

The decline in Indonesia's Exploration Performance *- and what can we do about it*

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Overview

1. Indonesia has a long history of exploration and mining
2. Location of discoveries made in the last 50 years
3. Size, number and type of discoveries
4. Exploration expenditures
5. Indonesia's discovery performance
 - And the possible reasons behind the recent decline
6. Country risk issues
7. Relative performance of local & foreign companies
8. Consequence to Indonesia of a decline in the discovery rate
9. What can we do to fix the problem?
10. Conclusions/Summary

Mining goes back 1000 years.

But the industry really only took off in the 1970s

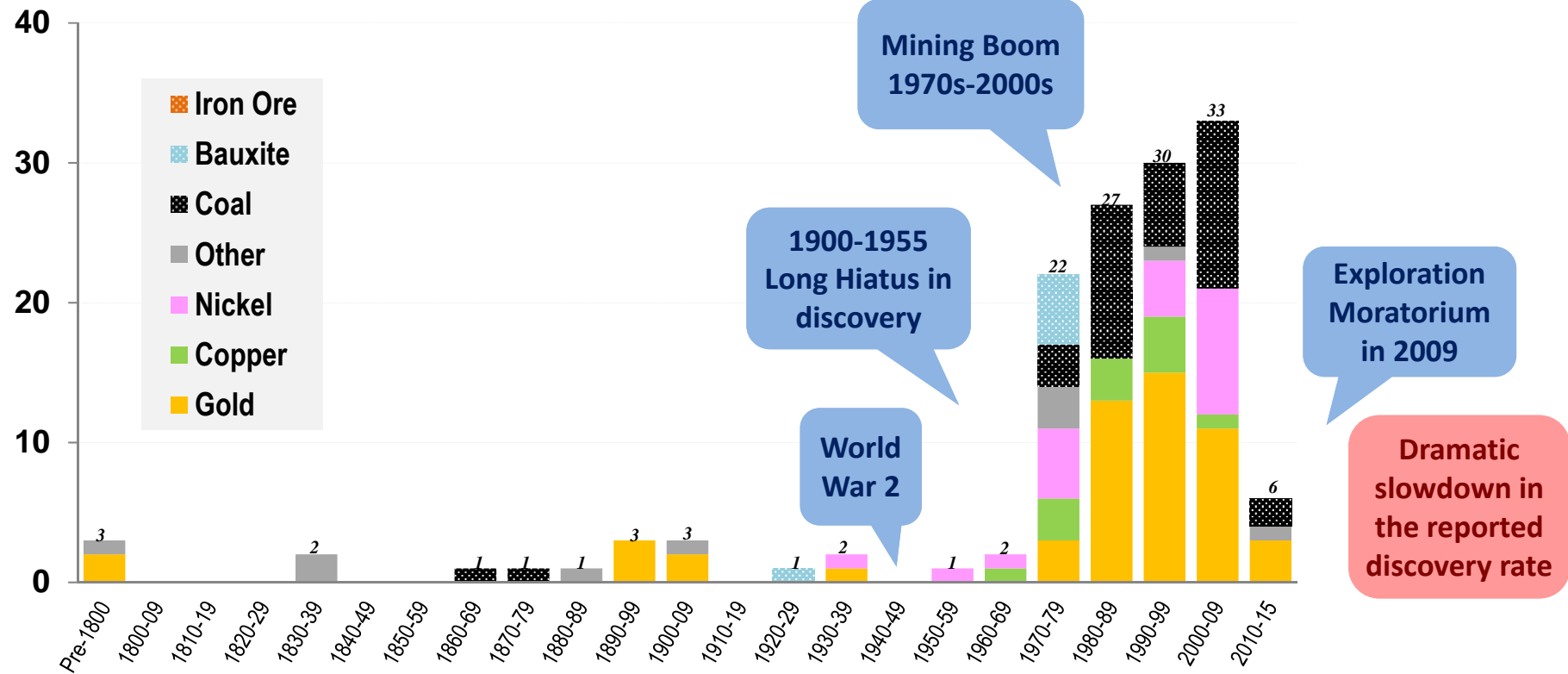
1. INDONESIA HAS A LONG HISTORY OF EXPLORATION AND MINING

Number of significant mineral discoveries in Indonesia: by decade

pre-1800 to 2016

Half of all deposits were found after 1983

Number of Discoveries per Decade



Note: Based on 138 discoveries >= "Moderate" in size, i.e. >0.1 Moz Au, >5 kt U₃O₈, >10 kt Ni, >0.25 Mt Zn+Pb, >0.1 Mt Cu-equiv
 >20 Mt Thermal Coal, >10 Mt Coking Coal, >10 Mt Fe, >10 Mt Al₂O₃
 Excludes 61 deposits without a discovery date (54 of which are coal).
 Excludes satellite deposits within existing camps

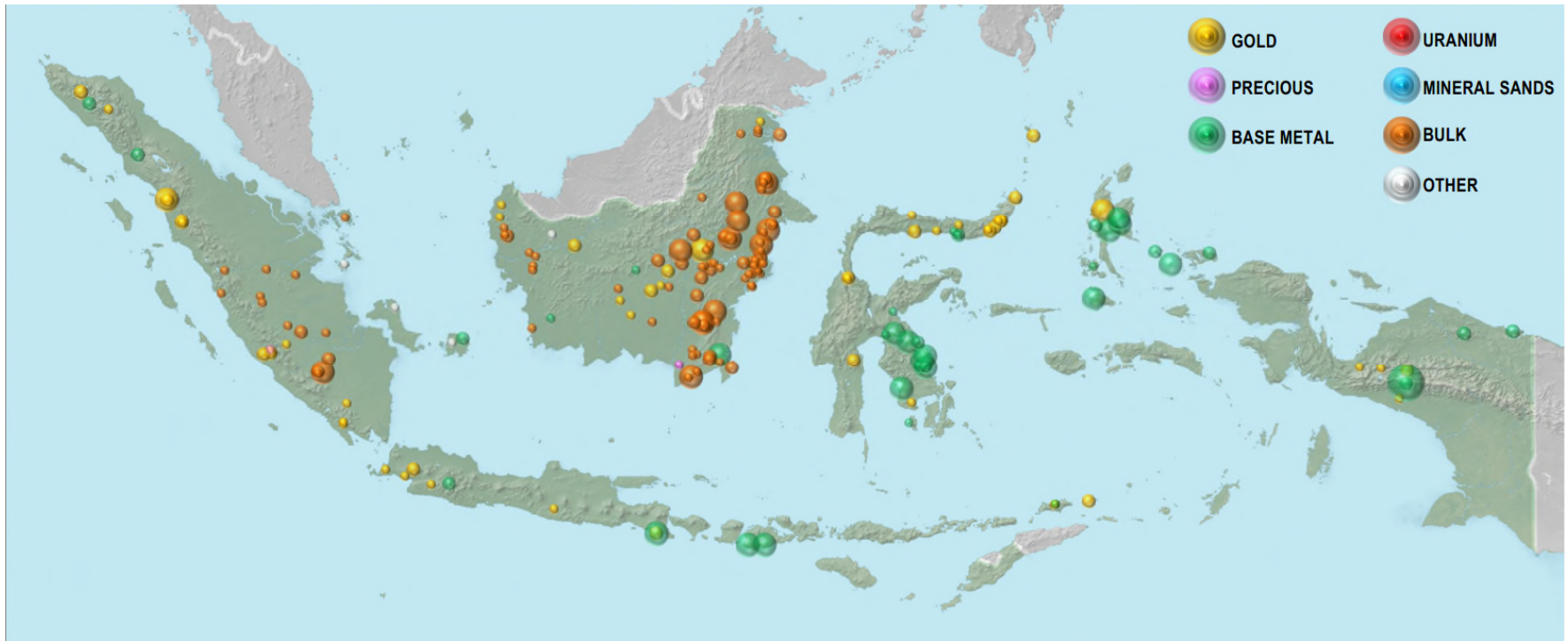
Source: MinEx Consulting © October 2016

Over the last 50 years, +119 significant deposits were found in Indonesia, including 19 in the last decade

2. LOCATION OF DISCOVERIES MADE IN LAST 50 YEARS

Indonesia Discoveries: ALL YEARS

Giants = 31



	Au	Cu	Ni	Zn/Pb	Coal	Bauxite	Other	TOTAL
No.	54	12	24	3	90	9	7	199
Metal	317 Moz	84 Mt	35 Mt	9 Mt	56450 Mt	390 Mt Al ₂ O ₃	Ag, Diamond Graphite, Sn	

Note: "Giant" is defined as >6 Moz Au, >125 kt U₃O₈, >1 Mt Ni, >12 Mt Zn+Pb, >5 Mt Cu-equiv, >1000 Mt Thermal Coal, >500 Mt Coking Coal, >500 Mt Fe, >500 Mt Al₂O₃

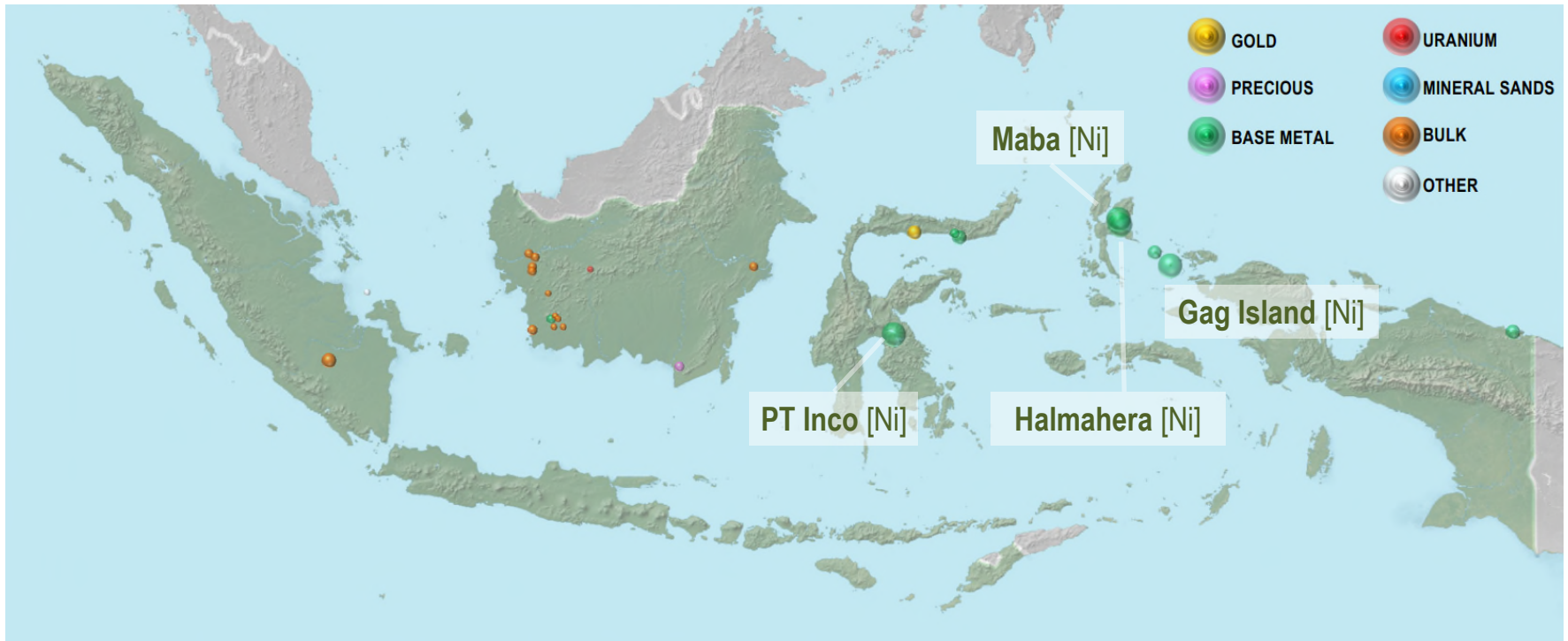
Source: MinEx Consulting © October 2016

Inc 237 Moz by-product

Inc 749 Mt of coking coal

Indonesia Discoveries: 1966-1975

Giants = 4

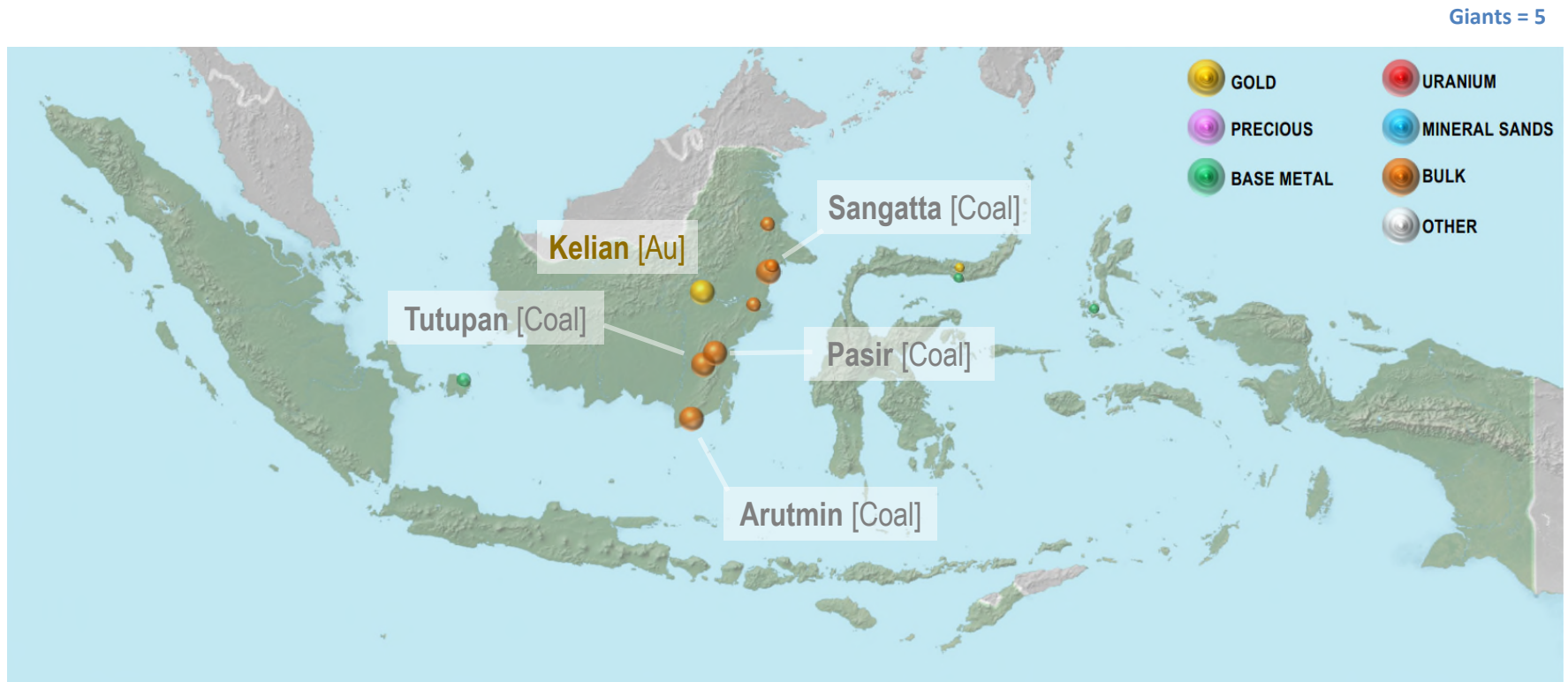


	Au	Cu	Ni	Zn/Pb	Coal	Bauxite	Other	TOTAL
No.	1	2	6	1	2	2	1	18
Metal	6.9 Moz	1.7 Mt	12.6 Mt	0.4 Mt	2367 Mt	201 Mt Al ₂ O ₃	Diamond	

Inc 4.5 Moz by-product

Source: MinEx Consulting © October 2016

Indonesia Discoveries: 1976-1985



	Au	Cu	Ni	Zn/Pb	Coal	Bauxite	Other	TOTAL
No.	2	2	-	1	7	-	-	12
Metal	8.8 Moz	0.6 Mt	-	2.7 Mt	13690 Mt	-		

Incl 0.6 Moz by-product

Source: MinEx Consulting © October 2016

Indonesia Discoveries: 1986-1995

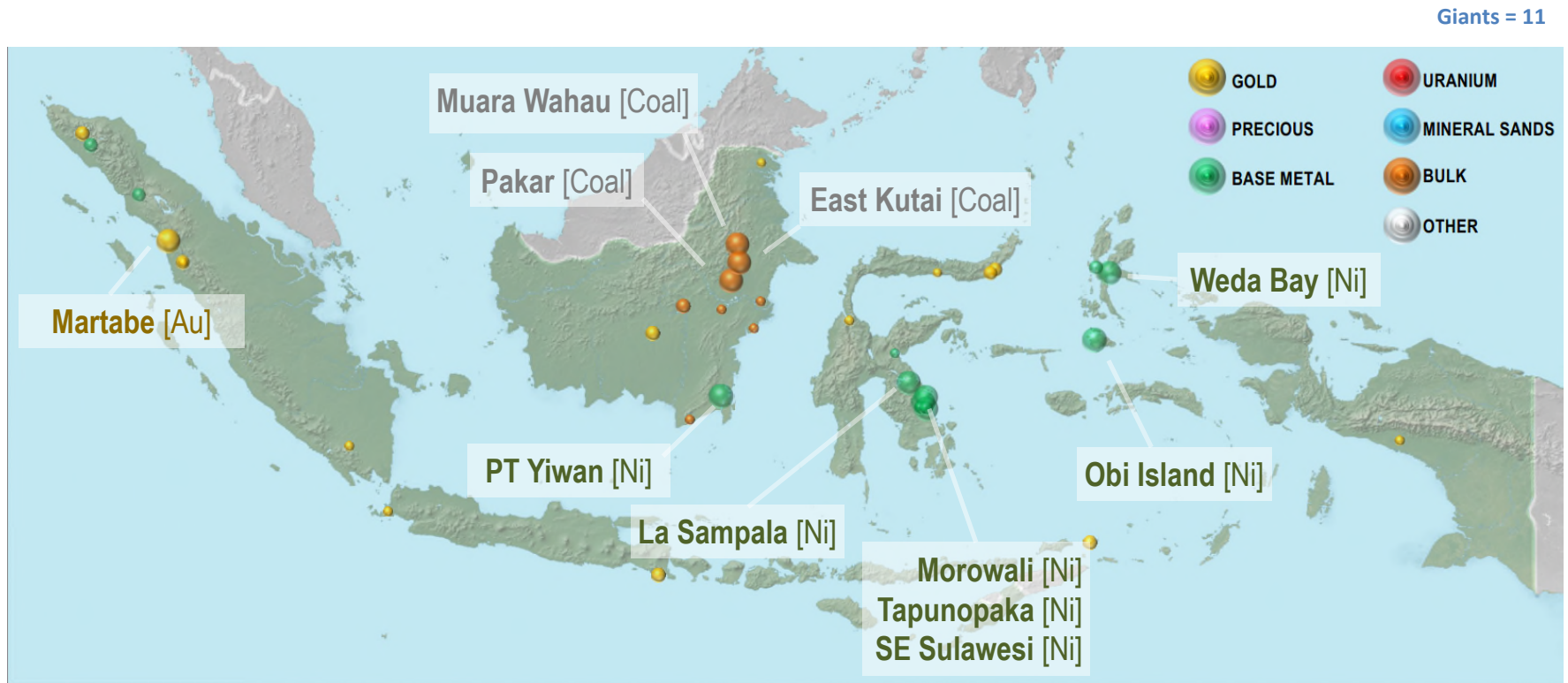


	Au	Cu	Ni	Zn/Pb	Coal	Bauxite	Other	TOTAL
No.	19	5	2	-	8	-	-	34
Metal	231.8 Moz	69.6 Mt	1.3 Mt	-	8406 Mt	-		

Inc 200.3 Moz by-product

Source: MinEx Consulting © October 2016

Indonesia Discoveries: 1996-2005



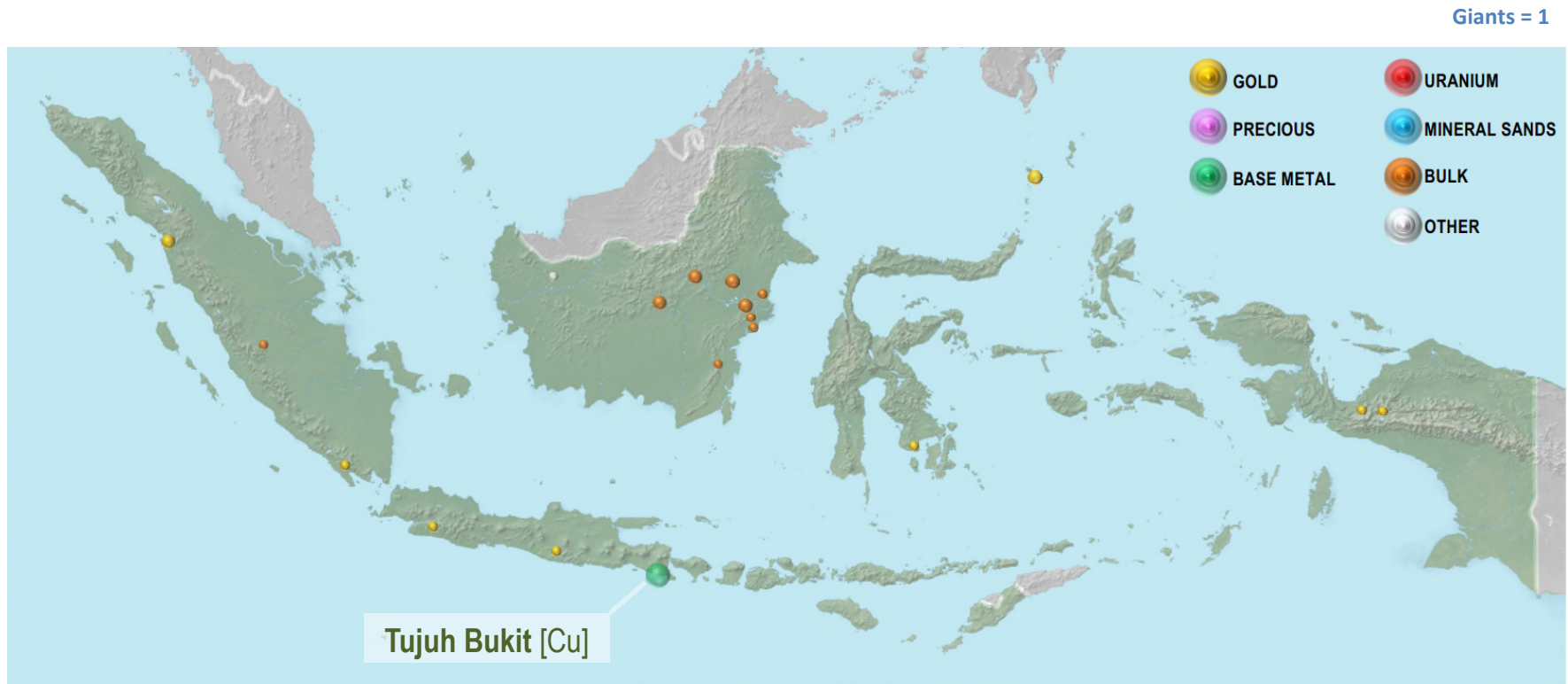
	Au	Cu	Ni	Zn/Pb	Coal	Bauxite	Other	TOTAL
No.	15	1	11	-	8	-	-	36
Metal	27.2 Moz	2.5 Mt	19.6 Mt	-	14877 Mt	-	-	

Inc 2.1 Moz by-product

Inc 398 Mt of coking coal

Source: MinEx Consulting © October 2016

Indonesia Discoveries: 2006-2015



	Au	Cu	Ni	Zn/Pb	Coal	Bauxite	Other	TOTAL
No.	8	1	-	-	9	-	1	19
Metal	34.3 Moz	8.8 Mt	-	0.1 Mt	1258 Mt	-	Graphite	

Inc 28.1 Moz by-product

All by-product

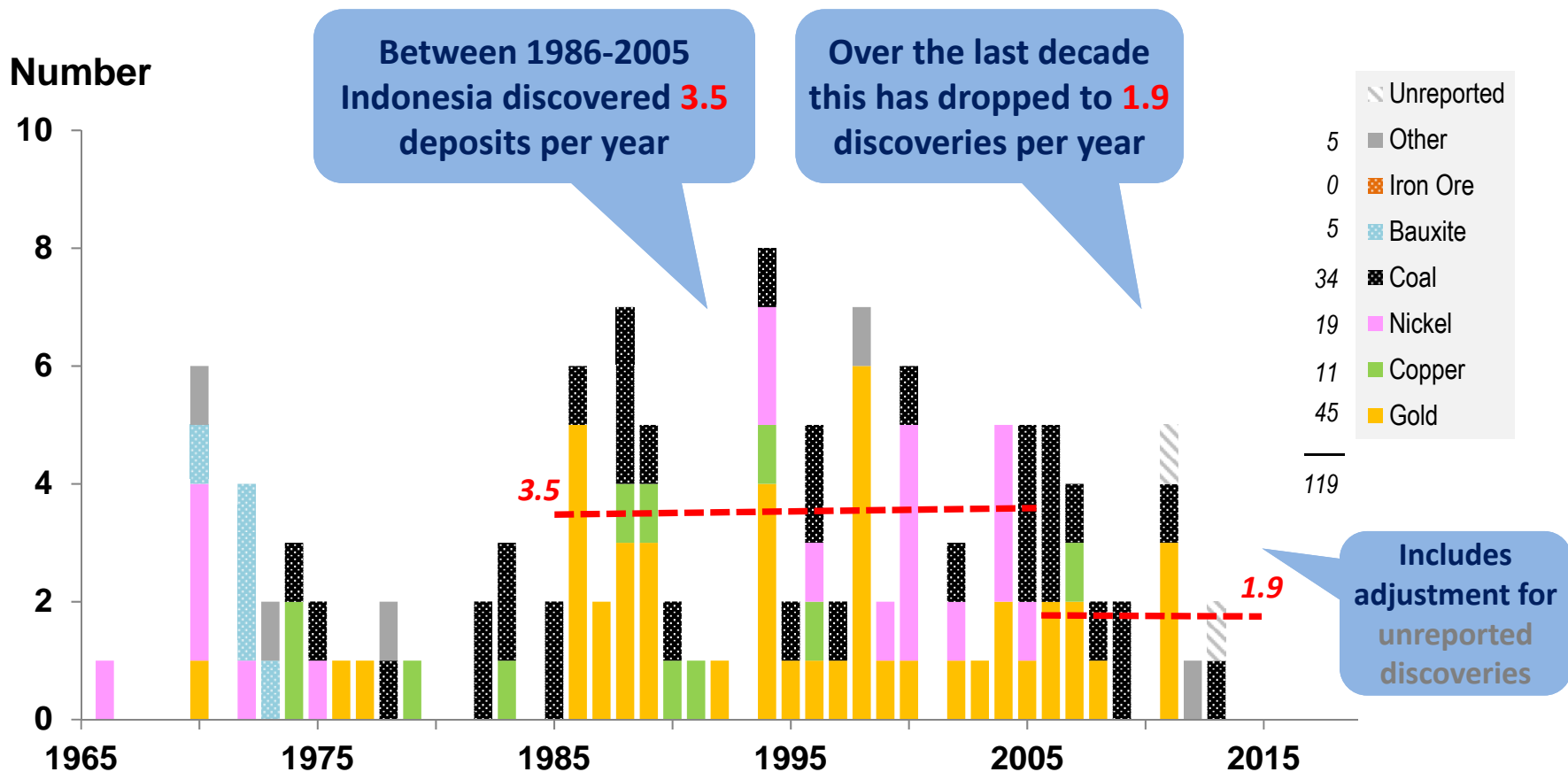
Inc 267 Mt of coking coal

Source: MinEx Consulting © October 2016

Discovery rates have slowed down in the last decade

3. NUMBER, SIZE AND TYPE OF DISCOVERIES

Number of discoveries in Indonesia since 1965 by commodity

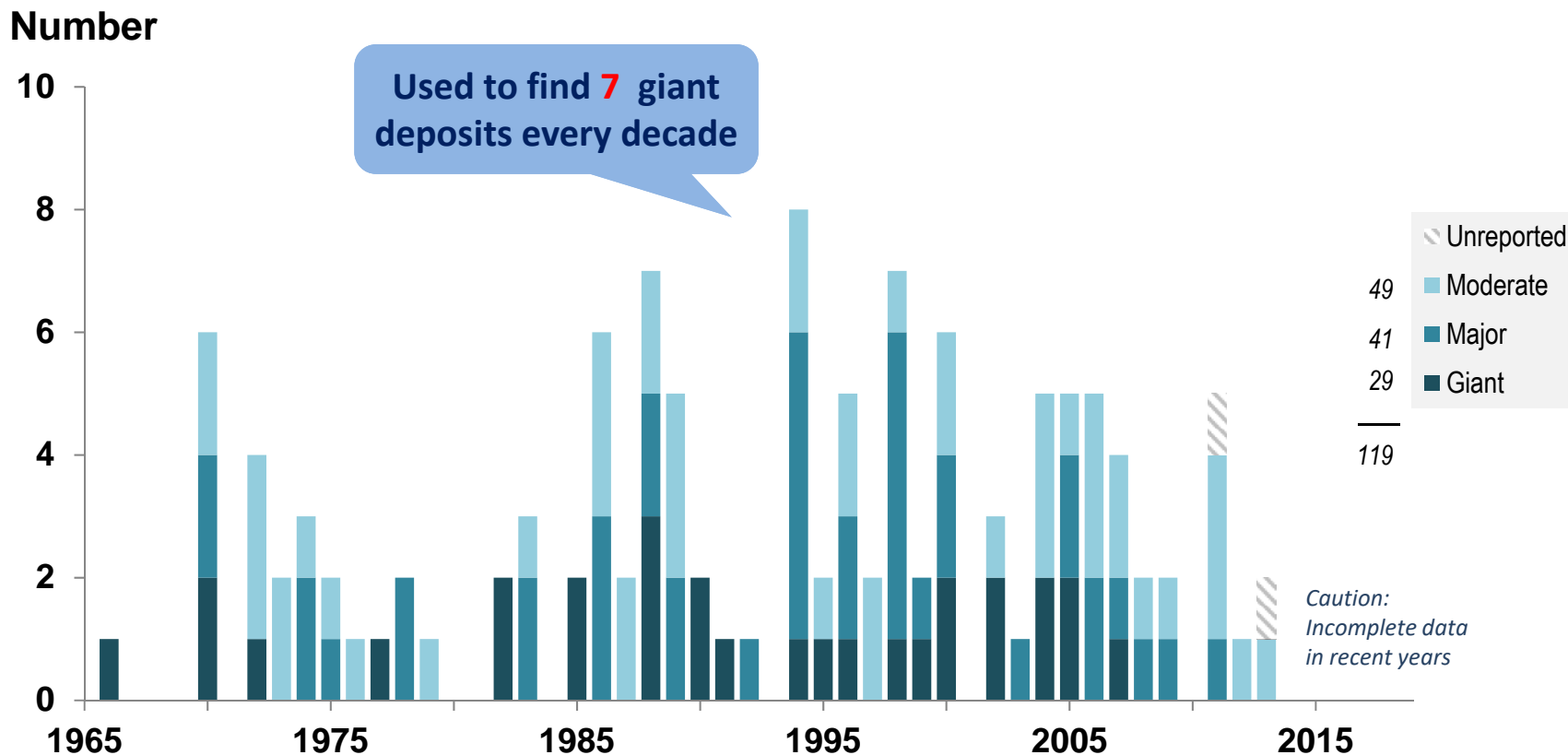


Caution: Incomplete discovery history for coal

Note: Analysis based on 119 Moderate-, Major- and Giant-sized deposits
Excludes satellite deposits found within existing Camps

Source: MinEx Consulting © October 2016

Number of discoveries in Indonesia since 1965 by size



Caution: Includes coal – but have incomplete discovery history

Note: Analysis based on 119 Moderate-, Major- and Giant-sized deposits
Excludes satellite deposits found within existing Camps

Last giant was
Tujuh Bukit in 2007

Source: MinEx Consulting © October 2016

Expenditures peaked in 2012, much lower now

4. EXPLORATION EXPENDITURES

Exploration expenditures by Commodity

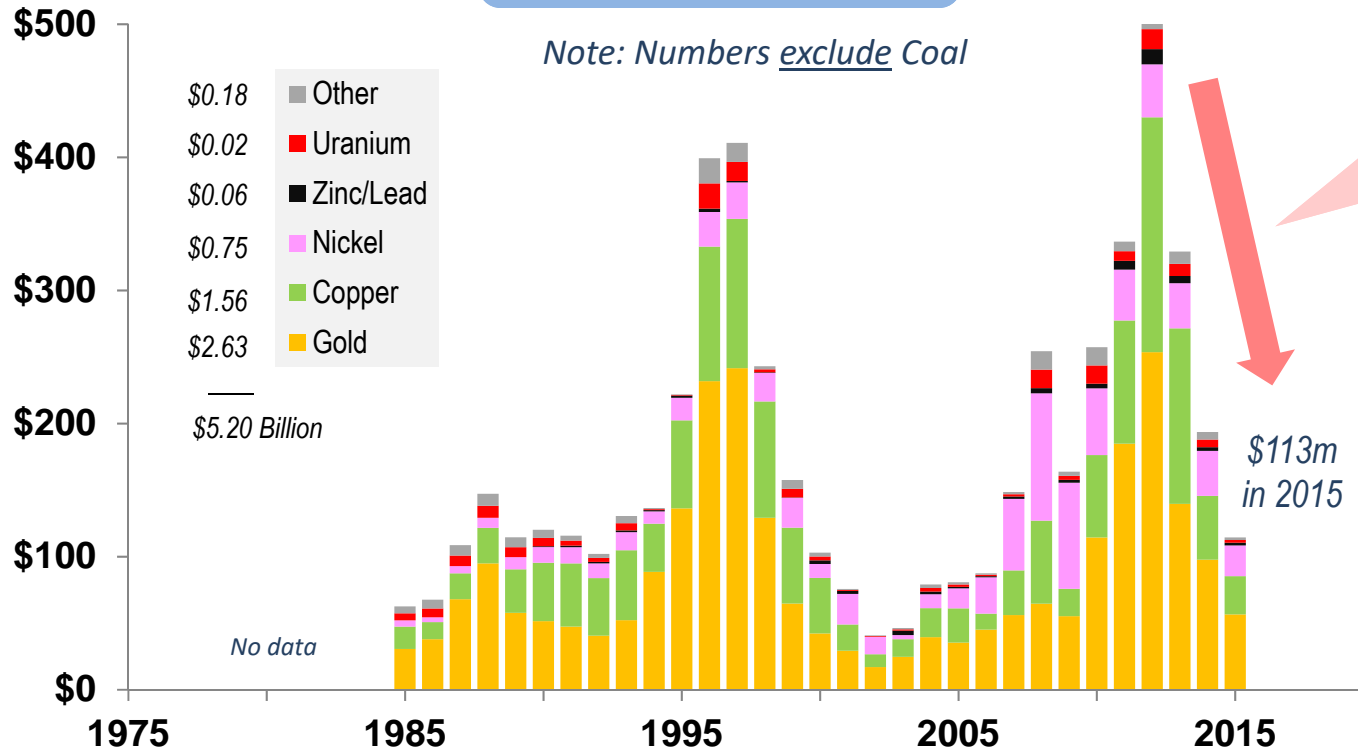
Indonesia: 1985-2015

Total Expenditures
(2015 US\$ Million)

80% of the expenditures were on gold and copper

\$497m
in 2012

Dramatic fall in
the last 3 years.
Down 77%



Note: Excludes expenditures on Bulk Minerals (such as Bauxite, Coal and Iron Ore)

Sources: Expenditure data (1997-2015) from SNL.
(1985-1996) MinEx estimates

Unit discovery costs has dramatically risen in the last decade

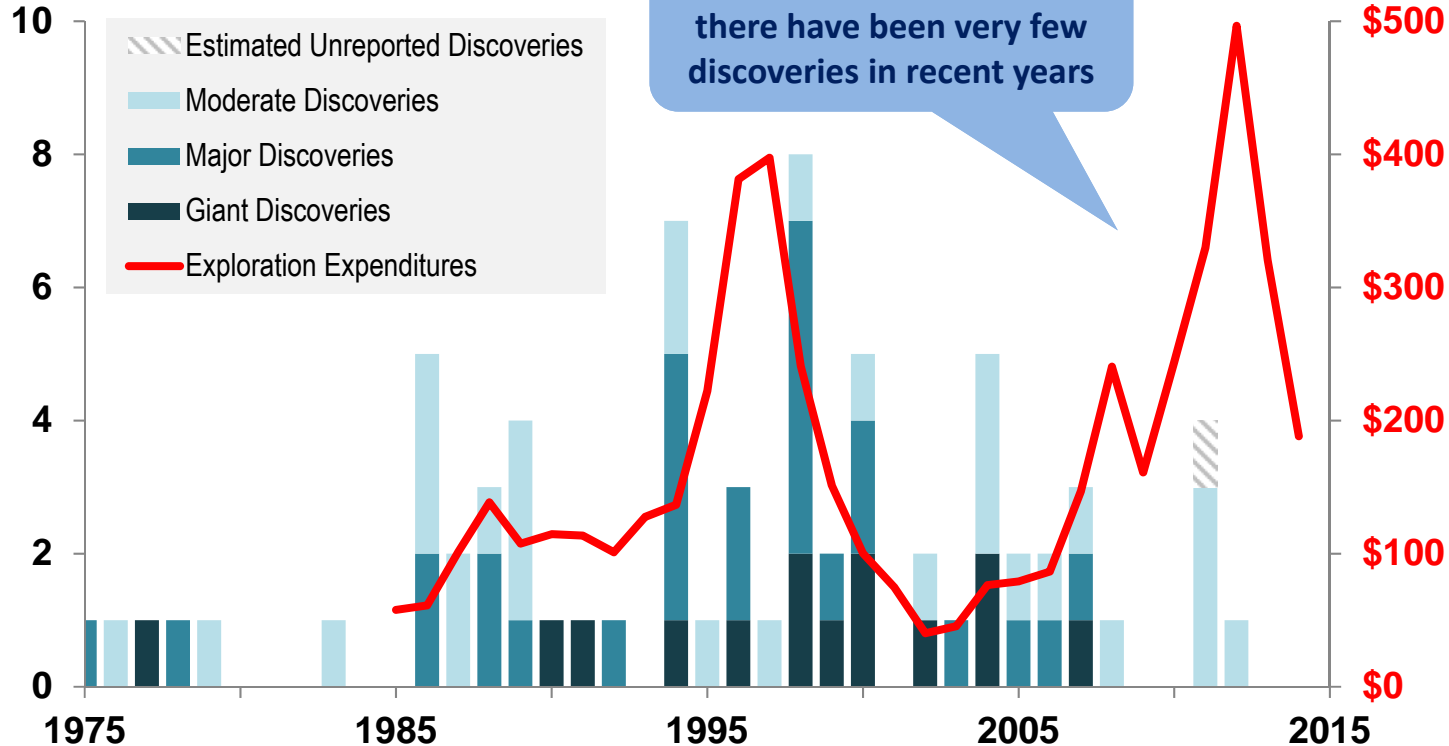
5. DISCOVERY PERFORMANCE

Number of discoveries versus \$ Exploration Spend

Indonesia: 1975-2015

Number of Discoveries

Total Expenditures
(2015 US\$ Million)



Note: Excludes expenditures and discoveries for Bulk Minerals (such as Coal)

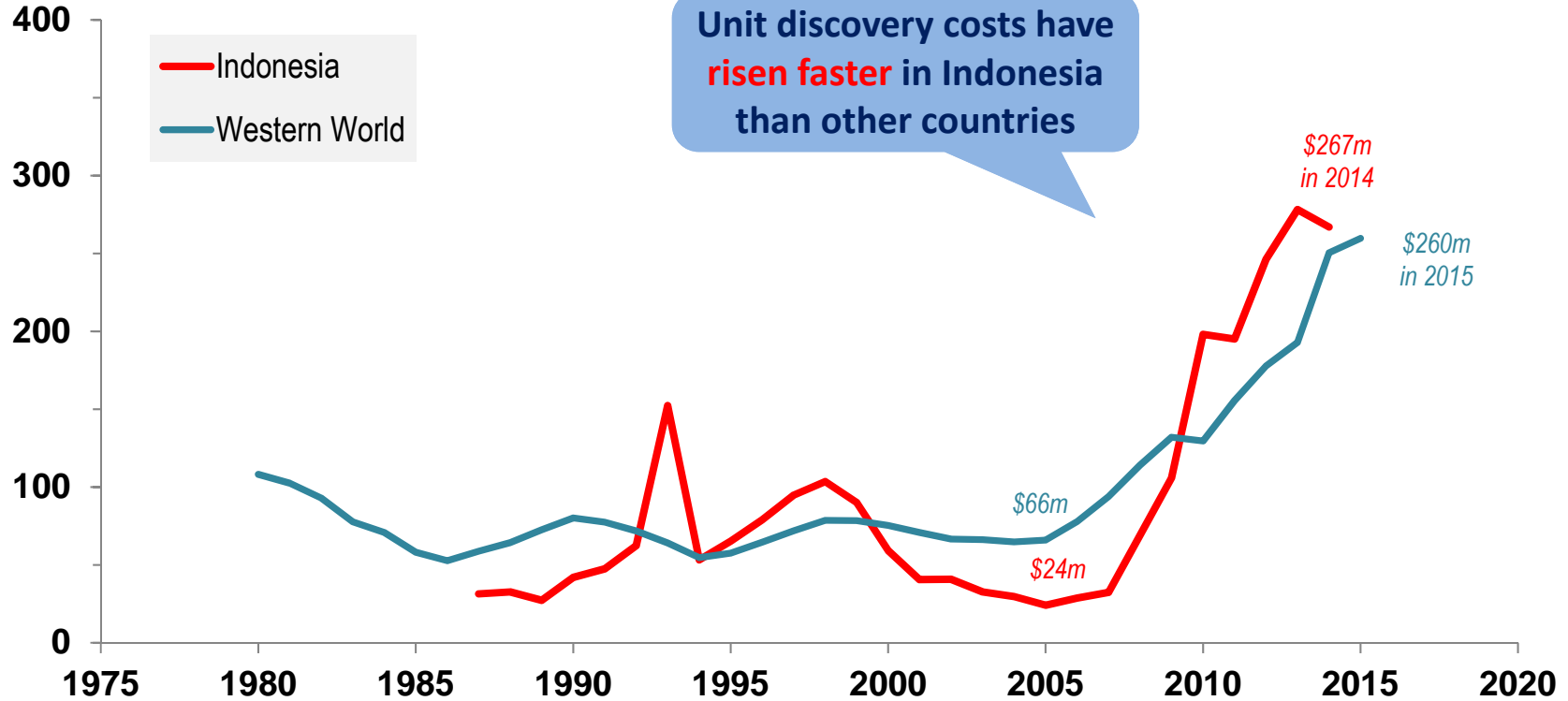
Note: Excludes satellite deposits within existing Camps.
Analysis based on Moderate-, Major- and Giant-sized deposits
No expenditure data available for Indonesia prior to 1985

Sources: MinEx Consulting © October 2016
Expenditure data (1997-2015) from SNL.
(1985-1996) MinEx estimates

Average cost per discovery

Indonesia vs Western World: 1980-2015

Average Cost per Discovery
(2015 US\$ Million)



Note: Costs are calculated on a 4-year rolling average
No expenditure data available for Indonesia prior to 1985

Source: MinEx Consulting © October 2016

Possible reasons behind the decline in discovery performance

These are common issues across the World

Some issues are structural & others are cyclical

- Higher input costs associated with the mining boom
 - For example, in Australia, between 2000 and 2012 the cost (as measured in constant US Dollars) of hiring a geologist and drilling a hole increased by 150% and 125% respectively. Office administration costs also rose by 170% of the same time period.
- Shift towards exploring under deeper cover
 - Its more difficult to identify suitable targets for drilling
- Shift away from greenfield to brownfield exploration
 - Brownfield is less likely to deliver large new discoveries
- Decline in the general quality of the exploration targets
 - Increased maturity (i.e. “all the easy / big deposits get found first”)
 - During the boom-times good money was often wasted exploring marginal projects
- In the current downturn, many companies have significantly reduced their exploration budgets
 - However, due to high fixed costs (for staff, offices and access fees), much of the cut-back has been directed to less field work. If you don't drill, you won't discover.

“Slow-burn” story”

“Slow-burn” story”

... in addition, Indonesia has its own special set of issues

- Moratorium (since 2009) on issuing new exploration licenses. Many of the existing/old IUP's are getting to the end of their lives.
 - Difficult to get fresh ground. Increased focus on feasibility study work at expense of finding new deposits
- Uncertainty over title on overlapping ground
 - No incentive to work the property – as you don't know if you can keep the discovery
 - 1/3rd of the licenses still waiting to be “clean-and-cleared”.
- Restrictive Forestry classifications (in protected areas)
 - Makes it difficult to access good exploration targets
- Long delays in getting permits to work in Forestry areas
 - Slows down mine development. Adversely impacts on project economics
- Requirement for foreign companies to progressively divest project (and restrictions on who they can sell to and what price they get)
 - Significantly reduces the incentive to explore their exploration budgets.
 - Missed opportunity to set up new / efficient local mining companies
- Ban on export of unrefined ore
 - Significant adverse impact on project economics – especially for small deposits
 - Considerable uncertainty on what will happen in the future (defer investment / close down?)

**The mining industry
hates “uncertainty”**

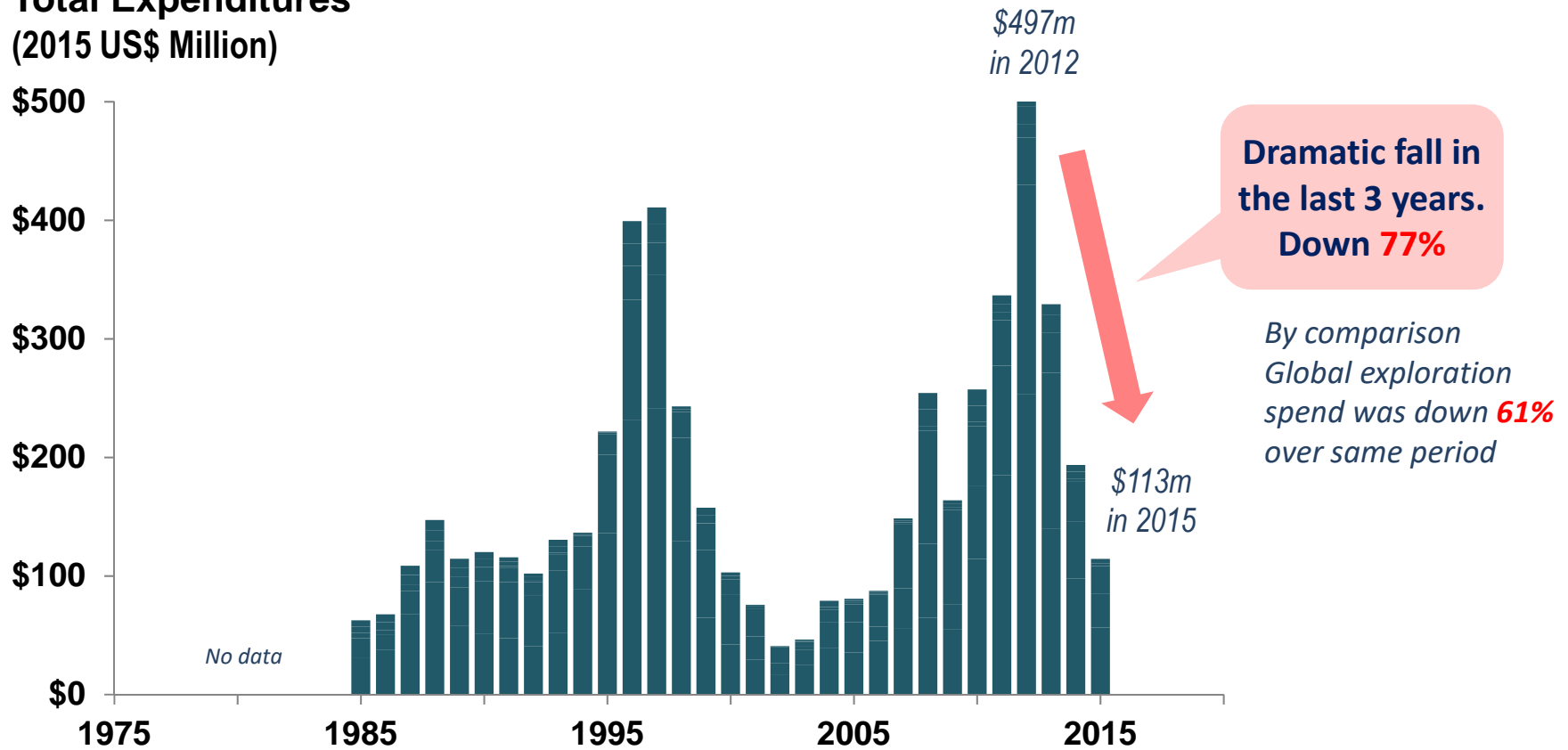
*... as a result, less money is being spent on
exploring in Indonesia ...*

*...and a greatly reduced focus on greenfield exploration
(which is the bit that makes the discoveries)*

Exploration expenditures by Commodity

Indonesia: 1985-2015

Total Expenditures
(2015 US\$ Million)



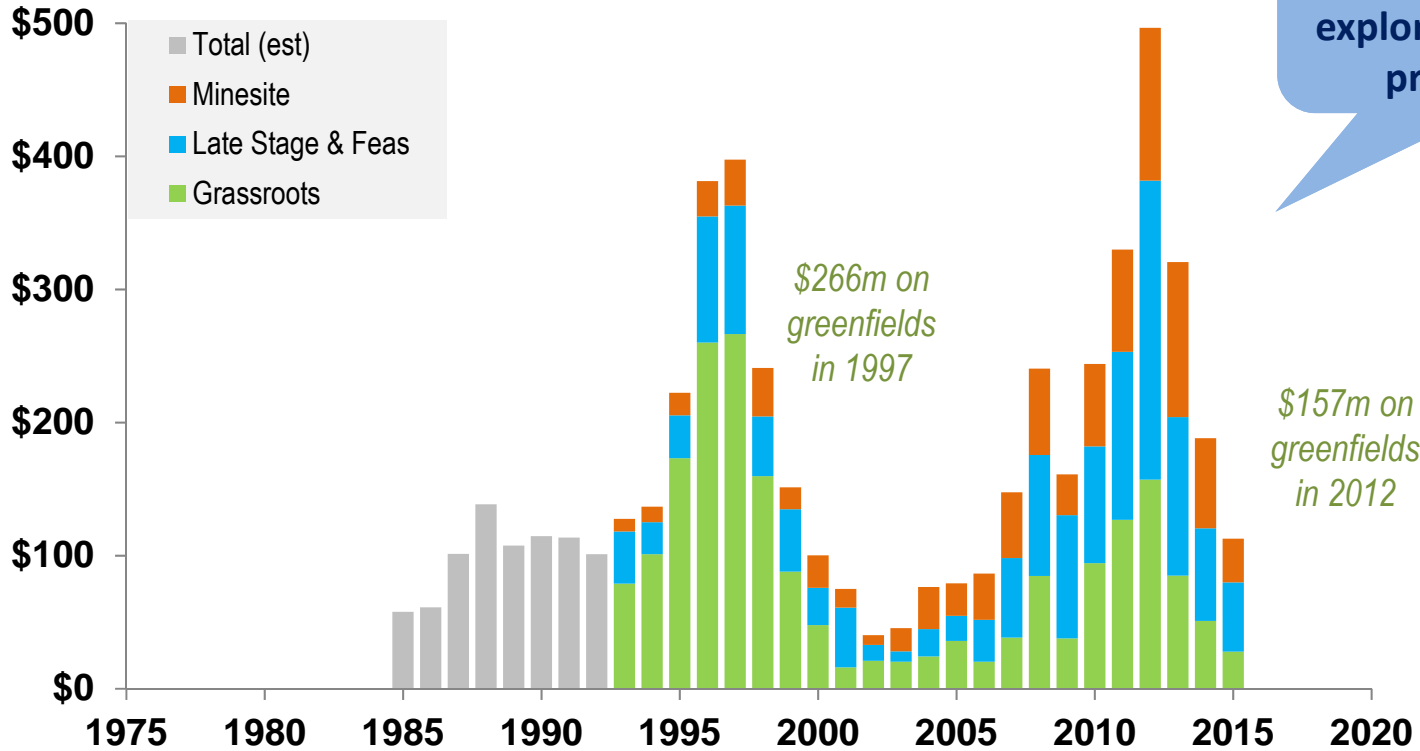
Note: Excludes expenditures on Bulk Minerals (such as Bauxite, Coal and Iron Ore)

Sources: Expenditure data (1997-2015) from SNL.
(1985-1996) MinEx estimates

Breakdown of exploration expenditures by Stage

Indonesia: 1975-2015

Total Expenditures (2015 US\$ Million)



In 2012 Indonesia spent less on greenfield exploration than in the previous boom

Note: Excludes expenditures on Bulk Minerals (such as Bauxite, Coal and Iron Ore)

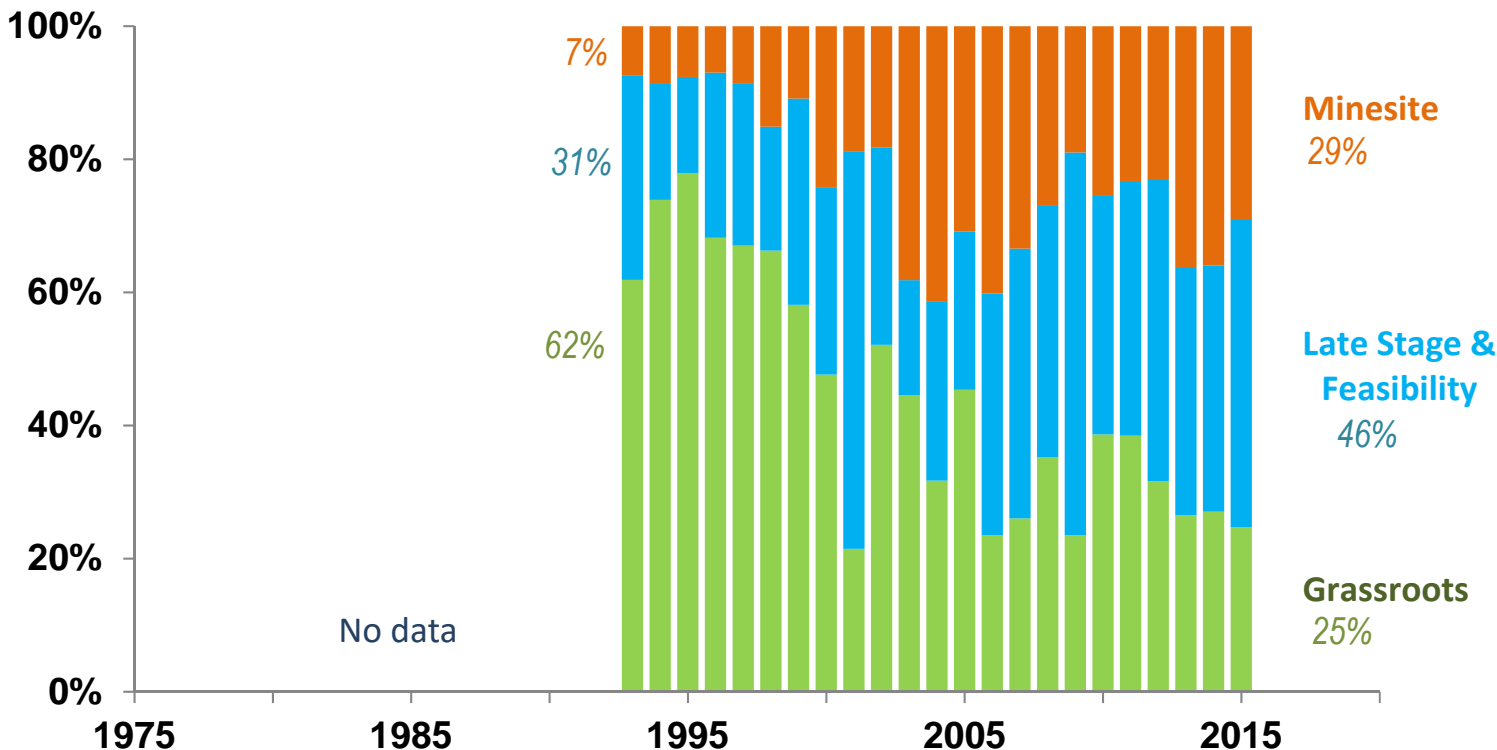
Sources: Expenditure data (1997-2015) from SNL.
(1985-1996) MinEx estimates

Breakdown of exploration expenditures by Stage

Indonesia: 1993-2015

In recent years, the focus has moved away from grassroots to late stage and mine site exploration

Share of Total



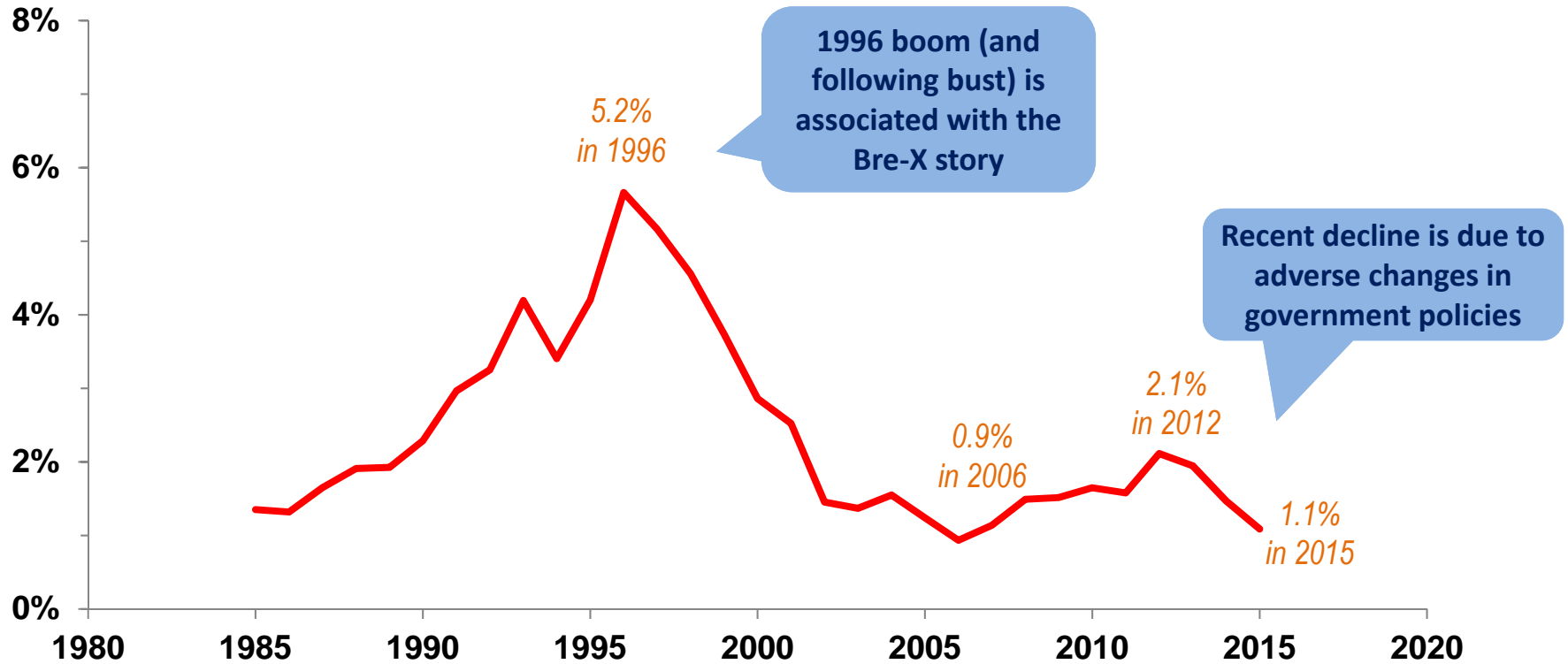
Note: Excludes expenditures on Bulk Minerals (such as Bauxite, Coal and Iron Ore)

Source: SNL various years

... so it is no real surprise that Indonesia's share of the World's Exploration Expenditures has shrunk

Indonesia vs World: 1985-2015

Indonesia's share of spend



Note: Excludes expenditures on Bulk Minerals (ie Bauxite, Coal and Iron Ore)

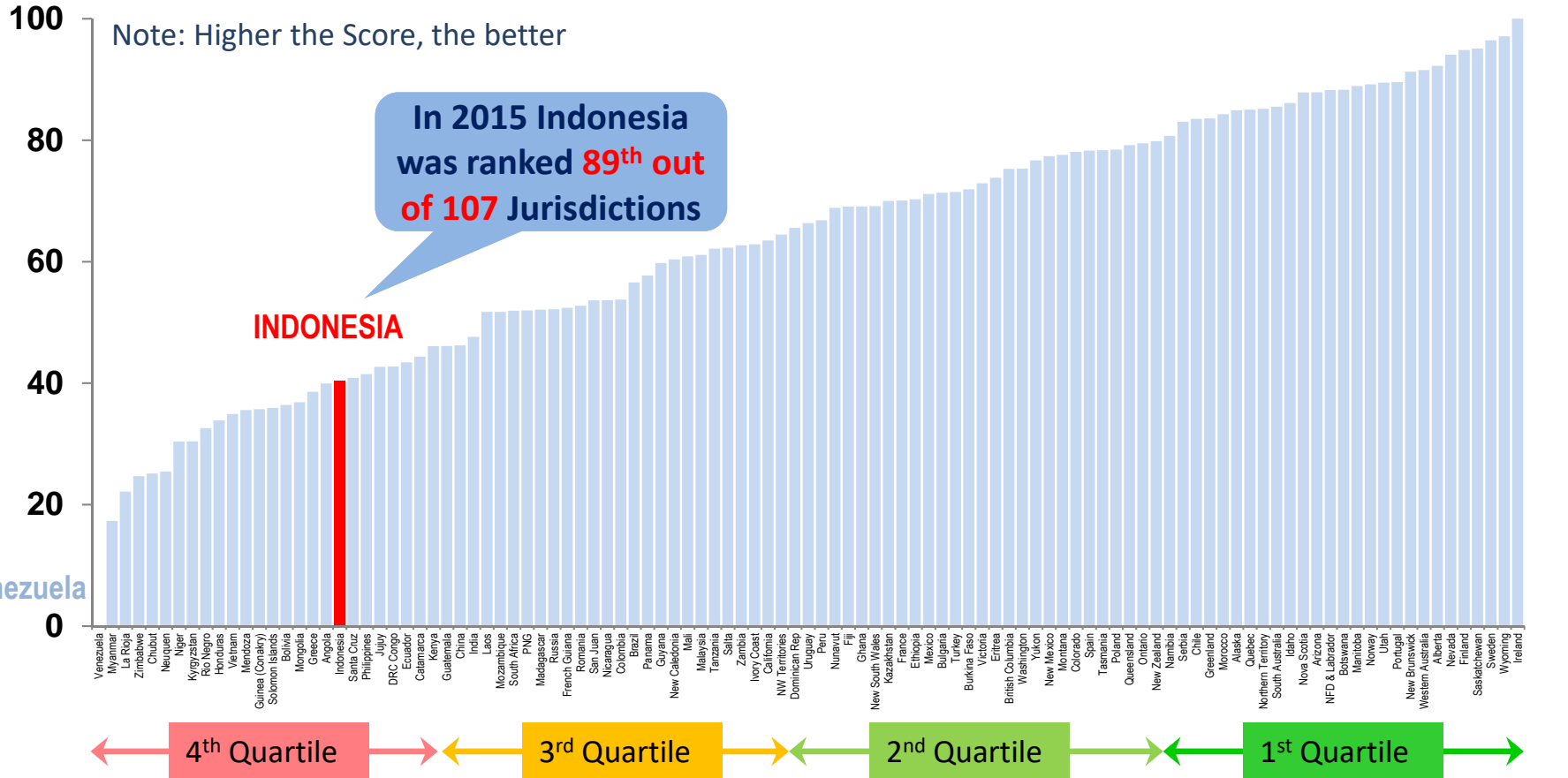
Sources: Various sources, including ABS, NRCan, IAEA, SNL and MinEx own estimates

Foreign companies perceive Indonesia to be a high risk country to explore and operate in

6. COUNTRY RISK ISSUES

A recent international survey of mining companies rated Indonesia a difficult place to explore and operate in

Policy Potential Index

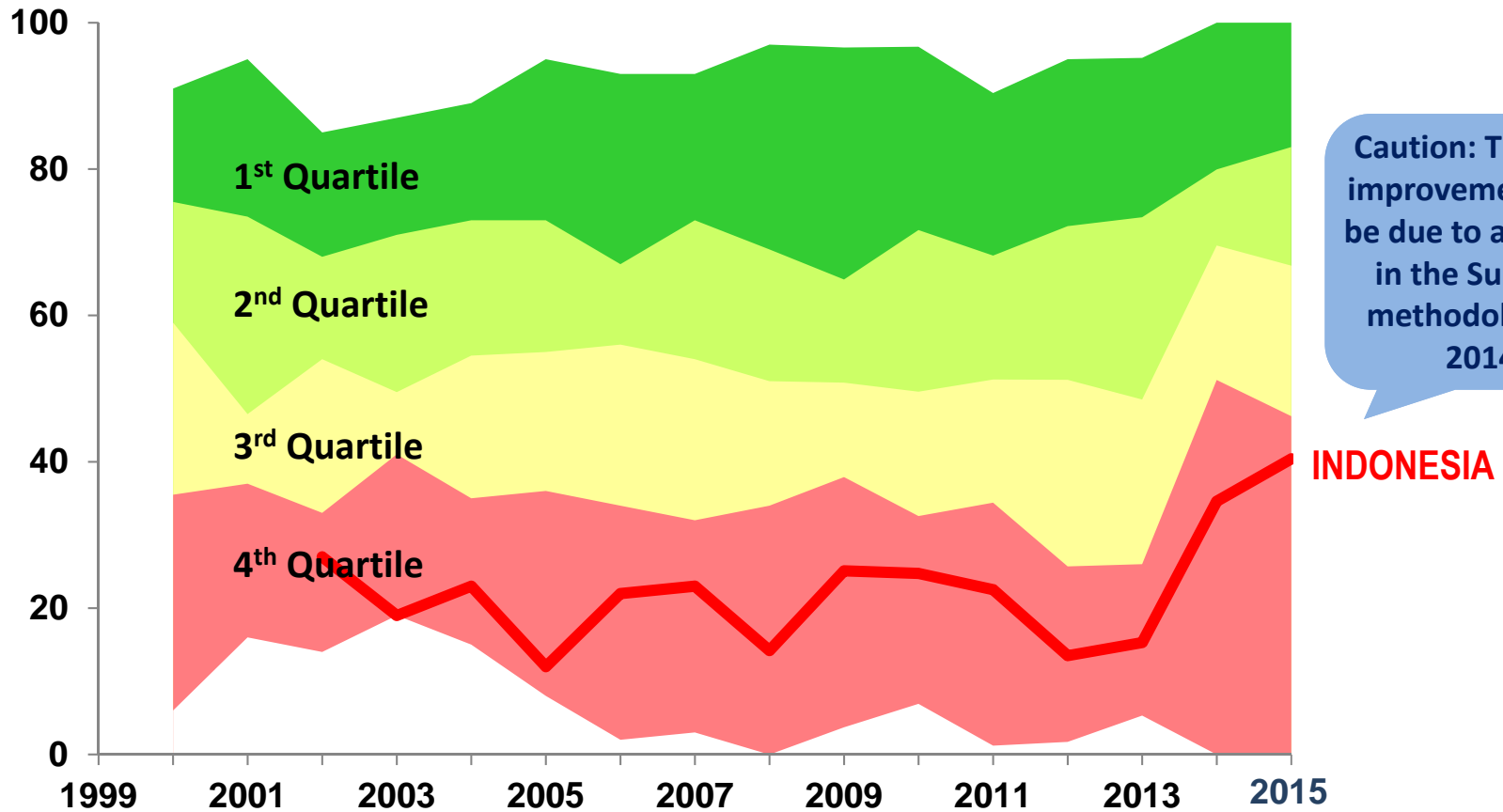


Source: Fraser Institute March 2016

Even so, Indonesia' ranking has (apparently) improved in recent years

... but is still in the bottom quartile

Policy Potential Index



Caution: The step improvement may be due to a change in the Survey's methodology in 2014

INDONESIA

Note: From 2014 onwards the Survey did not include an assessment of the *Amount of Corruption* or the *General level of Uncertainty in the country*

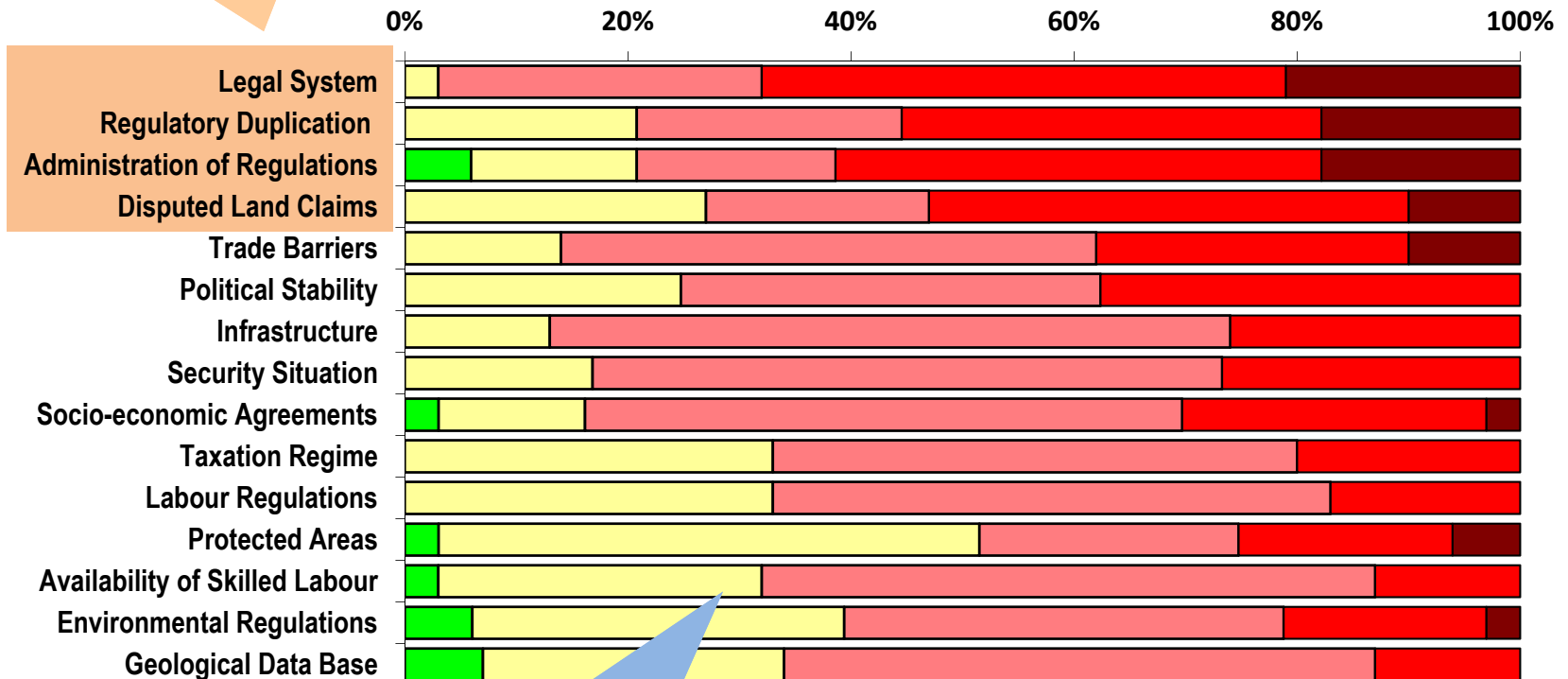
Source: MinEx Consulting analysis of Fraser Institute annual surveys

The Policy Potential Index is Based on 15 factors

Detailed Survey results for Indonesia : 2015

Four top concerns affecting mining investment

■ Encourages Investment
■ Not a Deterrent
■ Mild Deterrent
■ Strong Deterrent
■ Prevents Investment



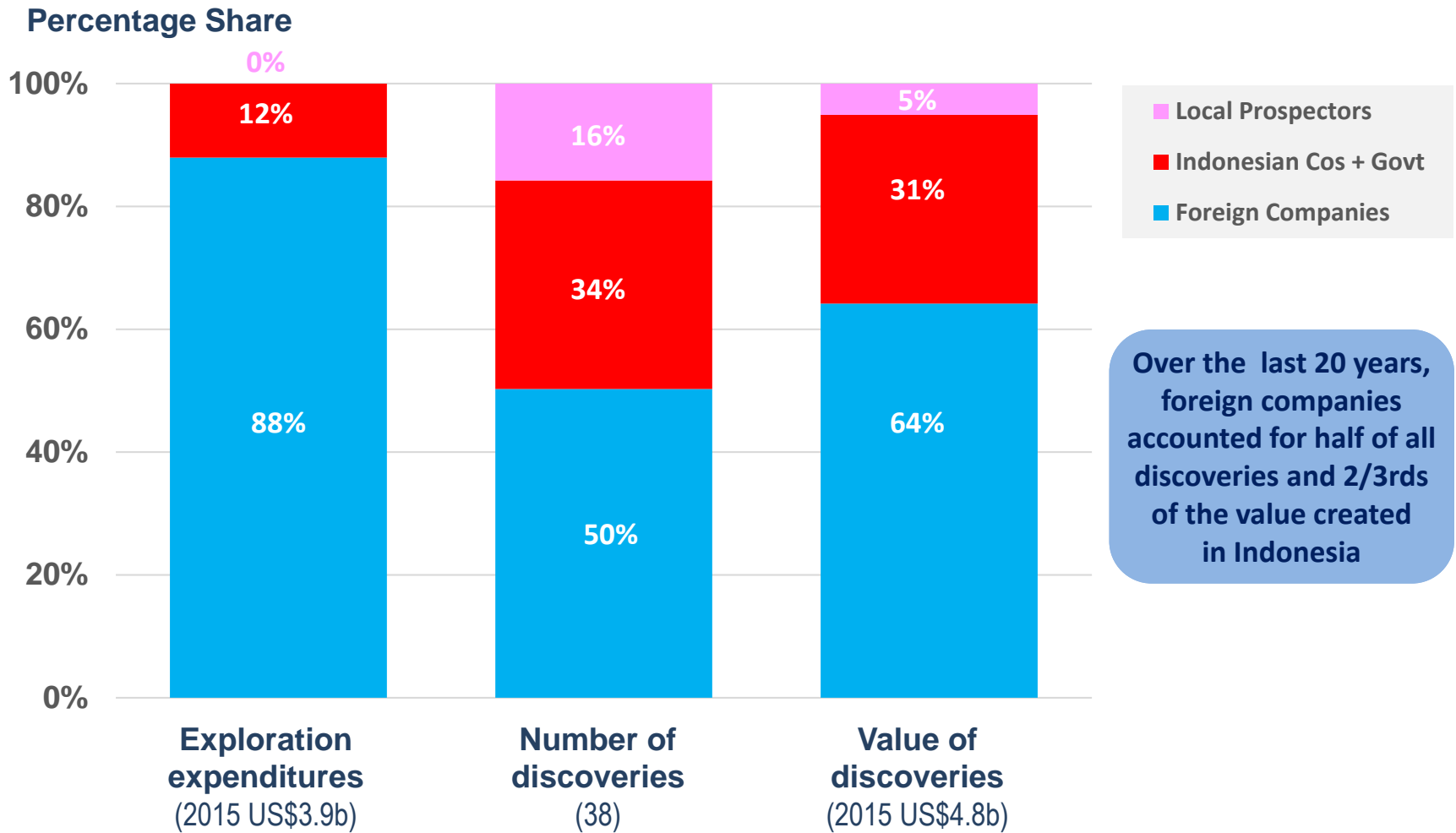
There is a wide diversity of opinion on how easy is it to work in Indonesia

Data: MinEx Consulting analysis of 2015 Fraser Institute survey

Over the last 20 years foreign companies account for most of the expenditures and most of the discoveries. For their size, local companies perform surprisingly well

7. RELATIVE PERFORMANCE OF LOCAL AND FOREIGN COMPANIES

Relative importance of foreign companies: 1996-2015



Note: Excludes expenditures and discoveries of Bulk Minerals

Source: MinEx Consulting © October 2016

If we don't support exploration now, the mining industry will quickly shrink in-size ... with obvious impact on employment and Government revenues

8. CONSEQUENCES OF A LONG TERM DECLINE IN THE DISCOVERY RATE

Mining & Exploration is high risk, long lead time activity

- 100 non-bulk deposits have been found in Indonesia since 1950, of these 44 have been mined
 - ... i.e. a **44%** conversion rate
- The average delay between discovery and development in Indonesia was **9.7** years

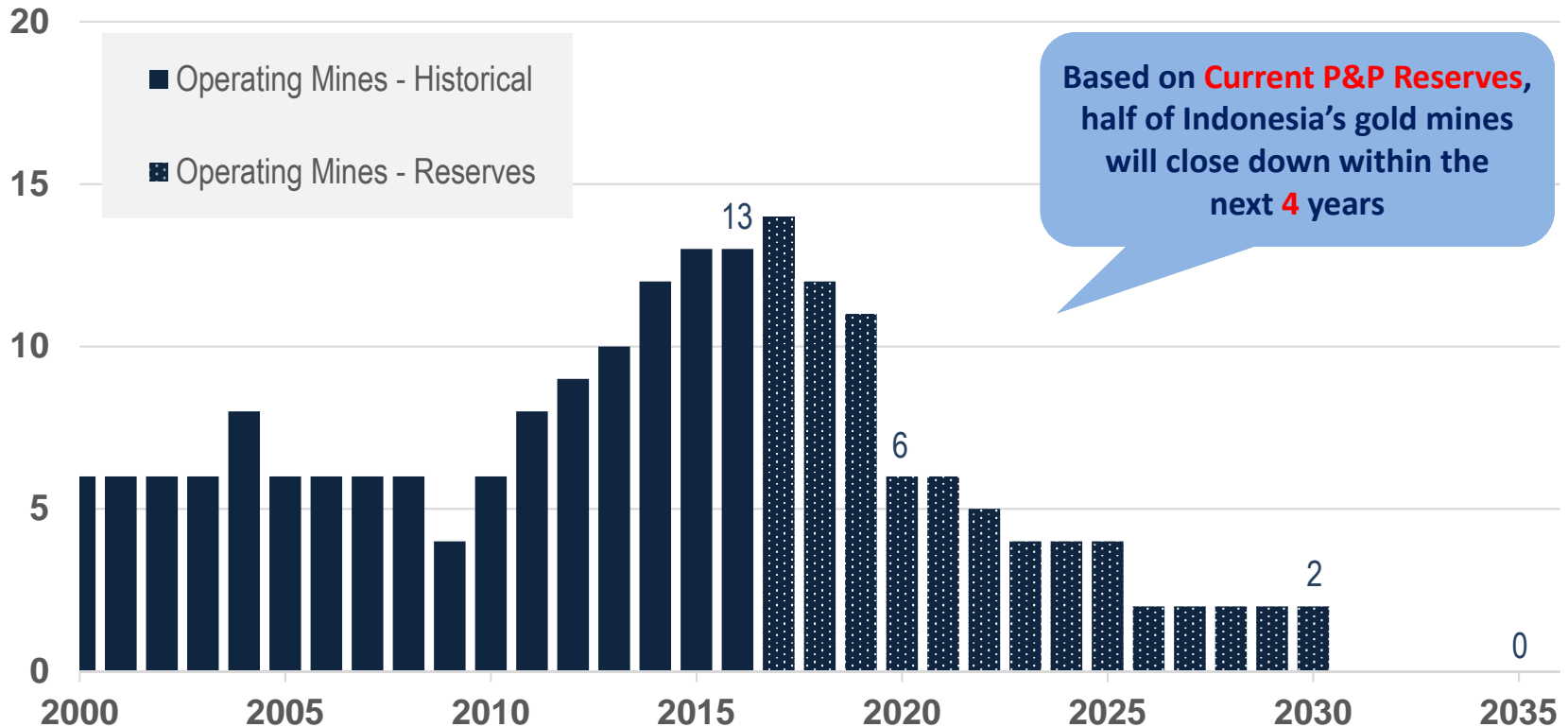
Average for
World was **45%**

Average for
World was **12.4**
years

To sustain the industry we need a strong pipeline of discoveries. Because of the inherent delays in converting a discovery into a mine, any downturn in exploration has major consequences on the long term size of the industry

Number of significant **gold** mines in Indonesia

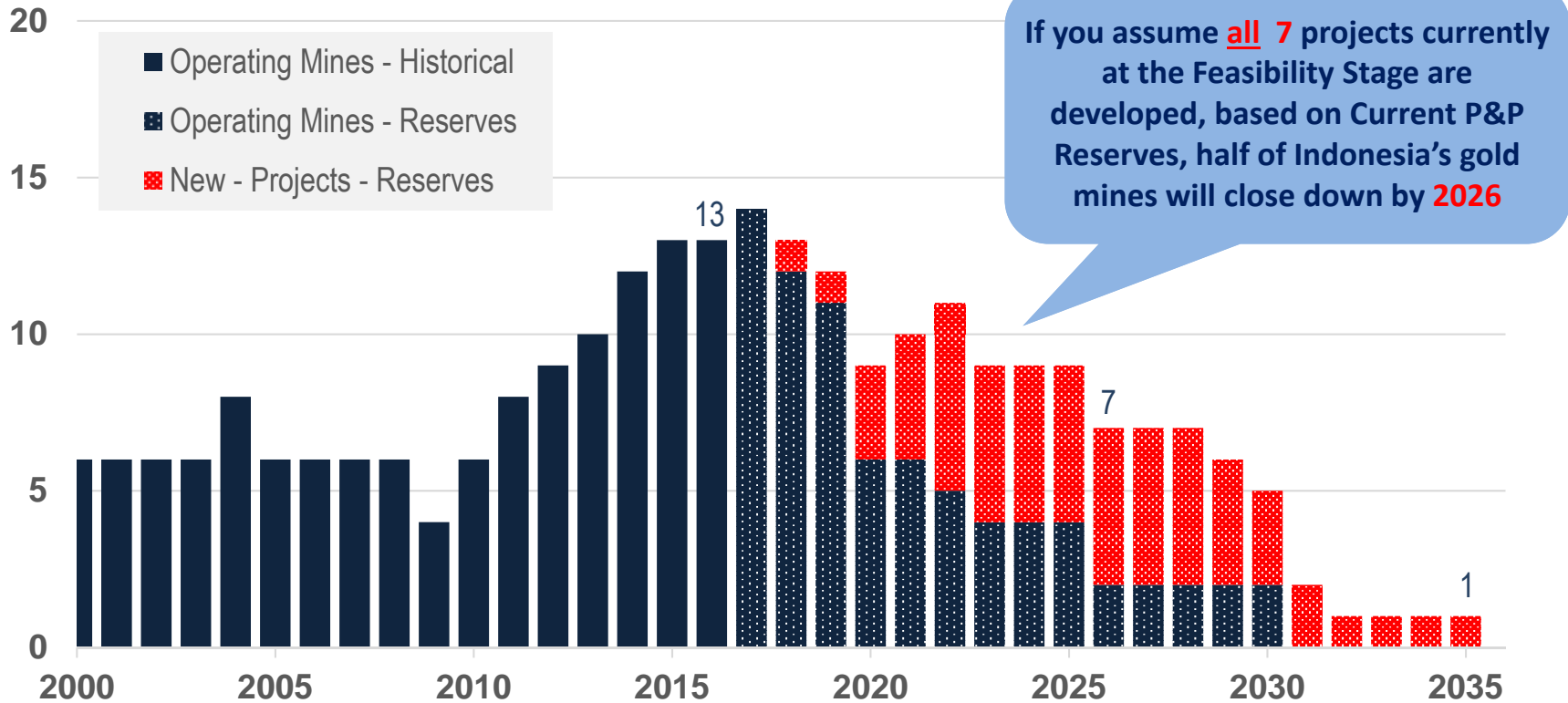
PESSIMISTIC SCENARIO



Note: Based on primary gold deposits containing >100 koz Au
 Excludes artisanal / alluvial mines
 Analysis ignore projects currently at the Advanced Exploration stage

Source: MinEx Consulting © October 2016

Number of significant **gold** mines in Indonesia

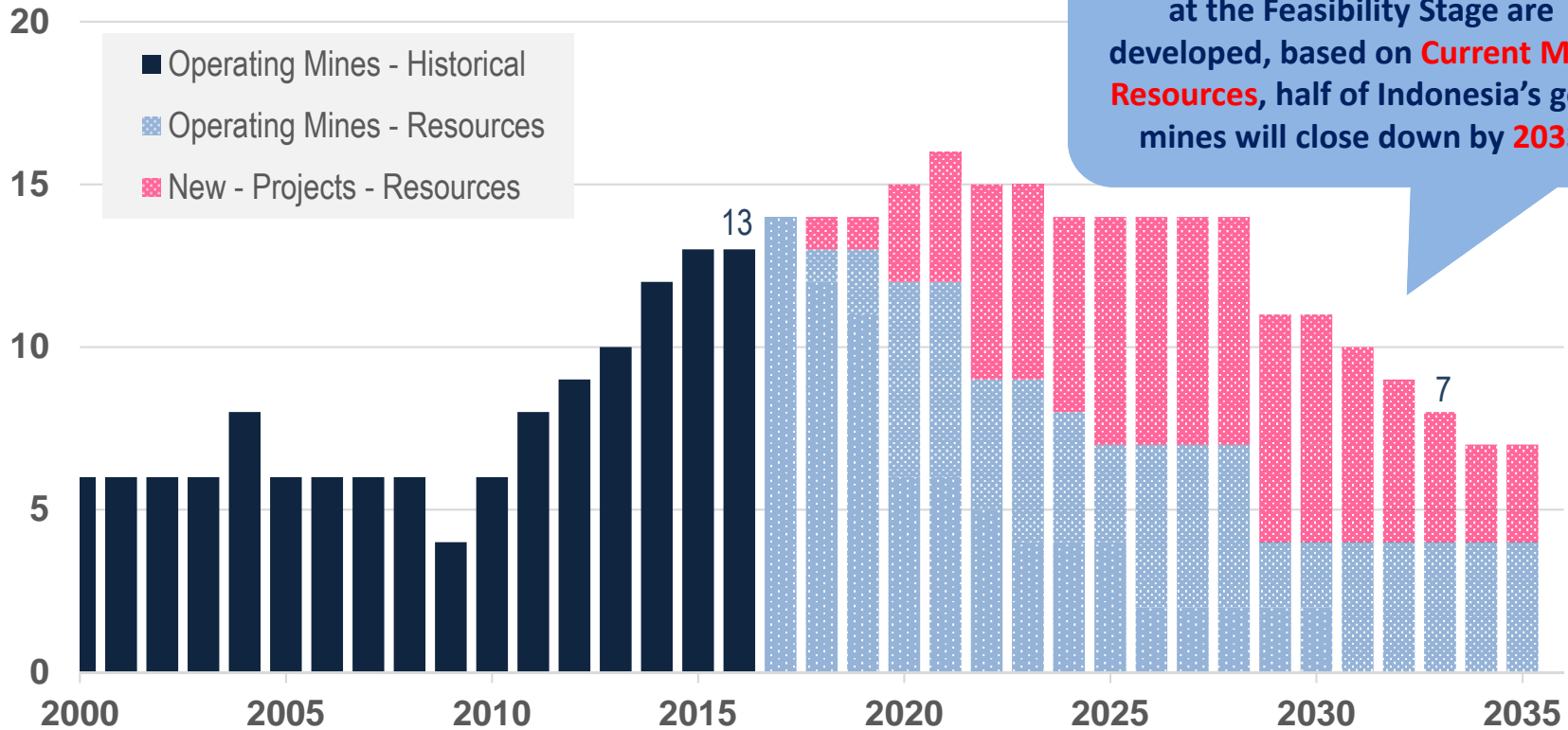


Note: Based on primary gold deposits containing >100 koz Au
 Excludes artisanal / alluvial mines
 Analysis ignore projects currently at the Advanced Exploration stage

Source: MinEx Consulting © October 2016

Number of significant **gold** mines in Indonesia

OPTIMISTIC SCENARIO



If you assume **all 7** projects currently at the Feasibility Stage are developed, based on **Current MI&I Resources**, half of Indonesia's gold mines will close down by **2033**

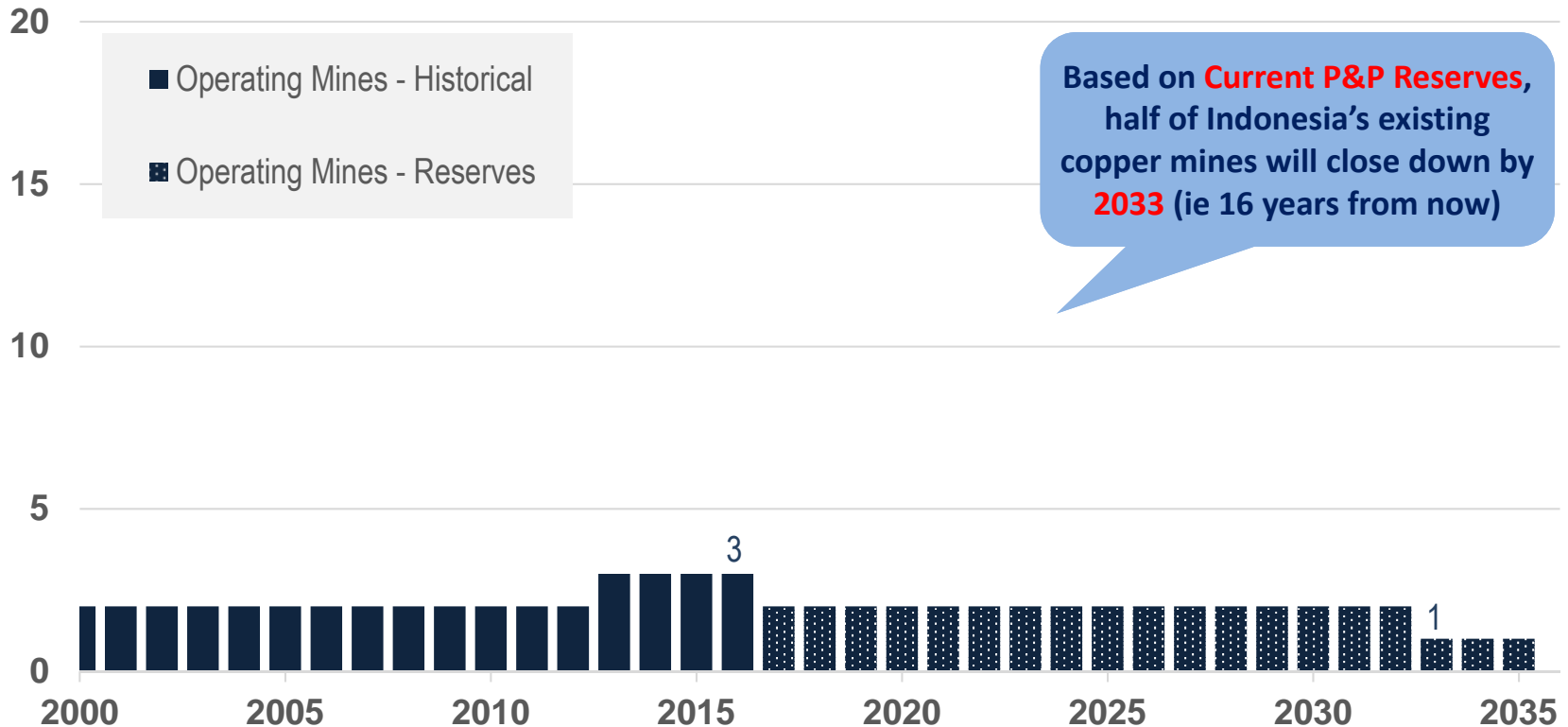
In practice not all of the new projects will be developed, and not all of the Resources will be mined

Note: Based on primary gold deposits containing >100 koz Au
Excludes artisanal / alluvial mines
Analysis ignore projects currently at the Advanced Exploration stage

Source: MinEx Consulting © October 2016

Number of significant copper mines in Indonesia

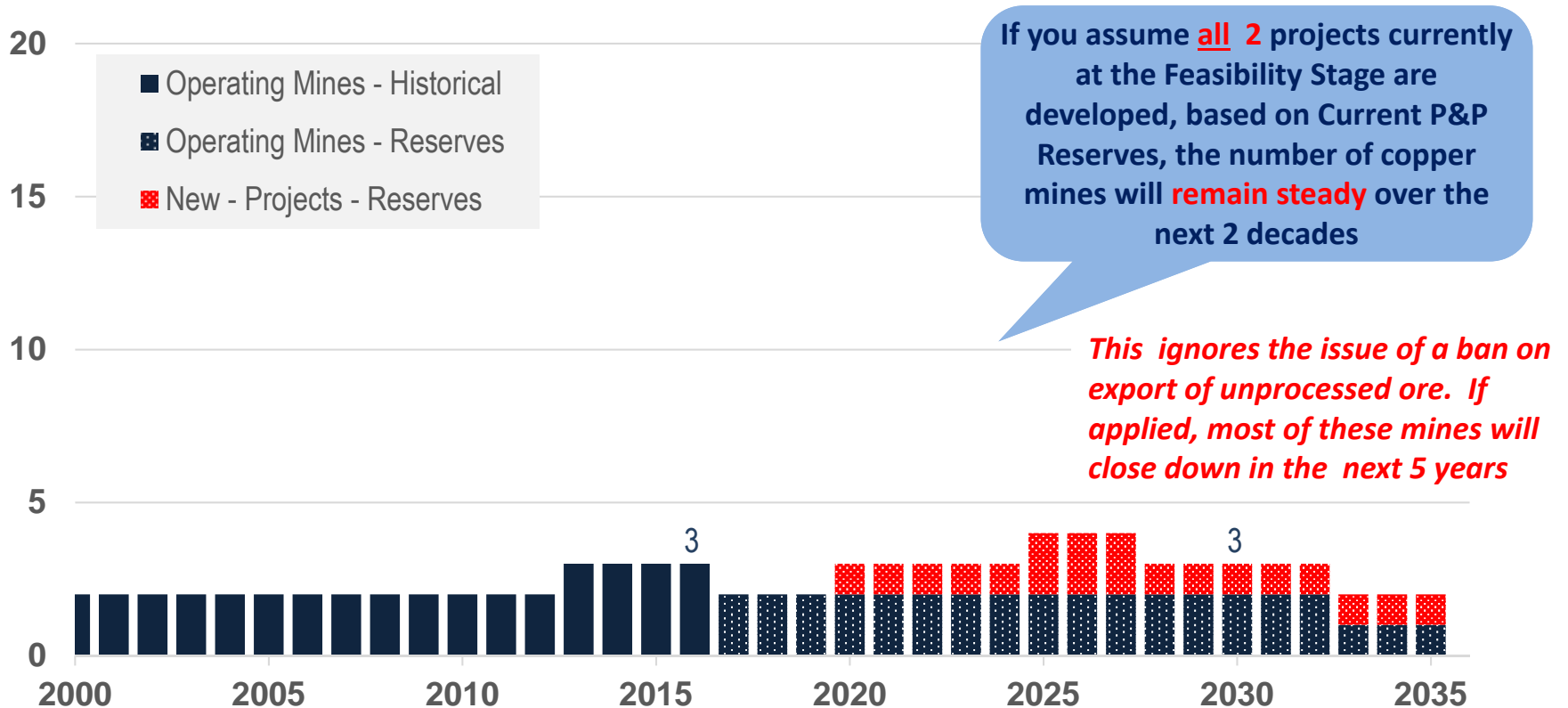
PESSIMISTIC SCENARIO



Note: Based on primary copper deposits containing >100 kt Cu
Analysis ignores projects currently at the Advanced Exploration stage

Source: MinEx Consulting © October 2016

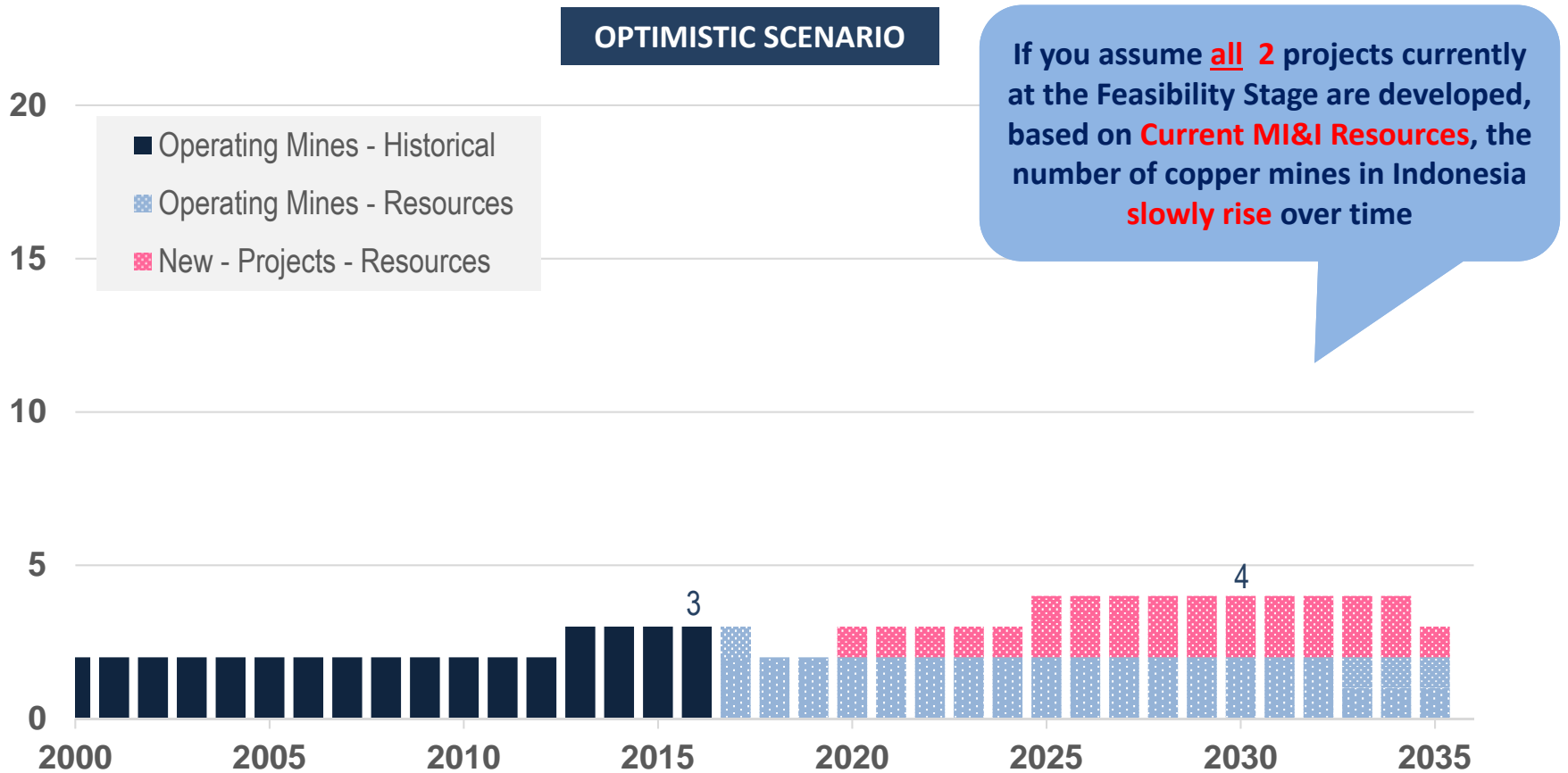
Number of significant copper mines in Indonesia



Note: Based on primary copper deposits containing >100 kt Cu
Analysis ignores projects currently at the Advanced Exploration stage

Source: MinEx Consulting © October 2016

Number of significant copper mines in Indonesia



In practice not all of the new projects will be developed, and not all of the Resources will be mined

Note: Based on primary copper deposits containing >100 kt Cu
Analysis ignores projects currently at the Advanced Exploration stage

Source: MinEx Consulting © October 2016

The solutions are obvious, but challenging.

9. WHAT CAN WE DO TO THIS THE PROBLEM OF DECLINING DISCOVERY RATES

What can we do to fix the problem ?

- Need to end the Moratorium on issuing new mining licenses
 - Reset the clock and give existing owners priority to “re-peg” old leases ... but only on condition they fund an aggressive exploration program
- Resolve the issue of overlapping titles
 - Let them lapse and allow companies to re-apply (same conditions as above)
- Introduce clear and sensible rules regarding access to forest reserves
- Reduce regulatory duplication and provide transparency in decision-making
- Allow foreign companies to sell their equity onto the open market
 - Encourage the public / superannuation funds to invest in mines
- Unwind the ban on exporting unprocessed minerals
 - Use the “carrot, not the stick” ... offer lower Royalty rates to companies processing material in-country, or
 - Government to invest in smelters, or
 - Set a size threshold on which mines need to process downstream
- Encourage local companies to be more active in greenfield exploration
 - Tax incentives, provide pre-competitive data (airborne surveys)

Summary / Conclusions [1/5]

1. Indonesia has a long history of exploration and mining

- Goes back over 1000 years, but half of all discoveries have been made in just the last 32 years

2. Location of discoveries in Indonesia

- Over the last 50 years, +119 significant deposits were found in Indonesia, including 19 in the last decade. The last known giant was Tujuh Bukit (2007)

3. Number, size and type of discoveries

- Between 1986-2005 ~3.5 significant discoveries were made each year. This has dropped to 1.9 discoveries p.a. in the last decade
- Most of the discoveries were coal and gold

4. Exploration expenditures

- Over the last 30 years \$5.2 billion (in 2015 US\$) was spent on mineral exploration in Indonesia (excluding bulk minerals, such as coal).
- 80% of the spend was on gold and copper

Summary / Conclusions [2/5]

5. Discovery performance

- Over the last decade, exploration expenditures rise, but the number of discoveries fell.
- The average cost per discovery rose from \$24m in 2005 to \$267m in 2014. The rate of increase was much faster than the World average
- General factors behind the decline in performance include:
 - Higher input costs, shift towards deeper cover, reduced focus on greenfield targets, decline in target quality and (more recently) lower exploration budgets ... which limit the amount drilling done
- Specific issues facing Indonesia include:
 - Moratorium on new IUPs, issue of overlapping titles, assess to Forests, need for foreign companies to divest, ban on exporting unprocessed ore

..... as a result, Indonesia's share of global exploration spend has halved in the last 3 years

-

Summary / Conclusions [3/5]

6. Country risk issues

- Investment in Indonesia is being held back by concerns over:
 - The legal system, regulatory duplication, administration of regulations and disputes over land
- Over the last decade Junior Companies accounted for ~52% of exploration spend, found 72% of the deposits and 45% of the value.

7. Relative performance of local and foreign companies

- Over the last 20 years, Foreign Companies accounted for 88% of the spend, 50% of the discoveries and 64% of the value-created

Summary / Conclusions [4/5]

8. Consequences of a long term decline in discovery rate

- On average less than half of all discoveries get developed into mines, and those that do, it takes (on average) ~10 years from discovery to startup :
 - any downturn in exploration (and discovery rates) has major consequences on the long term size of the local industry
 - Based on current reserves or resources, the number of gold mines in Indonesia will halve in the next 10-17 years.
 - There is a risk that most of the current copper mines could close down within 5 years. At the very least, it will adversely impact on investment decisions

Summary / Conclusions [5/5]

9. Possible solutions to improving the discovery rate

- Need to end the Moratorium on issuing new mining licenses
- Resolve the issue of overlapping titles
- Introduce clear and sensible rules regarding access to forest reserves
- Reduce regulatory duplication and provide transparency in decision-making
- Allow foreign companies to sell their equity onto the open market
- Encourage local companies to be more active in greenfield exploration
- Unwind the ban on exporting unprocessed minerals
 - Use the “carrot, not the stick” ... offer lower Royalty rates to companies processing material in-country

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