

Long term trends in gold exploration

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Overview

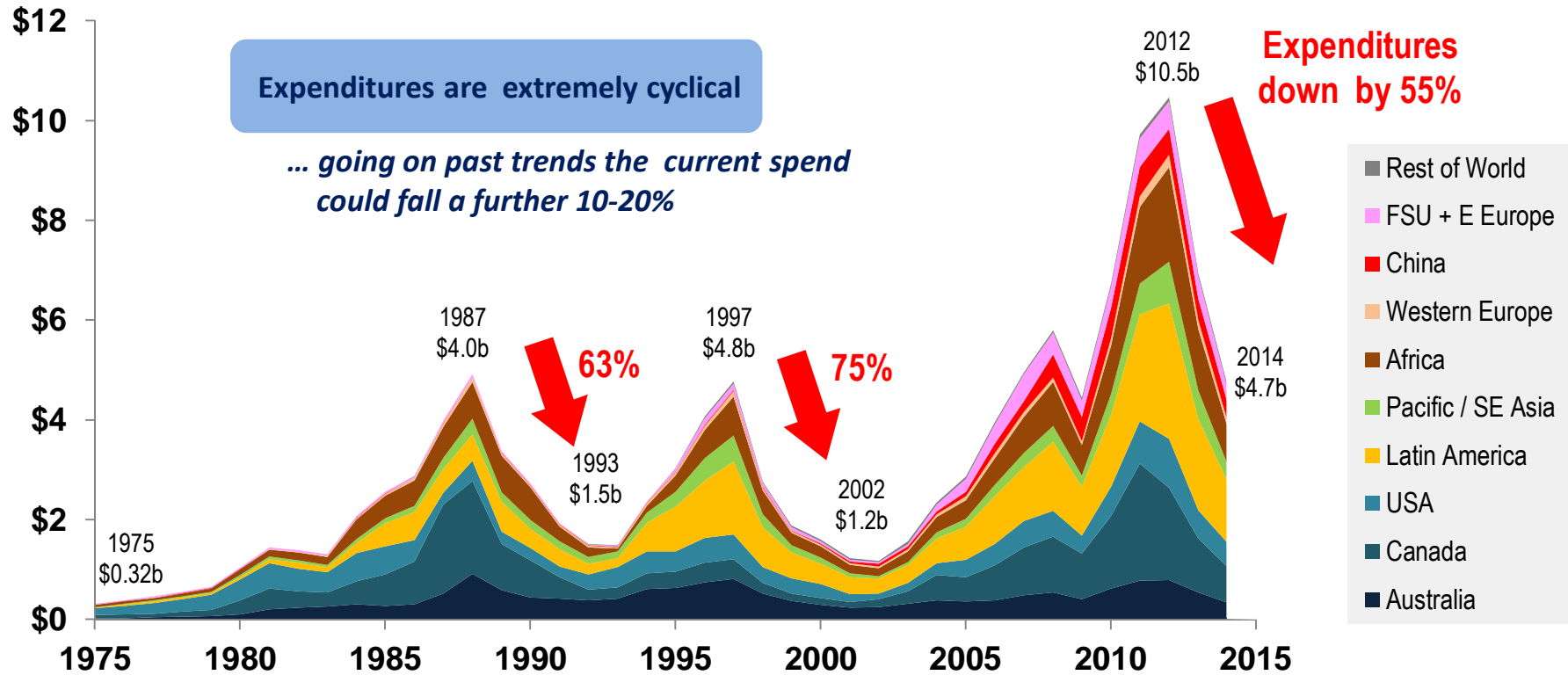
1. Trends in exploration expenditures
2. Trends in the number of discoveries and ounces – *How much found?*
3. Trends in the location of discoveries – *Where are the “hot spots”?*
4. Size and grade of discoveries - *Are we running out of “good” deposits?*
5. Trends in discovery methods – *Geochem versus Geophysics*
6. Depth of cover for discoveries – *What’s the average depth by Region?*
7. Who made the discoveries? – *Majors versus Juniors*
8. Quality of the discoveries – *What tonnes & grade are required for a Tier 1*
9. Trends in unit discovery costs – *\$/oz costs are rising over time*
10. Country-Risk issues – *Is it worth exploring in riskier places ?*
11. Are we finding enough gold to replace what we mine?
– *i.e. Is the industry sustainable?*
12. Conclusions

Exploration expenditures reached an all-time high in 2012

1. TRENDS IN EXPLORATION SPEND

Gold Exploration Expenditures: World

June 2015 US\$ Billion



Sources: MinEx Consulting estimates, based on data from ABS, NRCAN, MOLAR (China), Tilton (1988), Wallace (1992,93) and SNL © 2014

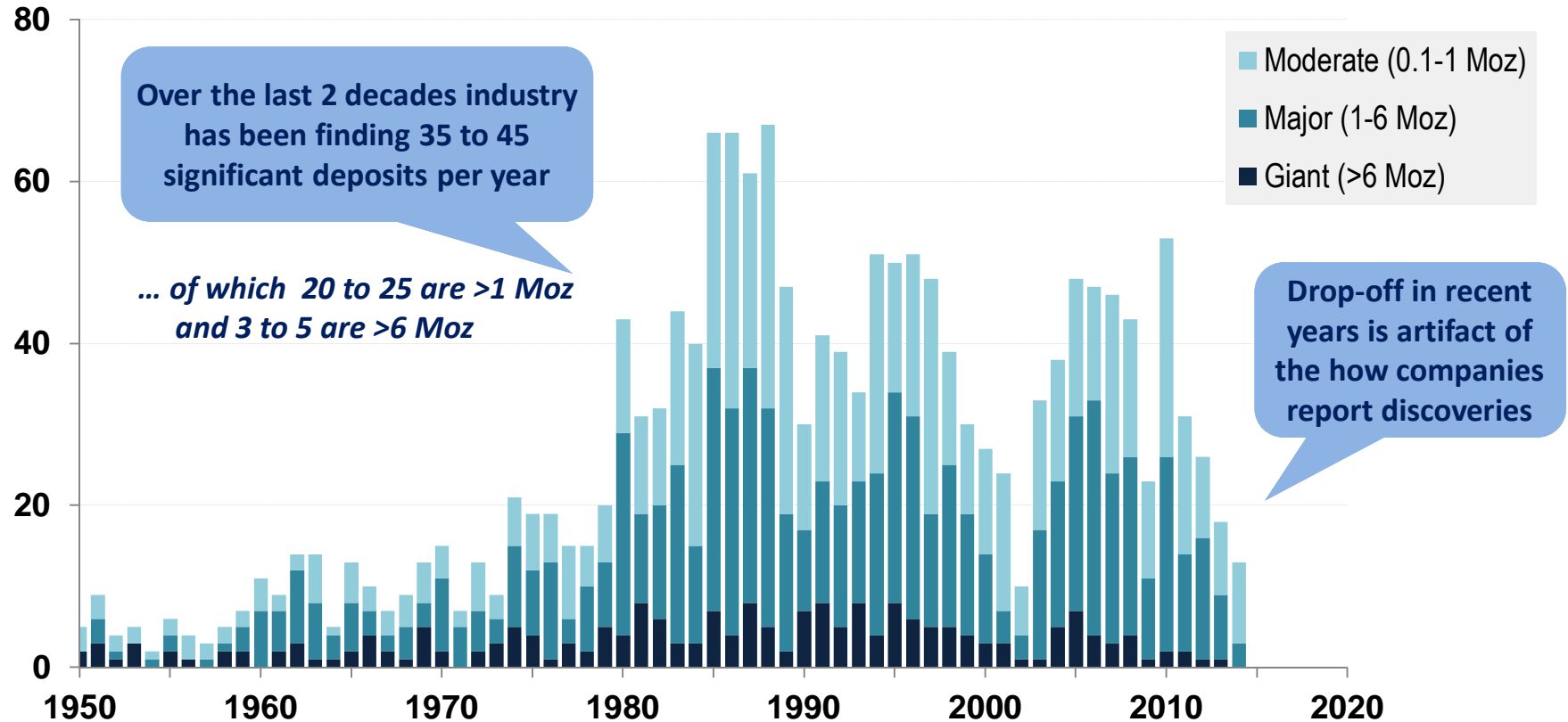
Discovery rates have plateaued (if not declining)

2. TRENDS IN THE NUMBER OF DISCOVERIES AND OUNCES FOUND

Number of Gold Discoveries: World

Primary Gold Deposits by **Size** : 1950-2014

Number of Deposits

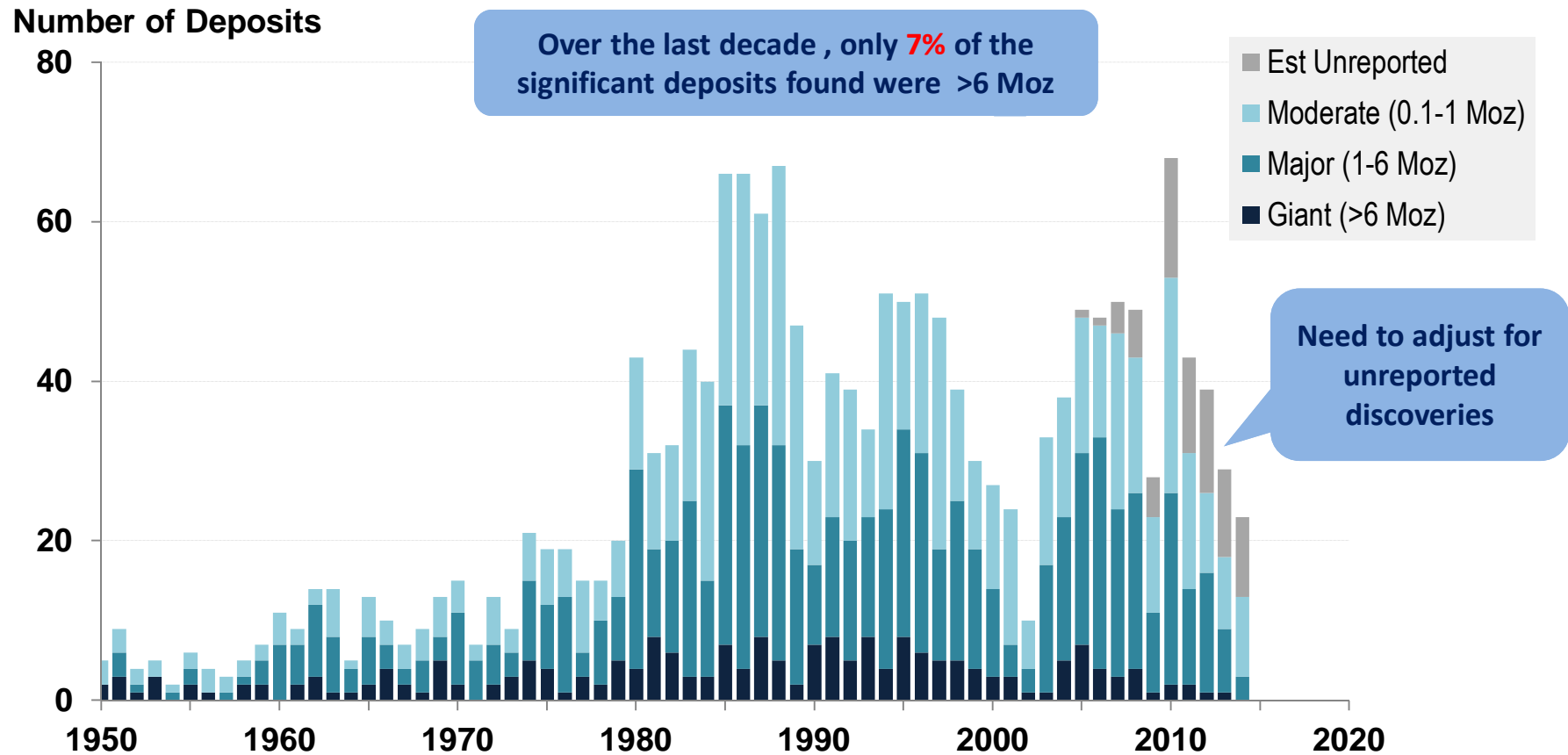


Note: Discoveries are for Primary gold deposits >0.1 Moz Au
Excludes satellite deposits within existing camps

Source: MinEx Consulting © October 2015

Number of Gold Discoveries: World

Primary Gold Deposits by Size : 1950-2014

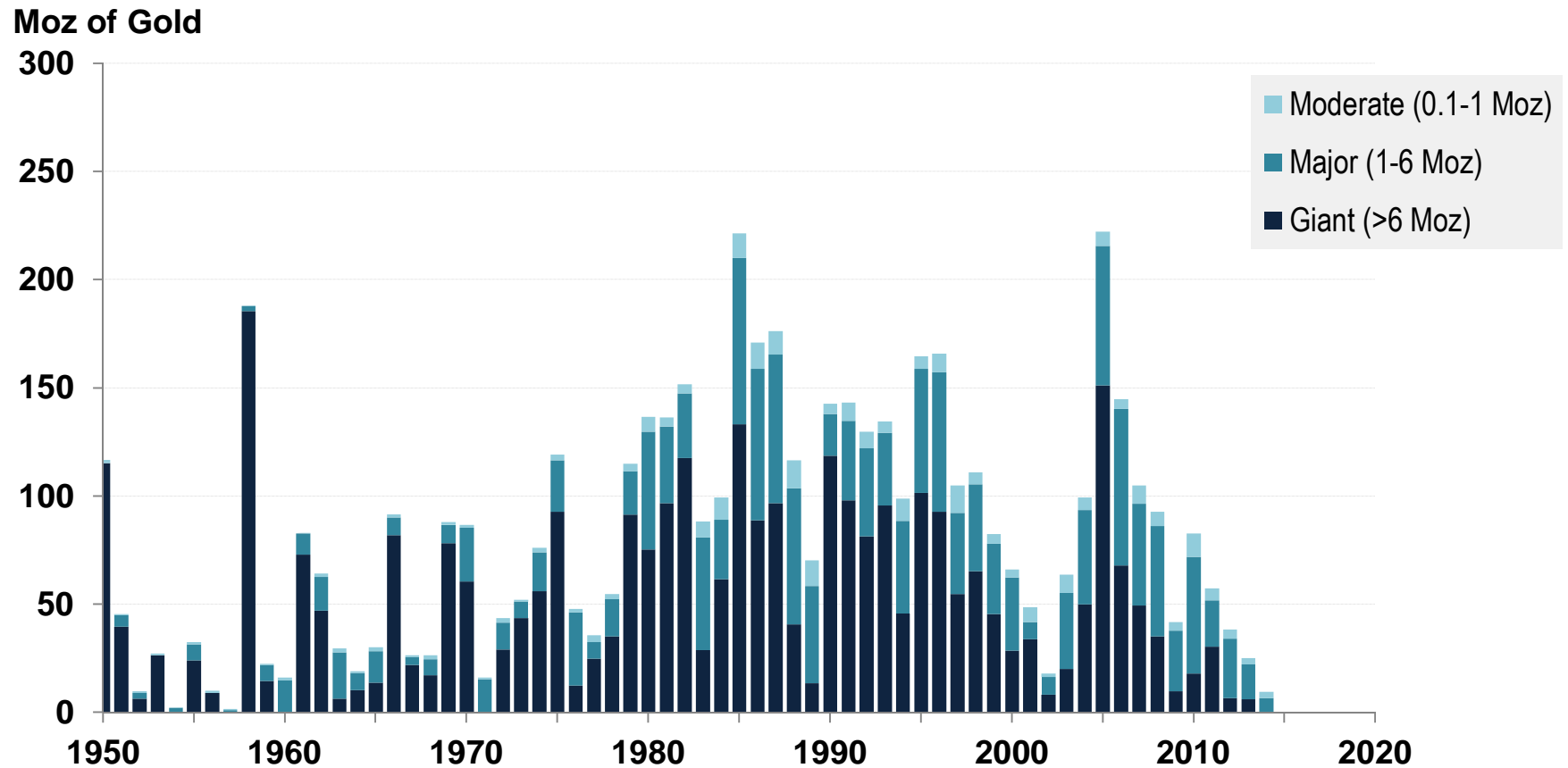


Note: Discoveries are for Primary gold deposits >0.1 Moz Au
Excludes satellite deposits within existing camps
Data from 2005 onwards have been adjusted for unreported discoveries

Source: MinEx Consulting © October 2015

Amount of Gold Discovered: World

Primary Gold by Size : 1950-2014

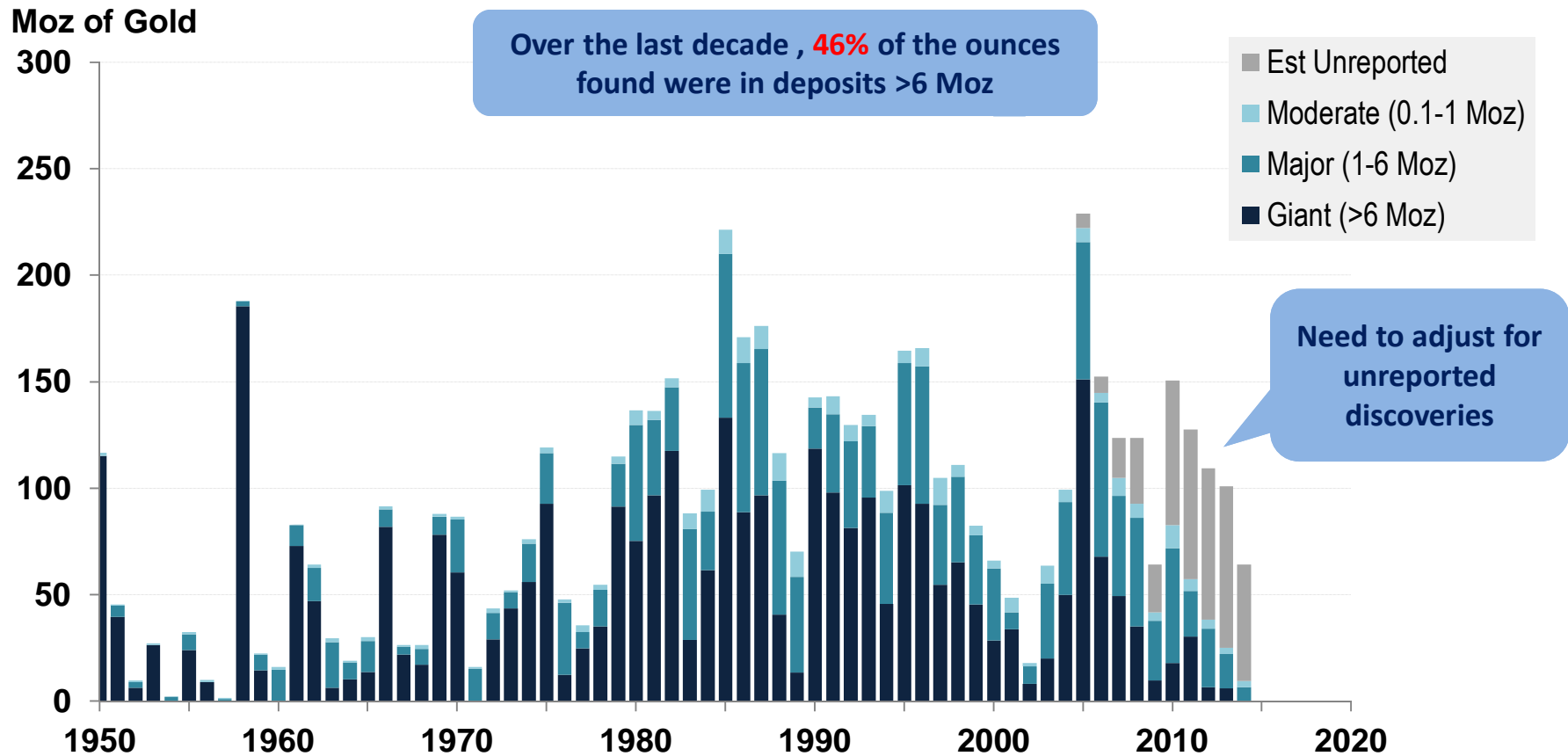


Note: Excludes by-product gold associated with base metal and other discoveries
Excludes satellite deposits within existing camps
Data from 2005 onwards have been adjusted for unreported discoveries

Source: MinEx Consulting © October 2015

Amount of Gold Discovered: World

Primary Gold by **Size** : 1950-2014



Note: Excludes by-product gold associated with base metal and other discoveries
Excludes satellite deposits within existing camps
Data from 2005 onwards have been adjusted for unreported discoveries

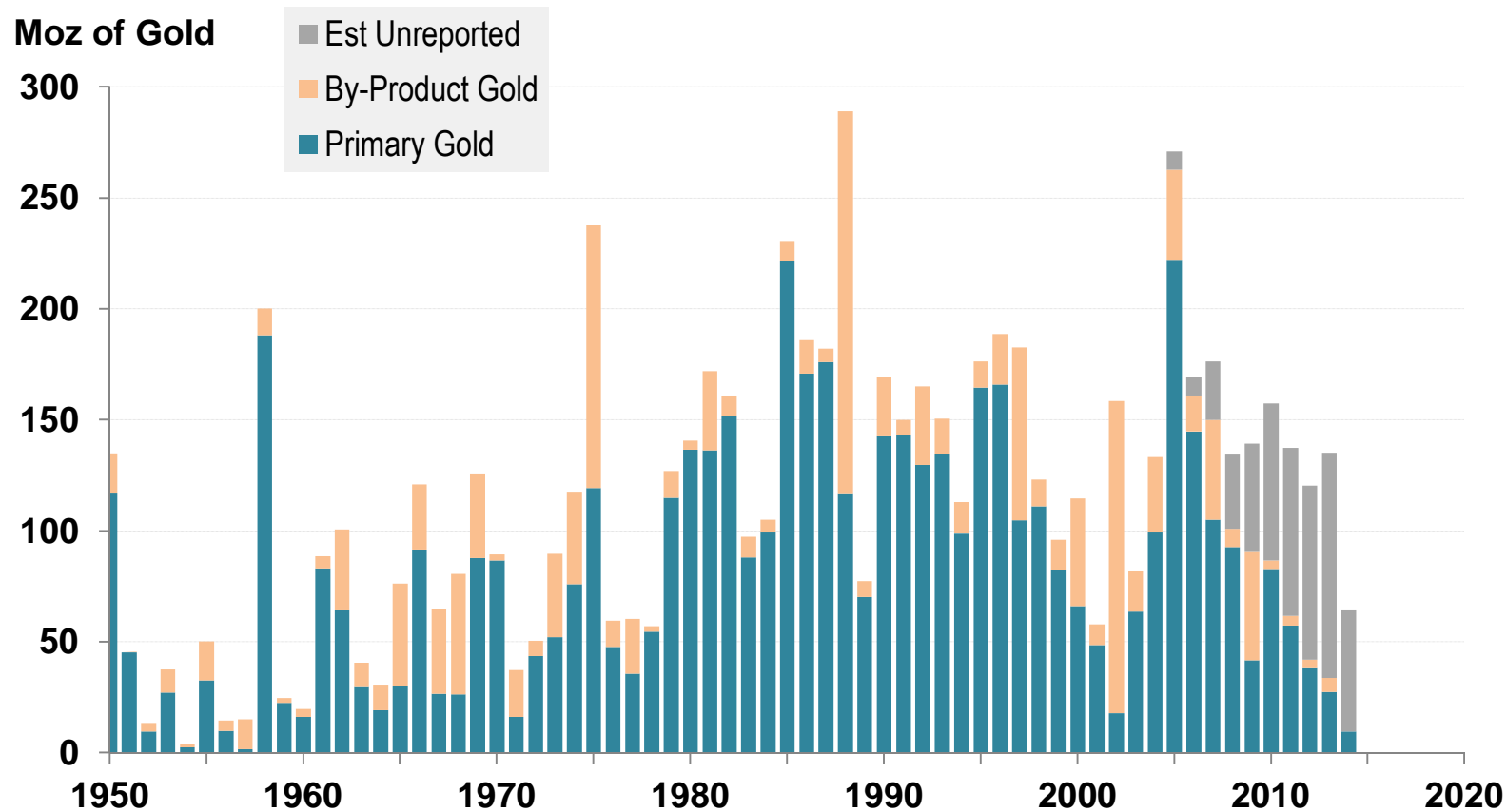
Source: MinEx Consulting © October 2015

Need to take into account by-Product Gold

Industry also finds gold in base-metal and other deposits

Amount of Gold Discovered: World

Primary & By-Product Gold : 1950-2014

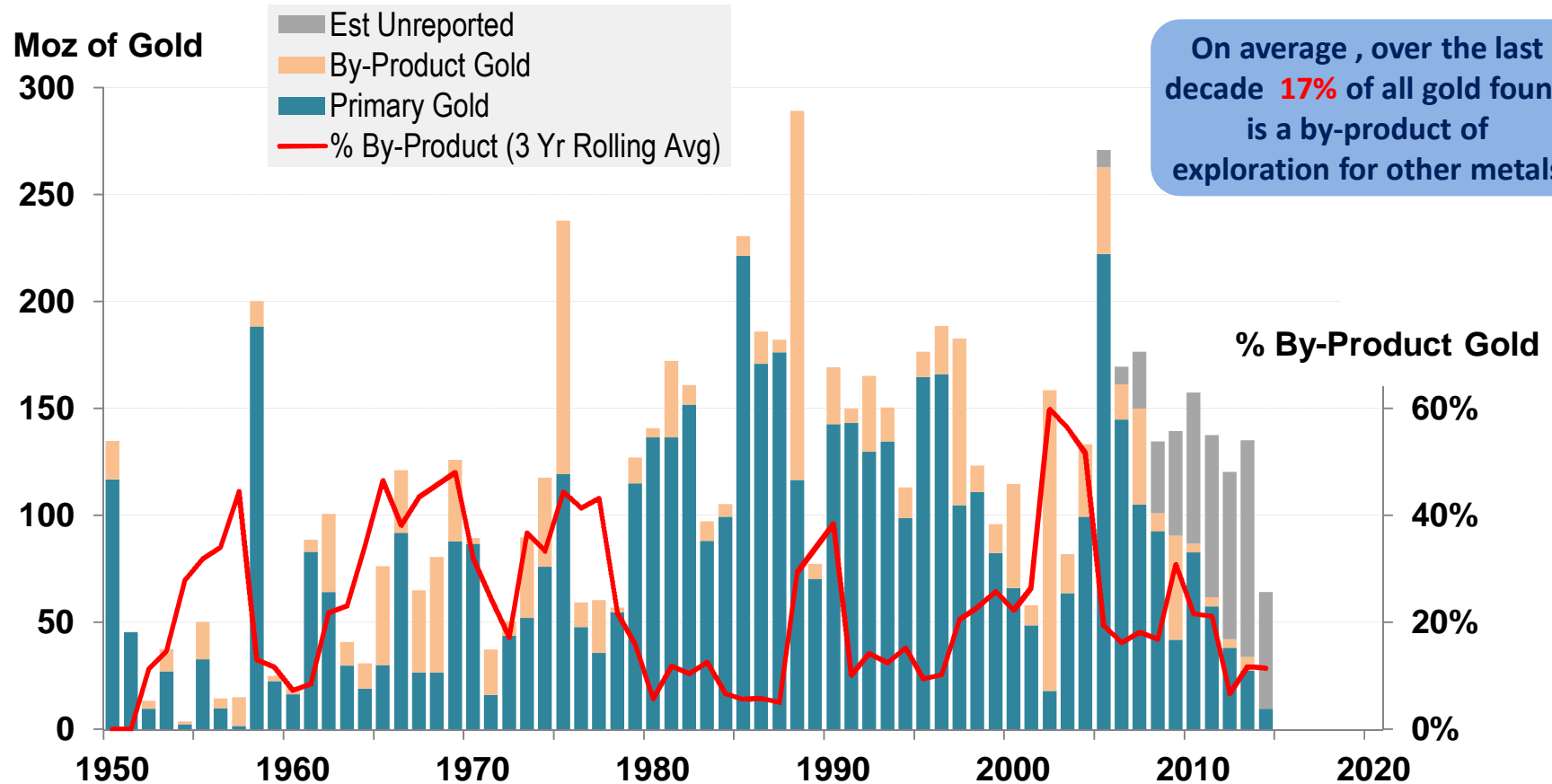


Note: Excludes satellite deposits within existing camps
 Data from 2005 onwards includes estimate for unreported discoveries

Source: MinEx Consulting © October 2015

Amount of Gold Discovered: World

Primary & By-Product Gold : 1950-2014

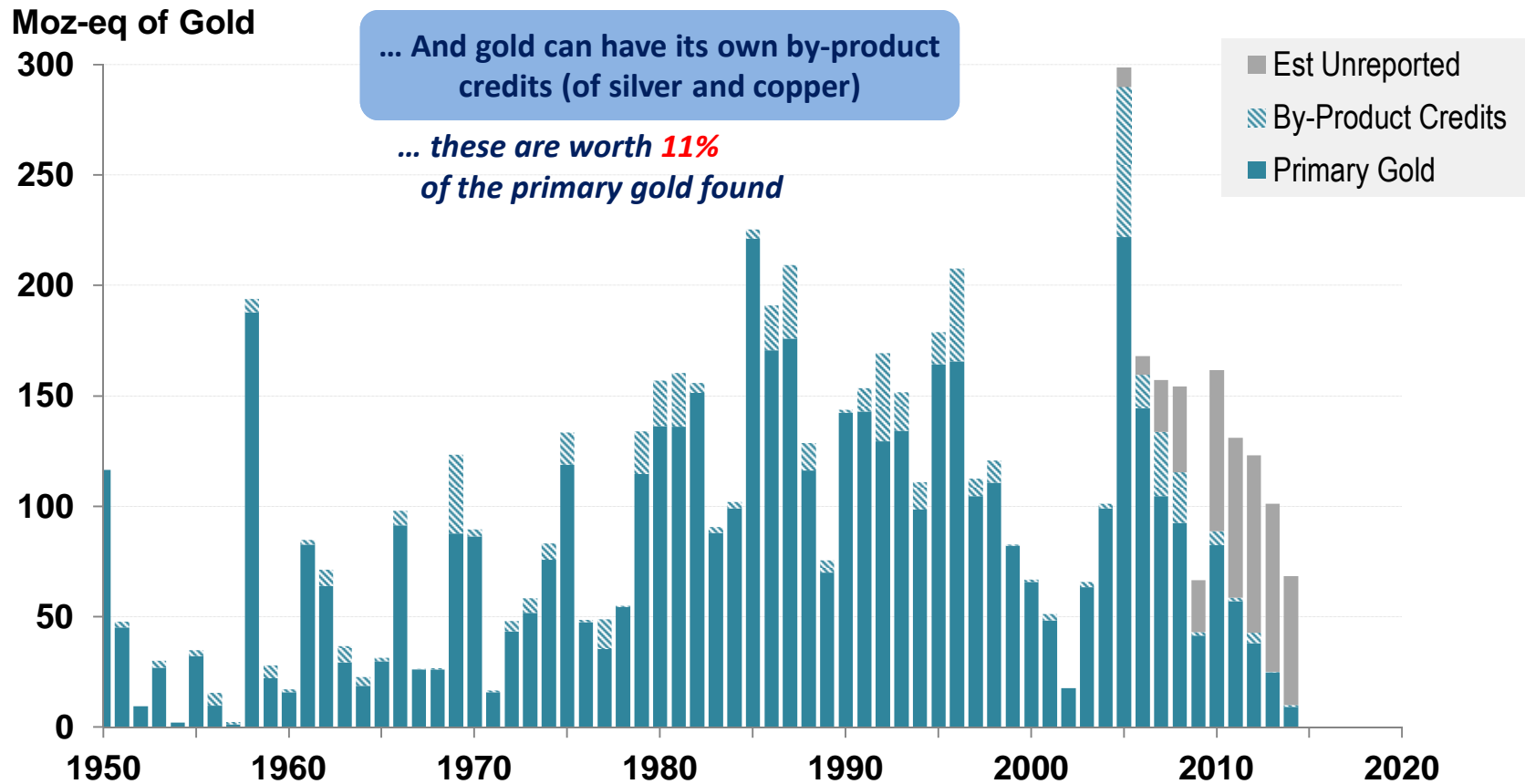


Note: Excludes satellite deposits within existing camps
 Data from 2005 onwards includes estimate for unreported discoveries

Source: MinEx Consulting © October 2015

Amount of Gold Discovered: World

Primary Gold plus associated By-Product Credits : 1950-2014



Note: Excludes by-product gold associated with base metal and other discoveries
Includes gold –equivalent value of base metal and other credits associated with the primary gold deposit
Data from 2005 onwards have been adjusted for unreported discoveries

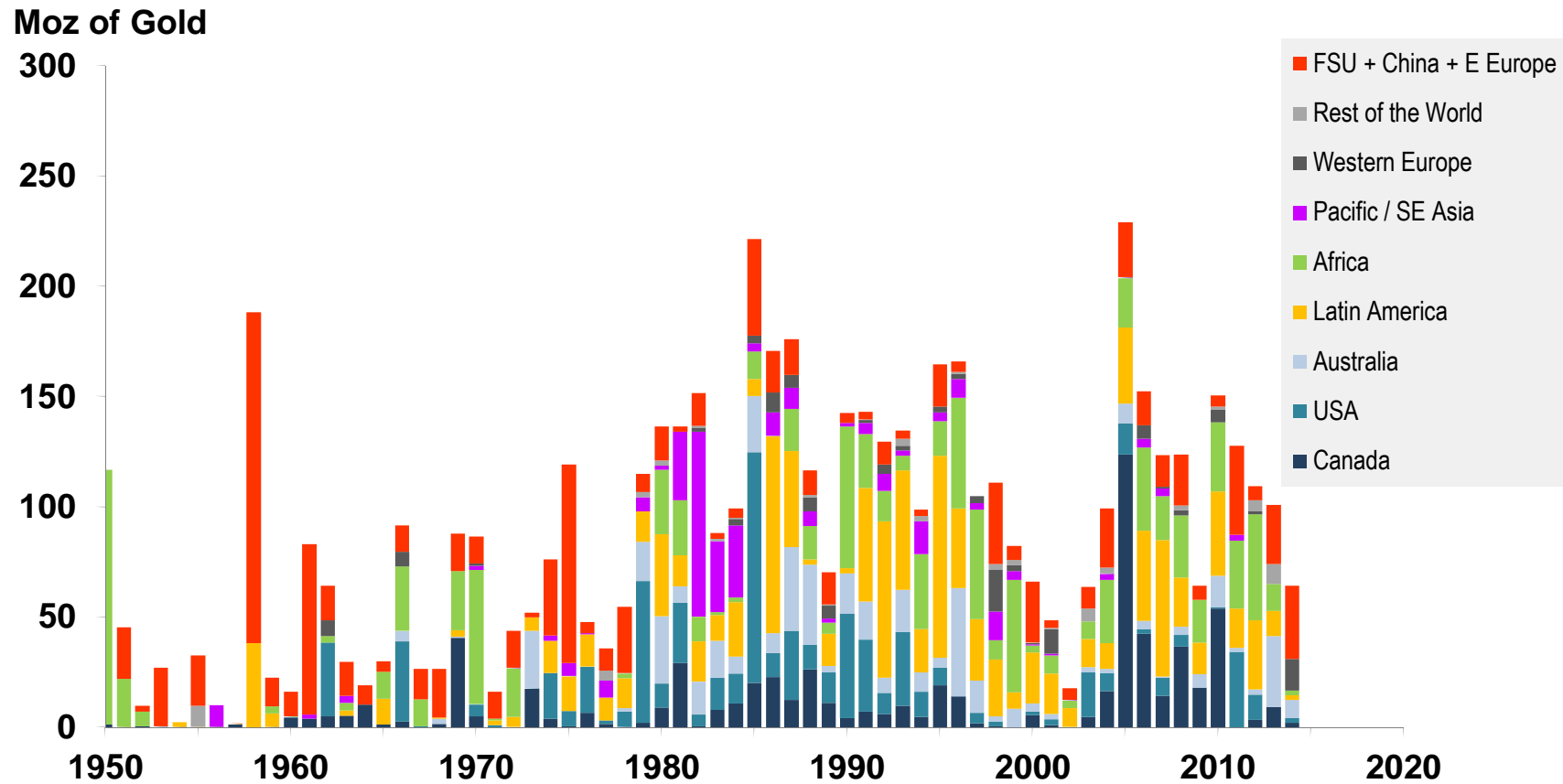
Source: MinEx Consulting © October 2015

There has been a progressive geographic shift in where gold is being discovered in the World

3. TRENDS IN THE LOCATION OF DISCOVERIES

Ounces discovered by Region

Primary Gold deposits found : 1950-2014



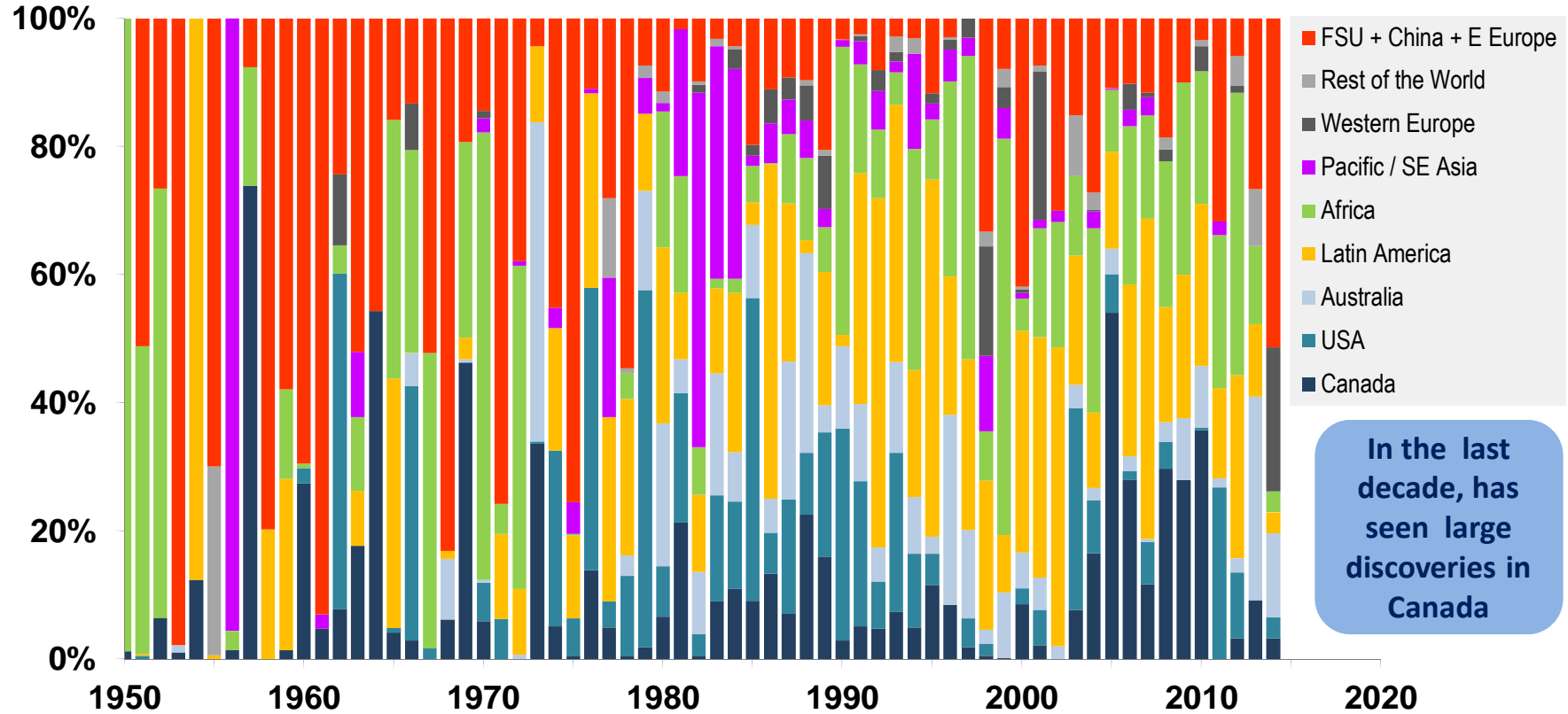
Note: Includes an adjustment for unreported discoveries in recent years
Excludes by-product credits

Source: MinEx Consulting © October 2015

Ounces discovered by Region

Primary Gold deposits found : 1950-2014

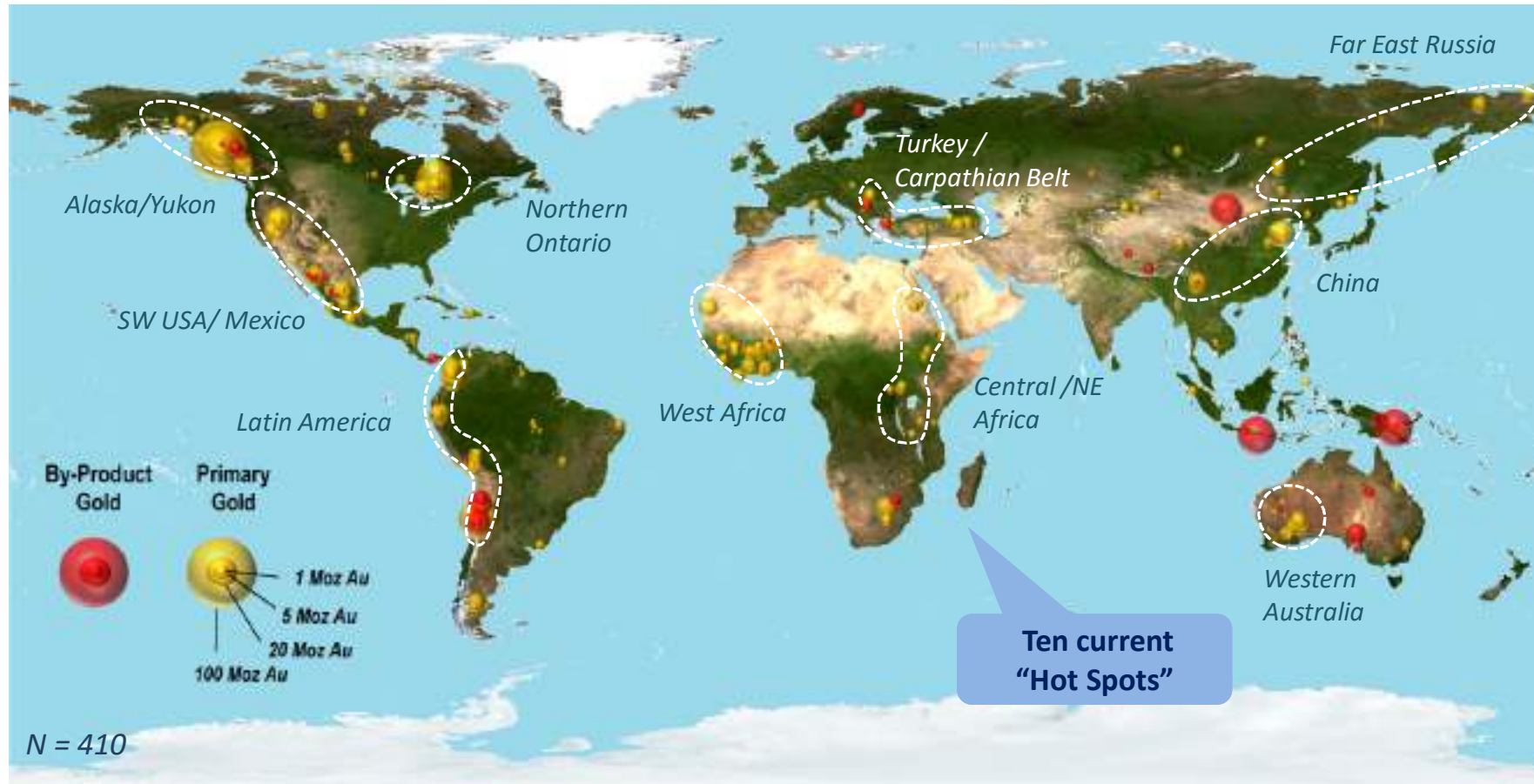
Percentage of ounces found



Note: Includes an adjustment for unreported discoveries in recent years
Excludes by-product credits

Source: MinEx Consulting © October 2015

Gold discoveries in the world: 2005-Present



Note: Based on deposits containing >0.1 Moz of gold

Source: MinEx Consulting © October 2015

Recent Tier 1 discoveries

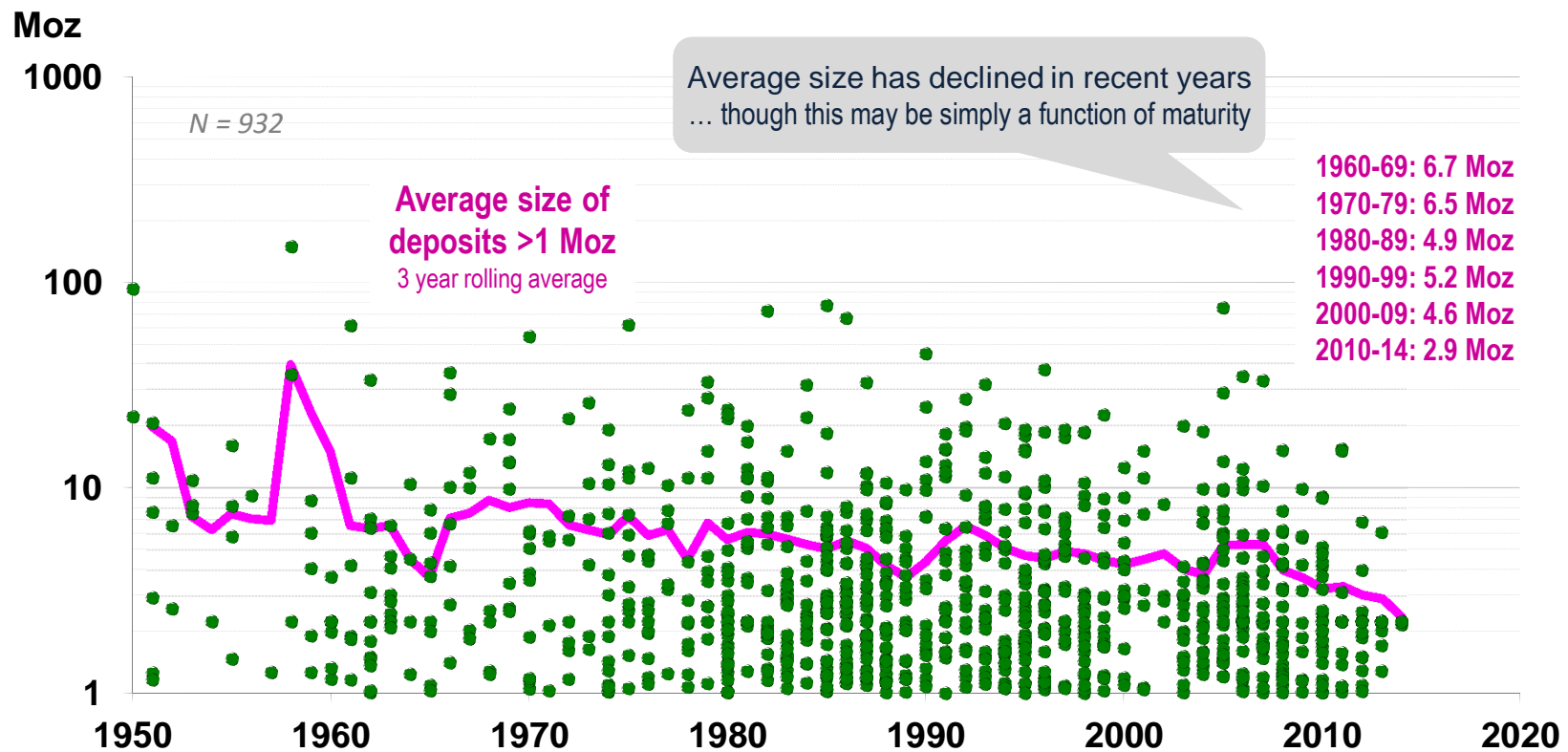
- Red Hill/Goldrush
 - Discovered in 2011 by Barrick next to its existing operation in Nevada. Current Resource is 96 Mt @ 5.0 g/t Au = 15.4 Moz
- Cote
 - Discovered in 2010 by Trelawney Mining & Exploration in Ontario. Current Resource is 331 Mt @ 0.80 g/t Au = 9.0 Moz
- Haiyu
 - Discovered in 2011 by Laizhou Ruihai in Shandong Province in China. Reported to contain 67 Mt @ 7.0 g/t = 15.1 Moz
 - A further 10 Moz has been found along strike in the district

There has been a slow decline in the size of deposits found.
Grades have remained fairly constant

4. TRENDS IN THE SIZE & GRADE OF GOLD DISCOVERIES

Trend in the average size of gold deposit discovered

All primary gold discoveries >1 Moz in the World: 1950-2014

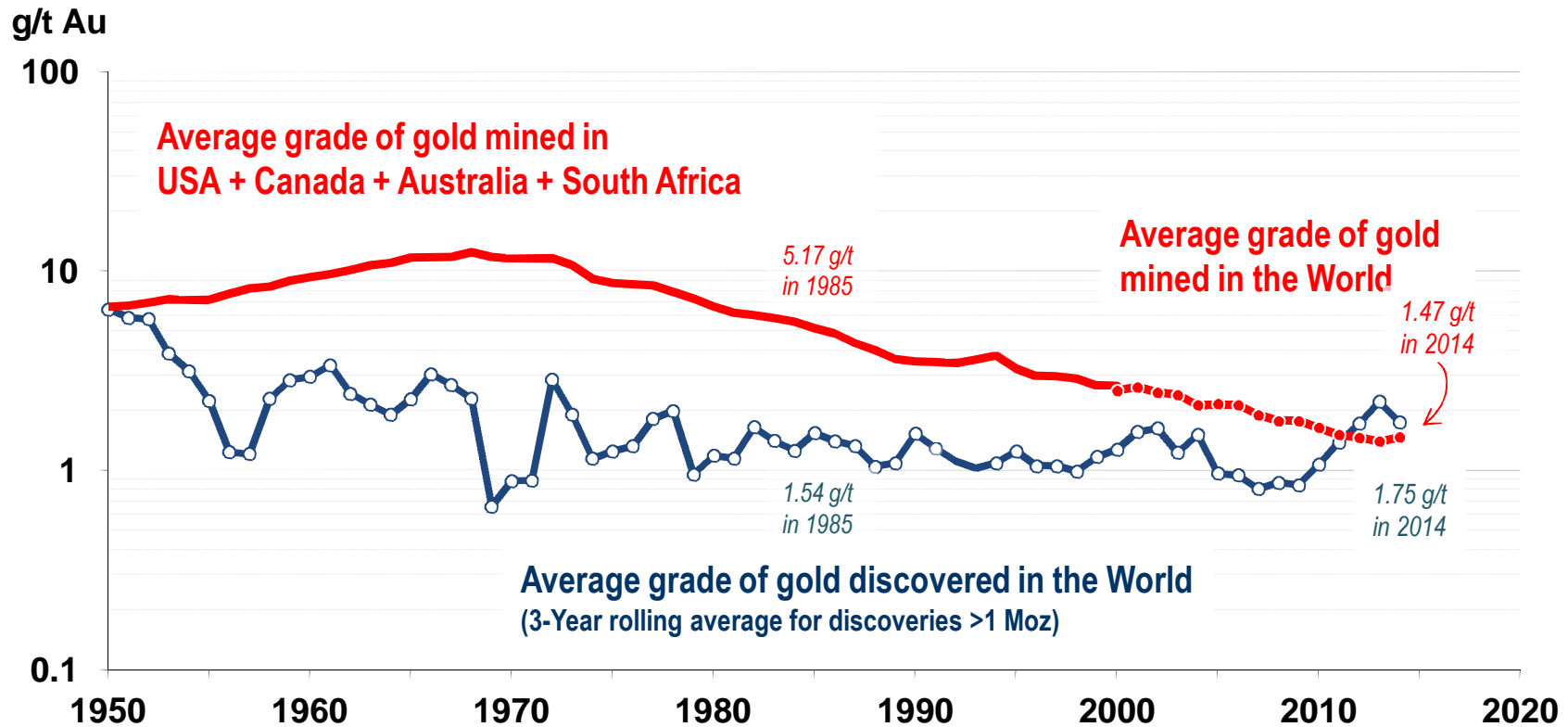


Note: Excludes deposits where gold is a by-product.
No adjustment made for growth in recent discoveries

Source: MinEx Consulting © October 2015

Trend in average ore grades

Average ore grade for all primary gold discoveries >1 Moz in the World versus average head grade of ore mined



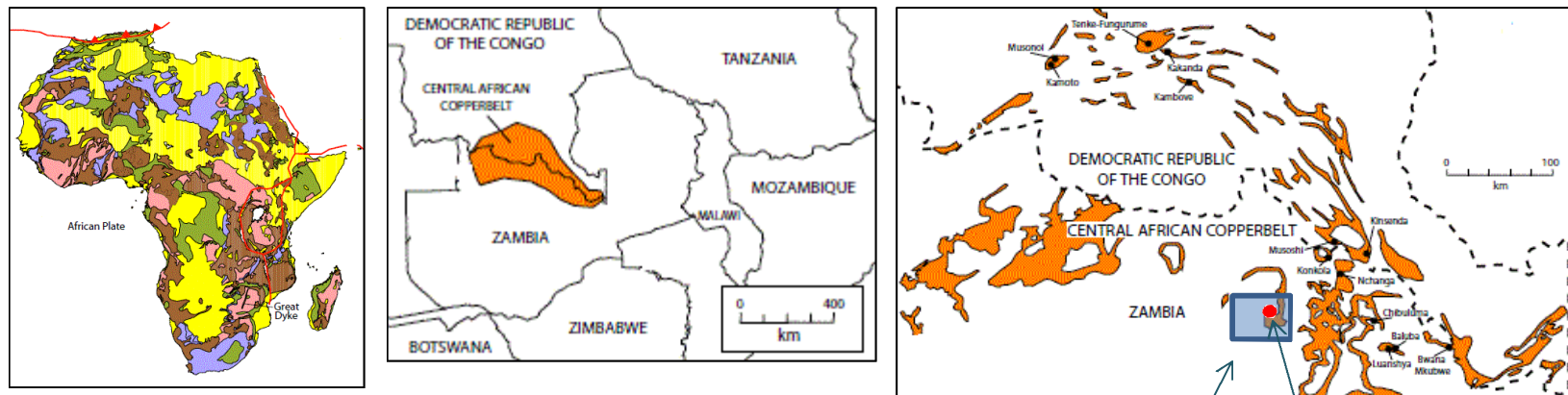
Note: Excludes deposits where gold is a by-product.
Also excludes artisanal mines and retreatment of waste dumps

Sources: MinEx Consulting © October 2015
Mudd (2010) for production data 1950-2000
MinEx Consulting for production data 2000-2014

5. TRENDS IN DISCOVERY METHODS

Trends in exploration methods

The preferred search method used varies by commodity type, depth of cover and "scale"



Continental-Scale

Province-Scale

District-Scale

Project-Scale

Prospect-Scale

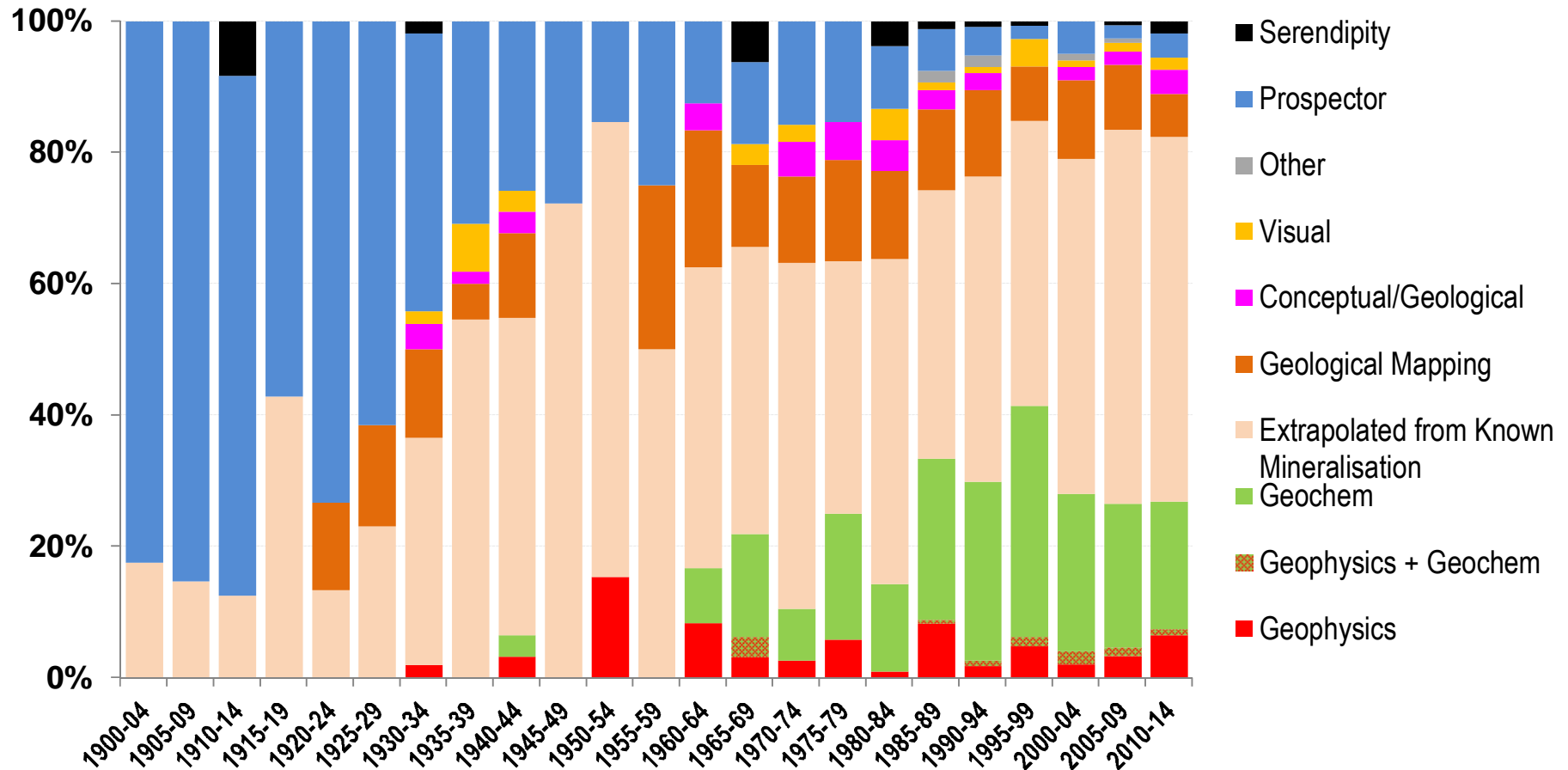
MinEx has carried out a detailed analysis of the discovery history of 1381 primary gold deposits at these two scales

Primary search method used at the project-scale

GOLD discoveries (>0.1 Moz) in the World: 1900-2014

ie What method was used to decide where to peg the leases

Percentage of total discoveries



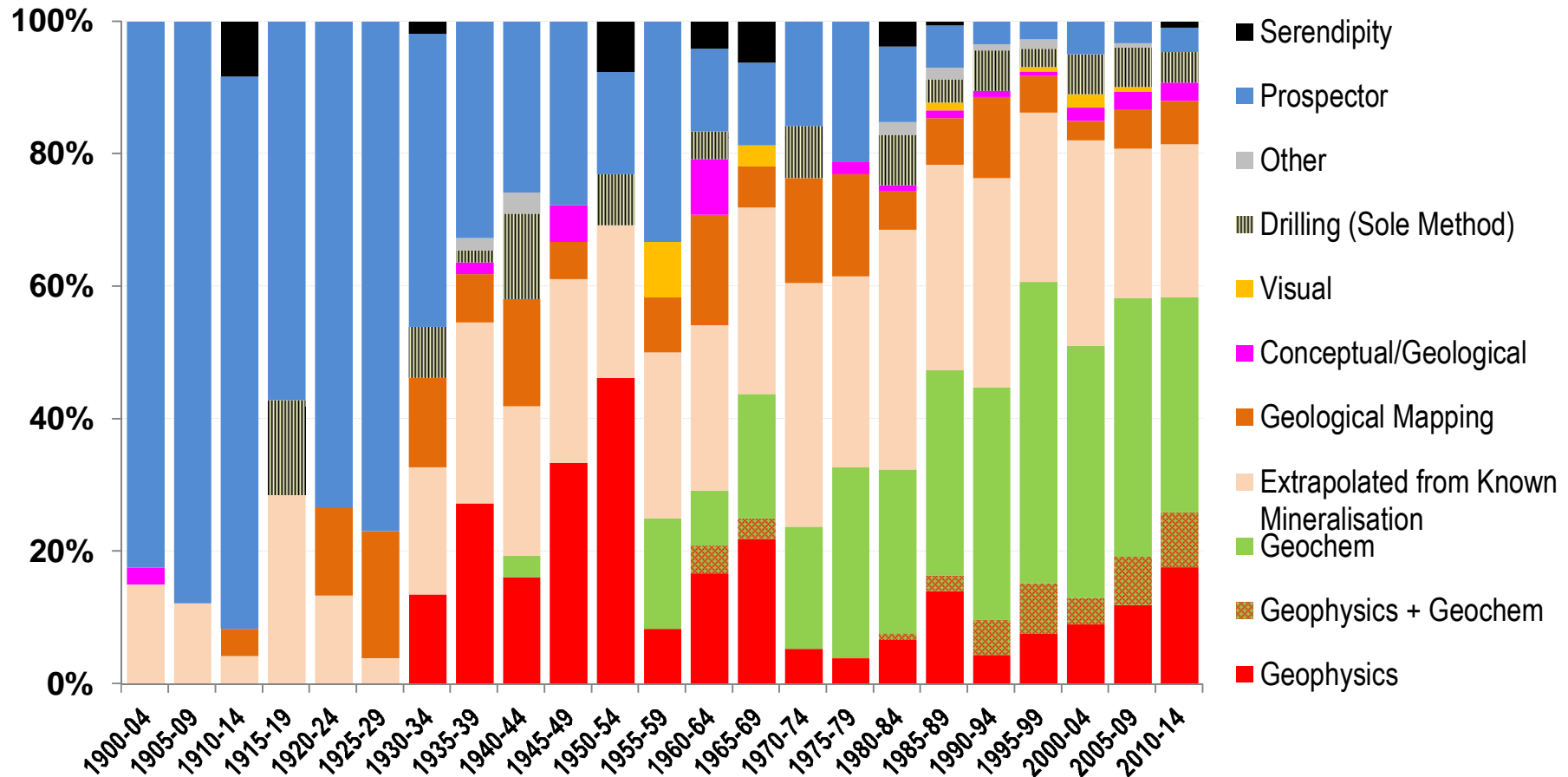
Note: Analysis based on detailed analysis of 1381 primary gold projects (out of 2179 known discoveries)

Source: MinEx Consulting © October 2015

Primary search method used at the prospect-scale GOLD discoveries (>0.1 Moz) in the World: 1900-2014

ie What method was used to decide where to **drill the first hole**

Percentage of total discoveries



Note: Analysis based on detailed analysis of 1381 primary gold projects (out of 2179 known discoveries)

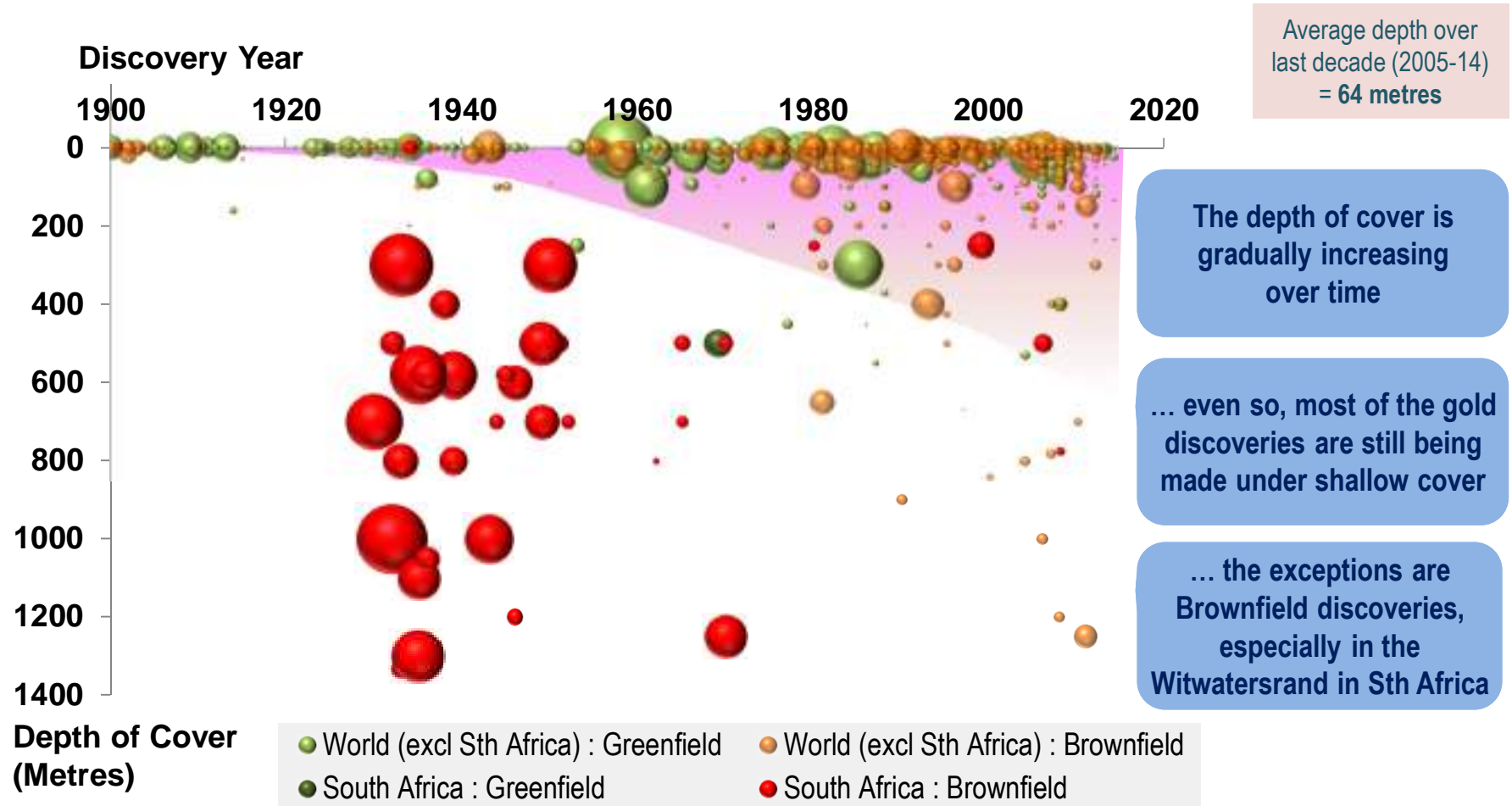
Source: MinEx Consulting © October 2015

We are progressively looking under deeper cover

6. TRENDS IN THE DEPTH OF COVER

... and we are exploring under deeper cover

Depth of cover for discoveries in World: 1900-2014

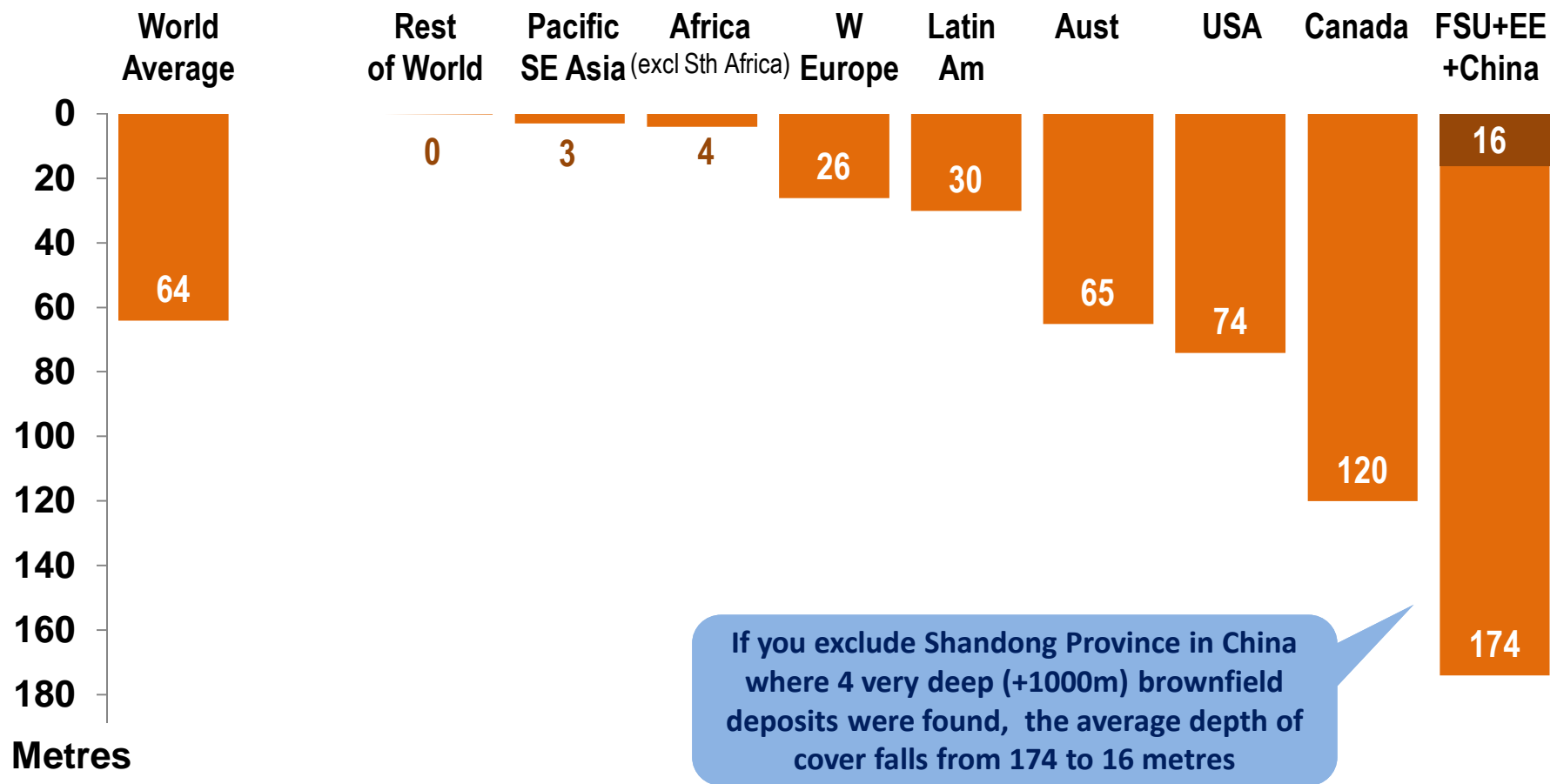


Note: Primary gold deposits > 0.1 Moz. Bubble size refers to Moz of pre-mined Resource
Excludes satellite deposits within existing Camps.

Source: MinEx Consulting © October 2015

Average depth of cover for gold discoveries

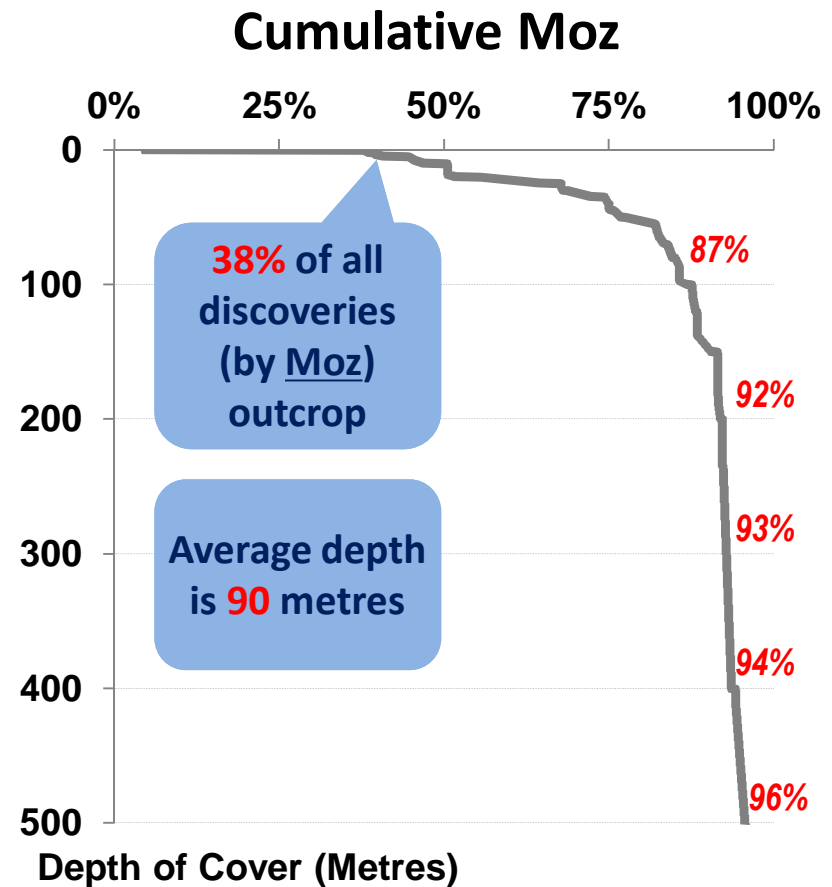
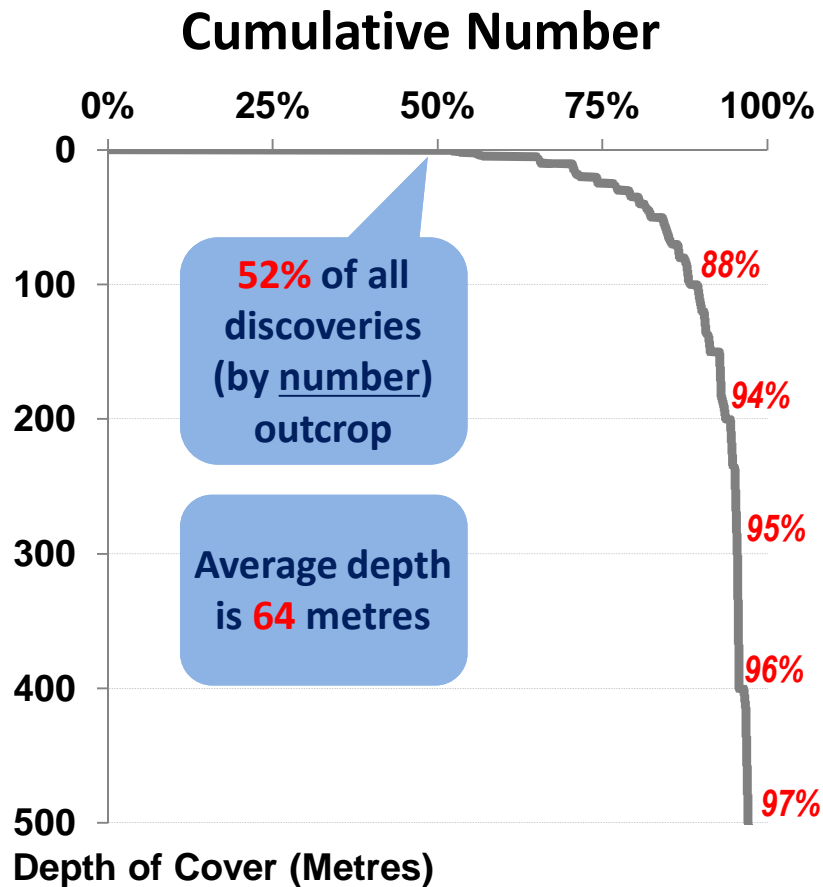
World: 2005-2014



Note: Based on 300 Primary gold deposits with reported depths and > 0.1 moz Au
Excludes satellite deposits in existing Camps

Source: MinEx Consulting © October 2015

Cumulative distribution of depth for primary gold deposits > 0.1 Moz found in the World in 2005-2014



Note: Analysis based on 300 deposits with known depth data and >0.1 Moz.
Includes both Greenfield and Brownfield discoveries

Source: MinEx Consulting © October 2015

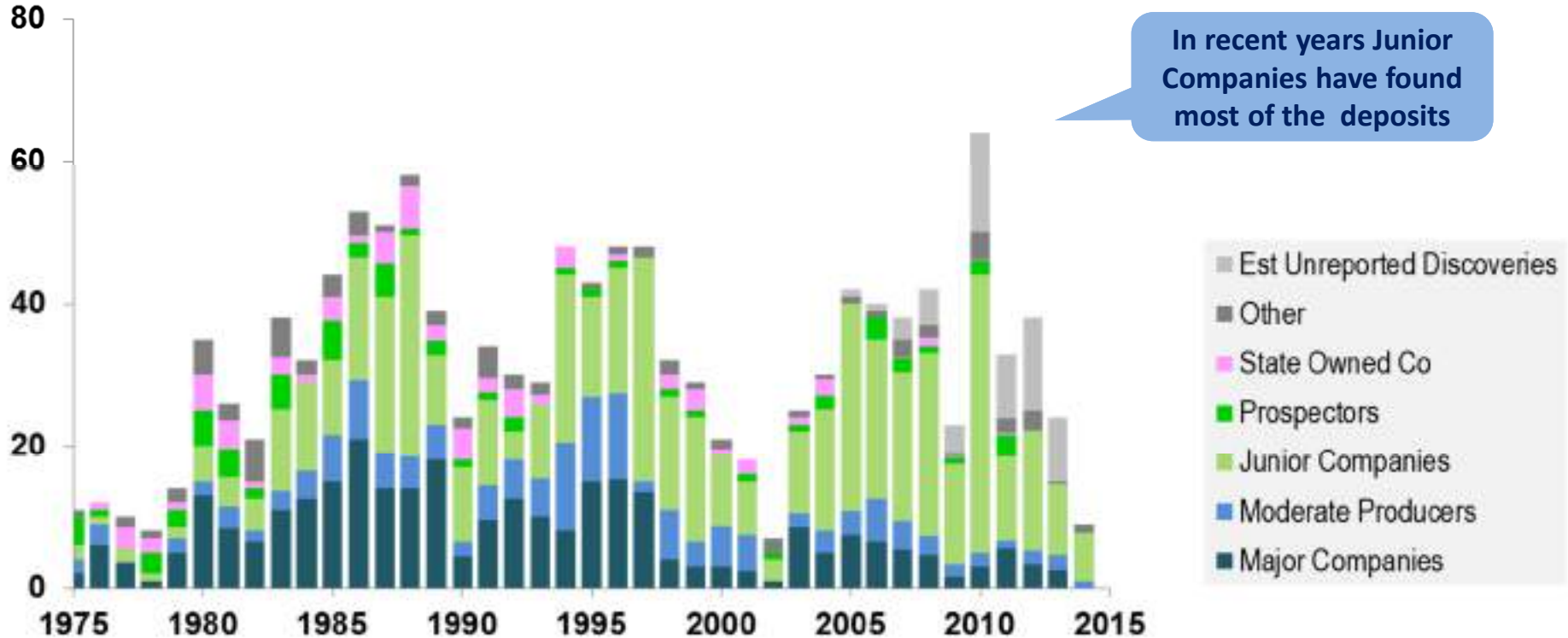
Majors versus Juniors

7. WHO MADE THE DISCOVERIES ?

Number of discoveries made by Company Type

Moderate+Major+Giant primary gold discoveries in Western World: 1975-2014

Number of Discoveries



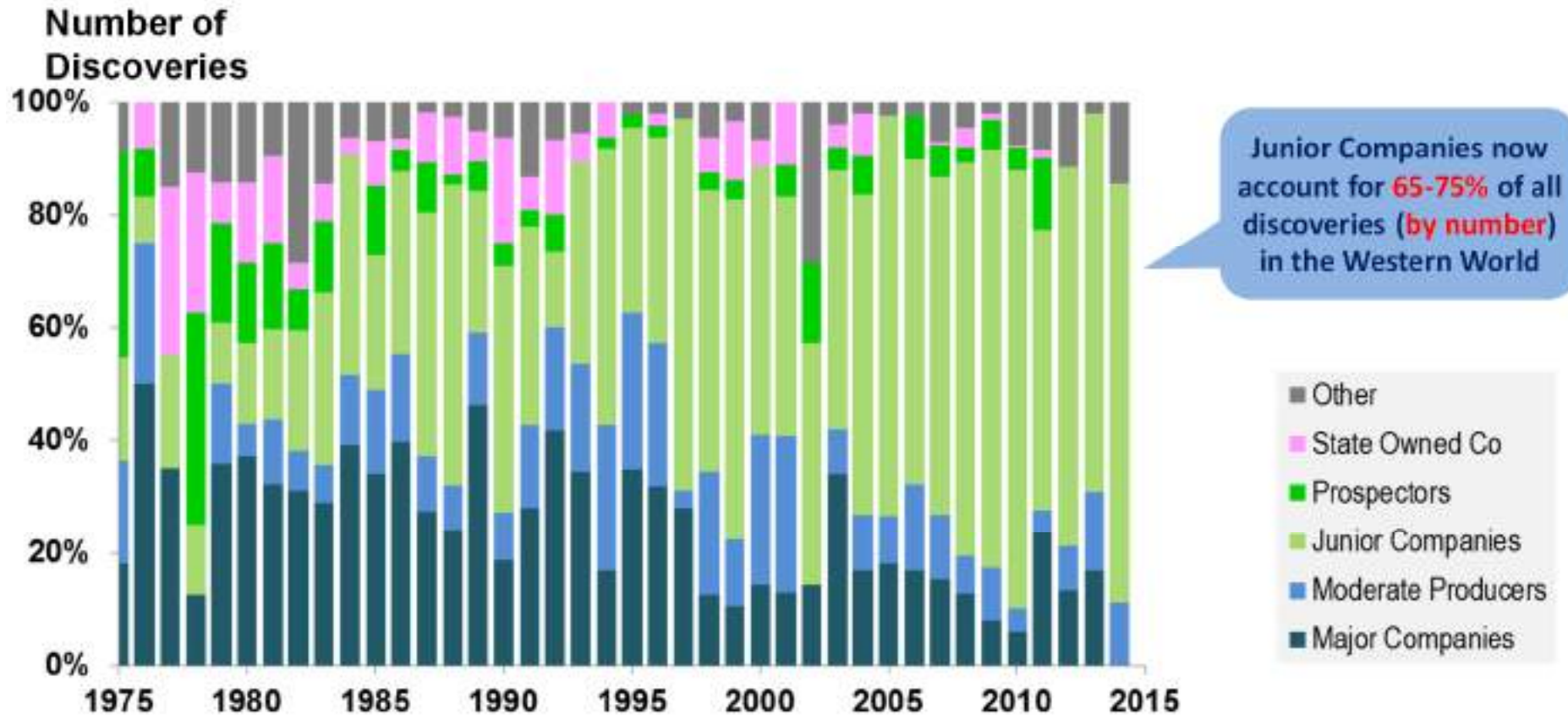
In recent years Junior Companies have found most of the deposits

Note: Figures are adjusted for shared discoveries
Excludes satellite deposits within existing Camps

Source: MinEx Consulting © November 2015

Percentage of discoveries made by **Company Type**

Moderate+Major+Giant primary gold discoveries in Western World: 1975-2014

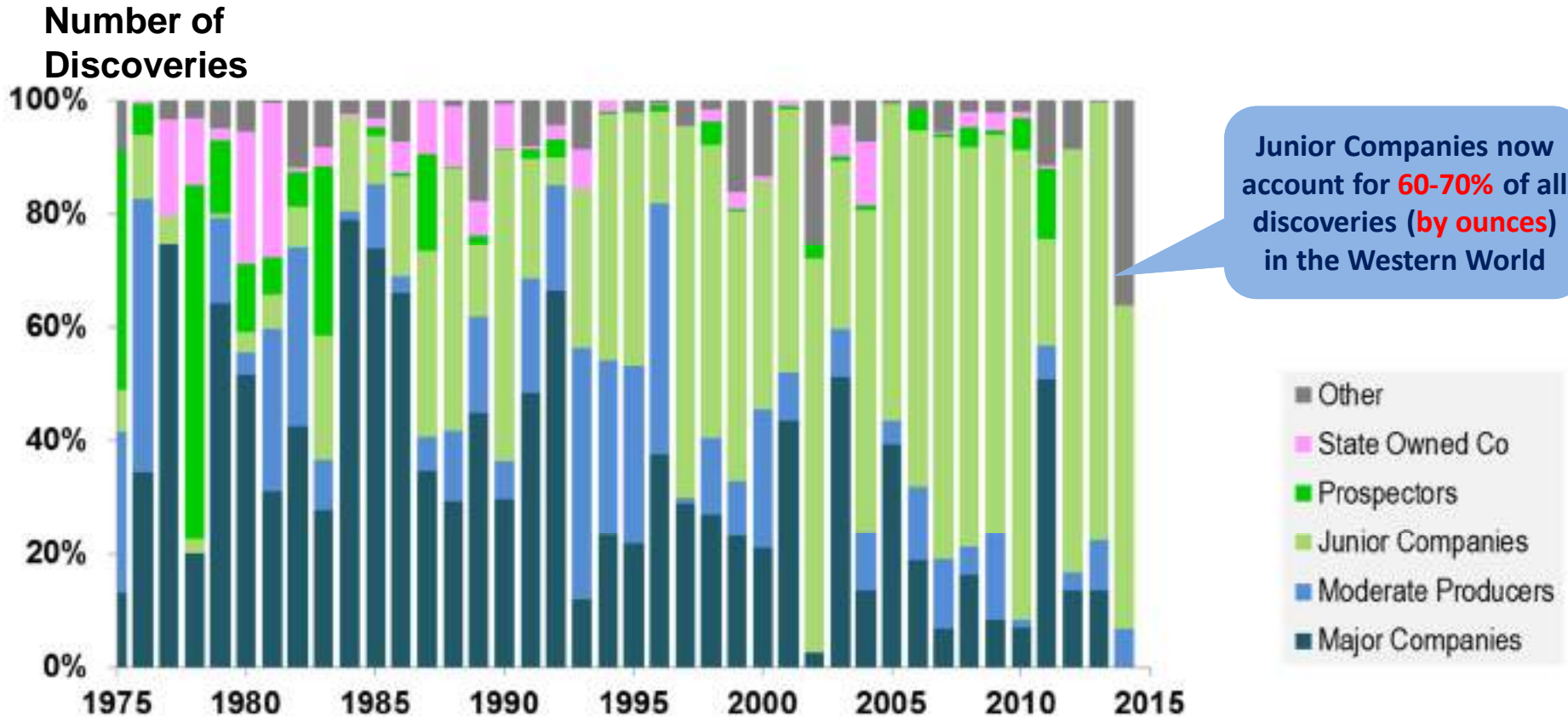


Note: Figures are adjusted for shared discoveries
Excludes satellite deposits within existing Camps

Source: MinEx Consulting © November 2015

Percentage of Ounces found by Company Type

Moderate+Major+Giant primary gold discoveries in Western World: 1975-2014

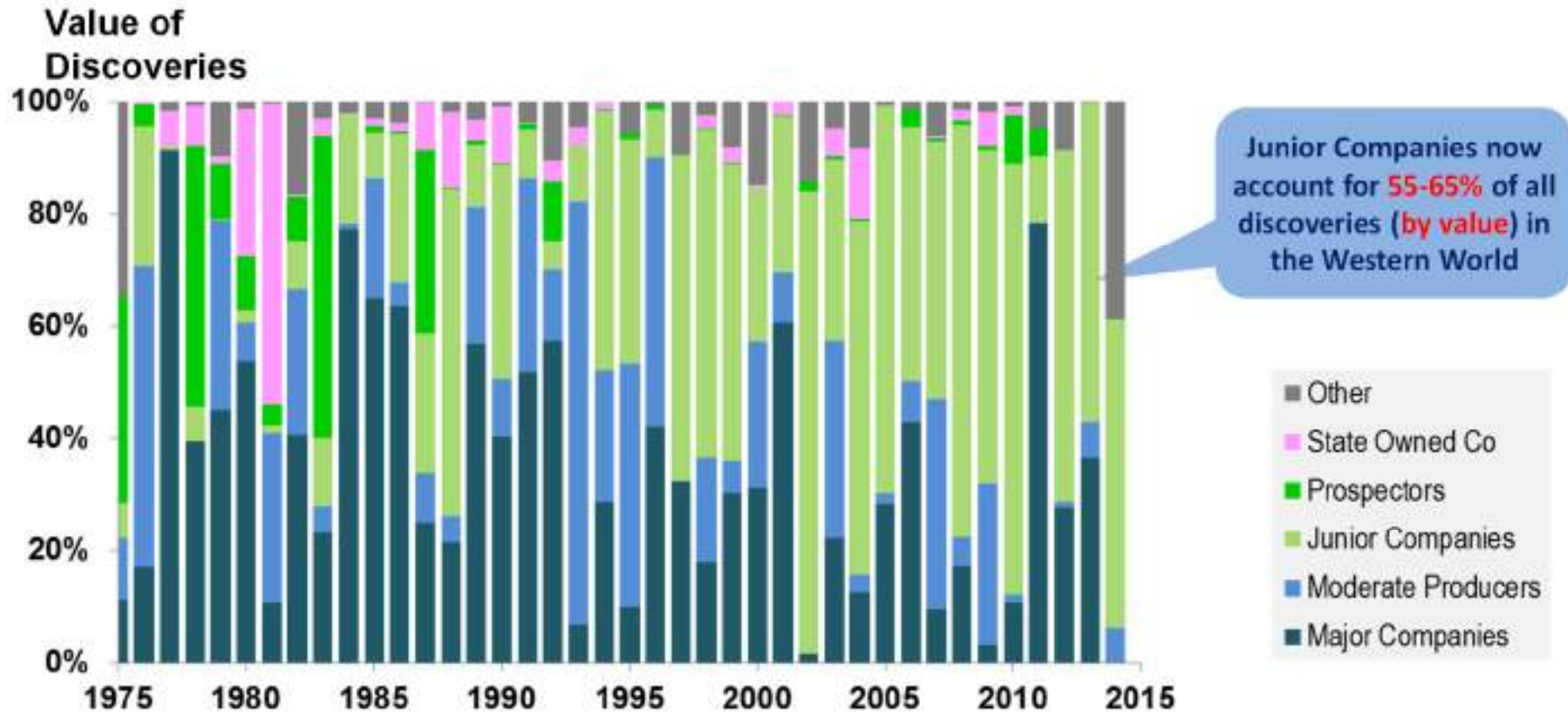


Note: Figures are adjusted for shared discoveries
Excludes satellite deposits within existing Camps

Source: MinEx Consulting © November 2015

Value created made by **Company Type**

Moderate+Major+Giant discoveries in Australia: 1975-2014

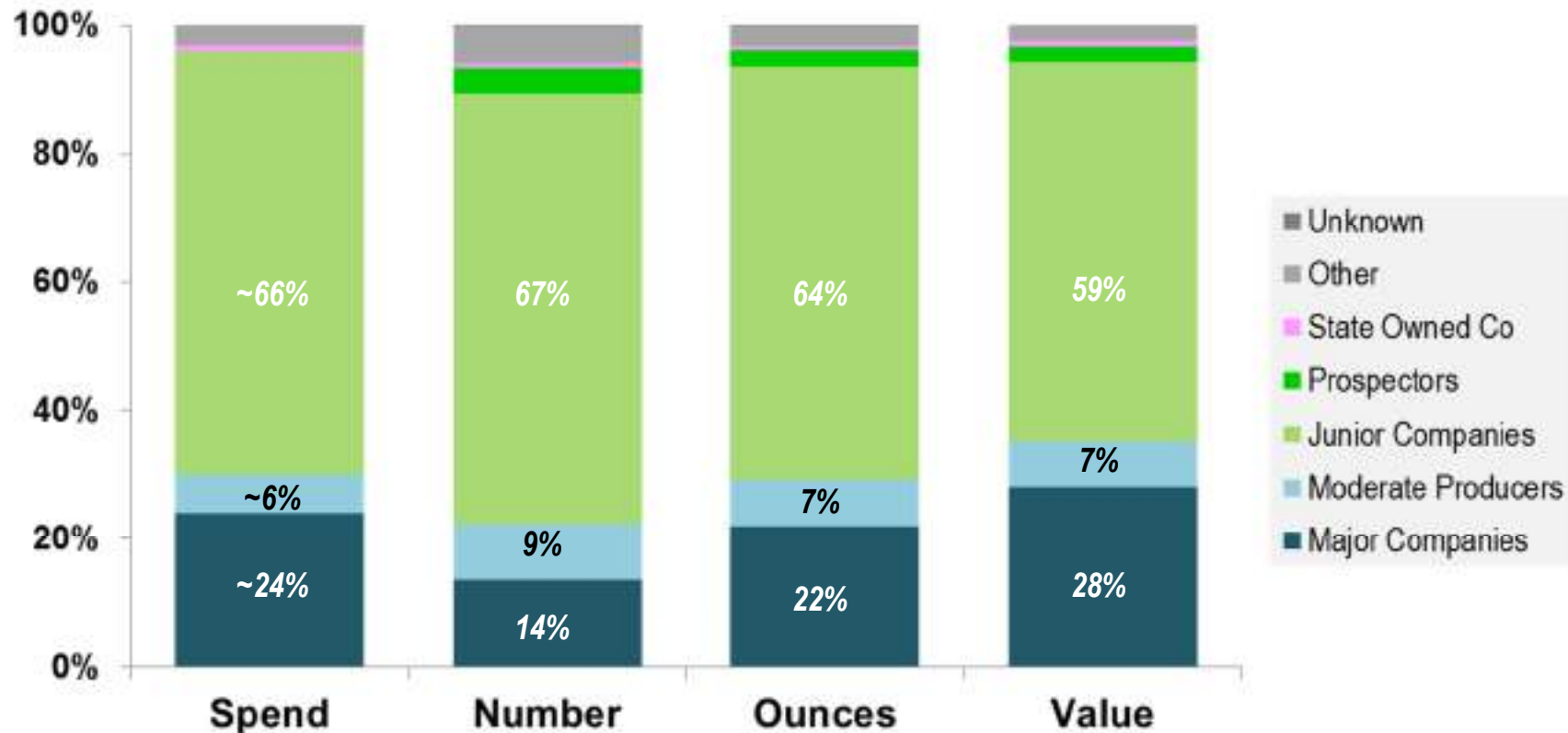


Note: Figures are adjusted for shared discoveries
Excludes satellite deposits within existing Camps

Source: MinEx Consulting © November 2015

Majors versus Juniors

Western World: 2005-2014



Note: Figures are adjusted for shared discoveries
 Excludes satellite deposits within existing Camps
 Exploration expenditures are approximate only

Source: MinEx Consulting © November 2015

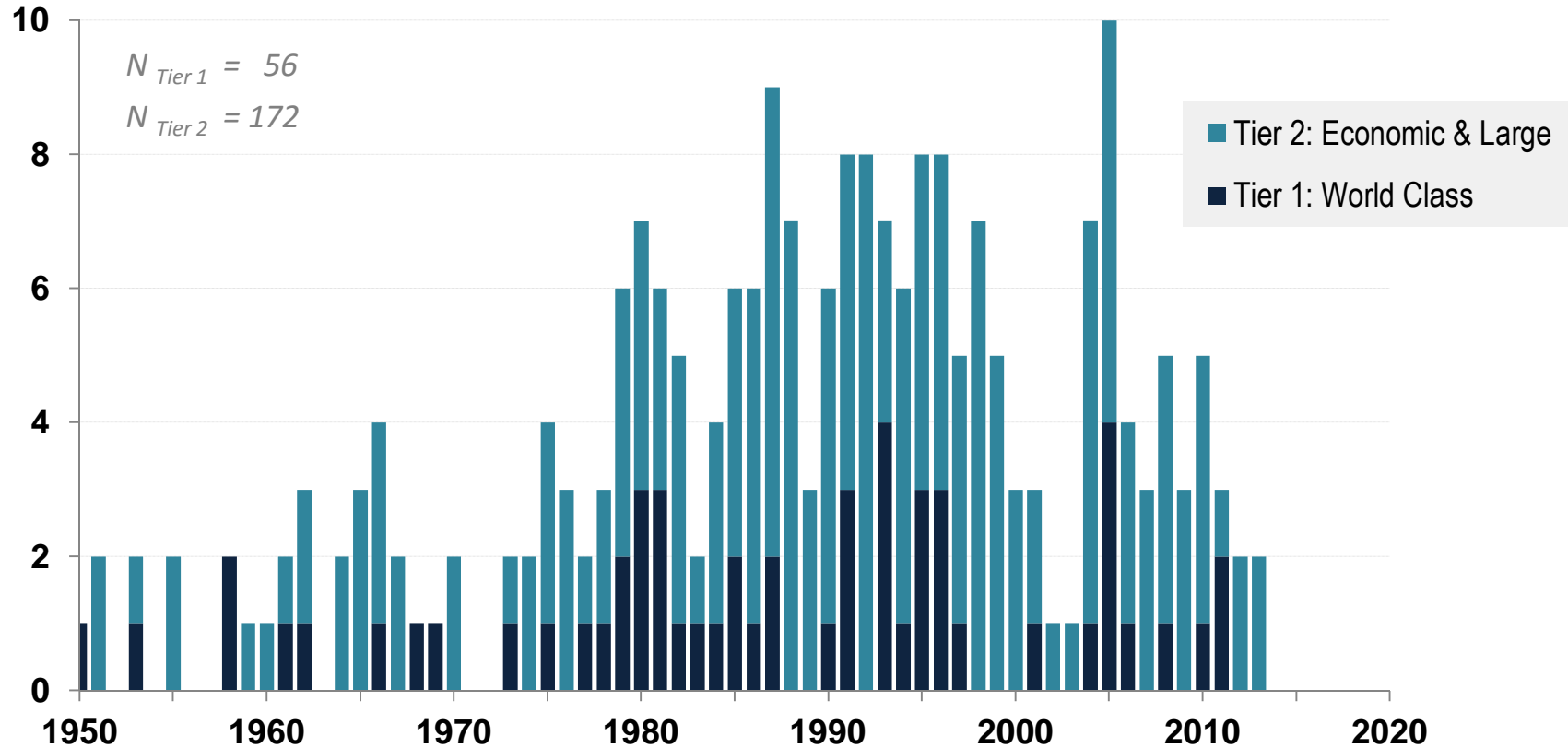
Tier 1 discoveries are rare but valuable

8. TRENDS IN THE QUALITY OF DISCOVERIES

Number of Tier 1 & 2 Gold Discoveries: World

Primary Gold Deposits: 1950-2014

Number of Deposits

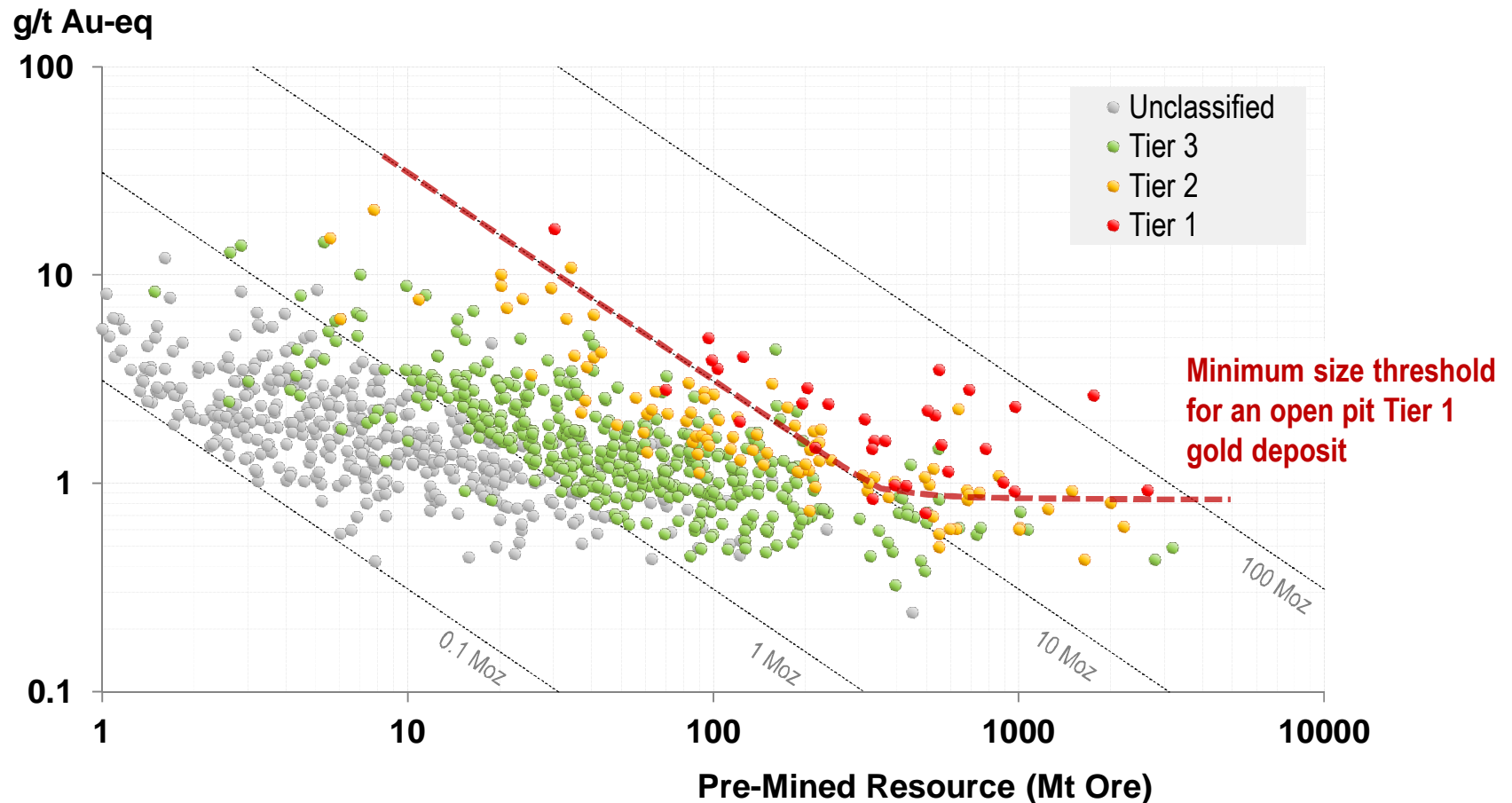


Note: Primary gold deposits only
 Caution: No adjustment made for unreported discoveries

Source: MinEx Consulting © October 2015

Tonnes and Grade of Tier 1, 2 and 3 primary deposits

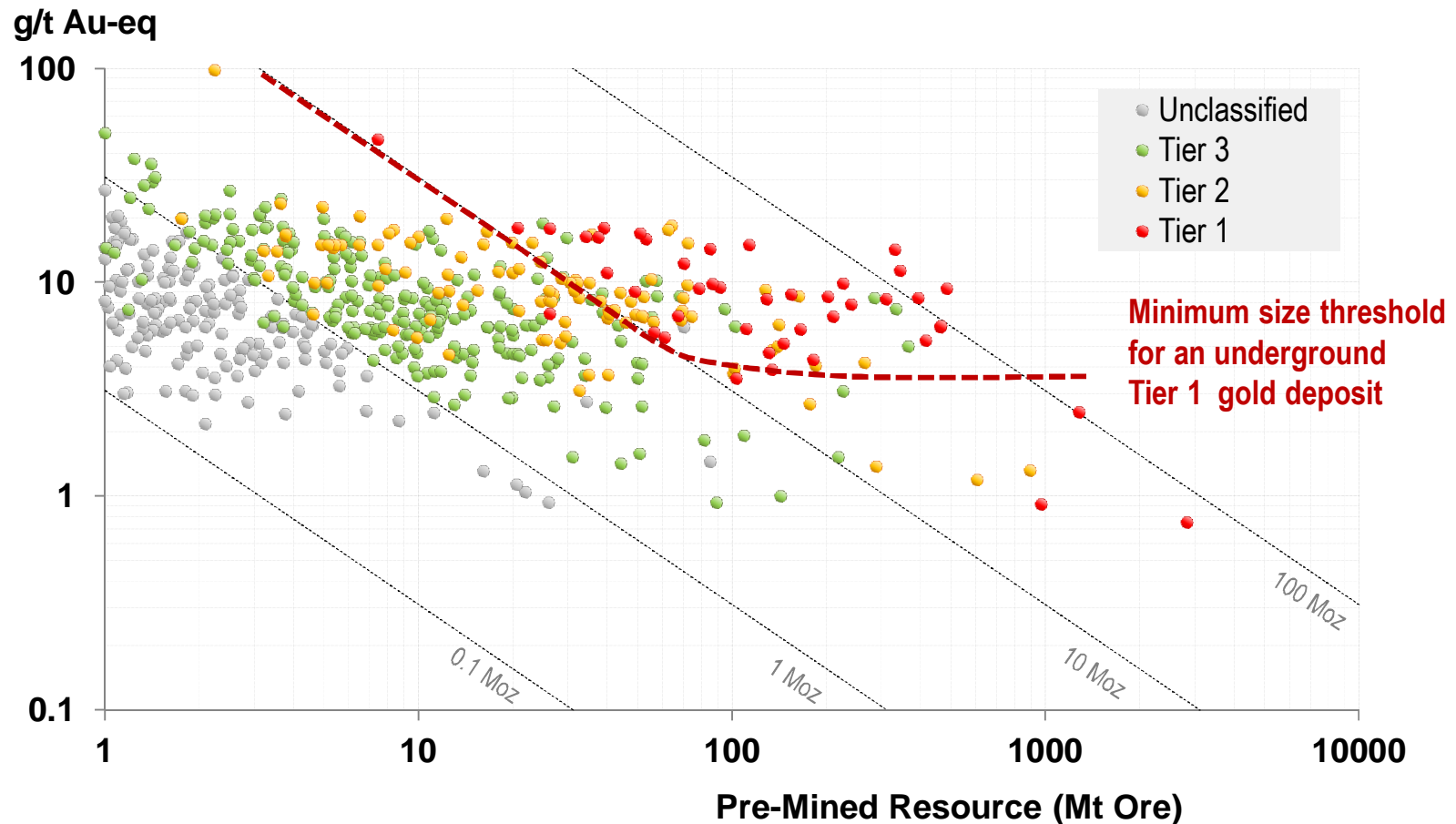
World all years, open pit



Note: Gold equivalent based on monthly average price over last 3 years
 1 g/t Au = 67 g/t Ag = 0.80% Cu = 4.14% Zn = 3.67% Pb

Source: MinEx Consulting © October 2015

Tonnes and Grade of Tier 1, 2 and 3 primary deposits World all years, **underground**



Note: Gold equivalent based on monthly average price over last 3 years
 1 g/t Au = 67 g/t Ag = 0.80% Cu = 4.14% Zn = 3.67% Pb

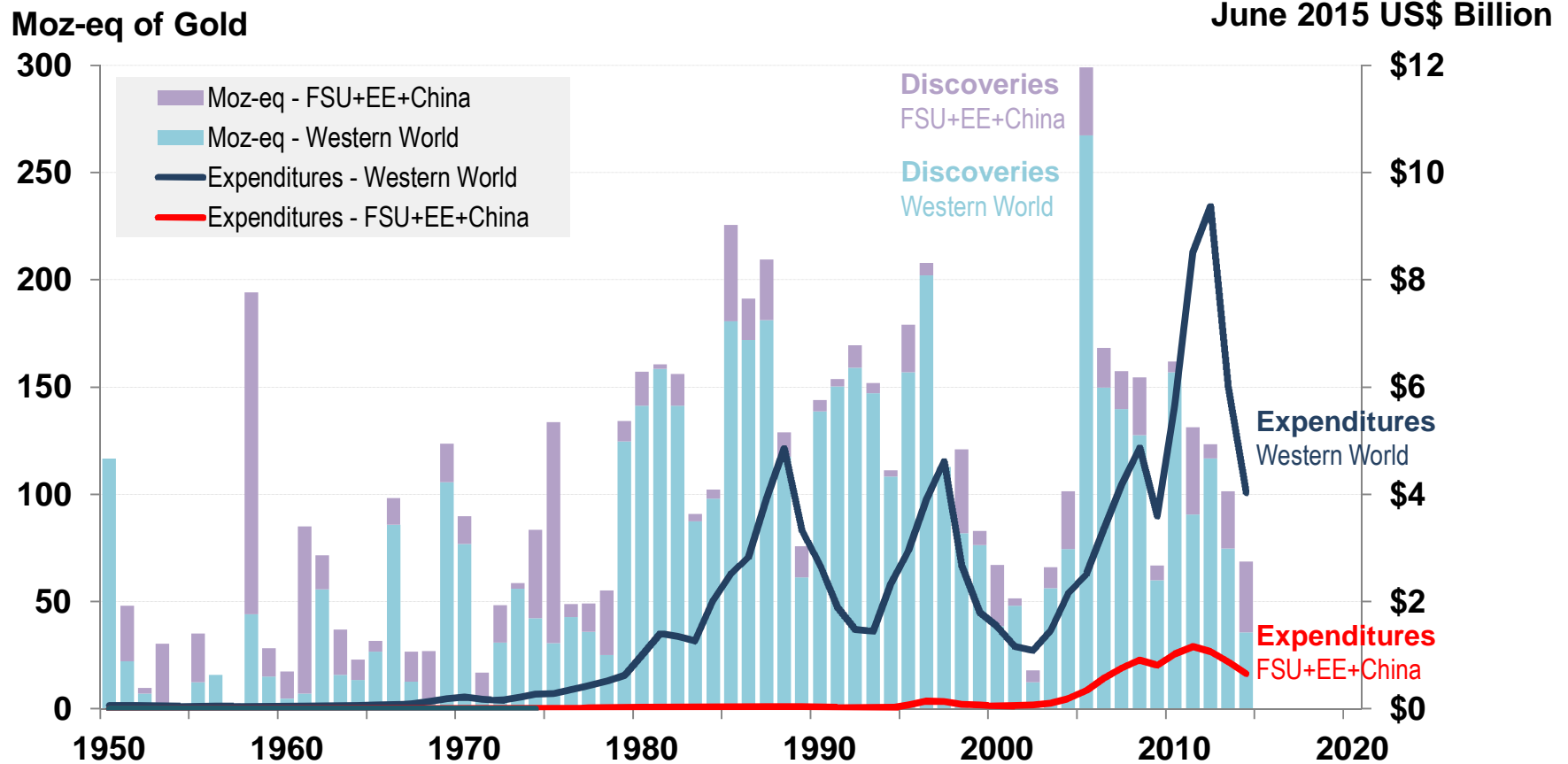
Source: MinEx Consulting © October 2015

Discovery cost per ounce has doubled in the last decade

9. TRENDS IN UNIT DISCOVERY COSTS

Exploration Expenditures and Gold Discovered

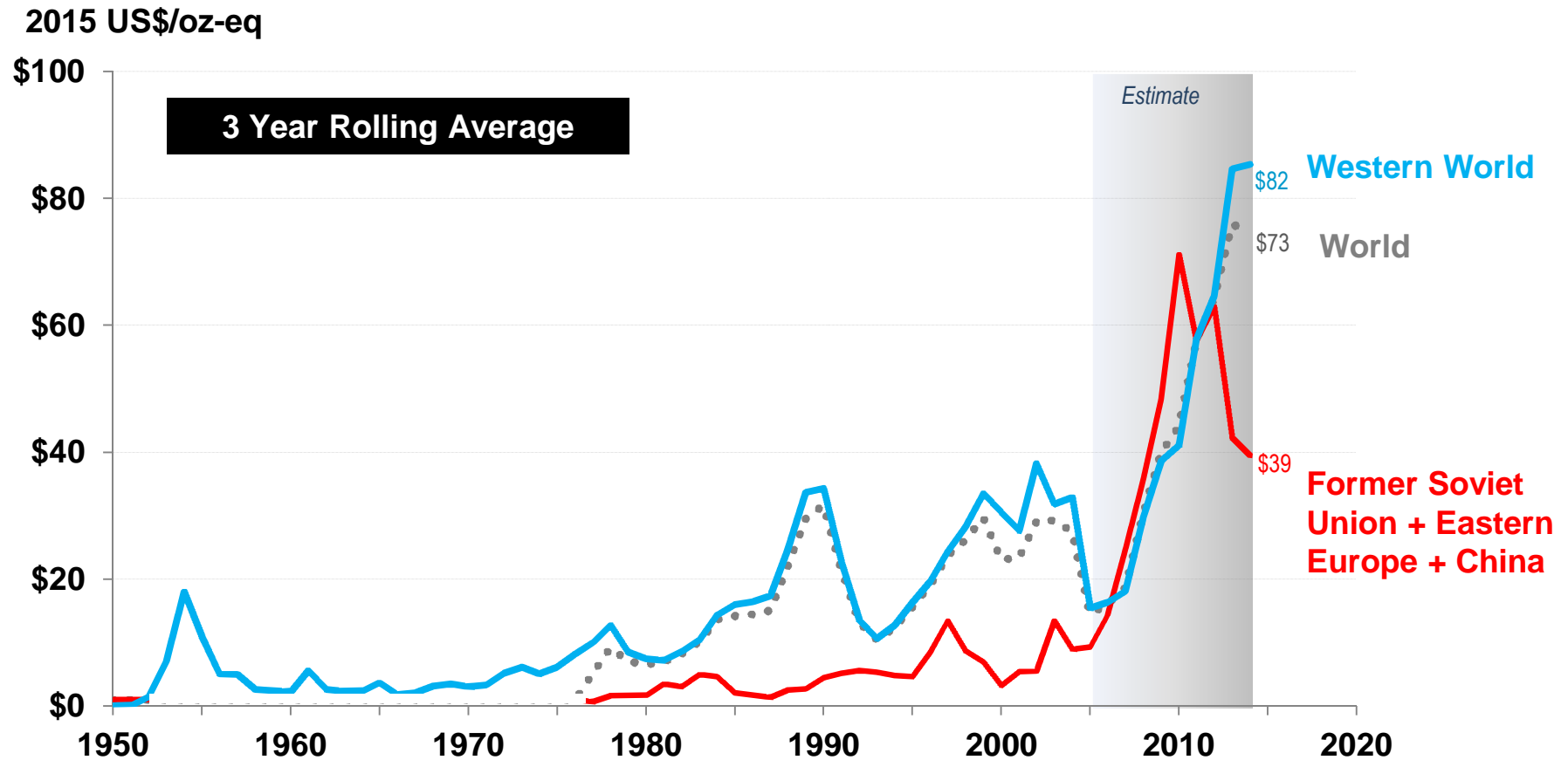
Primary Gold : 1950-2014



Note: Primary gold discoveries only, adjusted for Cu, Ag and Other by-product credits
 Data from 2005 onwards have been adjusted for unreported discoveries
 No expenditure data available for The FSU + Eastern Europe + China prior to 1975

Source: MinEx Consulting © October 2015

Unit Discovery Costs for Gold : 1950-2014



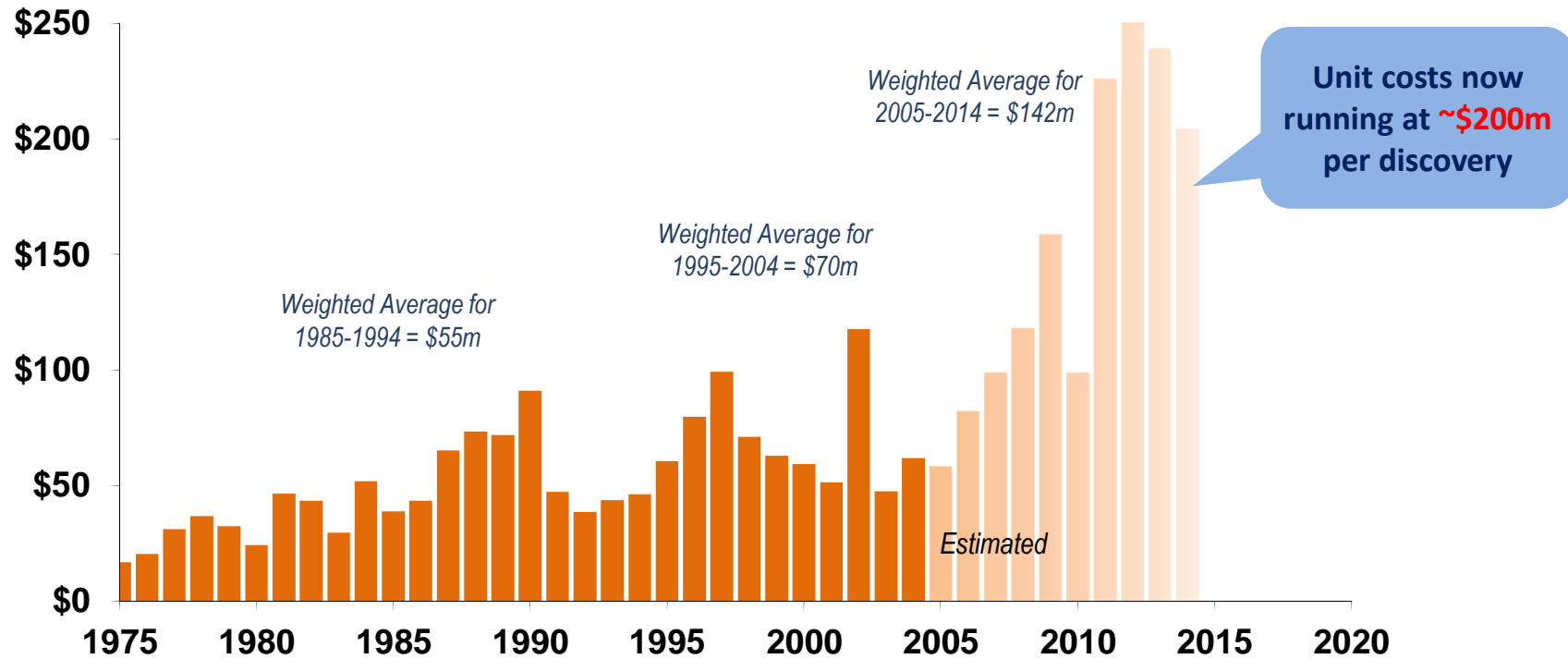
Note Includes value of by-product credits from other metals associated with the primary gold deposit
Data from 2005 onwards have been adjusted for unreported discoveries

Source: MinEx Consulting © October 2015

Trend in Unit Discovery costs: 1975-2014

Western World Primary Gold Deposits > 0.1 Moz

Average Cost per Discovery (2015 US\$m)



Note: Discoveries are for Primary gold deposits >0.1 Moz Au
Data from 2005 onwards have been adjusted for unreported discoveries

Source: MinEx Consulting © October 2015

Discovery performance by Region: 2005-2014

Canada had lowest discovery costs, PAC/SEA was highest

Region	Explorn Spend (2015 \$b)		Adjusted No of Discoveries		Adjusted Moz found				Avg Size Moz-eq	Cost US\$/oz-eq
					Au	BP Credits	Moz-eq			
Australia	\$5.3	9%	48	11%	83	4	86	6%	1.8	\$61
Canada	\$11.6	19%	46	11%	306	75	380	27%	8.3	\$31
USA	\$5.7	9%	19	4%	78	3	80	6%	4.2	\$71
Latin America	\$14.4	24%	82	19%	275	78	353	25%	4.3	\$41
Pacific/SE Asia	\$4.0	7%	10	2%	10	2	12	1%	1.2	\$334
Africa	\$9.5	16%	128	30%	252	1	252	18%	2.0	\$38
W Europe	\$1.4	2%	16	4%	31	5	36	3%	2.3	\$38
FSU+EE+China	\$8.2	14%	64	15%	196	17	213	15%	3.3	\$38
Rest of World	\$0.5	1%	7	2%	18	3	21	1%	2.9	\$26
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TOTAL	\$60.5	100%	420	100%	1246	187	1433	100%	3.4	\$42

Note: Includes adjustment for unreported discoveries

Source: MinEx Consulting © November 2015

Discovery performance by Region: Spend & performance by Region: 2005-2014

PAC/SEA was **below average**. Africa & Australia performed best

i.e. "Bang-per-Buck"

Region	Exploration Spend (2014 \$b)		No of Discoveries #		Tier 1+2 Discoveries		Estimated Value (2015 \$b)		Value / Spend
Australia	\$5.3	9%	48	11%	5	14%	\$4.6	11%	0.87
Canada	\$11.6	19%	46	11%	9	24%	\$11.1	27%	0.96
USA	\$5.7	9%	19	4%	3	8%	\$2.8	7%	0.49
Latin America	\$14.4	24%	82	19%	10	27%	\$8.3	20%	0.57
Pacific/SE Asia	\$4.0	7%	10	2%	0	0%	\$0.4	1%	0.09
Africa	\$9.5	16%	128	30%	6	16%	\$6.3	16%	0.67
W Europe	\$1.4	2%	16	4%	0	0%	\$0.5	1%	0.36
FSU+EE+China	\$8.2	14%	64	15%	4	11%	\$6.7	16%	0.82
Rest of World	\$0.5	1%	7	2%	0	0%	\$0.2	1%	0.43
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TOTAL	\$60.5	100%	360	100%	79	100%	\$40.9	100%	0.68

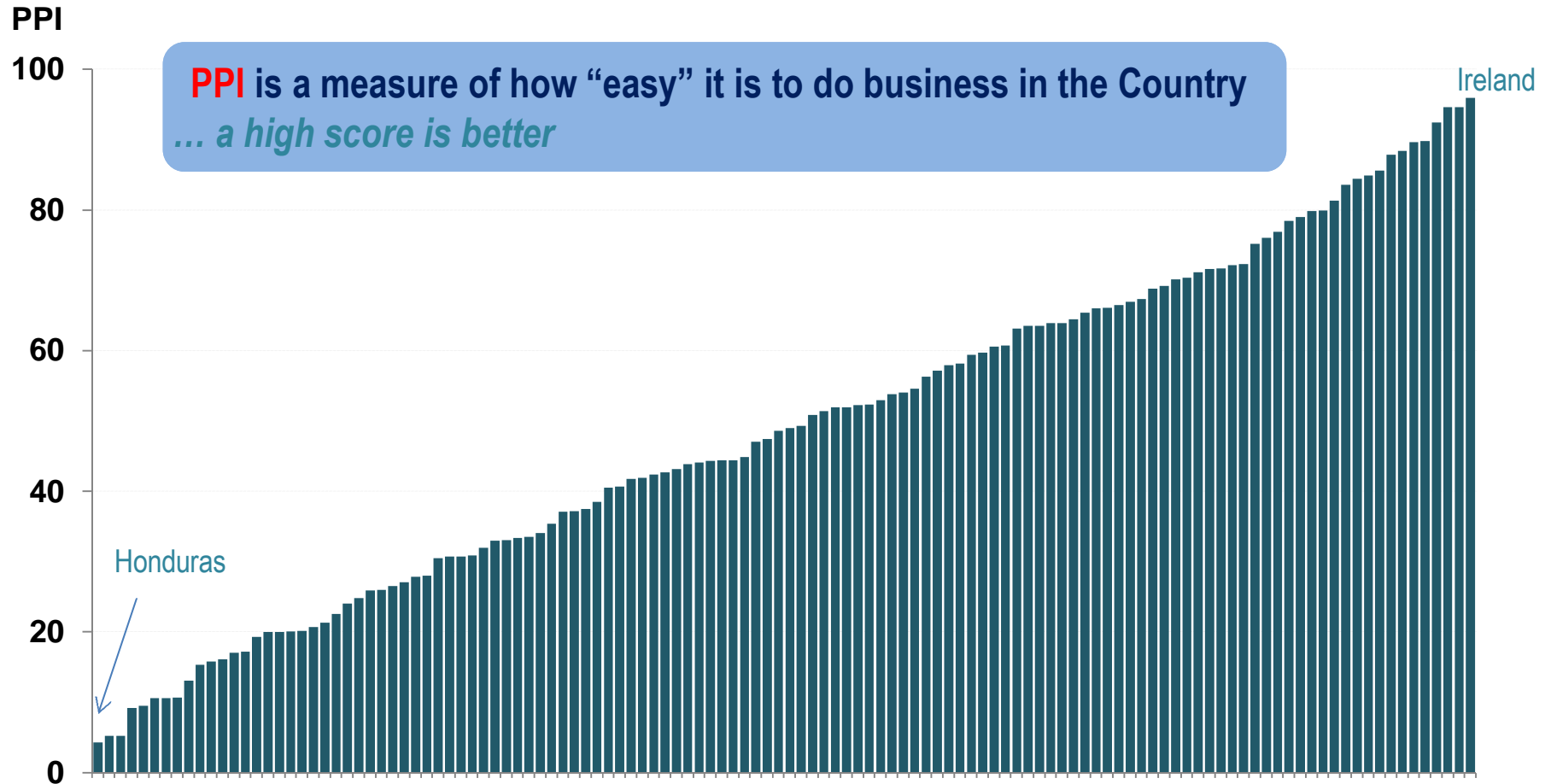
Note: Estimated values are **indicative** only

Source: MinEx Consulting © November 2015

10. TRENDS IN COUNTRY RISK

Policy Perception Index: March 2015

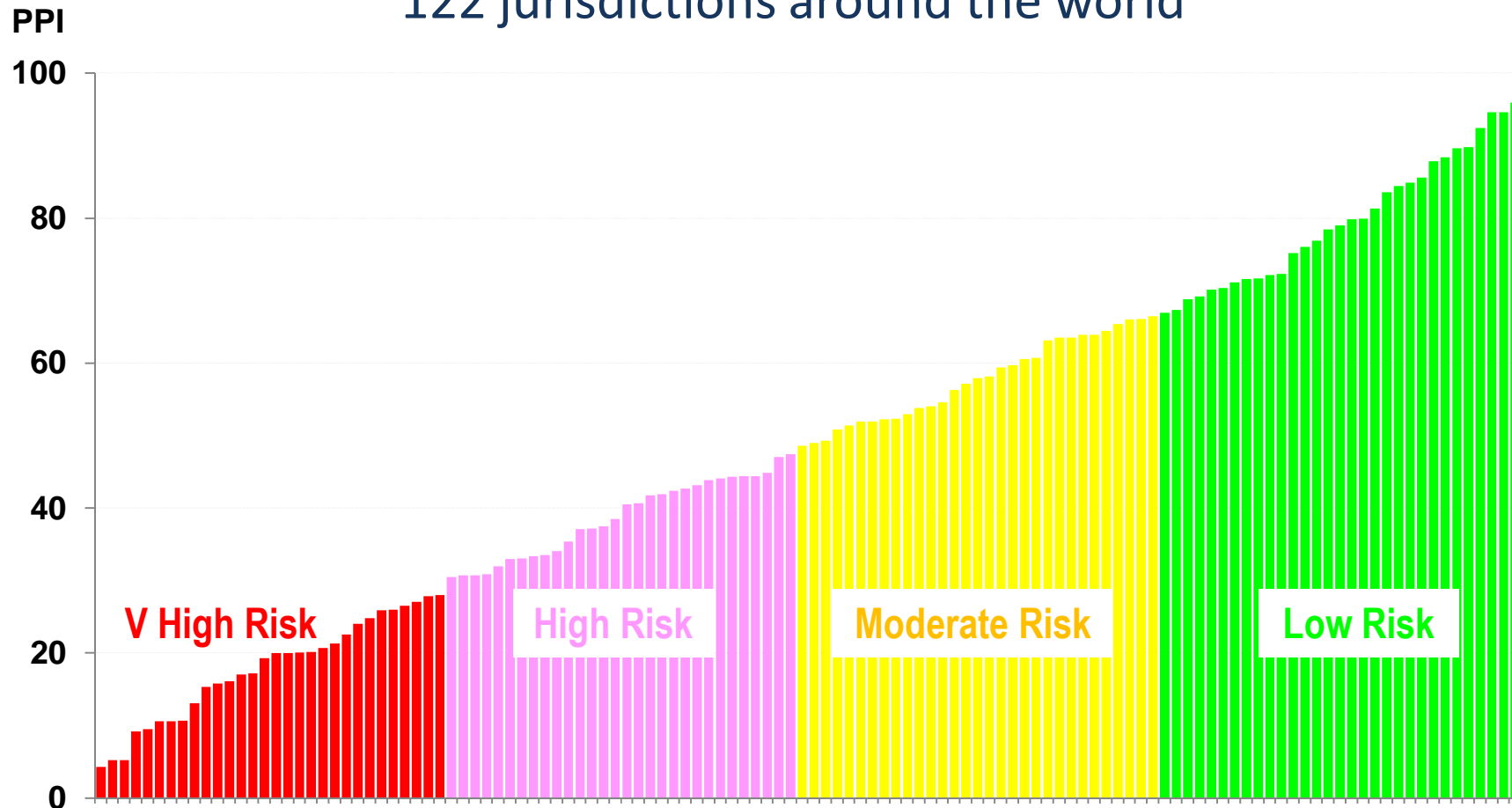
122 jurisdictions around the world



Source: Fraser Institute March 2015

Policy Perception Index: March 2015

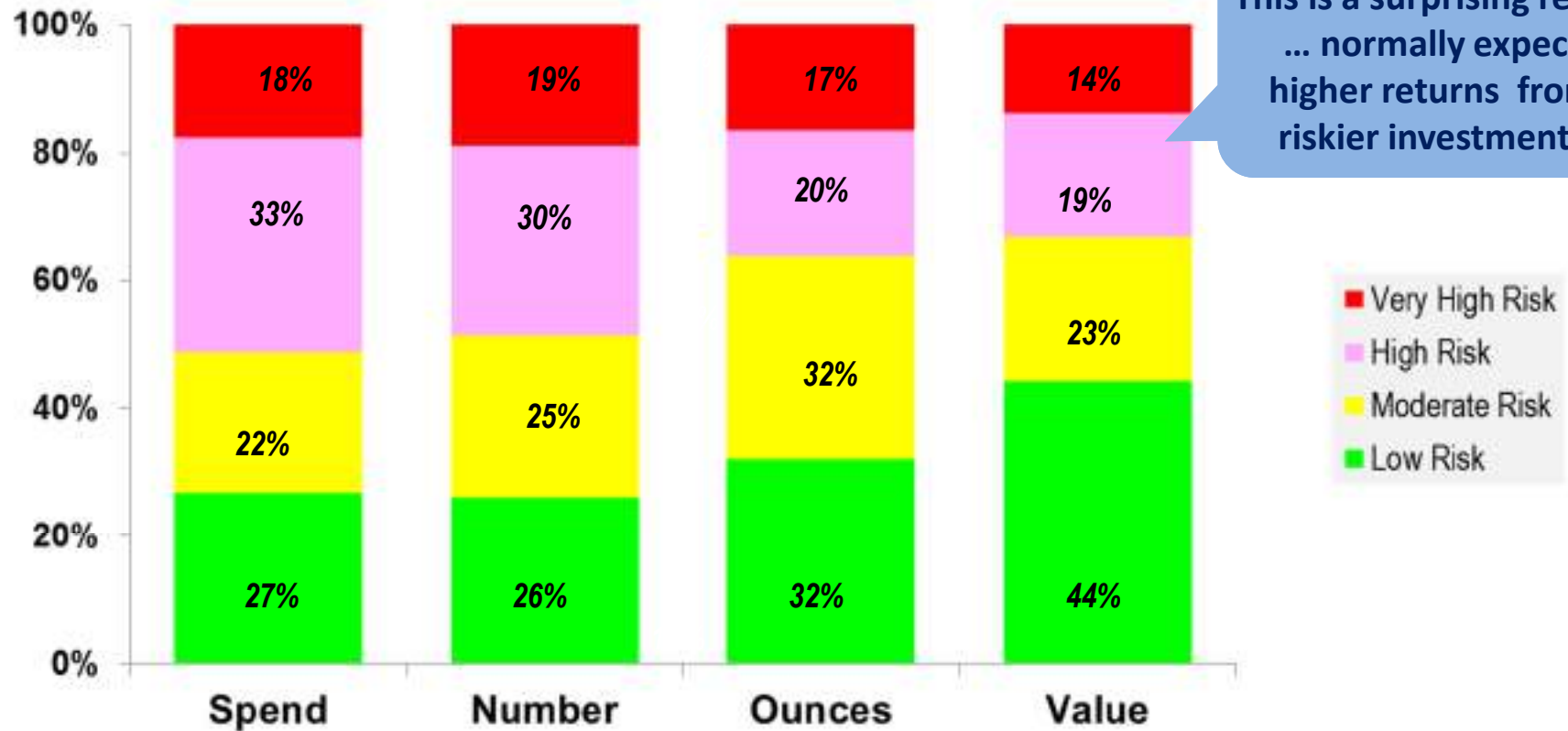
122 jurisdictions around the world



Note: Ratings will change from year to year

Source: Fraser Institute March 2015

Country Risk versus Reward Western World: 2005-2014



This is a surprising result ... normally expect higher returns from riskier investments

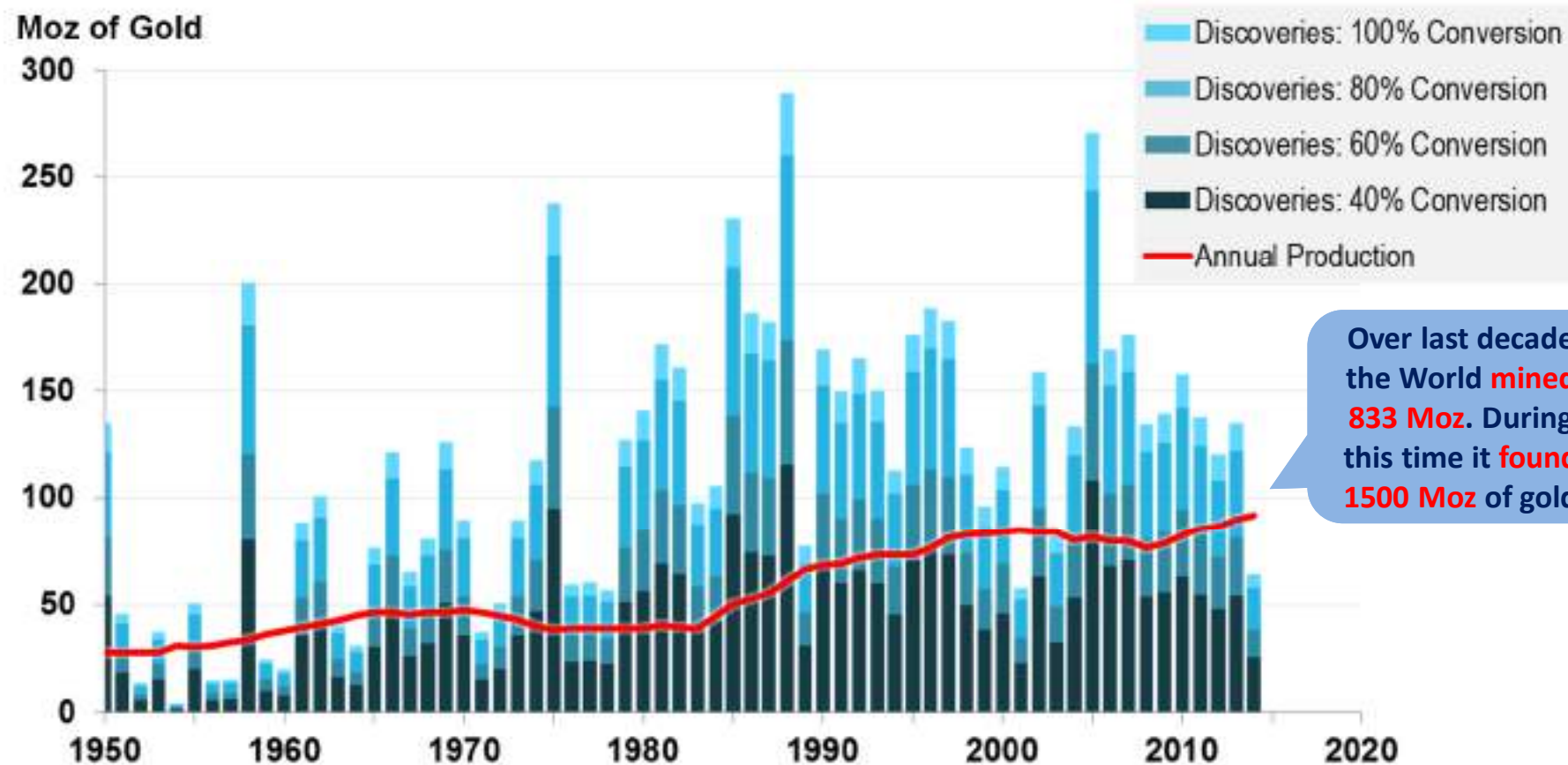
Note: Excludes FSU and China

Source: MinEx Consulting © November 2015

11. ARE WE FINDING ENOUGH GOLD ?

Amount of Gold Mined vs Discovered: World

Primary & By-Product Gold : 1950-2014



Note: Includes by-product gold associated with base metal and other discoveries
Data from 2005 onwards have been adjusted for unreported discoveries

Sources: MinEx Consulting © October 2015
USGS (for production data)

Summary / Conclusions : 1/4

1. Trends in exploration expenditures

- Gold exploration expenditures are extremely cyclical
- Global spend was US\$4.7 b in 2014 , down 55% from its peak in 2012 (of \$10.5b)

2. Trends in the number of discoveries and ounces

- The number of deposits and contained ounces found in the last decade (2005-2014) were at the same level as that of the boom period of the 1980s and 1990s
- Over the last decade 1246 Moz was found in 420 primary gold deposits (>0.1 Moz). This includes an adjustment for unreported discoveries
- 46% of the ounces found were in deposits >6Moz, but these only accounted for 7% by number
- In addition, 250 Moz was found as by-product gold associated with base metal and other deposits ... that's 17% of all gold found in the decade
- Primary gold deposits can have their own by-product credits (such as Ag and Cu). Converting these into gold-equivalent added an extra 187 Moz to the size of the discoveries

3. Trends in the location of discoveries

- Over the last decade Canada did well (at the expense of Latin America)
- By number, 11% of the discoveries were in Canada, 11% in Australia and 30% in Africa
- In terms of contained gold, 27% was found in Canada, 6% in Australia and 18% in Africa
- Top 10 “Hot Spots” are Alaska/Yukon, SW USA/Mexico, Northern Ontario, Latin America, West Africa, NE/Central Africa, Turkey / Carpathian Belt, China, Far East Russia and Western Australia

Summary / Conclusions : 2/4

4. Size and grade of discoveries

- Average size of discovery is falling (3.4 Moz in last decade versus ~5 Moz in 1980s and 1990s)
- Average grade was steady at ~1.5 g/t – but improved in last 5 years to 1.7 g/t due to some last high grade discoveries (Red Hill/Gold Rush 15.4 Moz @ 5.0 g/t, and Haiyu 15.1 Moz @ 7.0 g/t)
- Average grade mined has been steadily declining (1.7 g/t in last decade versus 3.3 g/t in 1990s)

5. Trends in discovery methods

- At the Project-scale level (i.e. deciding where to peg leases), the main targeting method is based on the presence of prior known mineralisation ... ie targeting is based on “nearology”
- At the Prospect-scale level (i.e. deciding where to drill the first hole) the two main methods are geochemistry (35%) and extrapolation from known mineralisation (23%). As we go deeper, geophysics is becoming more important (13% versus 5% in the 1990s)

6. Depth of cover for discoveries

- Depth is gradually increasing over time.
- Over the last decade the average depth of cover was 64 metres ... but half of the deposits found were outcropping (and most of these were in Africa)

Summary / Conclusions : 3/4

7. Who made the discoveries?

- Over the last decade Junior companies accounted for 69% of the exploration spend, 67% of gold discoveries (by number), 64% of the ounces and 59% of the value created
- Major companies were mainly focused on finding giant deposits. Over the last decade, they accounted for 24% of the spend, 14% of the discoveries, 22% of the ounces and 28% of the value

8. Quality of the discoveries

- Most of the value created was tied-up in Tier-1 and -2 discoveries. These are rare – only 2-3 being found each year in the World.
- As a rule of thumb, to have a chance of being considered Tier-1, the deposit needs to be >10 Moz in size and have a grade >1 g/t if open pit or >4 g/t if underground

9. Trends in unit discovery costs

- Unit discovery costs have progressively risen over time - from \$14/oz Au-eq in the 1980s to \$20/oz in the 1990s and \$25/oz in 2000s. It is currently running at ~\$60/oz
- Discovery costs vary widely by Region – the lowest was Canada (\$31/oz) & Africa (\$38/oz), and the highest was US (\$71/oz) & Pacific SE Asia (>\$300/oz)
- In terms of Value/Cost (i.e. “Bang-per Buck”) over the last decade the industry created \$0.68 worth of value per each Dollar spent on Exploration. Hopefully this will improve over time – as costs come down and recent discoveries grow in size

Summary / Conclusions : 4/4

10. Country Risk issues

- Over the last decade **51%** of the total exploration expenditures were in High-Risk and Very-High Risk countries. These accounted for **49%** of the discoveries by number, **37%** of the ounces but only **33%** of the value

This is a surprising result – as one would expect a higher return to compensate for the higher business risk associated with exploring there.

11. Are we finding enough gold to replace what we mine?

- Over the last decade, industry found 1.8 oz of gold resource for every ounce mined. However, not all discoveries turn into mines (~60%), and not all resource ounces are turned into reserves. Also ~10% of the reserves are lost during processing.

On this basis, the industry is currently struggling to sustain itself.

As a consequence the gold price has to rise (to stimulate more exploration and make more projects economic) or we have to either to be smarter/more efficient at exploration

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