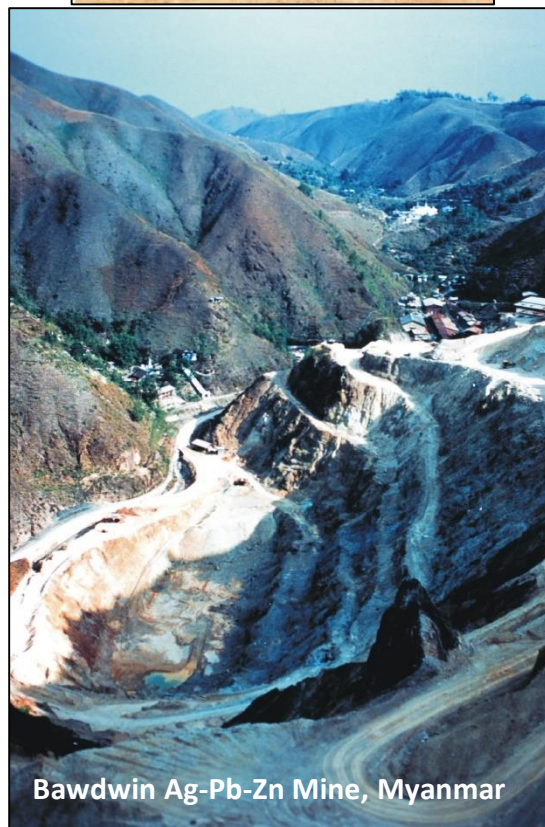
## Historical

- Long mining history – Bronze age mining and smelting in Thailand, Vietnam and Lao; Ban Chiang, Phu Lon
- Ancient shafts uncovered at the Khanong pit, Sepon Copper Mine
- Historic mining, especially of gold, underpinned the great Southeast Asian civilisations
- Colonial period saw larger mines developed – e.g. **Bawdwin** (Myanmar), **Lepanto** (Phillipines), **Lebong Tandai** (Indonesia), **Cho Dien** (Vietnam), **Bau** (Malaysia) **SE Asia Tin Belt** (mostly alluvial/colluvial), **Malaysian Gold Belt** etc.

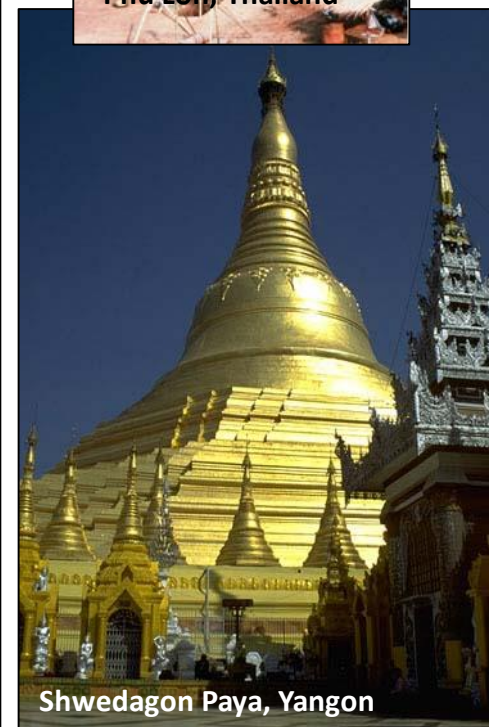
2000 BP mine shafts,  
Khanong, Lao



Phu Lon, Thailand



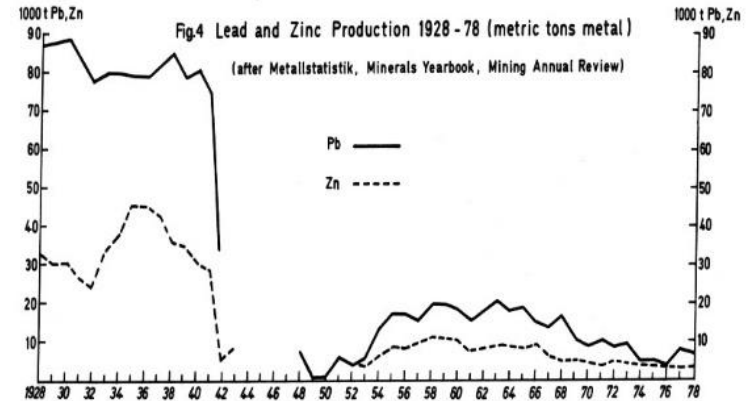
Bawdwin Ag-Pb-Zn Mine, Myanmar



Shwedagon Paya, Yangon

## Post-Colonial – Cold War & Vietnam War

- Nationalisation in several countries, degradation of old mines and reduction of mineral production, e.g. Myanmar
- Expansion of tin mining (gravel pumps and dredges) in the SE Asia Tin Belt until price collapse in 1985

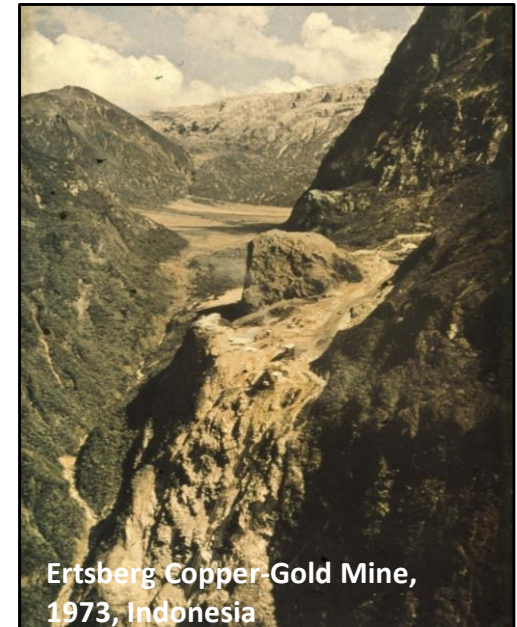


Myanmar Zn-Pb production



## Post-Colonial – Cold War & Vietnam War

- Nationalisation, degradation of old mines
- Expansion of tin mining (gravel pumps and dredges) until price collapse in 1985
- Limited exploration and new mine development, except:
  - Indonesia – CoW system stimulated regional exploration and mine development; **Ertsberg, Soroako, Pomalaa Ni Laterite**, etc.
  - Philippines – strong colonial-era mining industry continued with indigenous and foreign capital; **Lepanto, Atlas, Benguet Marcopper**, etc., also Ni laterite, **Surigao** etc.
- Often poor environmental controls when mines were developed, e.g. **Mamut** (legacy AMD issues), **Monywa** (concentrate plant, tailings spill), **Kyaukpahto** (concentrate plant and roaster, tailings spill), **Ertsberg** (riverine tailings disposal)



## Post-Cold War – Globalisation

- Increased appetite for foreign investment to deliver growth; **new mining laws** in several jurisdictions
- Socialist states investment liberalisation; Đổi Mới etc.
  - Lao MEPA system introduced – led directly to the **Sepon** and **Phu Bia** discoveries
  - Vietnam & Myanmar; brief phase of foreign investment
- 1990's mining boom – increase in exploration activity across the region, especially Indonesia
- A few big mines developed, e.g.:
  - Indonesia; **Batu Hijau, Mesel, Gosowong, Mt Muro, Kalimantan coal, Sulawesi Ni-laterite**
  - Lao; **Sepon, Phu Bia**
  - Thailand; **Padaeng (1980s), Chatree**
  - Myanmar; **Monywa** redevelopment (heap-leach/SX/EW)
  - Philippines; ..... **Rapu-Rapu, Ni-laterite**
  - Malaysia; **Penjom**
- Rising standards in the international mining industry; general acceptance of high environmental standards and a “**social license to operate**”

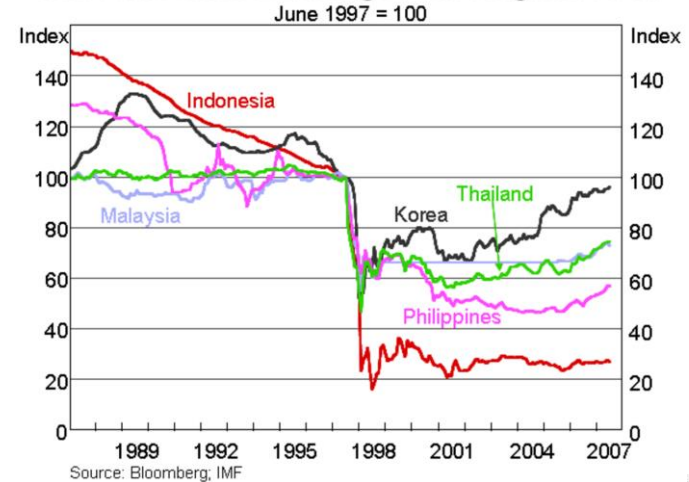




## 1998-2004 Downturn

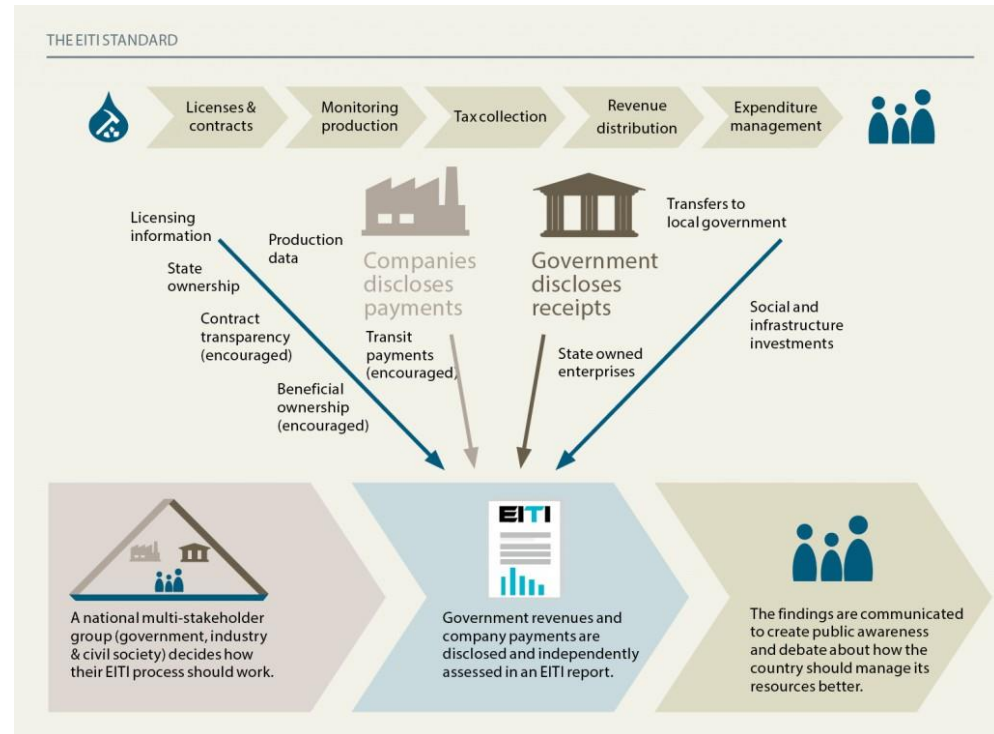
- Global mining industry downturn of late 1990's terminated the 'mini-boom' in Southeast Asia exploration
- Asian financial crisis and Bre-X fraud provided a "triple whammy"
- Coincided with rising resource nationalism and environmental & community anti-mining activism
- Indonesia CoW system suspended
- Projects stalled, e.g.:
  - Thailand; **Udon Thani potash, Phu Thep Cu-Au**
  - Philippines; **Tampakan Cu-Au, King-King Cu-Au**
  - Vietnam – **Nui Phao W-Cu-Au, Ban Phuc Ni, Da Lat bauxite**
- Increasing environmental awareness often stimulated by other natural resource exploitation, especially logging; e.g. 1988 Thailand floods led to establishment of conservation forests & watershed reserves

**Selected Asian Exchange Rates Against US\$**



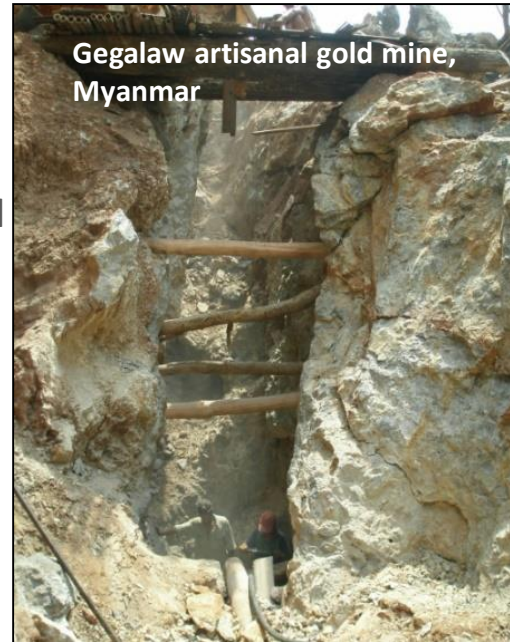
## 1998-2004 Downturn

- 2002 Extractive Industry Transparency Initiative (EITI; <https://eiti.org/>) initiated by industry – address two-sides of the problem; dysfunctional regulatory systems & corruption a greater issue than resource imperialism & multinational greed
- Indonesia (2010), Philippines(2013) & Myanmar (2014) now members
- However, limited bureaucratic or political buy-in to responsible mining industry development in SE Asia

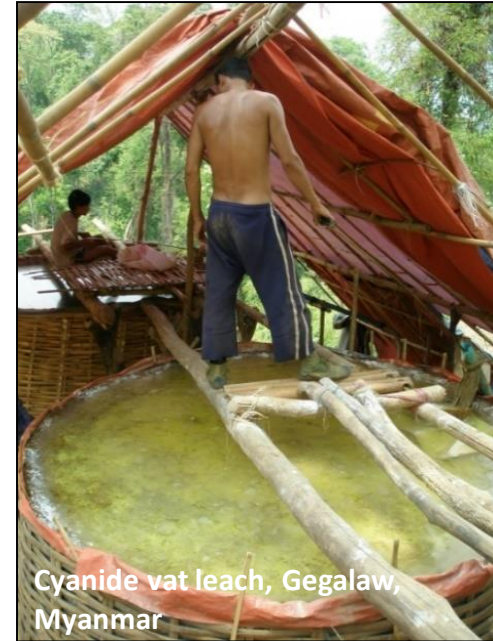


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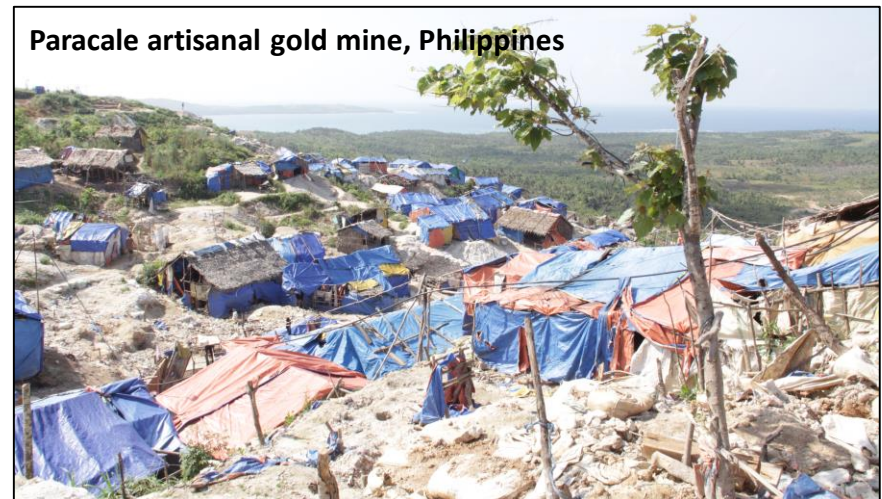
- 2002 Extractive Industry Transparency Initiative (EITI) initiated by industry – address two-sides of the problem; dysfunctional regulatory systems & corruption a greater issue than resource imperialism & multinational greed
- Little bureaucratic or political buy-in to responsible mining industry development in SE Asia
- Increasing scale & extent of ‘informal’ mining reflecting social issues, increasing organisation, & demand for resources due to economic growth in the region
- Fuelled by corruption and capacity failure; short-term return for the few wins out over long-term economic benefit for the many



Gegalaw artisanal gold mine, Myanmar



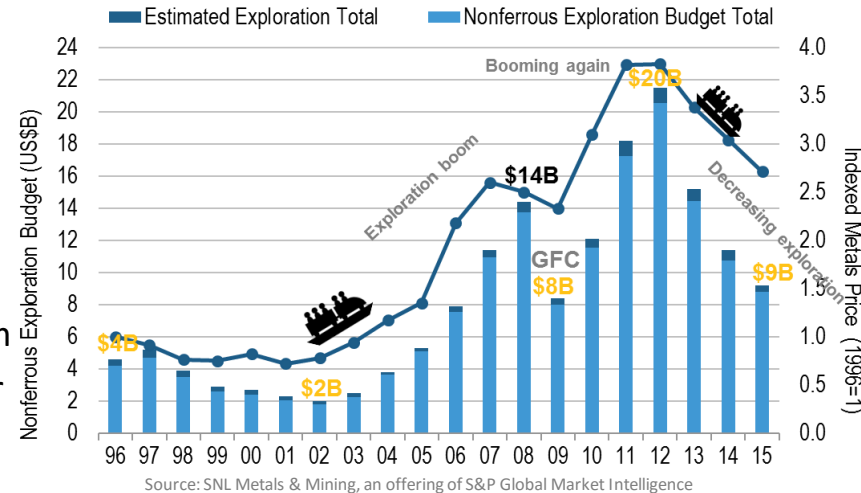
Cyanide vat leach, Gegalaw, Myanmar



Paracale artisanal gold mine, Philippines

## 2005-2012 Commodities 'Supercycle' Boom

- Commodities driven to peaks by China growth
- Mainland SE Asia
  - Limited exploration and almost no significant new mine developments; reflects continuing unfavourable investment regimes, e.g. end of MEPA system in Lao PDR
  - **Nui Phao** W-Cu-Au-Bi-F, **Ban Phuc** Ni in Vietnam
  - **Okvau** Au discovery in Cambodia – new frontier for exploration
- Indonesia
  - Exploration & development continued on CoW's; e.g. **Martabe** Gold Mine
  - **Coal and Ni boom** – contributed to environmental problems in Indonesia and Philippines and negative feedback for industry
  - Exploration stalled, CoW freeze and IUP system
- Philippines
  - Limited exploration & development, **Co-O**, **Dinkidi**, **Masbate** gold mines; **Boyangan** porphyry Cu-Au discovery

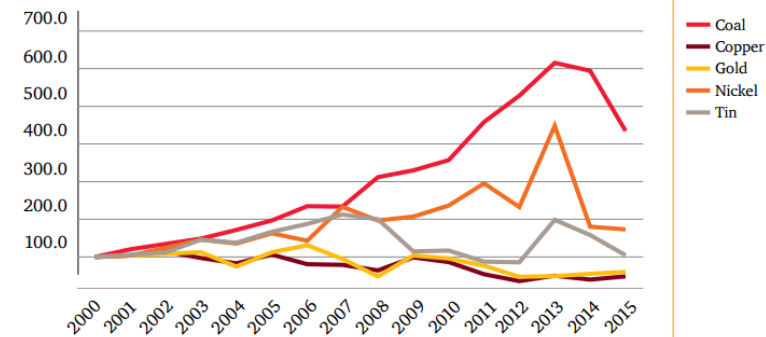


## Boom to 2012-2016 Crash

- SE Asia missed the boom, with the partial exception of Indonesia
- **Boom in SE Asia mostly occurred in poorly regulated mining by small-scale operators & artisanal miners**
- Larger Ni-laterite, coal and bauxite mines also often developed to poor standards
- 2012-2016 downturn crippled the industry, coinciding with rising resource nationalism
- Export ban in Indonesia devastated mining and exploration
- Continuing delays in project development in the Philippines; new political uncertainty
- Myanmar political changes open up a new frontier?
- Licence moratoria in Lao, Cambodia, Thailand
- **No movement anywhere in SE Asia to encourage responsible risk investment through best-practice operational frameworks**

## Indonesia coal & mineral production

Coal and mineral production



Source: Coal is from MoEMR and Petrominer (January 2016), whilst the minerals are from the US Geological Survey.

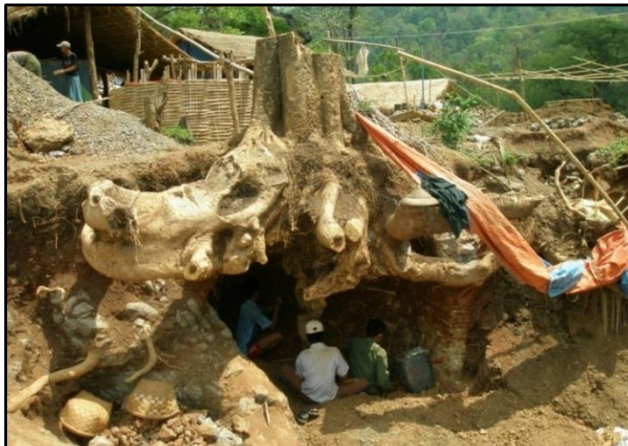
## Illegal laterite strip mining by Chinese-Philippine consortium, Philippines



## Where to from here?

- High mineral potential and limited exploration, especially modern exploration, enhances opportunities for shallow discovery in many parts of the Southeast Asia region
- Limited past exploration means that **high-risk investment in exploration** is essential to underpin discovery and mining industry development
- Responsible investment can underpin a modern best-practice mining industry with community support & limited environmental footprint
- Major potential contributor to growth especially in underdeveloped countries & regions
- Exploitation of local people for a short-term quick buck or responsible investment in exploration and mining for the benefit of all stakeholders?

THIS



OR  
THIS?







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# Exploration and Mining Investment Drivers and International Perception of Southeast Asia





## Macro factors



- Provide operating paradigm but cannot be locally influenced, e.g.:
  - World economy – *growth, urbanisation, standard of living*
  - Commodity prices – *growth & demand / supply issues*
  - Access to capital – market sentiment driven

## Local factors



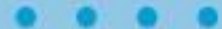
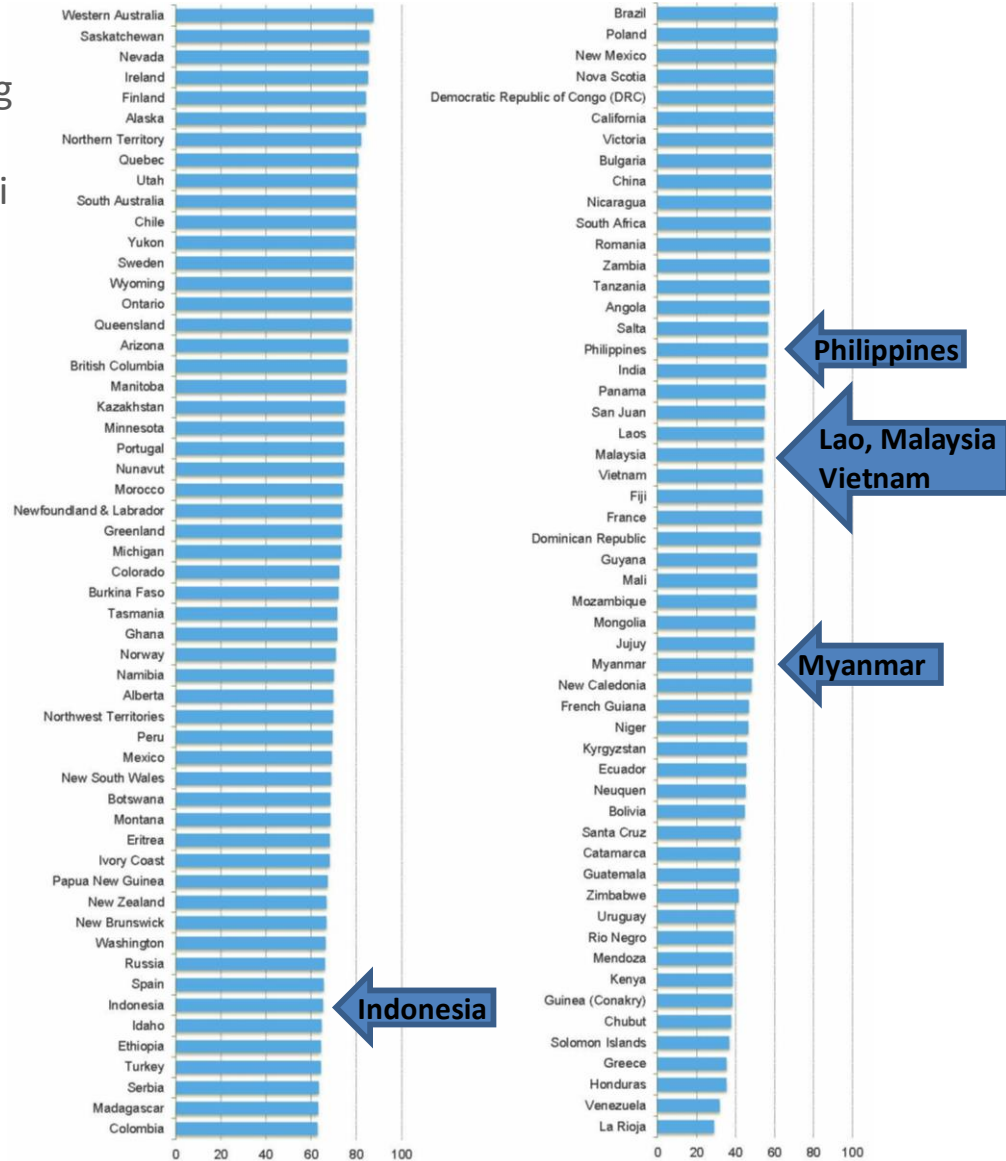
- Not influenced by economic development & policy settings, e.g.:
  - Geological – well endowed in economic minerals
  - Prospectivity – *track-record* or under-explored
- Influenced by local economic conditions and policy settings
  - Regulatory & Operational
    - Regulatory environment – *laws, regulations, policy etc.*
    - Ease & cost of business set-up and administration
    - Data – *access to regional geological & exploration data, pre-competitive data availability*
    - Bureaucracy & corruption – *minimise for efficient operation*
    - Infrastructure framework – *transport, power, etc.*
    - Services & workforce – *availability and cost*
  - Security & health risks – *security, civil unrest, disease*



# How does SE Asia rate?



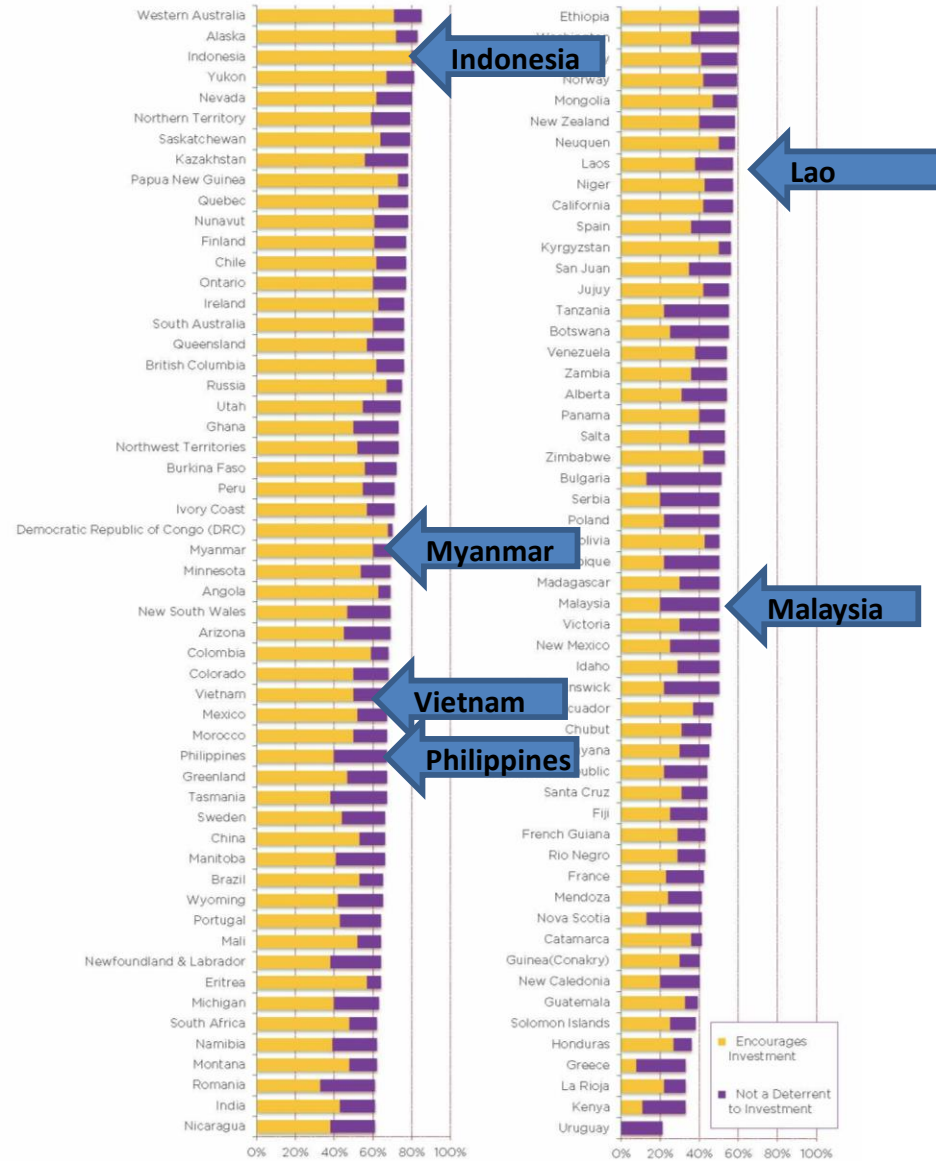
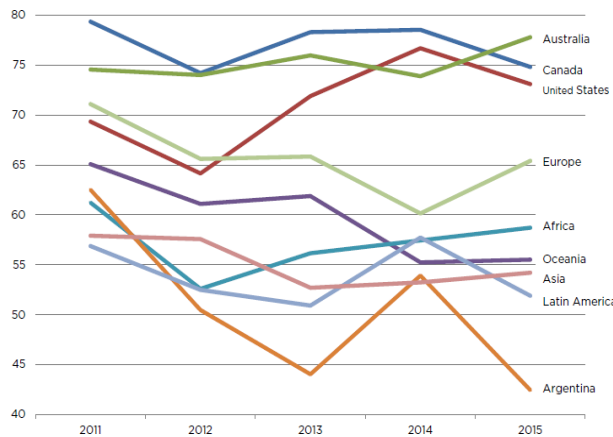
- Fraser Institute 2015 Survey of Mining Companies (<https://www.fraserinstitute.org/studies/annual-survey-of-mining-companies-2015>)
- **Investment Attractiveness Index** combines geological potential and investment framework
- Perception of SE Asia is poor to very poor in the international mining industry
- Investment perception is critical in terms of responsible mining industry investment



# How does SE Asia rate?



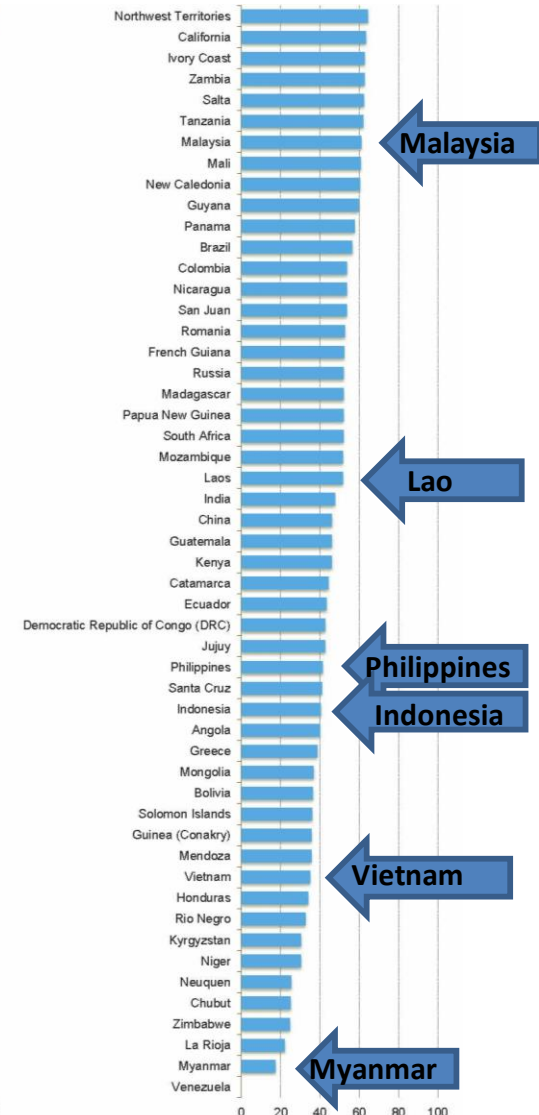
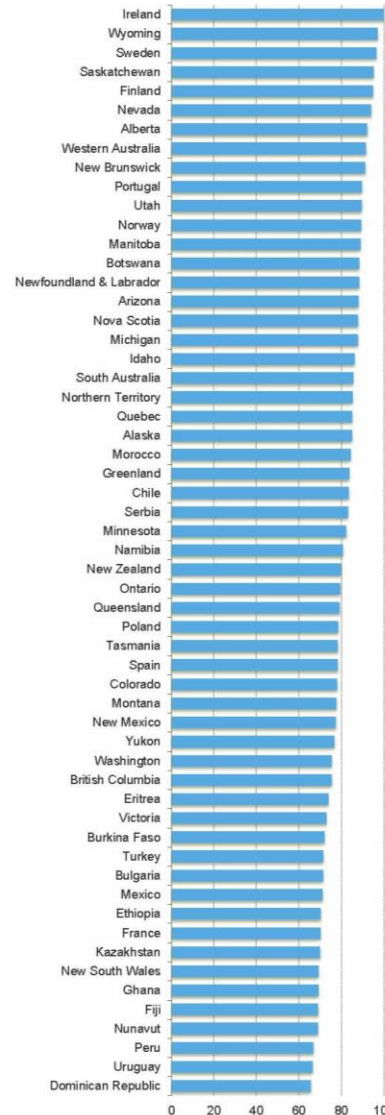
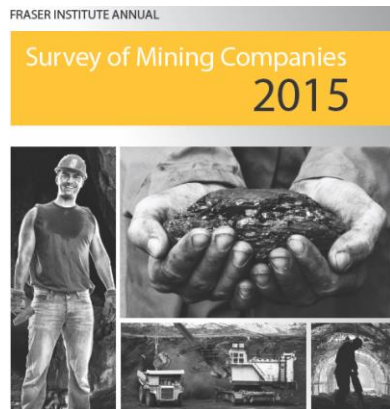
- Fraser Institute 2015 **Best Practices Mineral Potential Index** – perceived geological potential assuming ideal investment environment
- Local geological factors without influence by government factors
- Perception of SE Asia mineral endowment and prospectivity is positive
- Highlights OPPORTUNITY to attract foreign investors by modifying investment environment



# How does SE Asia rate?

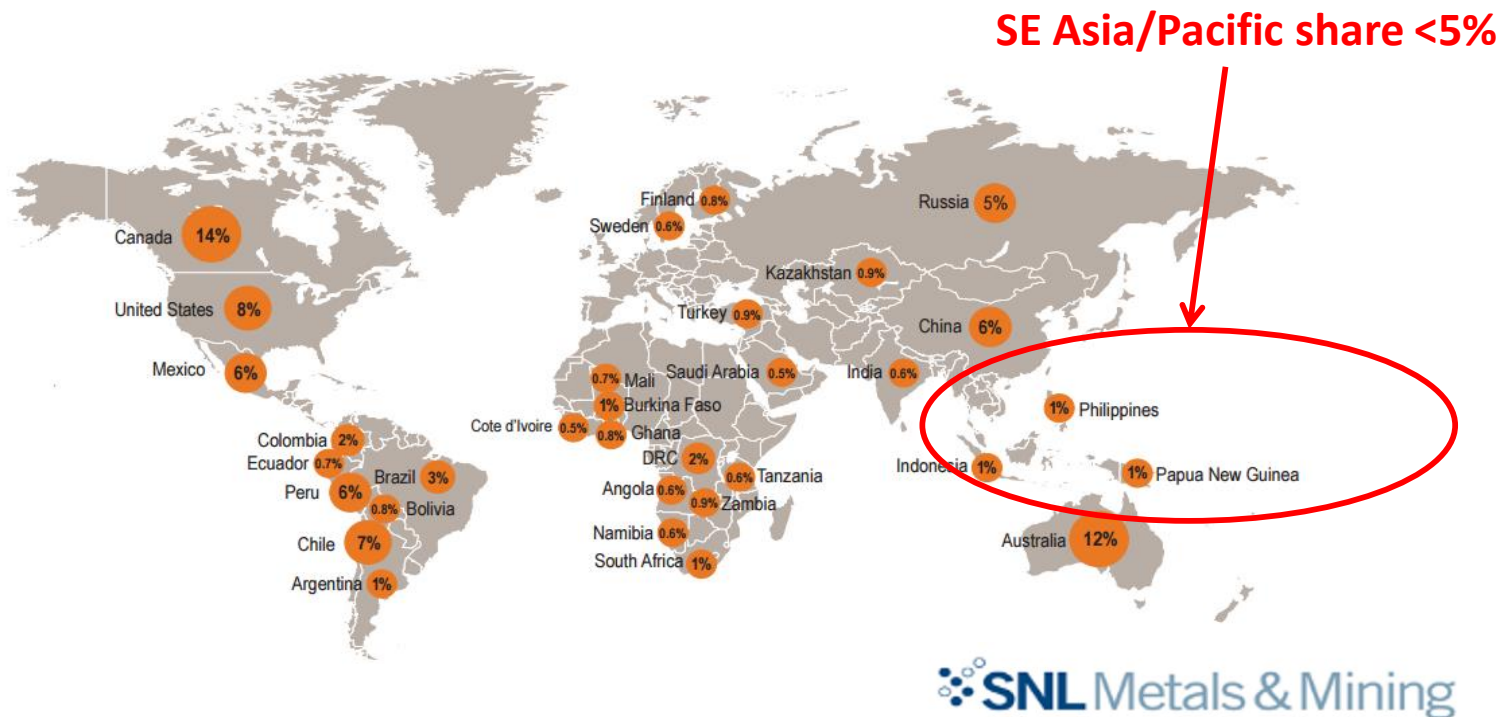


- Fraser Institute 2015 **Policy Perception Index**
- Local regulatory and operational factors that can be influenced by government laws, policy & procedures
- **The international perception of SE Asia jurisdictions is poor to abysmal**
- Presents OPPORTUNITY to attract investment to match perceived potential by modifying policy settings



# 2015 Exploration Budgets

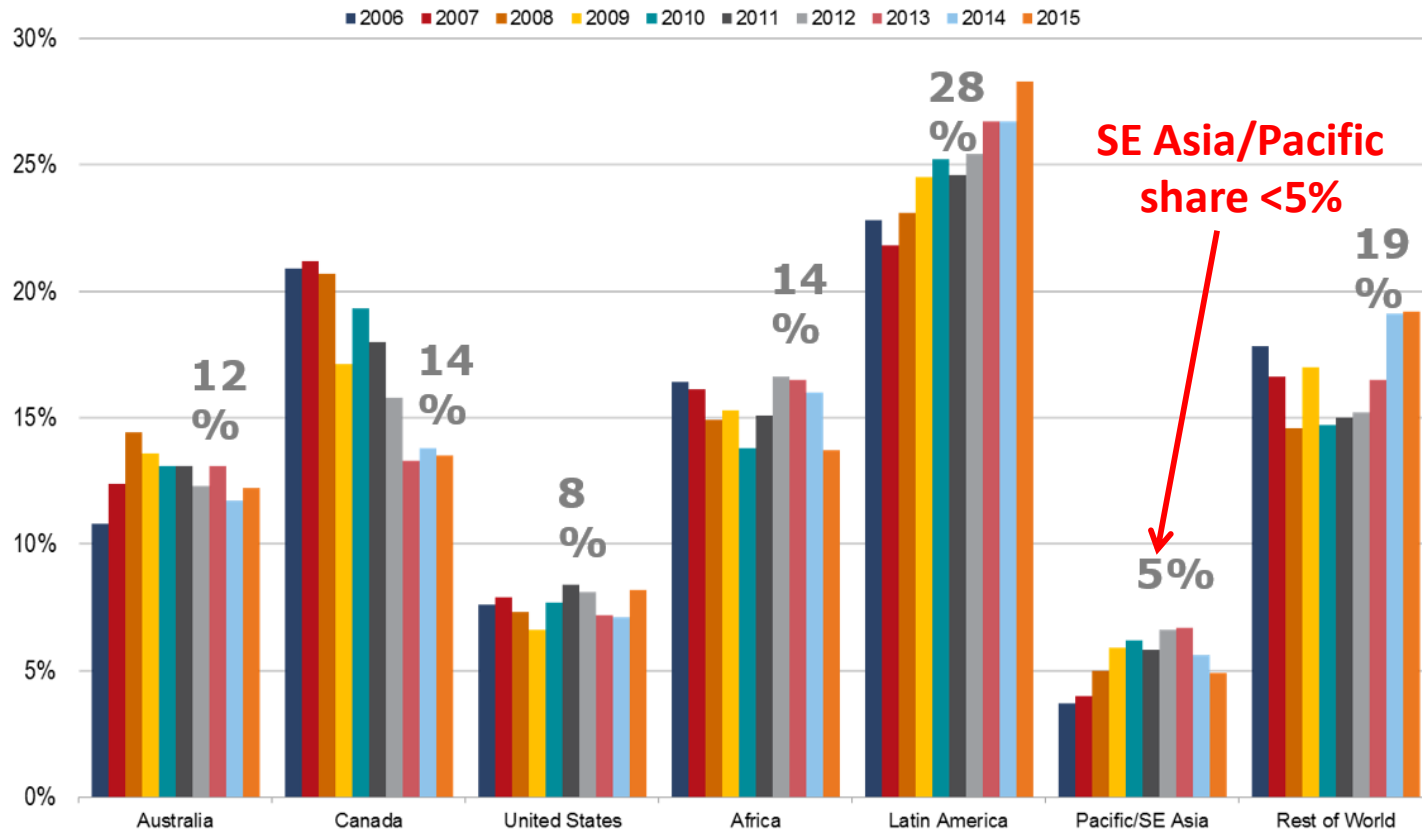
- Worldwide non-Fe exploration budgets fell by 19% in 2015
- SE Asia attracts a tiny and falling proportion of global exploration budgets
- Most of this is in Indonesia, Philippines and PNG; mainland SE Asia attracts minimal investment in exploration
- Increased exploration will only occur with improved international perception that can only be achieved by improved policy settings operating environments



87 other countries and regional allocations account for 12.5%.

# 2015 Exploration Budgets

- SE Asia small and falling proportion of global exploration budgets



Source: SNL Metals & Mining, an offering of S&P Global Market Intelligence





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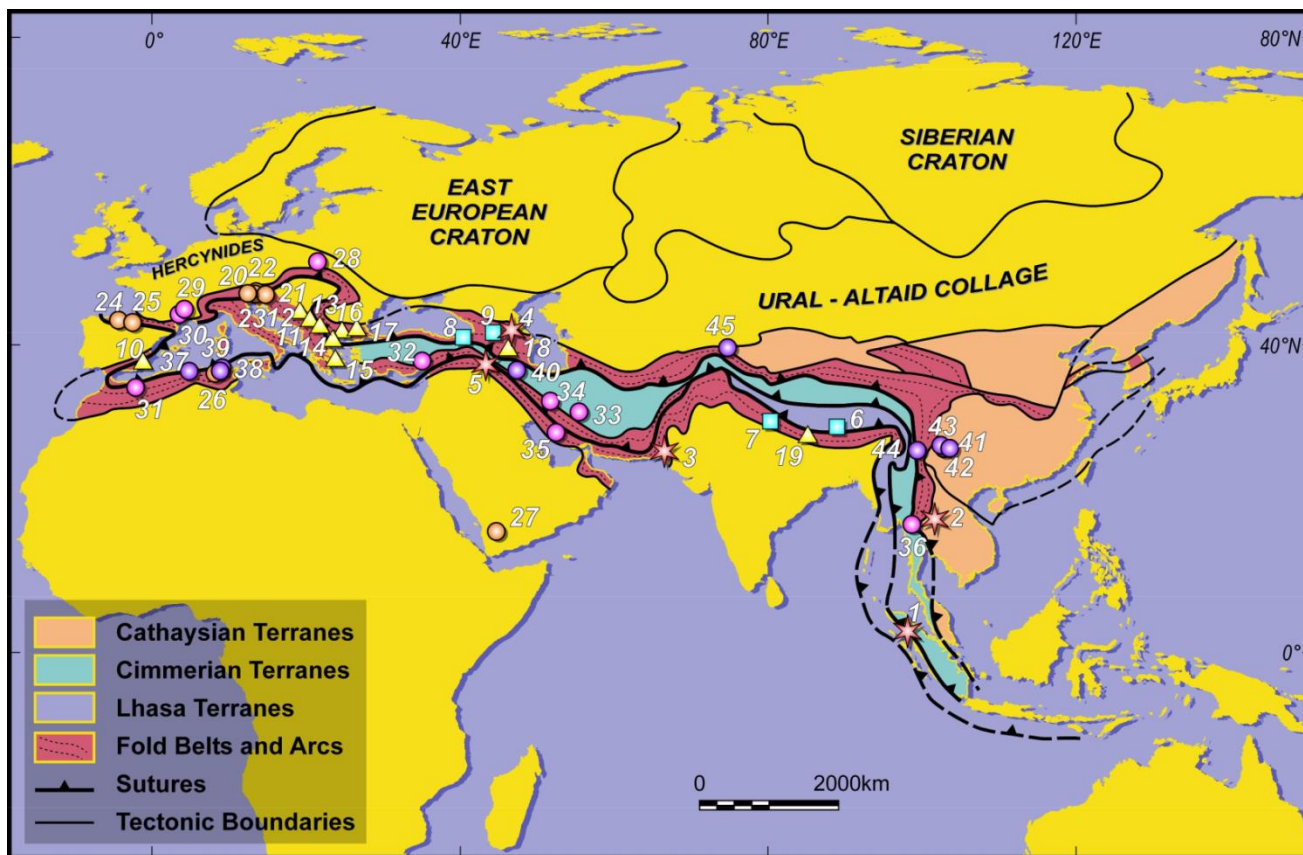
# Geology, Metallogeny, & Mineral Potential in Southeast Asia





# Geotectonic Setting

- SE Asia occupies the eastern Tethyan belt, long-lived Palaeozoic to Neogene orogenic belt
- Important metallogenic belt, accretionary terrains with volcanic arc belts and micro-continental blocks

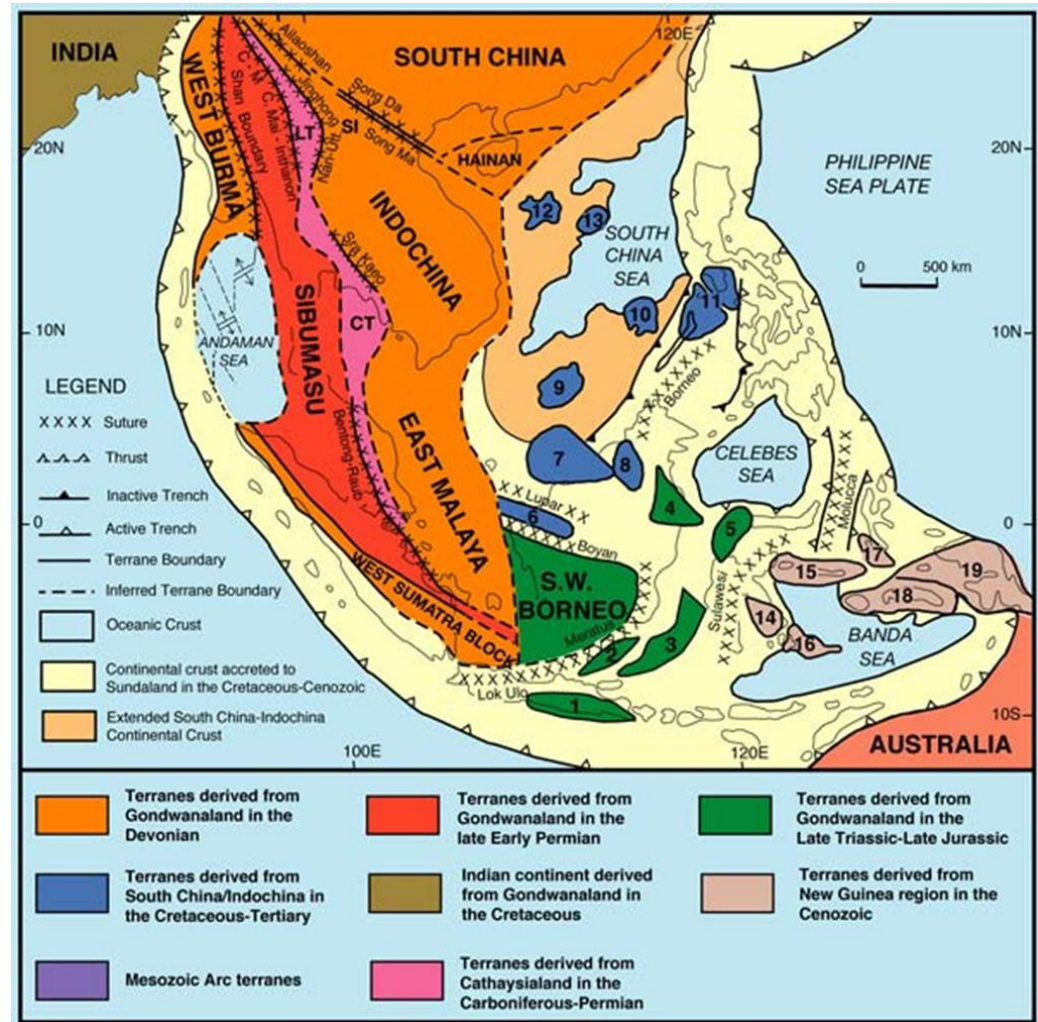


From Reynolds & Large, 2010, SEG Special Publication 15

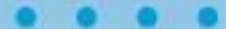


# Geotectonic Setting

- Mainland Southeast Asia is a collage of continental fragments rifted from Gondwana between the Devonian and Permian and accreted to Asia between the Triassic and Cretaceous
- Indonesia and Philippines represent the latest stage of this accretion as Australia moves north towards Asia
- Metallogenic history intimately related to cycles of rift, drift, convergence and collision

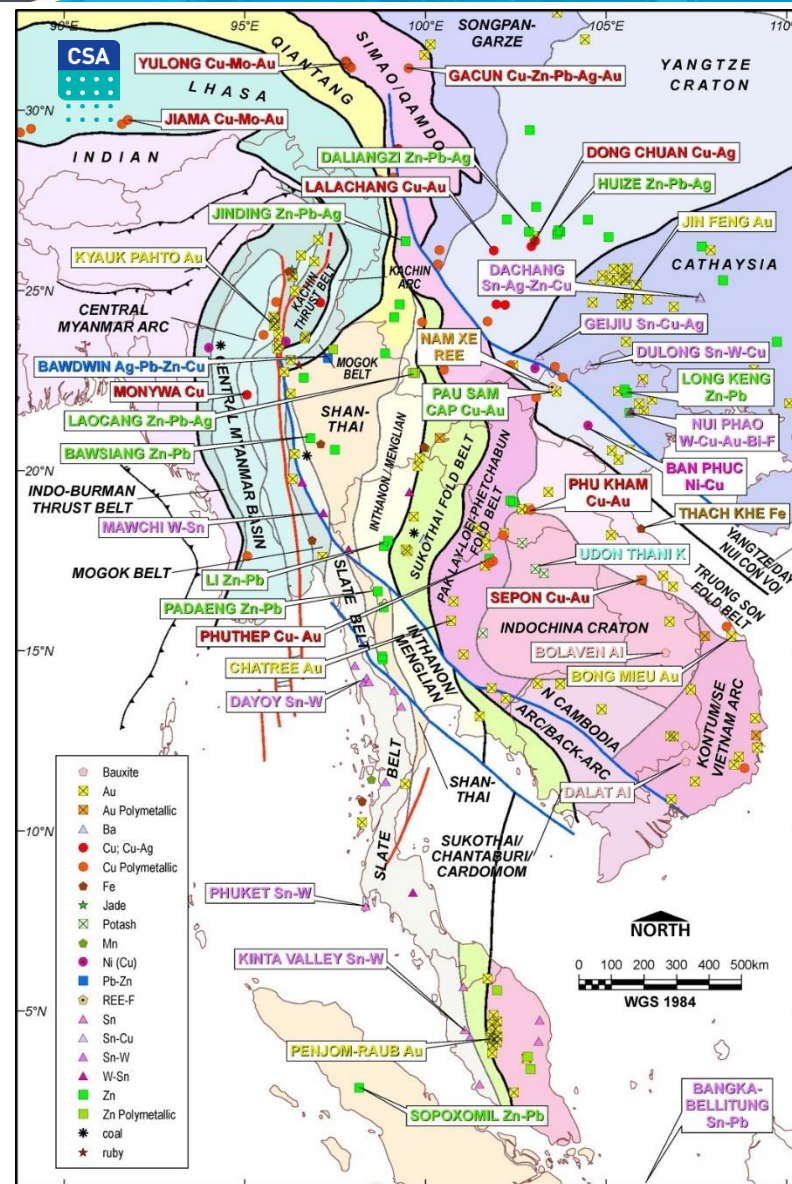


From Metcalfe <http://metcalfeian.com/web-data/Research/PalGeog/Palaeogeog.html>





- Large to world class deposits of **Cu**, **Cu-Au-Mo**, **Au-Ag**, **REE**, **Ni-Cu**, **Fe**, **Fe-Ti-V**, **Zn-Pb-Ag**, **Sn-W**, and **Al** exist in metallogenic belts that occur in SE Asia and adjacent China
- Mineral-system understanding in the context of regional metallotectonic belts can be used to prioritise potential and opportunities
- This provides a guide to **explorers** but also to **policy makers**
- **Understanding and promotion of the mineral potential on a metallogenic belt and mineral-system basis will help promote exploration in mineral exploration in Southeast Asia**





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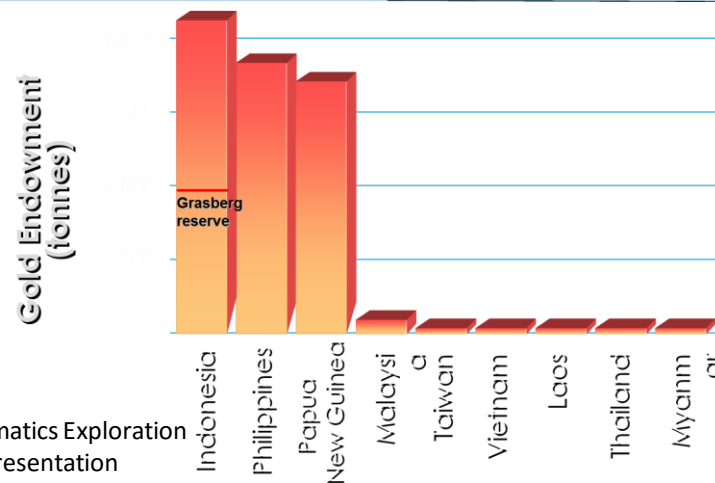
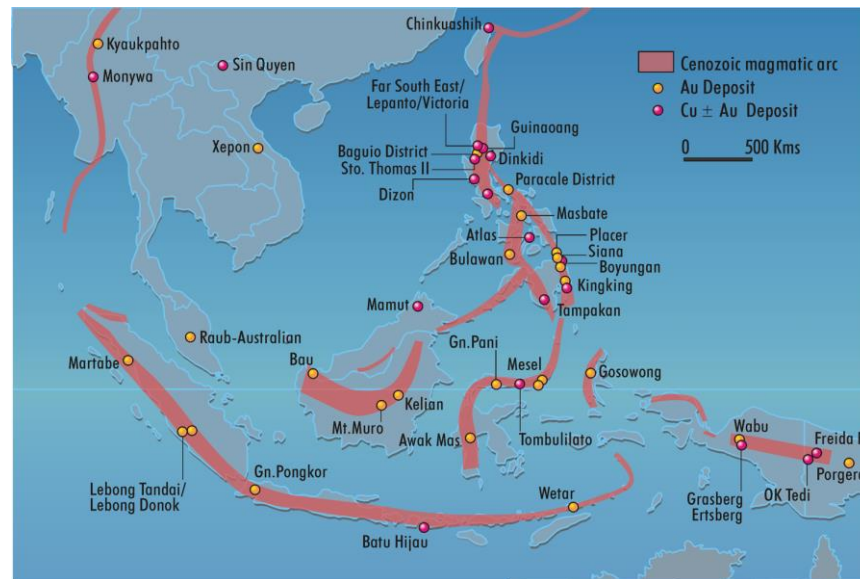
# Examples of Priority Mineral System Plays in Southeast Asia





## Tertiary Volcanic Arcs – Philippines, Indonesia & Myanmar

- World-class Cu-Au & Au orebodies – porphyry and epithermal; **Grasberg/Ertsberg, Lepanto/Far Southeast, etc.** etc.
- Miocene to Pleistocene age
- Complex, young active continental margins in convergent zone between Australia and Asia (Sundaland)
- **Philippines & Indonesia arc belts have potential to rival Latin America in Cu and Au production**
- Myanmar potential is constrained by limited extent of Tertiary arc volcanics (**Monywa, Kyaukpahto**)
- Older Eocene ‘reactivated’ arc-porphyry belt in NW Vietnam



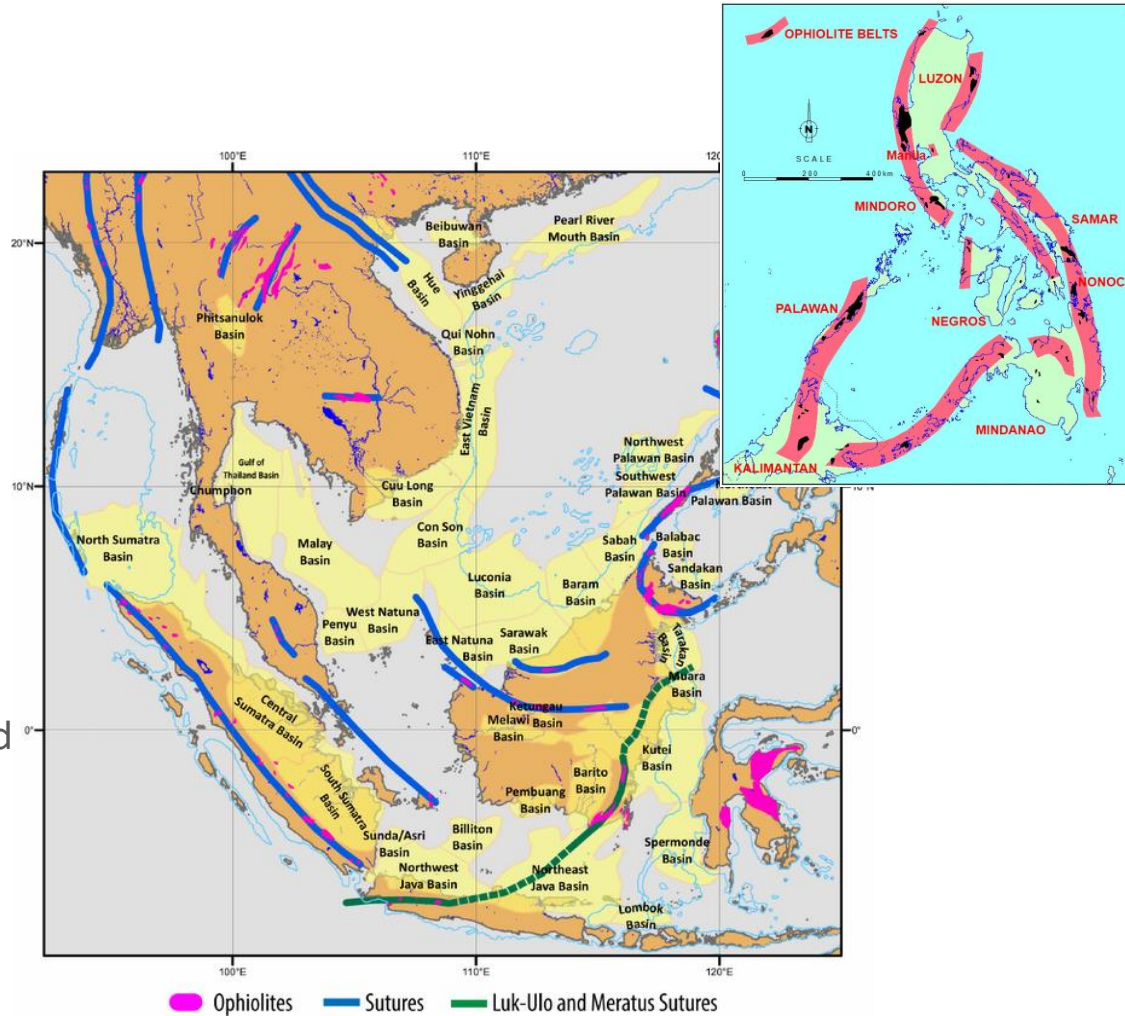
From S. Garwin, 2003, Geoinformatics Exploration Centre for Global Metallogeny presentation





## Tertiary Ophiolites – Philippines, Indonesia & Myanmar

- Globally important endowment of Ni-Co laterites; obducted ophiolites (oceanic crust) subjected tropical weathering
- Occur within the same complex, young and active continental margins as the arc-related Cu and Au deposits
- Collisional events emplaced ophiolites, slices of oceanic crust, notably Sulawesi, Halmahera, Philippines
- Myanmar ophiolites are related to an older Cretaceous collisional event – ophiolites are mostly steeply dipping and dismembered limiting lateritic Ni-Co potential



From Zahirovic et al., 2014, Solid Earth, 5, 227–273

## Tertiary Ophiolites – Philippines, Indonesia & Myanmar

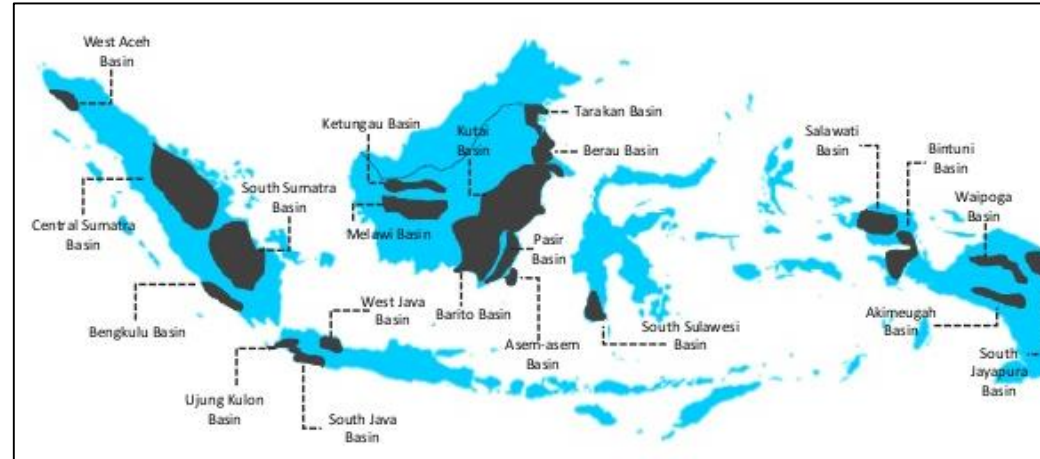
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- Myanmar ophiolites related to older collisional event – ophiolites mostly steeply dipping and dismembered limiting lateritic Ni-Co potential
- ..... **but JADE in metamorphosed ophiolites of Myanmar; provides Myanmar's most valuable mineral export**



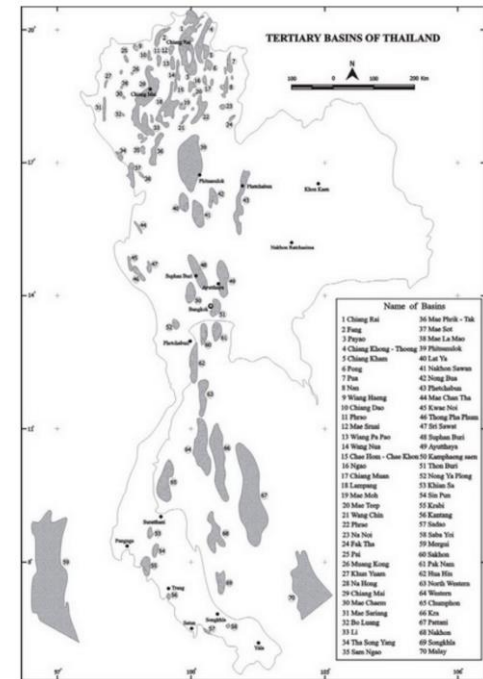


## Tertiary Basins – Coal

- Tropical deltaic environments and basins developed in back-arc settings in Indonesia; extensive coal measures especially in Kalimantan, also Sumatra & Papua
- Extensive deltaic coal measures in Myanmar
- More restricted pull-apart basins in Thailand, Lao, Philippines
- Key to economic potential is maturation; rapid subsidence & burial +/- magmatic heat
- Thermal bituminous & coking coal in Indonesia, brown coal in mainland SE Asia
- **Drove Indonesia to No. 5 global coal producer in 2015**



Indonesia coal basins;  
Geology Agency MEMR, 2014

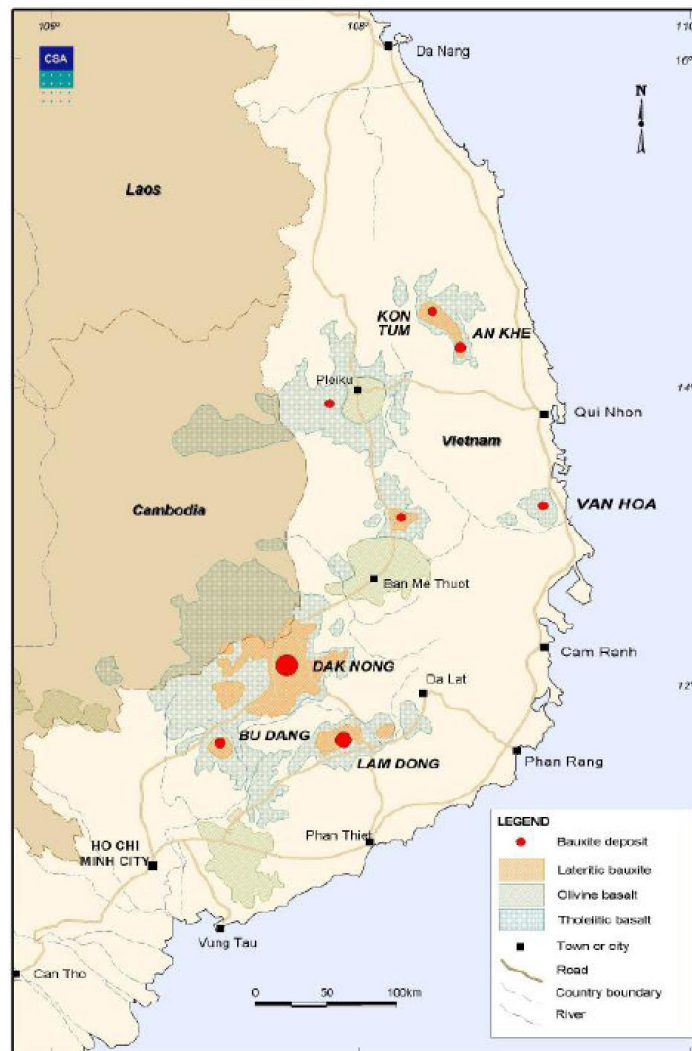


Tertiary basins in Thailand

[http://www.dmr.go.th/main.php?filename=GeoThai2015\\_\\_\\_EN](http://www.dmr.go.th/main.php?filename=GeoThai2015___EN)

## Tertiary magmatism & Weathering – Bauxite, REE, & Gems

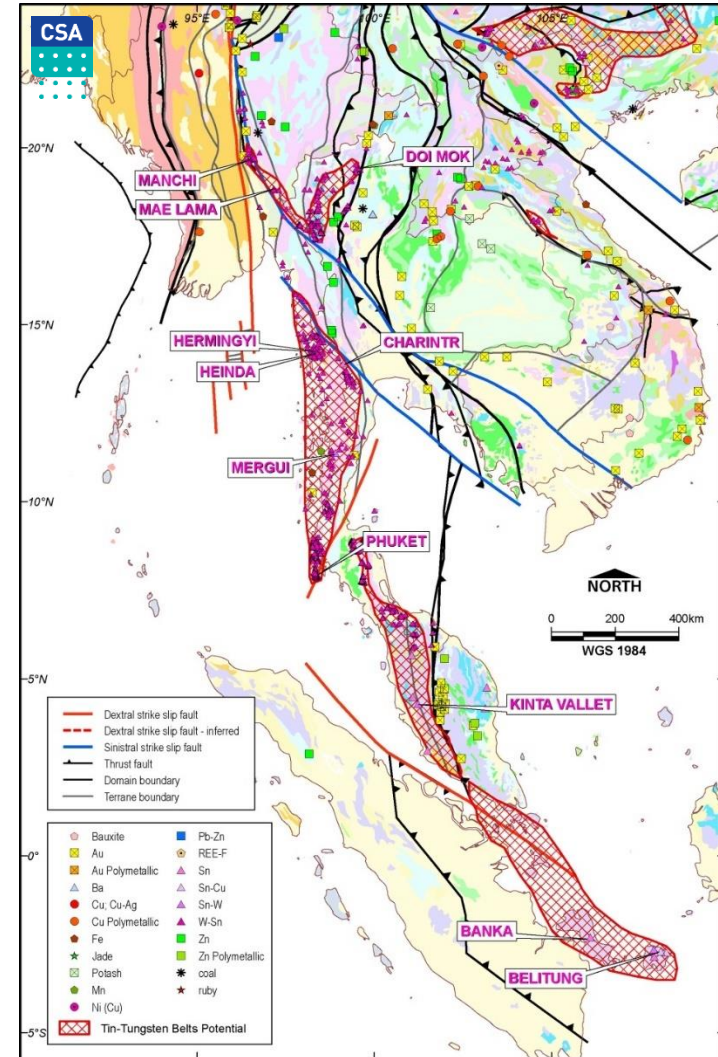
- **Globally significant bauxite resources** in Vietnam, Cambodia & Lao
- Intense tropical weathering of Plio-Pleistocene flood basalts; related to extensional magmatism following Indian collision with Asia
- Significant bauxite resources also occur in Malaysia, Indonesia
- Other weathering deposits; potential for “Ionic” REE potential related to weathering of A-type Mesozoic to Eocene granites
- Gem fields of Cambodia and Thailand also related to the flood basalts
- Mogok Belt of Myanmar – rich gem deposits, especially rubies





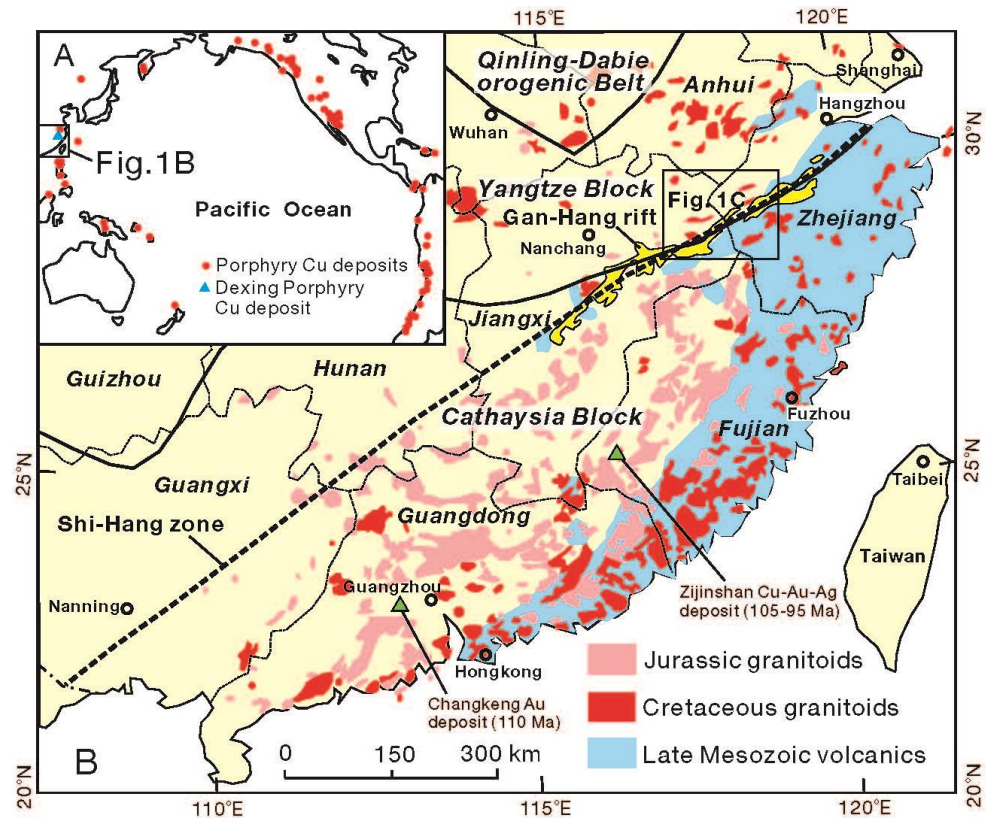
## Mesozoic-Palaeogene Granites – SE Asia Tin Belt(s)

- 2800 km long belt from eastern Myanmar Thailand and Malaysia to the Indonesian “Tin Islands” of Bangka and Belitung
- Total estimated production c. 9.6 Mt of tin, or **54% of the world's historical tin production**
- Mainly related to two evolved granite belts:
  - Central or Main Range belt; Late Triassic age S-type biotite granites resulting from crustal thickening following Indosinian collision.
  - Western belt; Late Cretaceous I-type/A-type granites in an extensional Andean-type continental back-arc setting following West Burma arc collision
- Most production from palaeo-placers, much from offshore dredging
- **Almost no modern exploration focused on hard-rock potential**



## Yanshanian Jurassic-Cretaceous Continental Arc

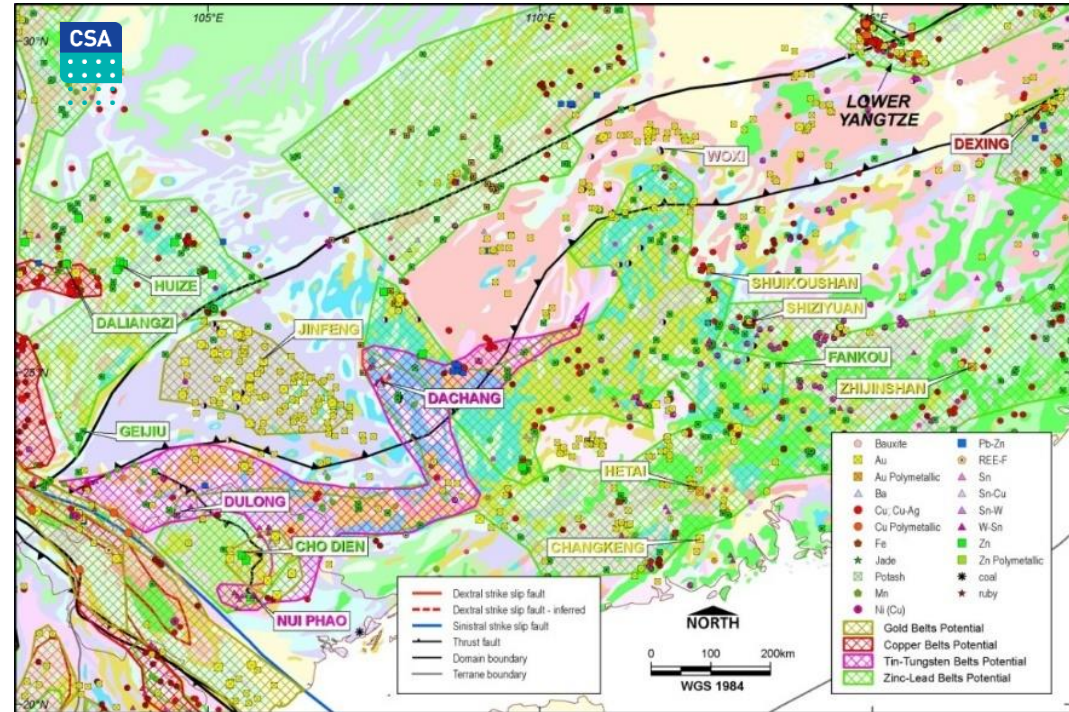
- Extensive and large mineral systems accompanying staged Jurassic and Cretaceous continental arc magmatism on the SE China margin
- Huge economic importance in China; Au (Zijinshan, Jinfeng), Cu (Dexing, Lr Yangtze), Sn (Geijiu, Dachang), Zn-Pb (Fankou)



Source: Zhou et al., Economic Geology 107, pp. 1507-1514

## Yanshanian Jurassic-Cretaceous Continental Arc

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- Huge economic importance in China; Au (**Zijinshan, Jinfeng**), Cu (**Dexing, Lr Yangtze**), Sn (**Geijiu, Dachang**), Zn-Pb (**Fankou**)
- Extensions in Vietnam & Cambodia; **Okvau; Nui Phao**
- **Nui Phao** Project in N Vietnam; complex skarn-hosted polymetallic deposit, 97 Mt at 0.18%  $WO_3$ , 7.73%  $CaF_2$ , 0.18% Cu, 0.08% Bi, and 0.18 g/t Au

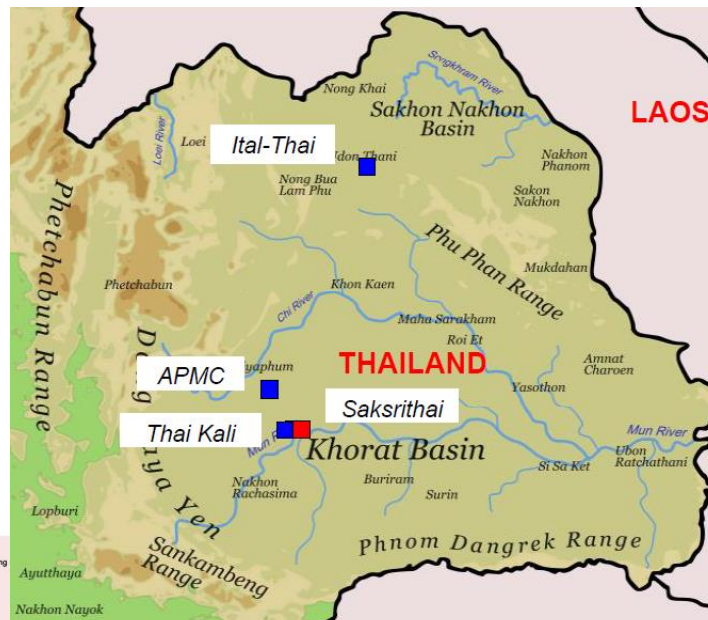


Source: CSA Global



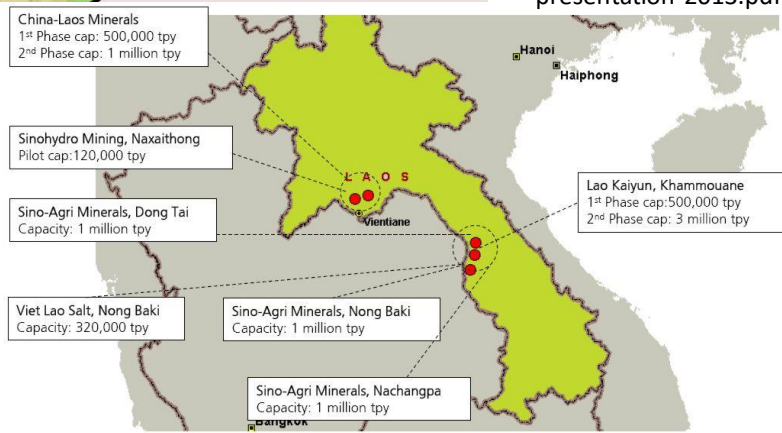
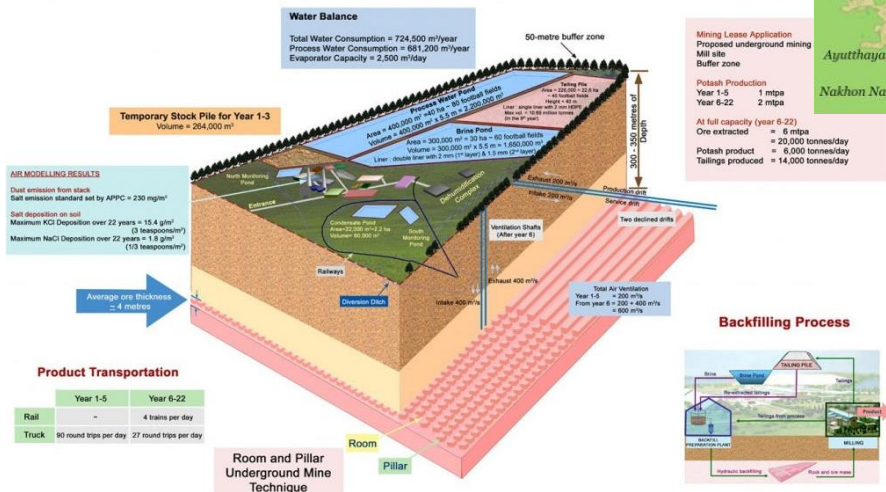
## .... and behind the Jurassic-Cretaceous Arc

- Arid continental red-beds and evaporites in foreland basins with periodic marine influx
- Korat and Sakhon Nakhon Basins, mainly in Thailand but extending into Laos
- Globally significant potash resources, potentially >400 Bt



Thai potash projects;  
<http://rockstone-research.com/index.php/en/research-reports/1251-Vatic-Ventures-is-back>

Lao potash projects;  
<https://www.integer-research.com/wp-content/uploads/2013/11/Potash-webinar-presentation-2013.pdf>

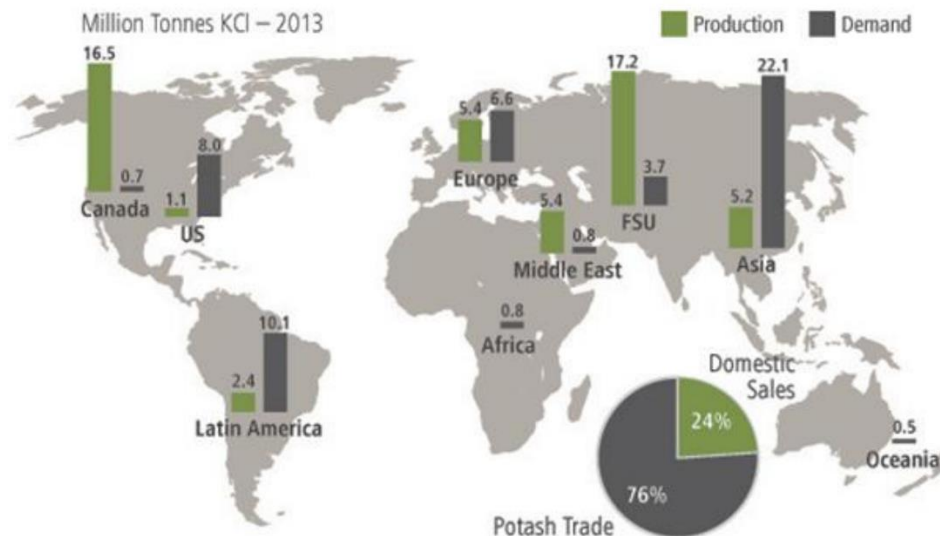


Udon Thani Potash Project, Ital-Thai; <http://www.udonmap.com/udonthaninews/udon-than>



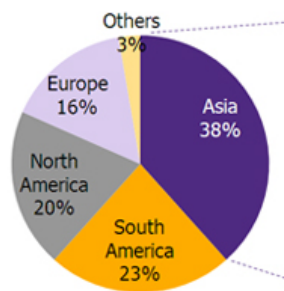
## .... and behind the Jurassic-Cretaceous Arc

- Arid continental red-beds and evaporites in foreland basins with periodic marine influx
- Korat and Sakhon Nakhon Basins, mainly in Thailand but extending into Laos
- **Globally significant potash resources, potentially >400 Bt**
- Located next to the largest global market but remains largely undeveloped
- Thai government in 2015 announced renewed support for development ...
- Projects in Lao more advanced



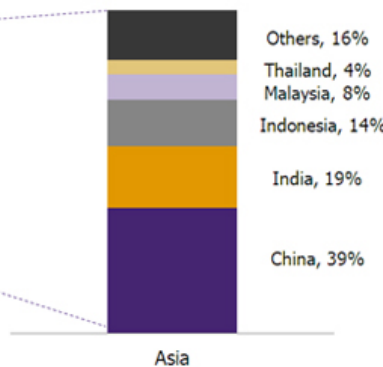
<http://www.argusmetalscorp.com/i/pdf/Argus-Potash-Presentation-v2.pdf>

Key importing regions of potash, 2013

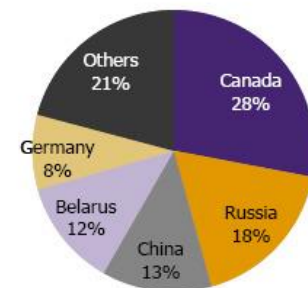


100% = 44 million tons per year

Key global potash producers, 2014



Asia



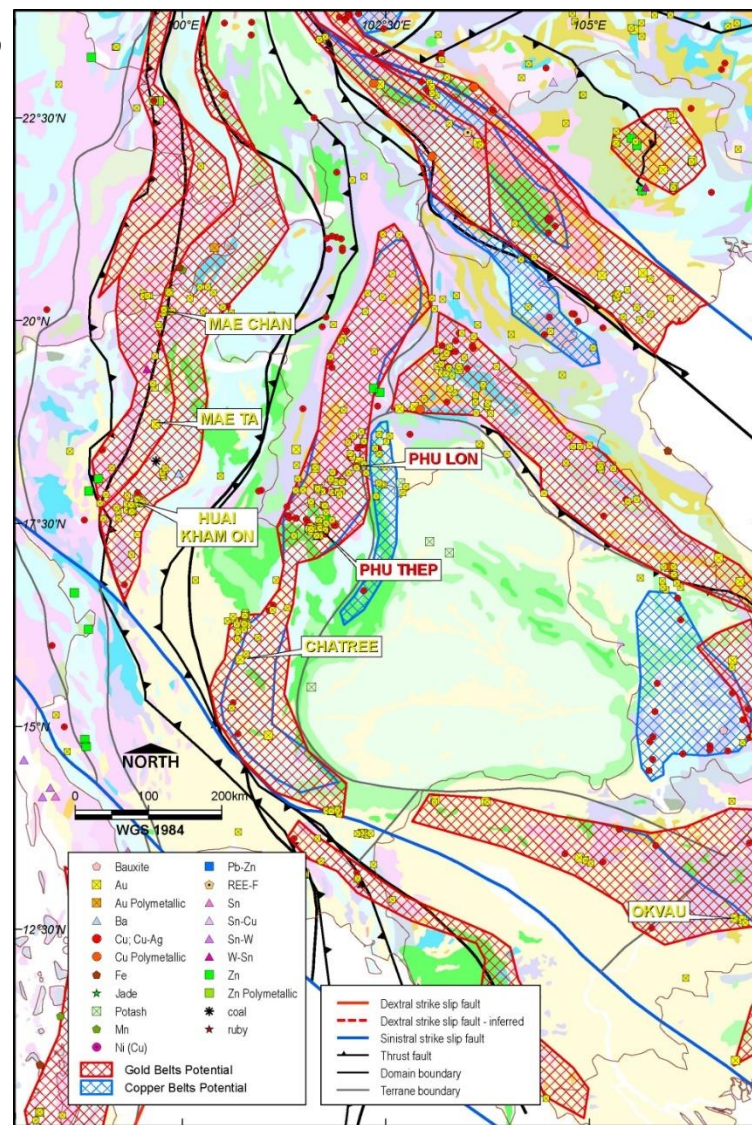
100% = 35 million tons per year





## Permian-Triassic Arcs & Back-Arcs

- Volcanic arc belts and accretionary orogenic terrains related to older Indosinian period
- Underpin much of the gold and base-metal potential in mainland SE Asia
- Environment equally favourable for porphyry/epithermal Cu/Au as Tertiary arcs; key is preservation in older terrains with subsequent uplift and erosion
- **Sepon** and **Phu Kham** copper-gold deposits in Early Permian back-arc in Laos
- **Thach Khe** iron skarn in Vietnam
- **Chatree, Phu Thep, Mengapur & Pou Sa** gold and copper-gold porphyry deposits in Early Triassic arcs
- Volcanic-hosted massive sulphide deposits in back-arc basins (e.g. Laocang in Yunnan)
- Sediment-hosted & orogenic Au potential?

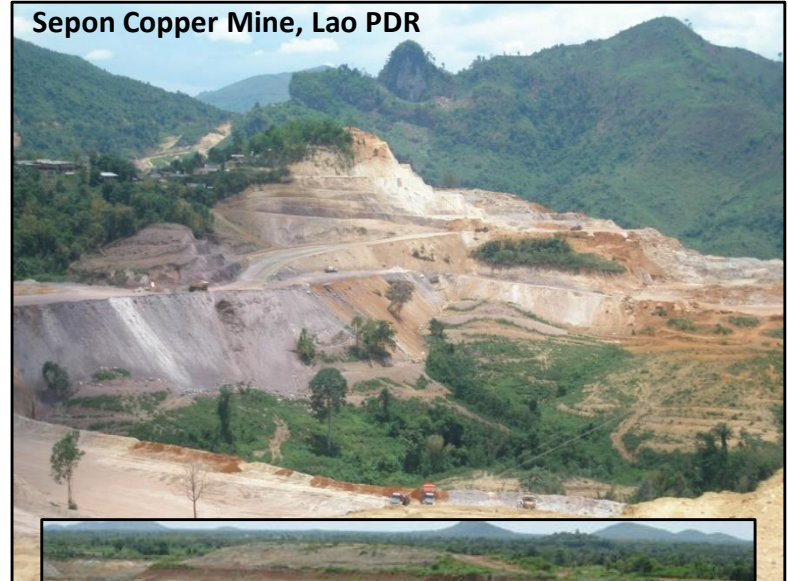




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Sepon Copper Mine, Lao PDR

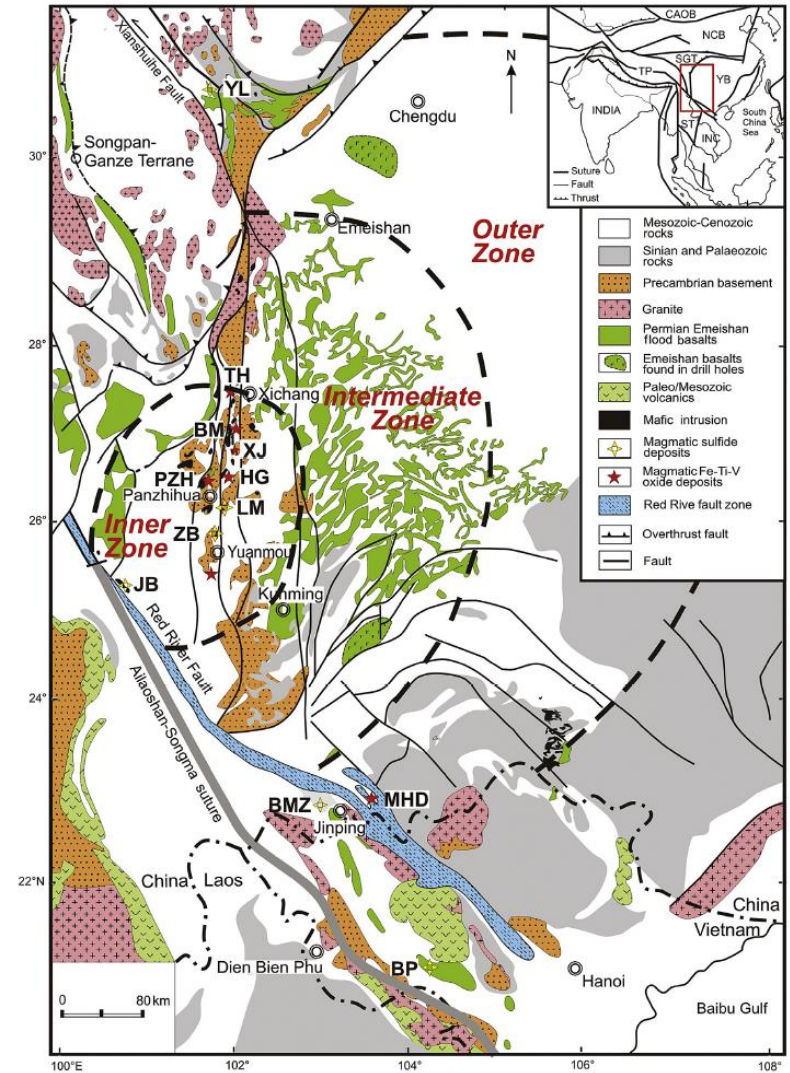


Chatree Gold Mine, Thailand



## Older Metallotects, but significant ....

- Mid Permian intrusive-hosted Ni-Cu-PGE; **Ban Phuc**, Vietnam
- Numerous deposits in adjacent Yunnan

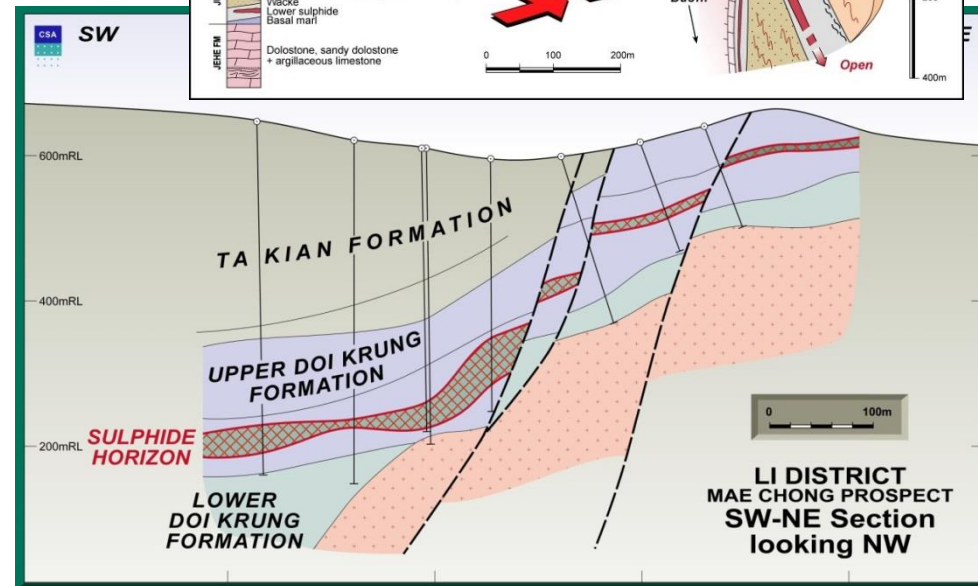
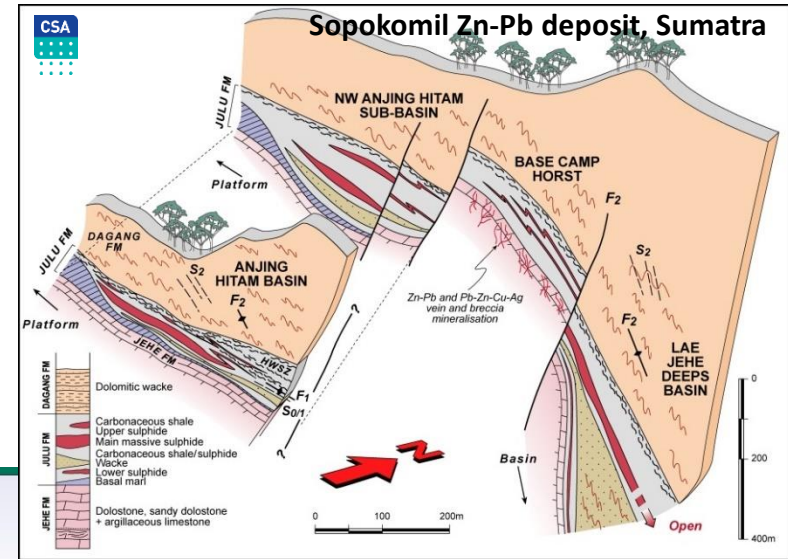


Magmatic Ni & Fe-Ti-V deposits of the Emeishan LIP; from Zhou et al., 2013, Geoscience Frontiers 4, pp. 481-502



## Older Metallotects, but significant ....

- Mid Permian intrusive-hosted Ni-Cu-PGE; **Ban Phuc**, Vietnam
- Carboniferous-Triassic VHMS, Myanmar, Thailand, Malaysia
- Carboniferous SHMS Zn-Pb deposits; **Sopokomil**, Sumatra
  - comparable basin geology occurs in Malaysia, Thailand & Myanmar
- Ordovician Irish-type Zn-Pb-Ag; **Kanchanaburi**, **Bawsaing**, **Mae Chong** etc.; extensive host-basin sequences in Thailand-Myanmar and in Yunnan where two deposits are currently mined



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- Carboniferous SHMS; **Sopokomil**, Sumatra
- Ordovician Irish-type Zn-Pb-Ag; **Kanchanaburi**, **Bawsaing** etc, Thailand-Myanmar
- Ordovician VHMS; **Bawdwin**, Myanmar
- Proterozoic hosted IOCG? **Sin Quyen** Cu-Au, Vietnam



INDUSTRIAL MINERALS ARE ALSO CRITICAL AND A KEY ECONOMIC DRIVER, BUT OUTSIDE SCOPE OF THE CURRENT PRESENTATION

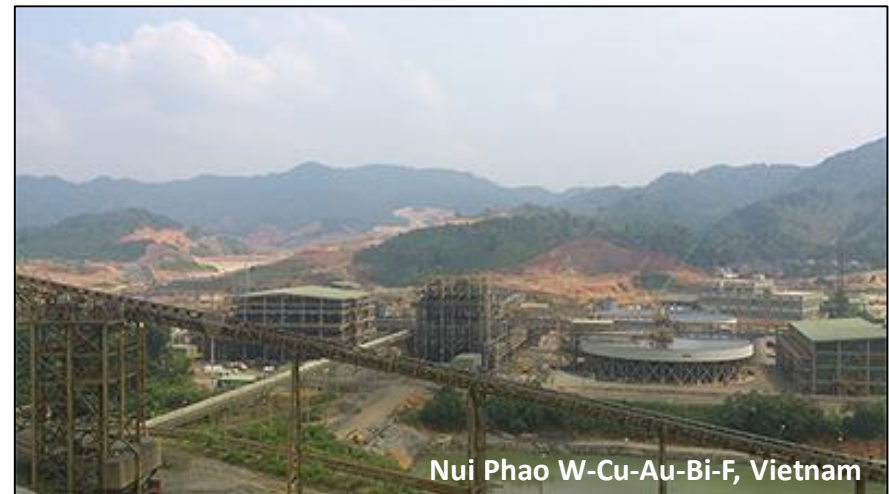


# Unlocking ASEAN Mineral Potential?



# ASEAN Mining Industry Status

- ✓ Diverse endowment, large and world-class deposits
- ✓ Responsible mining to world's best standards is happening today – e.g. **Chatree, Sepon, Batu Hijau, Masbate, Nui Phao**
- X Widespread illegal and informal mining
- X Negative environmental and community impact, poor community understanding and support
- X Limited understanding of the industry by regulatory authorities and politicians
- X Increased resource nationalism
- X Policies and regulatory settings negative for high-risk investment in exploration and mining



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**THE NEGATIVES CAN BE OVERCOME – ROBUST TRANSPARENT SYSTEMS, ENFORCED FAIRLY, PROVIDING RETURN FOR ALL STAKEHOLDERS**

- ✓ **Leverage natural resources for economic benefits especially regional growth**
- ✓ **Effective management of environmental & community impacts**

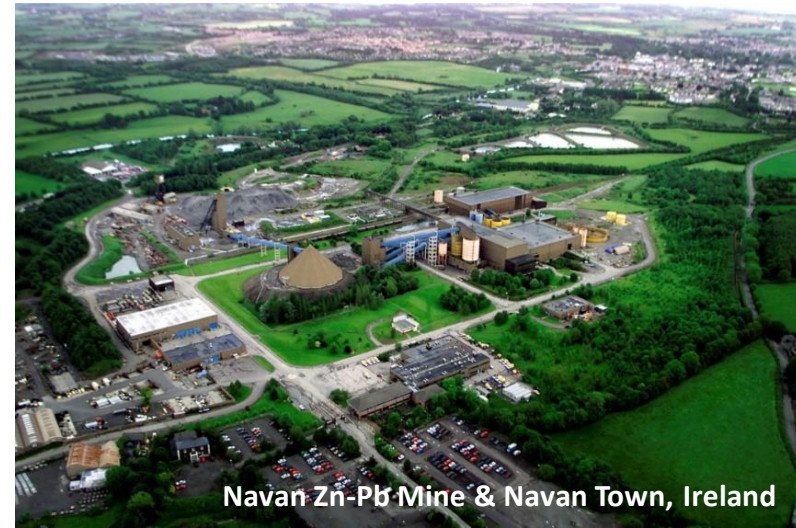
### *Truisms*

**MINES ARE WHERE THE DEPOSITS ARE, THE LOCATION IS NOT CHOSEN**

**MINERAL RESOURCES ARE NOT ASSETS UNTIL DISCOVERED**

# The Example of Ireland

- Canadian investors discovered **Tynagh** and **Silvermines** Zn-Pb-Ag deposits in 1962 & 1965, **Navan** in 1970
- Spawned an Irish mining-industry service sector and a junior exploration sector
- **Crowe Schaffalitzky Associates (CSA)** founded in Dublin in 1984
- **Lisheen** discovered in 1990 by CSA for a Joint Venture between **Ivernia plc**, an Irish-listed junior exploration company, and **Chevron Inc.**, a US multinational oil and minerals company
- Following some environmental issues with the early mines, Navan was developed and operated to the highest environmental and community standards
- Mining has successfully coexisted with agriculture, rural communities and towns
- RESPONSIBLE MINING CAN CO-EXIST WITH OTHER ECONOMIC ACTIVITIES IN DEVELOPED ECONOMIES



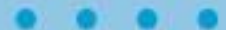


# The Example of Ireland

- Ranked No. 1 in Fraser Institute 2015 **Policy Perception Index**, No. 4 in **Investment Attractiveness Index**
- The recipe? Includes:
  - state-owned and -controlled minerals
  - easy availability of open-file and pre-competitive data
  - competitive investment incentives, welcomes international investment
  - transparent, robust & supportive regulatory and administrative system
  - strong environmental regulation
  - no in-country processing requirements
- The return?
  - largest Zn-Pb producer in Europe
  - substantial local and national economic benefit
  - indigenous service sector in Ireland now has annual turnover of c. €400 M
  - Irish junior explorers active globally

Summary of Components of Economic Impacts of Mineral Exploration and Mining Sector in Ireland	
	Estimates for 2012
<b>Employment Supported (Mining and Exploration)</b>	
Direct Employment – Full-Time Equivalent Persons (FTEs)	1,373
Indirect and Induced Employment Supported (FTEs)	1,933
Economy-wide Employment Supported (FTEs*)	3,306
<b>Sales Turnover (Mining)</b>	
Value of Sales Turnover - € Million	€426.1
<b>Expenditures (Mining and Exploration)</b>	
Direct Expenditure on Wages and Salaries - € Million	€107.3
Total Mining and Exploration Expenditure - € Million	€313.2
Economy-wide Expenditure Impact - € Million*	€809.7
<b>Gross Value Added (Mining)</b>	
Gross Value Added - Mining - € Million	€274.2
<b>Exchequer, Local Authorities and Local Communities (Mining and Exploration)</b>	
Exchequer Contributions (including Local Authority rates etc) - € Million	€56.6
Other Income to the State (Royalties, Licence Fees, etc.) - € Million	€9.0
Financial Contributions to Local Communities - € Million	€0.459
Source: Indecon analysis	
* Economy-wide impacts represent the indirect and induced multiplier impacts arising from the estimated direct impacts.	

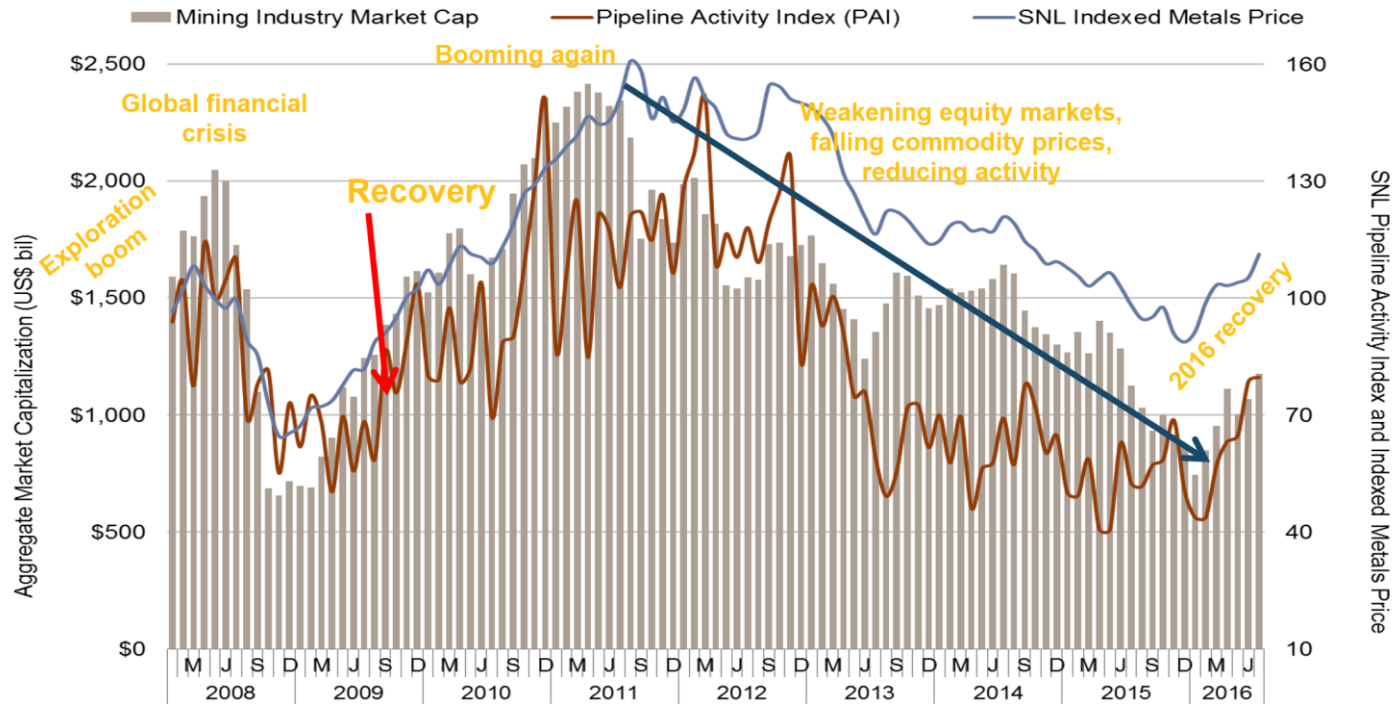
Source: <https://www.gsi.ie/NR/rdonlyres/DCFE220F-E5DE-402C-81EB-D9624A732278/0/AssessmentofEconomicContributionofMineralExplorationandMininginIreland.pdf>;



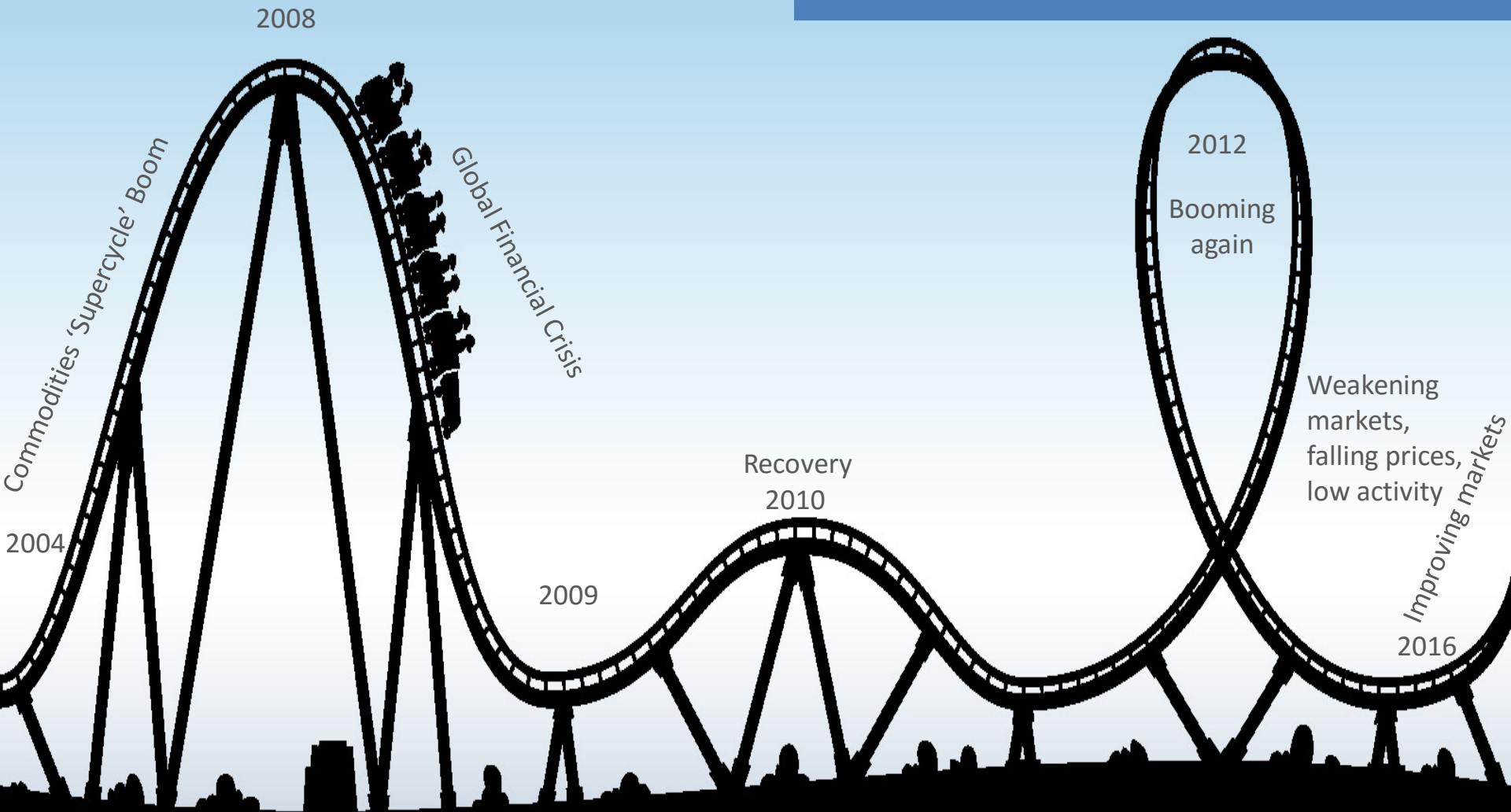
# ASEAN Mining Industry Future



- A future viable mining industry in ASEAN depends on investment in exploration; lack of exploration in ASEAN means a major catch-up is required
- High-risk investment in exploration will not occur without changed policy settings
- The next cycle is starting – ASEAN can gain the economic benefits but **FUNDAMENTAL** changes are required



# Mining Industry booms and busts





# CSA Global

Mining Industry Consultants



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**For more information  
please contact:**

Neal Reynolds

[neal.reynolds@csaglobal.com](mailto:neal.reynolds@csaglobal.com)

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