

Overview of Exploration in the Asia Pacific Region – the rising importance of China

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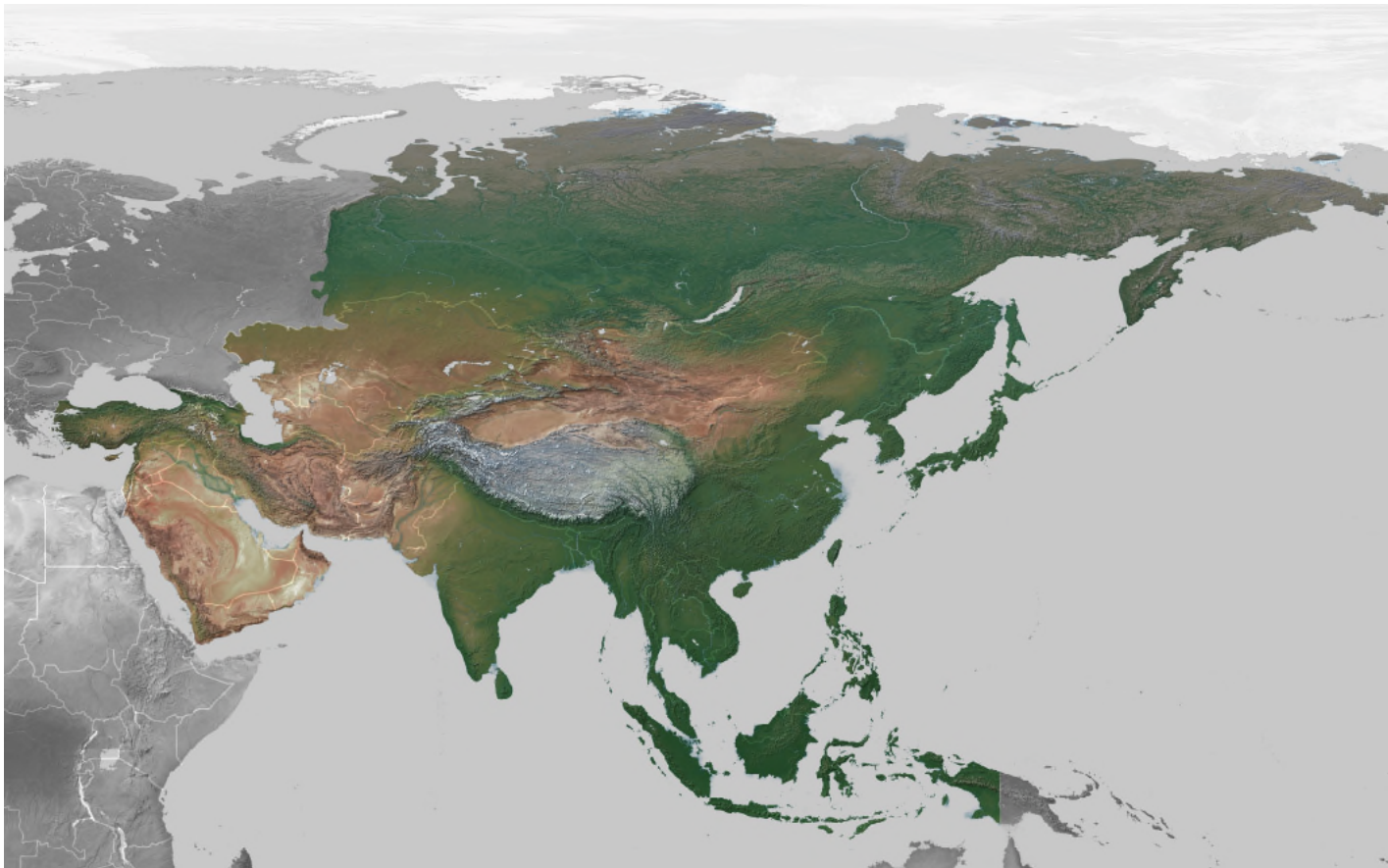
Overview

1. Countries covered in the analysis
2. Trends in exploration spend
3. Number of discoveries made – *How many were found and what metal?*
4. Location of deposits – *Where were they found?*
5. Location of discoveries made in last decade
6. Quality and value of the discoveries – *focus on finding Tier 1 & 2 deposits, and does exploration make money?*
7. Overview of China's mining sector – *it's much bigger than you think !*
8. Conclusions

There are 50 countries in Asia and it spans across 1/3rd of the World

1. COUNTRIES COVERED IN THE ANALYSIS

Asia

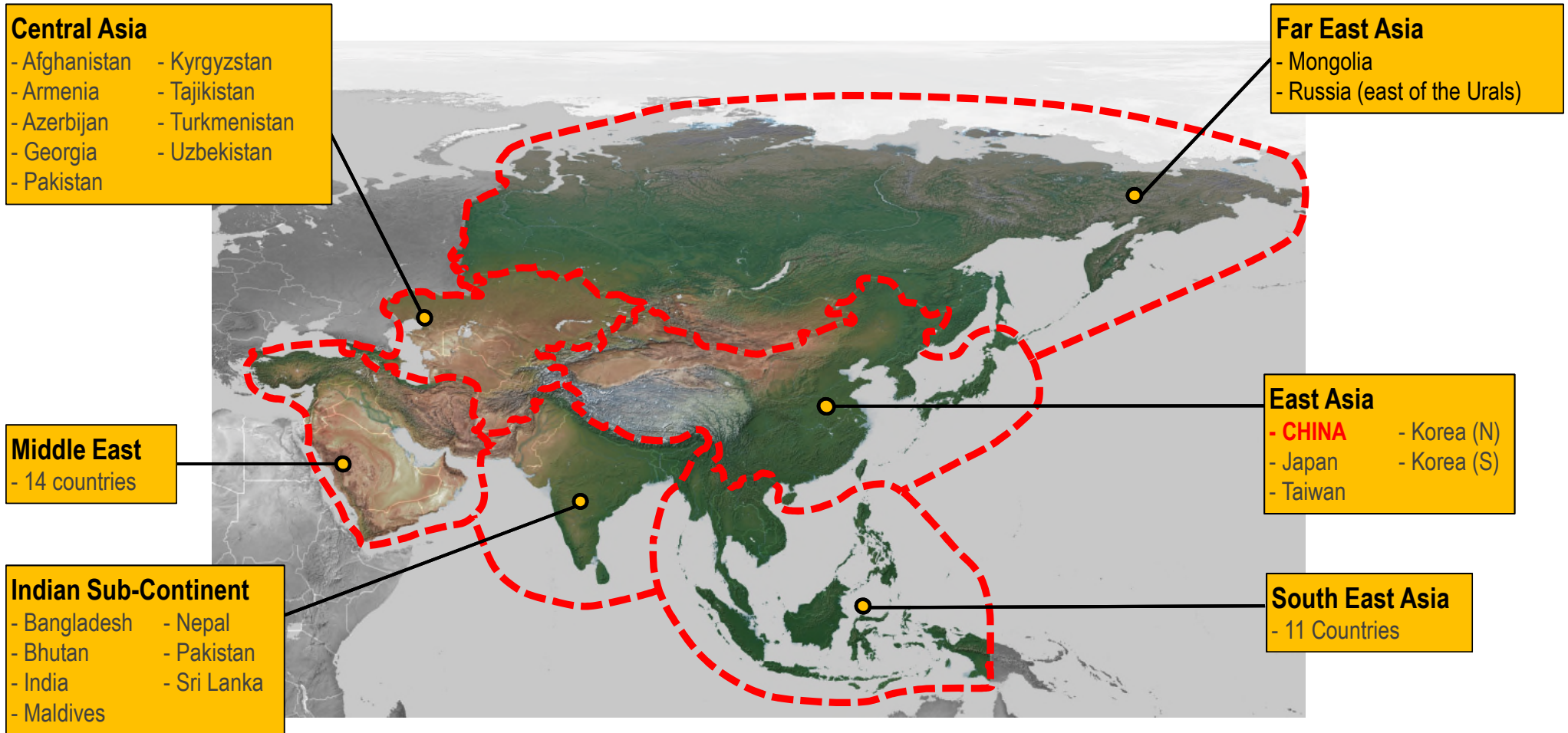


Asia covers **33.4%** of the World's# land area

China's share is 7%

Excluding Antarctica

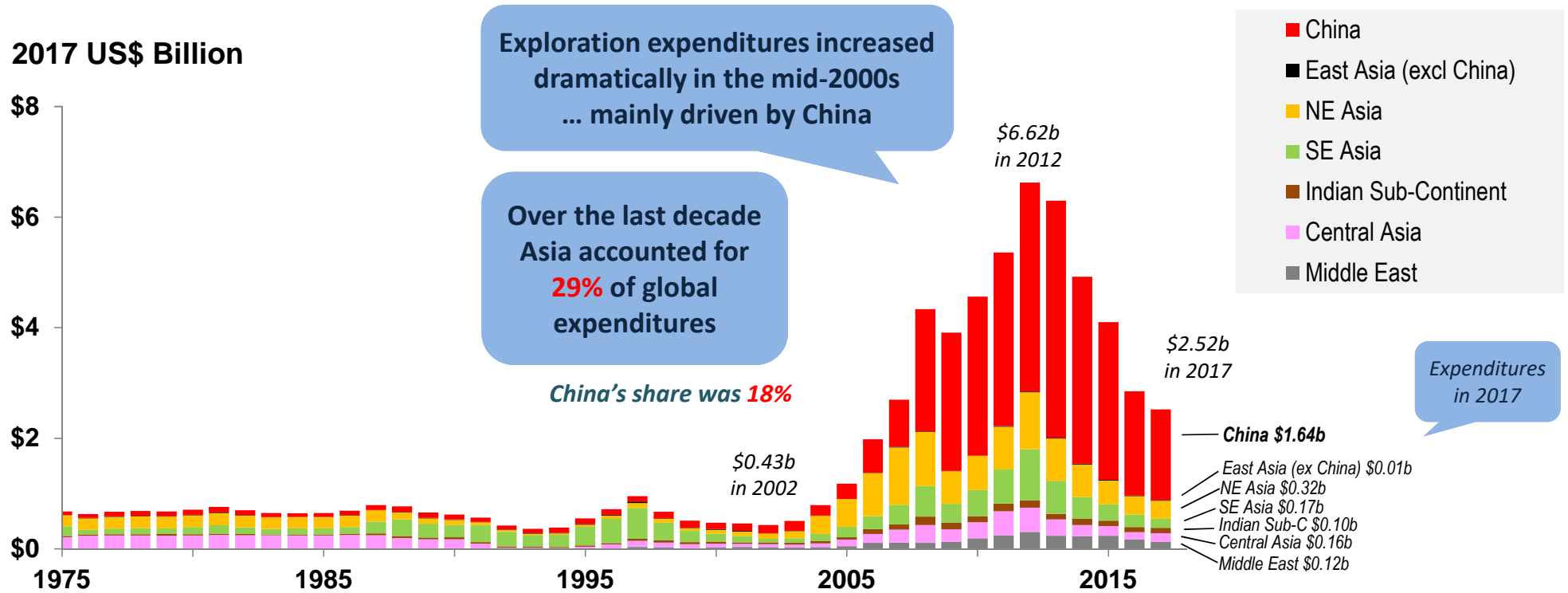
6 Regions in Asia



Exploration expenditures have increased dramatically

2. TRENDS IN EXPLORATION SPEND

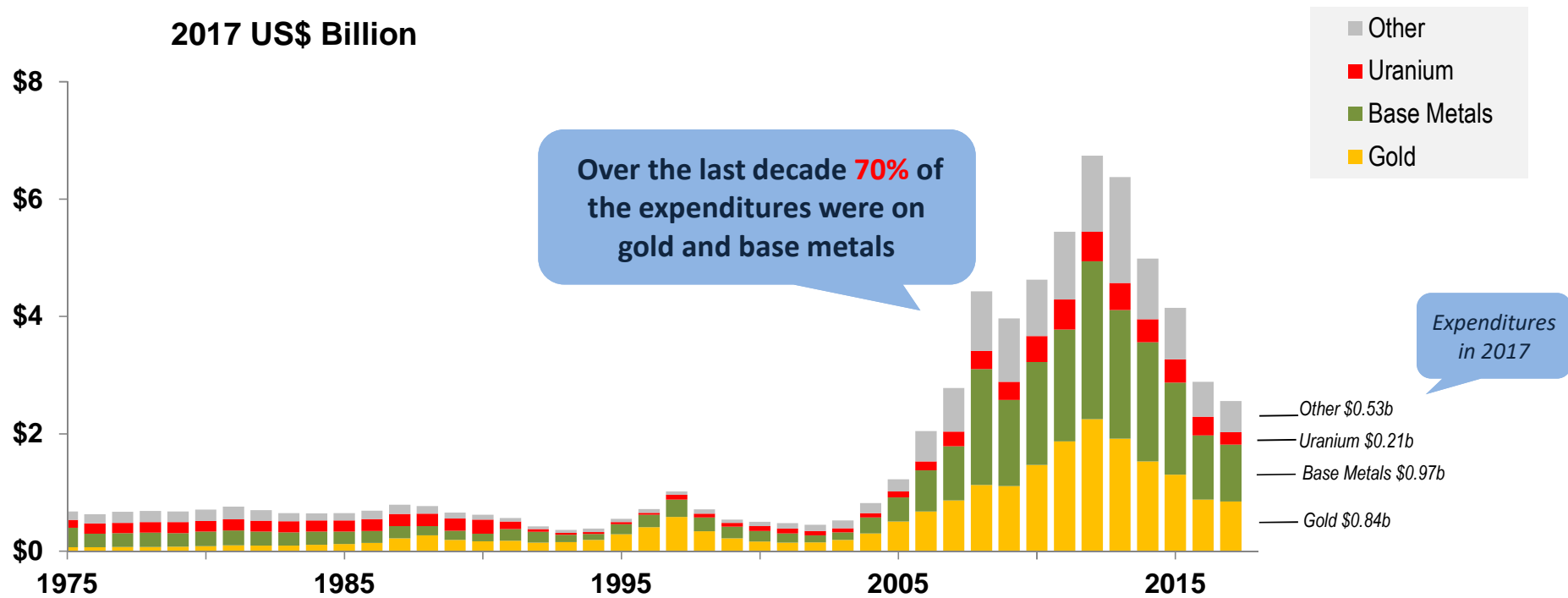
Exploration Expenditures by regions within Asia : 1975-2017



Note: Excludes Bulk Minerals (i.e. bauxite, coal and iron ore)

Source: Estimates by MinEx Consulting © April 2018 based on data from the OECD (for uranium), MOLAR (for China) and SNL Metals & Mining data, an offering of S&P Global Market Intelligence

Exploration Expenditures by commodity within Asia : 1975-2017



Note: Excludes Bulk Minerals (i.e. bauxite, coal and iron ore)

Source: Estimates by MinEx Consulting © April 2018 based on data from the OECD (for uranium), MOLAR (for China) and SNL Metals & Mining data, an offering of S&P Global Market Intelligence

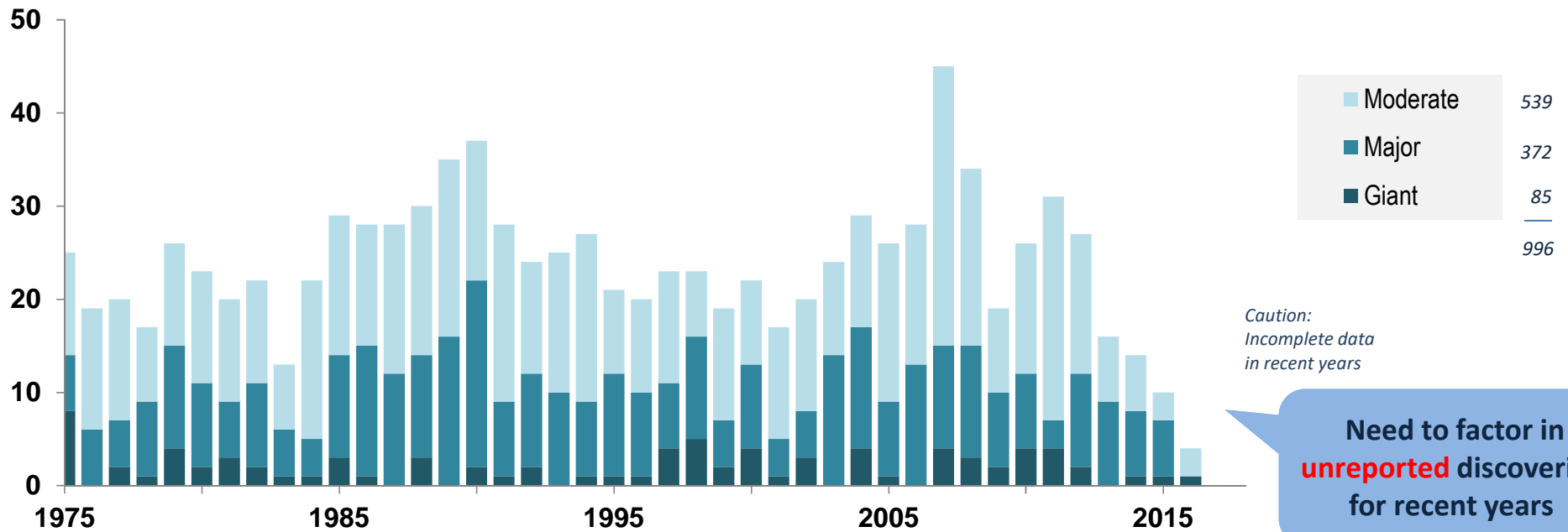
Since 1975, 1047 significant deposits were found in Asia,
including 241 in the last decade

3. NUMBER OF DISCOVERIES MADE

Number of discoveries by size

Mineral discoveries in Asia: 1975-2017

Number



Note: Excludes Bulk Mineral discoveries (i.e. bauxite, coal and iron ore)

"Moderate" >100koz Au, >10kt Ni, >100Kt Cu equiv, 250kt Zn+Pb, >5kt U₃O₈

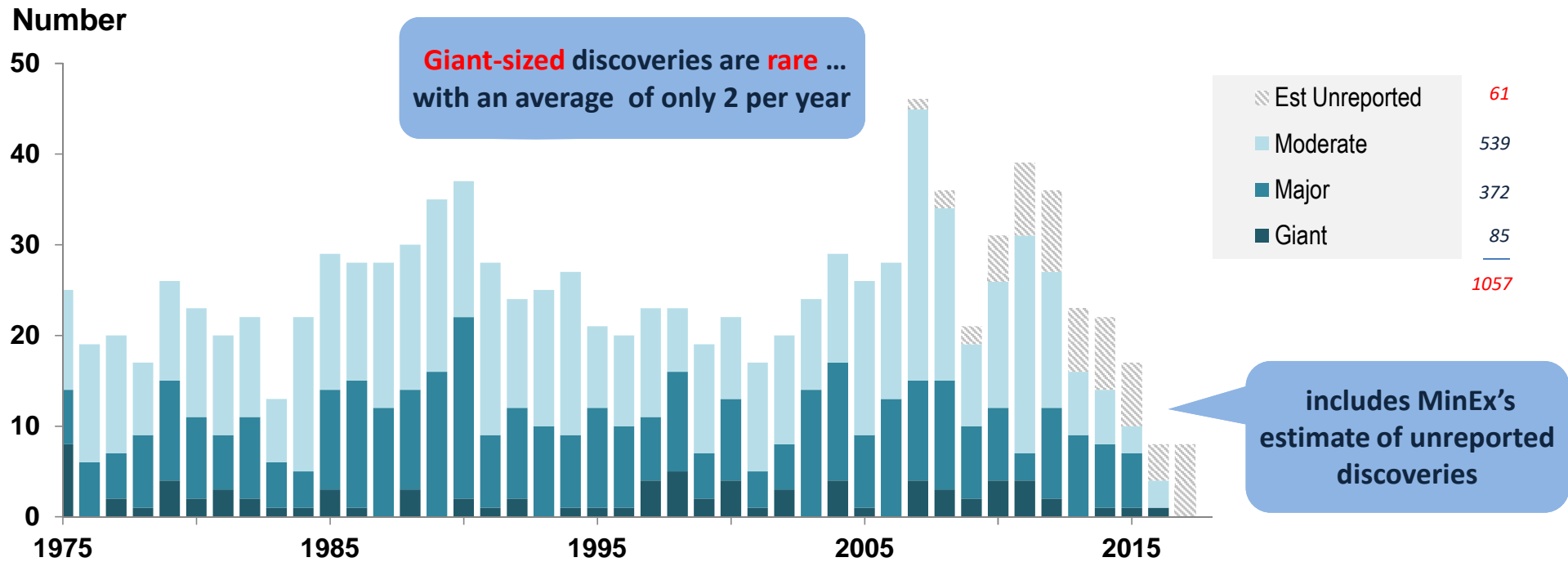
"Major" >1Moz Au, >100kt Ni, >1Mt Cu equiv, 2.5Mt Zn+Pb, >25kt U₃O₈

"Giant" >6Moz Au, >1Mt Ni, >5Mt Cu equiv, 12Mt Zn+Pb, >125kt U₃O₈

Source: MinEx Consulting © April 2018

Number of discoveries by size

Mineral discoveries in Asia: 1975-2017



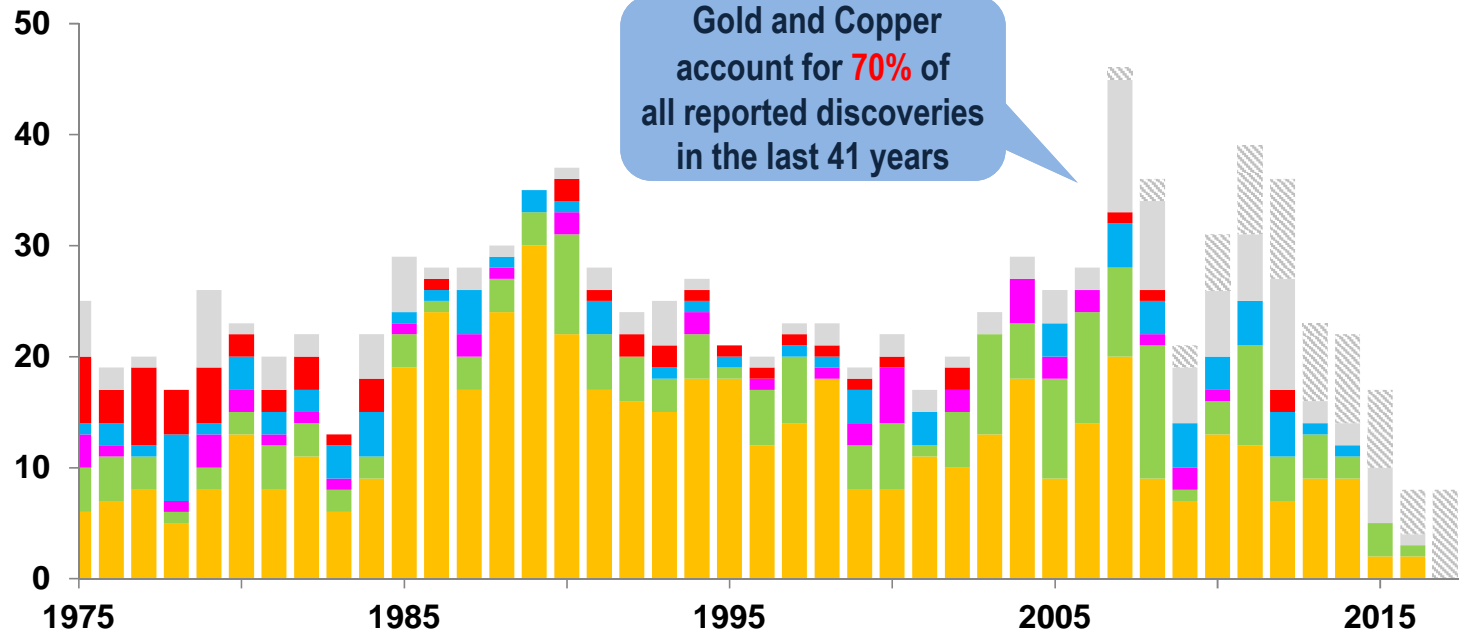
Note: Excludes Bulk Mineral discoveries (i.e. bauxite, coal and iron ore)
 "Moderate" >100koz Au, >10kt Ni, >100Kt Cu equiv, 250kt Zn+Pb, >5kt U₃O₈
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Source: MinEx Consulting © April 2018

Number of discoveries by commodity

Mineral discoveries in Asia: 1975-2017

Number



Est Unreported	61
Other	120
Uranium	57
Zinc/Lead	76
Nickel	44
Copper	173
Gold	526
	1057

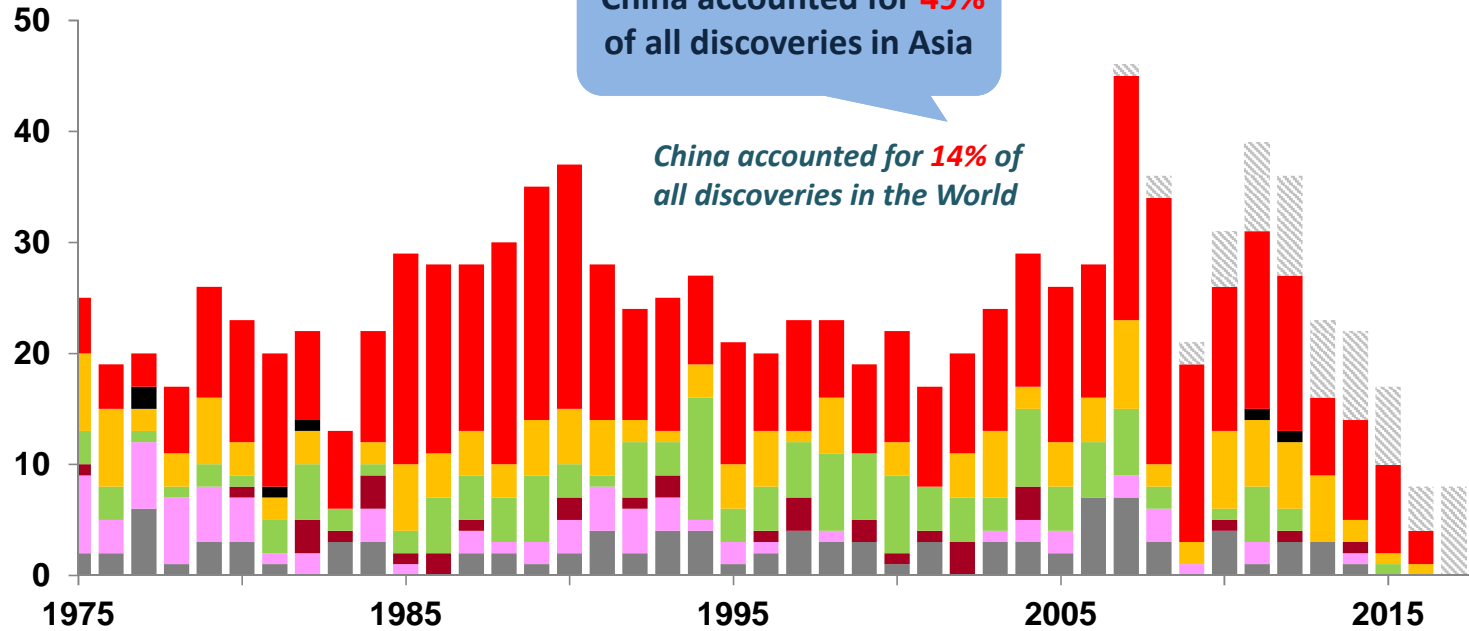
Note: Based on Moderate-, Major- and Giant-sized deposits
 Excludes Bulk Minerals (such as bauxite, coal and iron ore)
 Excludes satellite deposits in existing camps

Source: MinEx Consulting © April 2018

Number of discoveries by location

Mineral discoveries in Asia: 1975-2017

Number



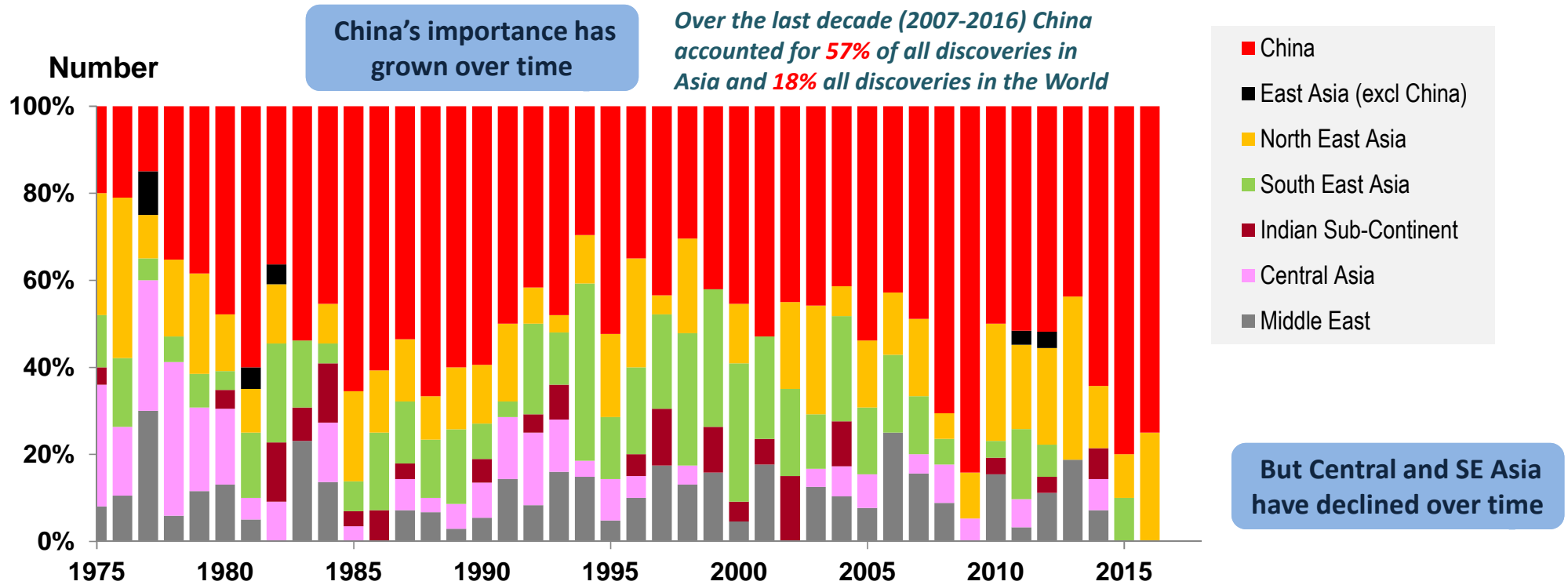
Est Unreported	61
China	486
East Asia (excl China)	6
North East Asia	152
South East Asia	142
Indian Sub-Continent	35
Central Asia	76
Middle East	99
Total	1057

Note: Based on Moderate-, Major- and Giant-sized deposits
 Excludes Bulk Minerals (such as bauxite, coal and iron ore)
 Excludes satellite deposits in existing camps

Source: MinEx Consulting © April 2018

Number of discoveries by location

Mineral discoveries in Asia: 1975-2017



Note: Based on Moderate-, Major- and Giant-sized deposits
 Excludes Bulk Minerals (such as bauxite, coal and iron ore)
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Source: MinEx Consulting © April 2018

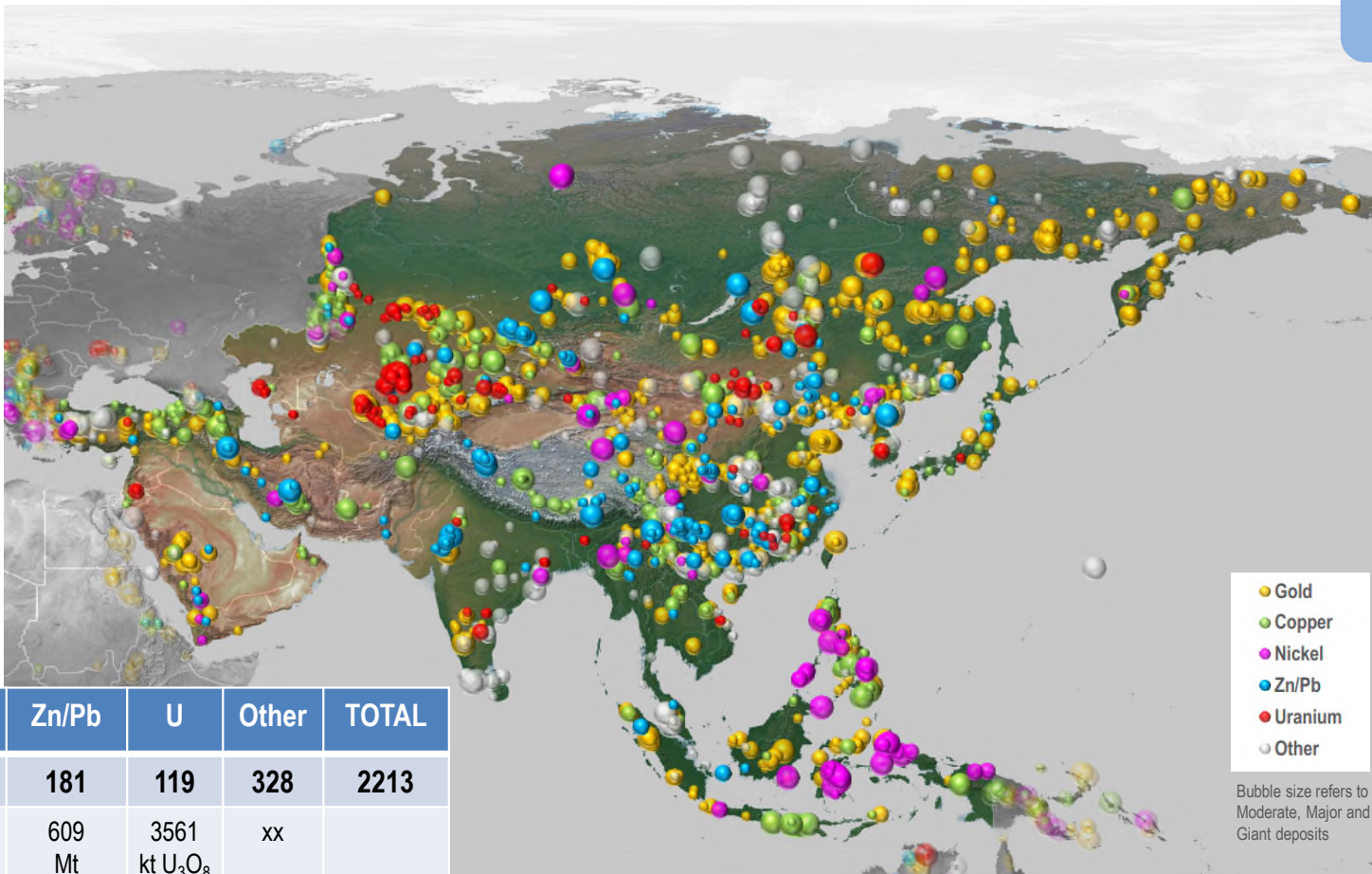
Over a quarter of the World's mineral deposits are in Asia

4. LOCATION OF DEPOSITS

Asia – known deposits : All Years

There are **2213** significant# mineral deposits in Asia

Accounts for **27%** of the World. China's share is **11%**



- Gold
- Copper
- Nickel
- Zn/Pb
- Uranium
- Other

Bubble size refers to Moderate, Major and Giant deposits

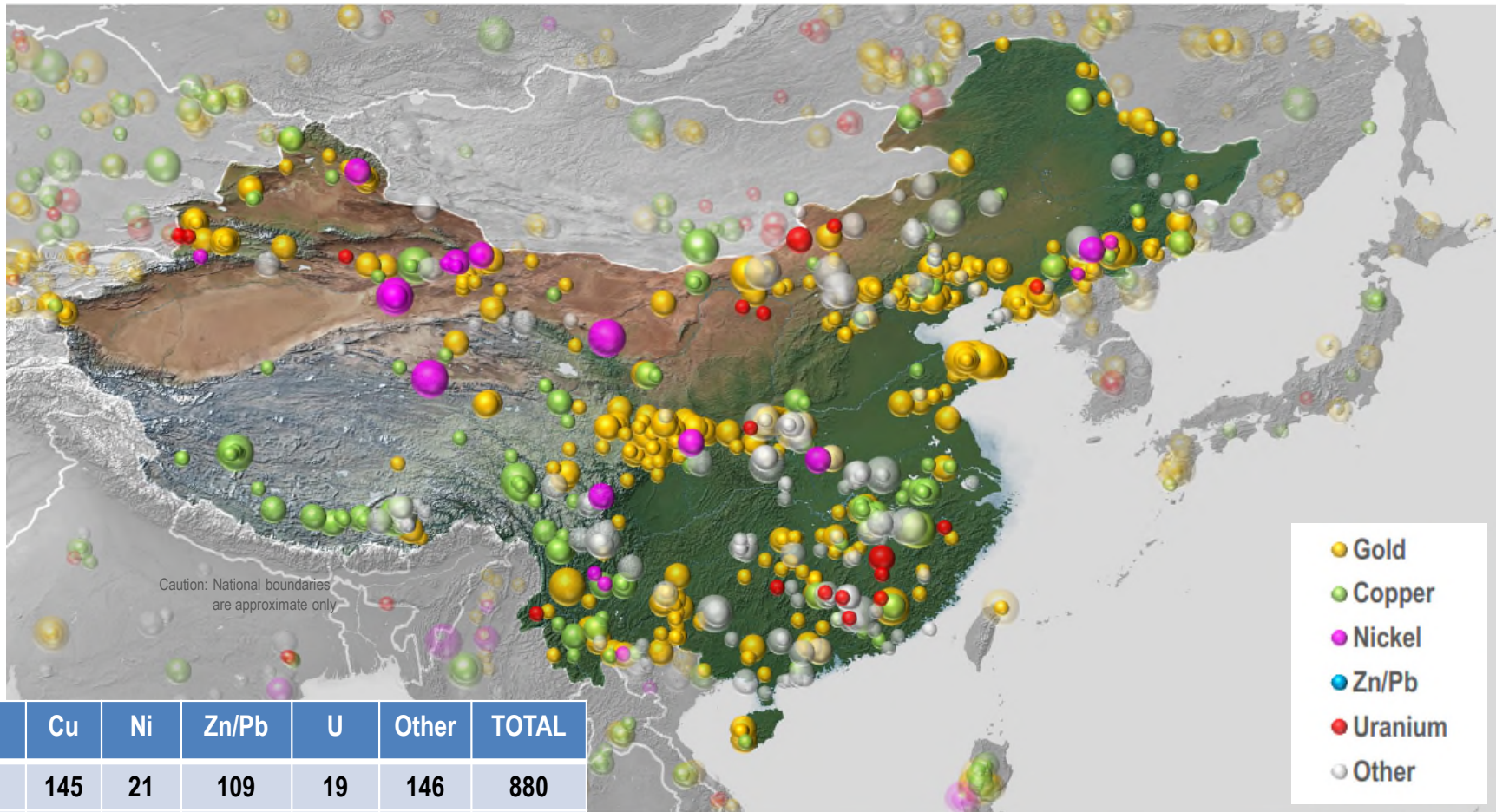
Asia (50 Countries)

	Au	Cu	Ni	Zn/Pb	U	Other	TOTAL
No.	1100	395	90	181	119	328	2213
Metal	3009 Moz	767 Mt	97 Mt	609 Mt	3561 kt U ₃ O ₈	xx	

Significant defined as “>=Moderate” i.e. Pre-mined resources >100koz Au, >10kt Ni, >100kt Cu equiv, 250kt Zn+Pb, >5kt U₃O₈. Analysis excludes Bulk Mineral deposits.

Source: MinEx Consulting © April 2018

China : All Years



China

	Au	Cu	Ni	Zn/Pb	U	Other	TOTAL
No.	440	145	21	109	19	146	880
Metal	586 Moz	171 Mt	10 Mt	264 Mt	287 kt U ₃ O ₈	xx	

Source: MinEx Consulting © April 2018

Asia versus the World

Number of significant deposits and contained metal (on a pre-mined resource basis)

	Land Area	Au	Cu	Ni	Zn/Pb	U ₃ O ₈	Other	TOTAL
		Number of Deposits						
World (including Asia)	135 M km² #	4164	1329	415	535	380	1330	8153
Asia	45 M km² (33%)	1100 (26%)	395 (30%)	90 (22%)	181 (34%)	119 (31%)	328 (25%)	2213 (27%)
China	10 M km² (7%)	440 (11%)	145 (11%)	21 (5%)	109 (20%)	19 (5%)	146 (11%)	880 (11%)
		Contained Metal						
World (including Asia)		12,874 Moz	3,942 Mt	339 Mt	1,886 Mt	15,521 kt		
Asia		3,009 Moz (23%)	767 Mt (20%)	97 Mt (29%)	609 Mt (33%)	3,561 kt (23%)		
China		586 Moz (5%)	171 Mt (4%)	10 Mt (3%)	264 Mt (14%)	287 kt (2%)		

While China has lots of deposits, they tend to be small in size

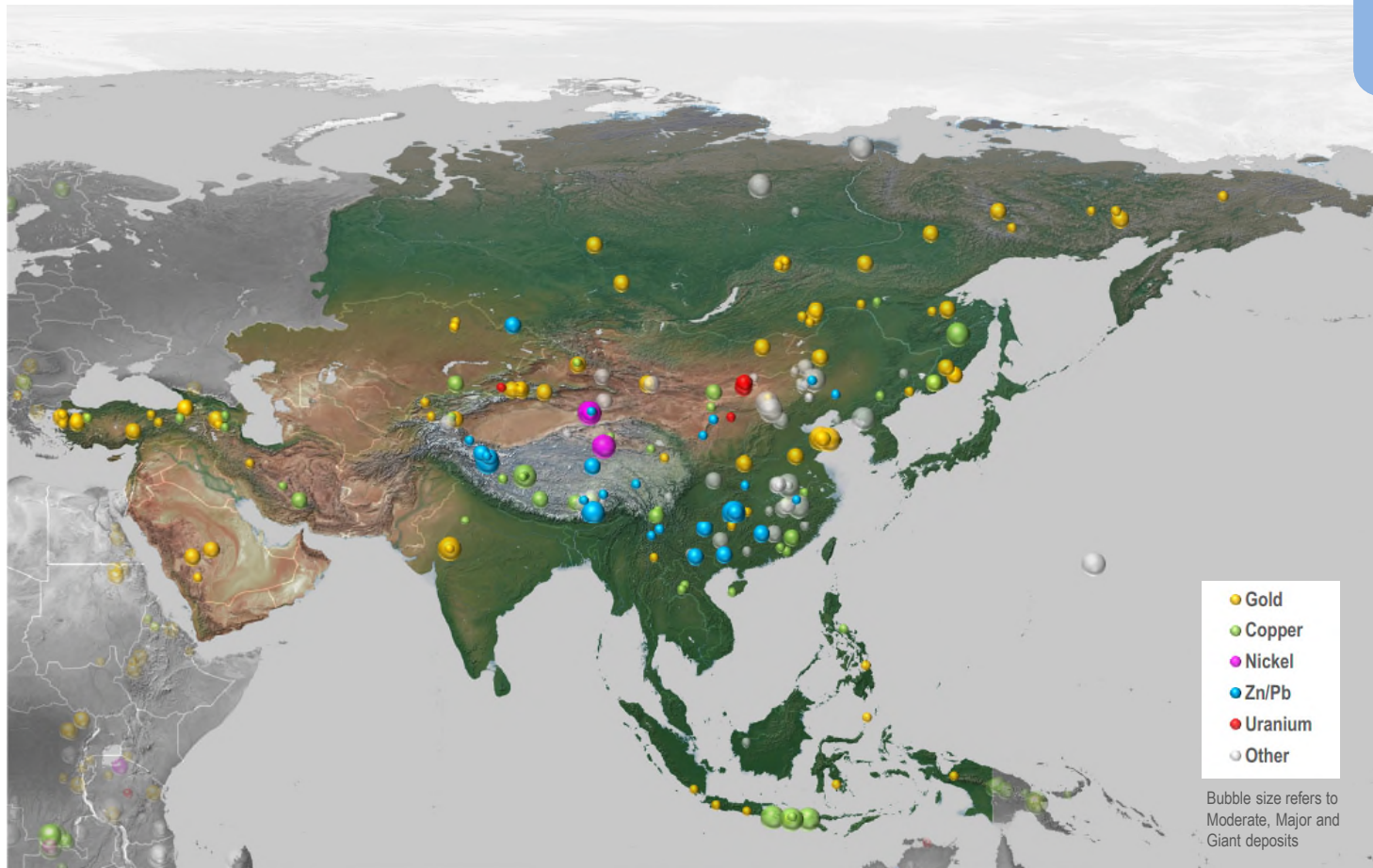
Excludes 14 million km² for Antarctica

Source: MinEx Consulting © April 2018

Over the last decade (2007-16) a total of 226 significant deposits were found in Asia

5. LOCATION OF DISCOVERIES MADE IN LAST DECADE

Asia Discoveries : 2007-2016



226 known discoveries in Asia
Not counting estimated 53 unreported discoveries

132 of these were in China

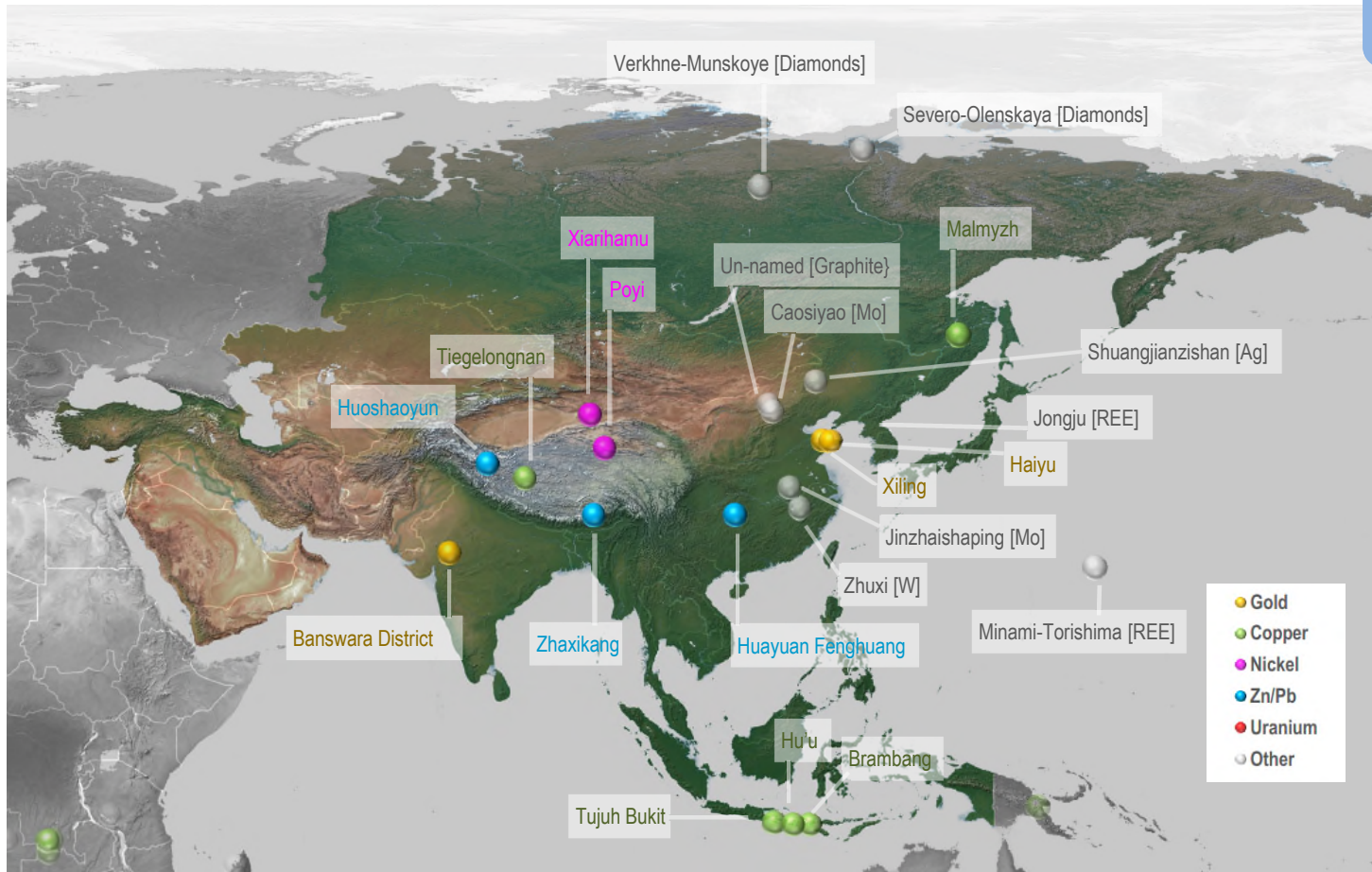
Base on >= Moderate-sized deposits >100koz Au, >10kt Ni, >100kt Cu equiv, 250kt Zn+Pb, >5kt U₃O₈

Source: MinEx Consulting © April 2018

Asia Discoveries: 2007-2016 : Giant Deposits only

22 discoveries were Giants

13 were in China

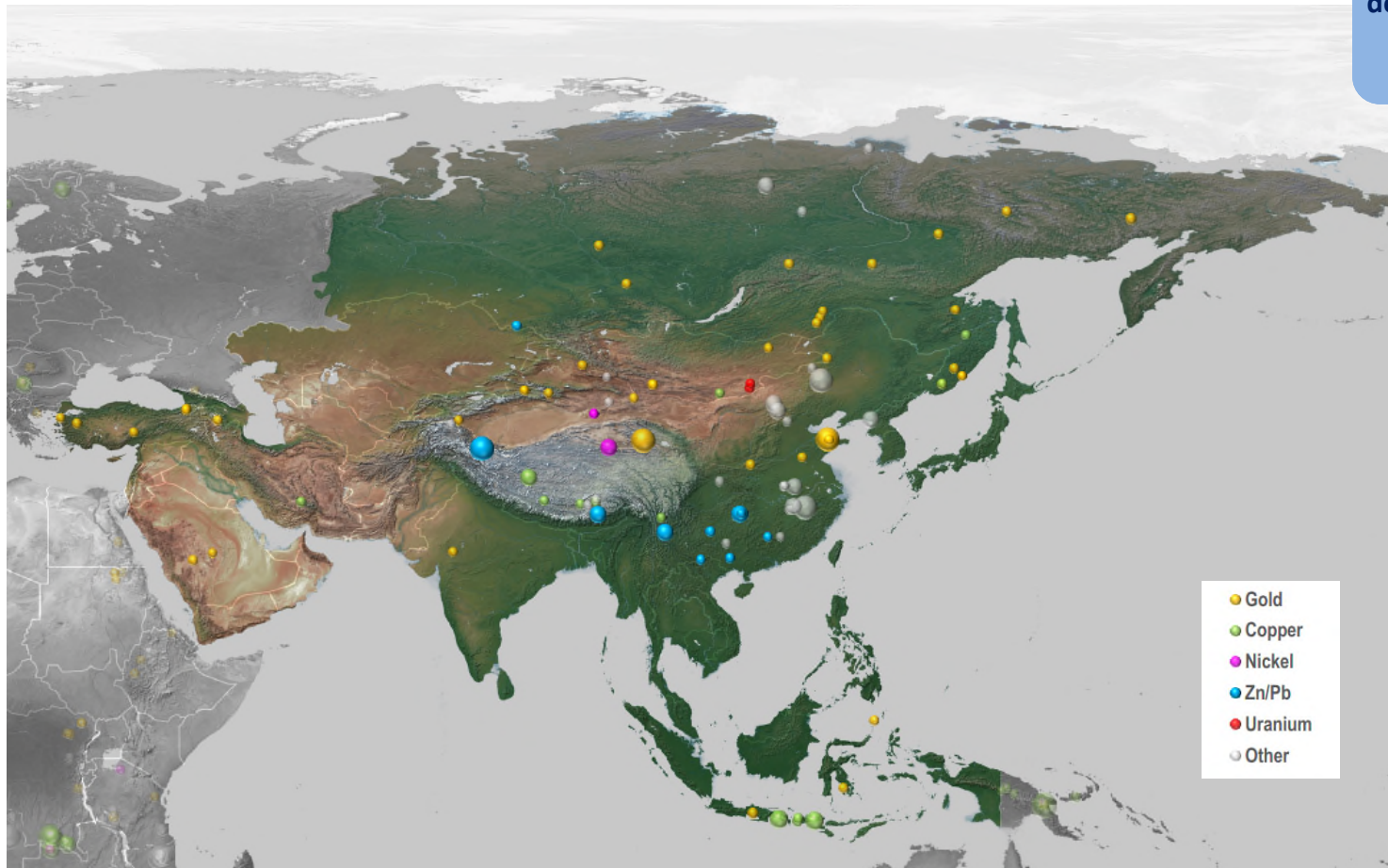


"Giant" defined as >6Moz Au, >1Mt Ni, >5Mt Cu equiv, 12Mt Zn+Pb, >125kt U₃O₈

Source: MinEx Consulting © April 2018

Asia Discoveries: 2007-2016 : **by Tier**

A total of **5 Tier-1** deposits, **14 Tier-2** and **83 Tier-3** deposits were found in Asia



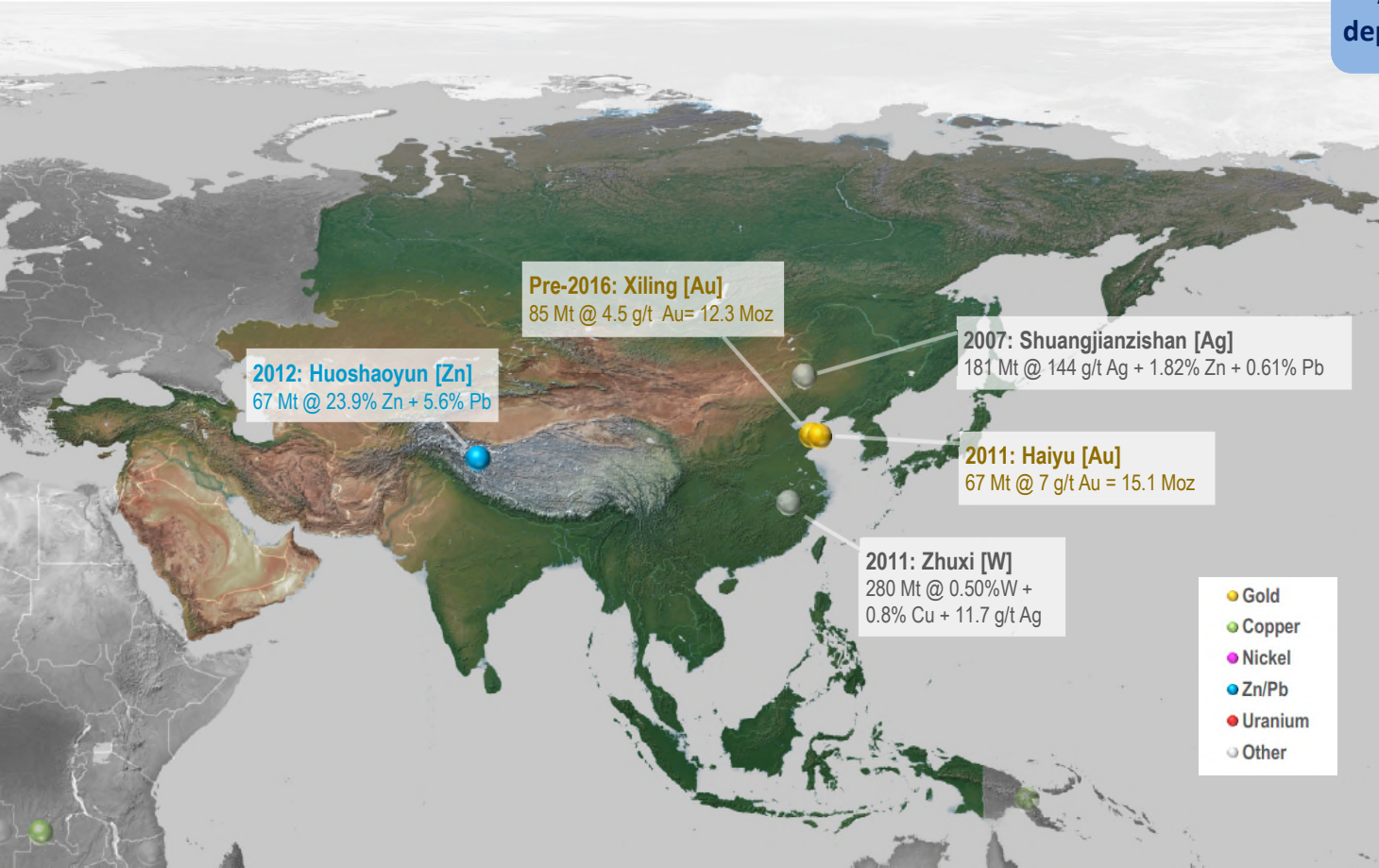
Bubble size refers to Tier-1, Tier-2 and Tier-3 deposits.
See Slide 26 for definitions of the different Tiers

Source: MinEx Consulting © April 2018

Asia Discoveries: 2007-2016 : Tier-1 only

All 5 of the Tier-1 deposits were in **China**

The total for the World was **15**



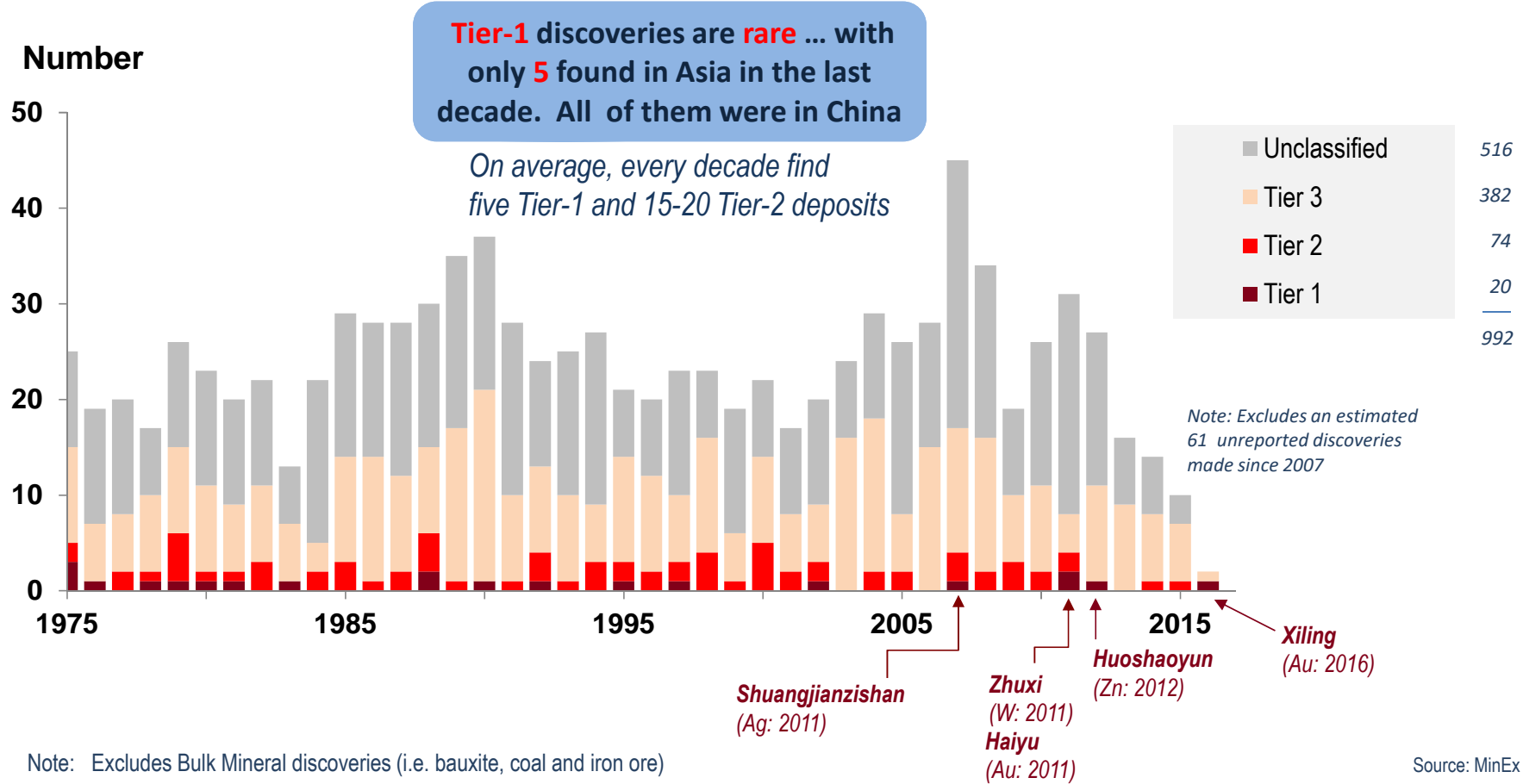
See Slide 38 for a definition of a Tier-1 deposit

How many Tier 1, 2 and 3 deposits were found in Asia? What are they worth? And was it enough to cover the cost of exploring for them?

6. QUALITY AND VALUE OF DEPOSITS FOUND

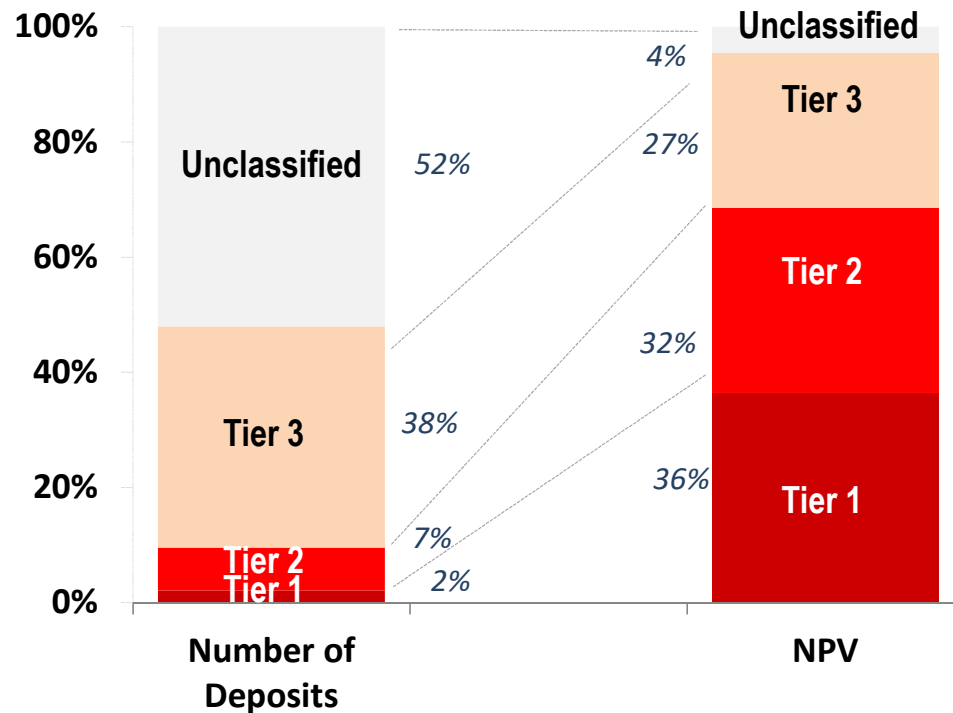
Number of discoveries by quality

Tier 1, 2 and 3 discoveries in Asia: 1975-2016



Most of the wealth created are in Tier 1 and 2 discoveries

Estimated value of 996 discoveries found in Asia between 1975-2016



Note: Limited to deposits >="Moderate" in size
 NPV values refer to the Net Present Value at the Decision-to-Build stage
 EV = Expected Value, which is the weighted average value of the NPV range
 Values are based on long run commodity prices as prevailing at Jan 2013

Caution: Values are indicative / approximate-only

Definitions

'Unclassified deposits' are small deposits that are less than "Major" in size and/or of minimal value. EV of (say) ~\$10m

Example: Red Rabbit [Gold]

'Tier 3 deposits' are small / marginal deposits. While they can be profitable they often only get developed at the top of the business cycle. At they don't meet more than one of the Tier 1 or 2 criteria. NPV of \$0 to \$200m, EV of ~\$100m

Example: Dornod [Uranium]

'Tier 2 deposits' are "Significant" deposits - but are not quite as large or long life or as profitable as Tier 1 deposits. They have an NPV of \$200-1000m and EV of ~\$500m

Example: Chatree [Gold]

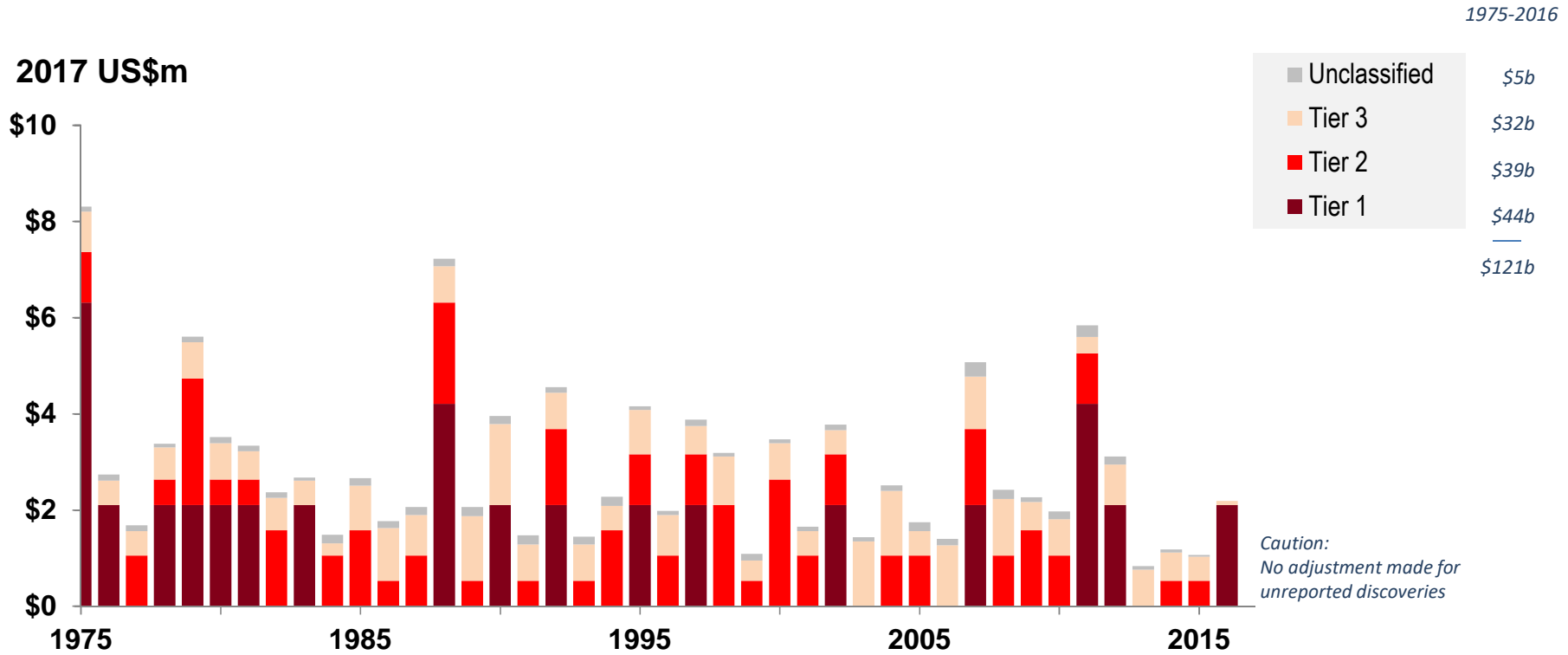
'Tier 1 deposits' are Company making" mines. They are large, long life and low cost. ... ie >20 Years, >200 ktpa Cu or >250koz pa Au, and Bottom Quartile costs. Have an NPV of >\$1000m, and EV of ~\$2000m in 2013 Dollars

Example: Oyu Tolgoi [Copper]

Source: MinEx Consulting © April 2018

Estimated value of discoveries

Tier 1, 2 and 3 discoveries in Asia: 1965-2016



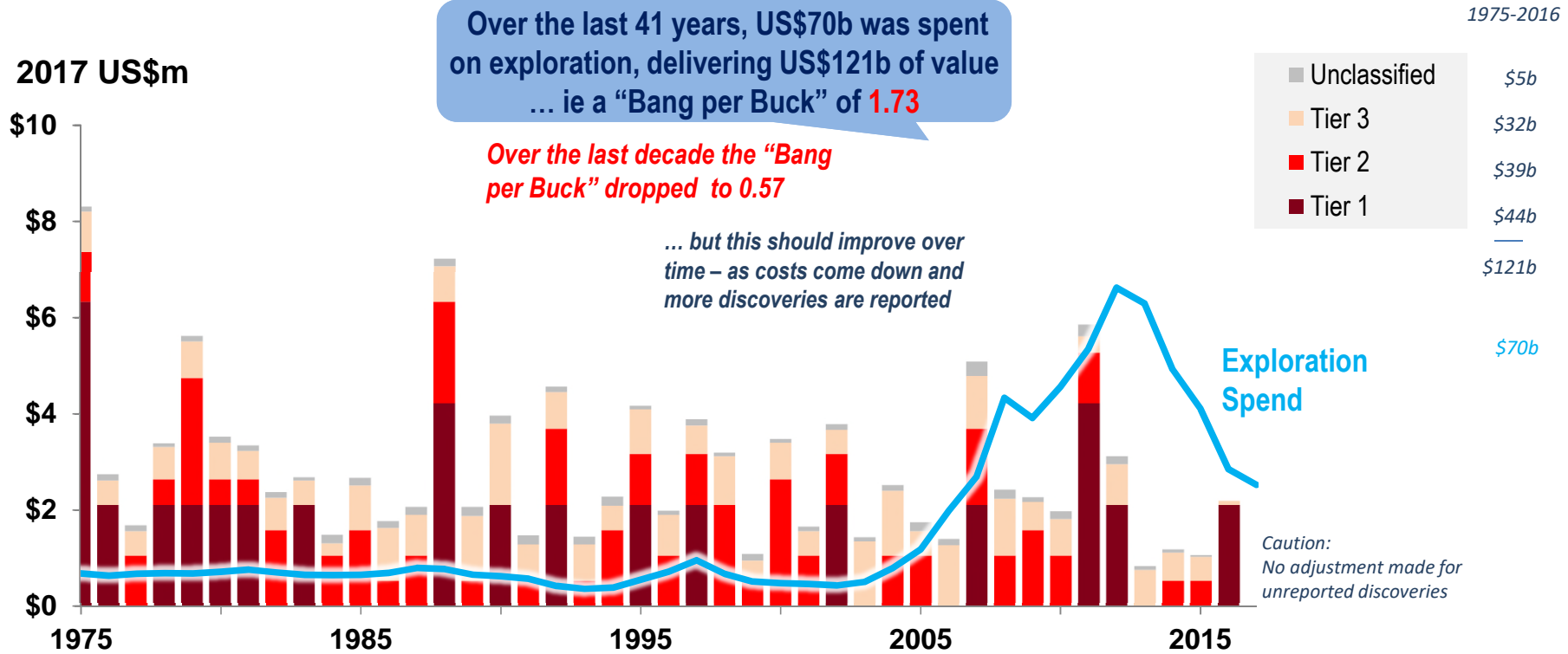
Note: Excludes Bulk Mineral discoveries (i.e. bauxite, coal and iron ore)

Caution: Values are indicative / approximate-only

Source: MinEx Consulting © April 2018

Estimated value of discoveries

Tier 1, 2 and 3 discoveries in Asia: 1965-2016



Note: Excludes Bulk Mineral discoveries (i.e. bauxite, coal and iron ore)

Caution: Values are indicative / approximate-only

Source: MinEx Consulting © April 2018

The returns vary widely across the Region

Spend & performance by Countries within Asia: 2007-2016

Over the last decade the best performing region was East Asia (i.e. China)

Region	Exploration Spend (2017 \$b)		No of Discoveries #		Tier 1+2 Discoveries		Estimated Value (2017 \$b)		Value / Spend
Middle East	\$1.96	4%	22	10%	0	0%	\$0.8	3%	0.42
Central Asia	\$2.75	6%	9	4%	0	0%	\$0.2	1%	0.09
Indian S-C	\$1.15	3%	3	1%	0	0%	\$0.1	<1%	0.09
SE Asia	\$4.77	10%	17	8%	2	11%	\$1.4	6%	0.30
NE Asia	\$7.15	16%	41	18%	1	5%	\$2.9	11%	0.40
East Asia	\$27.87	61%	134	59%	16	84%	\$20.5	79%	0.70
(China)	\$27.77	61%	132	58%	15	79%	\$20.0	77%	0.72
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TOTAL Asia	\$45.65	100%	217	100%	19	100%	\$26.0	100%	0.57

Note: Analysis excludes bulk minerals, and excludes satellite deposits found within existing camps
Discoveries refer to Moderate-, Major- and Giant-sized deposits.
The Estimated Value is approximate only, and ignores the value of unreported discoveries

As more discoveries are drilled-out & reported, these returns should improve over time

Source: MinEx Consulting © April 2018

It's the biggest in the World !

7. CHINA'S EXPLORATION & MINING SECTOR

Overview of China's mining sector in 2016

It's the biggest in the World !

- Is the No.1 producer in the World of 40 commodities
- Total sales revenue of \$214 billion
 - This is larger than the combined total for Australia (\$112b) and Canada (\$42b)
- More than 10,000 operating mines (though most are small)
 - ~1500 mines in Australia and 1200 in Canada
- Employed 6 million workers (half in coal mining)
 - 154,000 workers in Australia
- 2691 registered exploration enterprises – most of which are SOEs and private companies. Only 71 publicly listed companies
 - 600 junior companies in Australia and 2200 in Canada
- Spent \$2317m on domestic mineral exploration (including \$475m for bulk minerals)
 - This is larger than the combined total for Australia (\$1057m) and Canada (\$1230m)
- Drilled 9.13 million metres
 - Combined total of 10.71 million metres for Australia and Canada

8. CONCLUSIONS

Conclusions: [1/3]

1. Countries covered in the analysis

- Asia covers 33% of the earth's surface and spans 50 countries across 6 regions.
-

2. Trends in exploration spend

- Expenditures have grown substantially since the early 2000s.
- In 2017, \$2.52b was spent on exploration in Asia, including \$1.64b in China
- Over the last decade, Asia accounted for 29% of global exploration expenditures on non-bulk minerals
- Most of this was in China (18% of World's total). In 2016 China spent more than Australia and Canada combined.
- The two main targets are gold and copper.

3. Number of discoveries made

- There are over 8150 significant deposits in the World. 2213 (27%) are in Asia. This includes 880 (11%) deposits in China.
- Over the last decade (2007-2016) 750 new deposits were found in the World. 226 of these were in Asia, including 132 in China (18% of the World's total).

Conclusions: [2/3]

3. Continued ...

- Over the last decade 69 Giant deposits were found in the World. 22 of these were in Asia, including 13 in China (19%).
- 15 Tier-1 deposits were found in the World. 5 of these were in Asia – all of which were in China (33%).

Discovery Performance ... value proposition for Exploration

- 70% of the value created by industry comes from finding Tier-1 and Tier-2 deposits (which make up only 9% of the total by number).
- Over the last decade, US\$45.7b was spent on exploration in Asia, delivering US\$26.0b of value ... a “Bang per Buck” of 0.57. Over the same time period the World average was 0.56
- “Bang per Buck” varied widely between Regions
 - Central Asia (0.09), Indian Sub-Continent (0.09), South East Asia (0.30), Middle East (0.42), North East Asia (0.40) and East Asia (0.70).
 - China (which is part of East Asia) achieved a “Bang per Buck” of 0.72

As more discoveries are drilled-out & reported, these returns will improve over time

Conclusions: [3/3]

Asia is an important contributor to the World's mineral endowment and new discoveries. 27% of the World's known deposits are in Asia.

China is central to all of this ... over the last decade it accounted for 18% of the total exploration expenditures, found 18% of the deposits and (more importantly) accounted for 5 of the 15 Tier-1 discoveries

China's mining industry is the biggest in the World – and is hungry for more metal.

In short, the future of the World's mining industry depends greatly on whether China can continue to deliver significant new discoveries.

The Great Wall, or
the Golden Road?



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