WHAT DO WE MEAN BY A WORLD-CLASS DEPOSIT? AND WHY ARE THEY SPECIAL ?

Richard Schodde

AMEC Conference, Perth

8th June 2006

bhpbilliton

Disclaimer

The following presentation is based on an analysis carried out by the author prior to joining BHP Billiton. It therefore doesn't necessarily reflect the company's business strategy.

The reported valuations differ from internal BHP Billiton estimates, in part, because of different assumptions regarding cost of capital and future commodity prices.

Any reference to the word "we" refers to the minerals industry, not BHP Billiton.

Disclaimer

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Overview

- What do we mean by “world-class” ?
  - Current definitions and issues associated with them
  - Proposed definition – $250 million NPV threshold (based on an analysis of 143 significant mineral discoveries)
- How often are they found ?
  - On average 2-4 are found each year in the Western World
- What makes them so “special” ?
  - Special characteristics of world-class mines
  - Impact on investors, government and society

What do we mean by “world-class” ?

There are wide range of definitions for world class

World-class means different things to different people … i.e. for:

- The general public …Something of outstanding quality
- Investors ….. They make lots of money for a long time!
- Geologists … A deposit with a very big mineral endowment
- Promoters … Something that might be big

The risk is that the term is being over-used by industry to the point of devaluing its meaning

Definitions commonly used by geologists

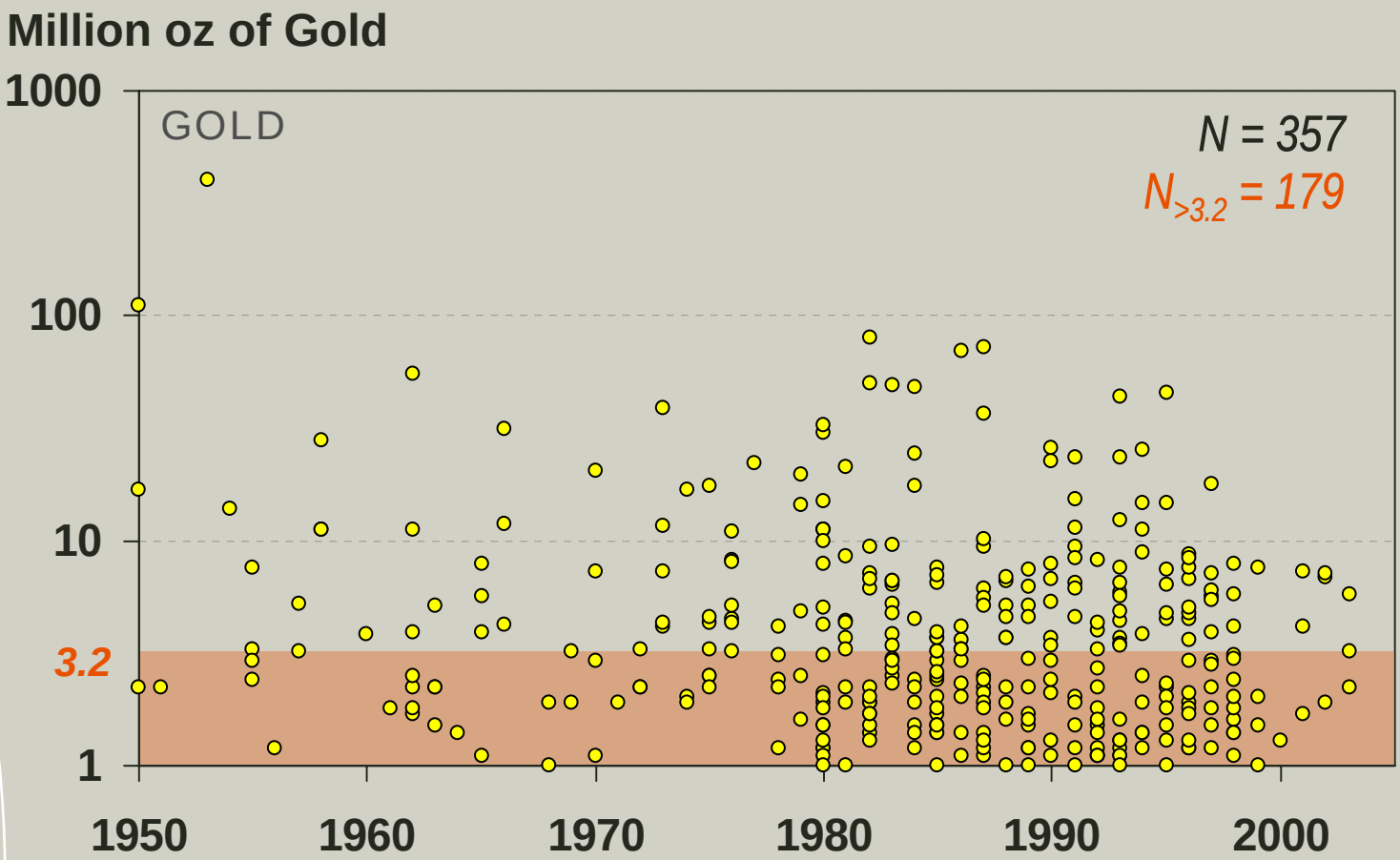
- Donald Singer (1995)

  Upper 10 percent of deposits in his database ordered in terms of contained metal. This equates to 3.2 Moz for gold, 77 Moz for silver, 2 Mt for copper, 1 Mt for lead and 1.7 Mt for zinc.

- Peter Laznicka (1999)

  "An informal term applied to ore deposits with an exceptionally large tonnage of economically recoverable metals". …. "The term attests to an exceptional economic benefit these deposits provide, or potentially provide, and consequently this class of deposits is eagerly sought by the industry".

Major gold deposits discovered in the Western World between 1950 and 2003



Singer's threshold for world-class gold deposits

Source: WMC June 2005

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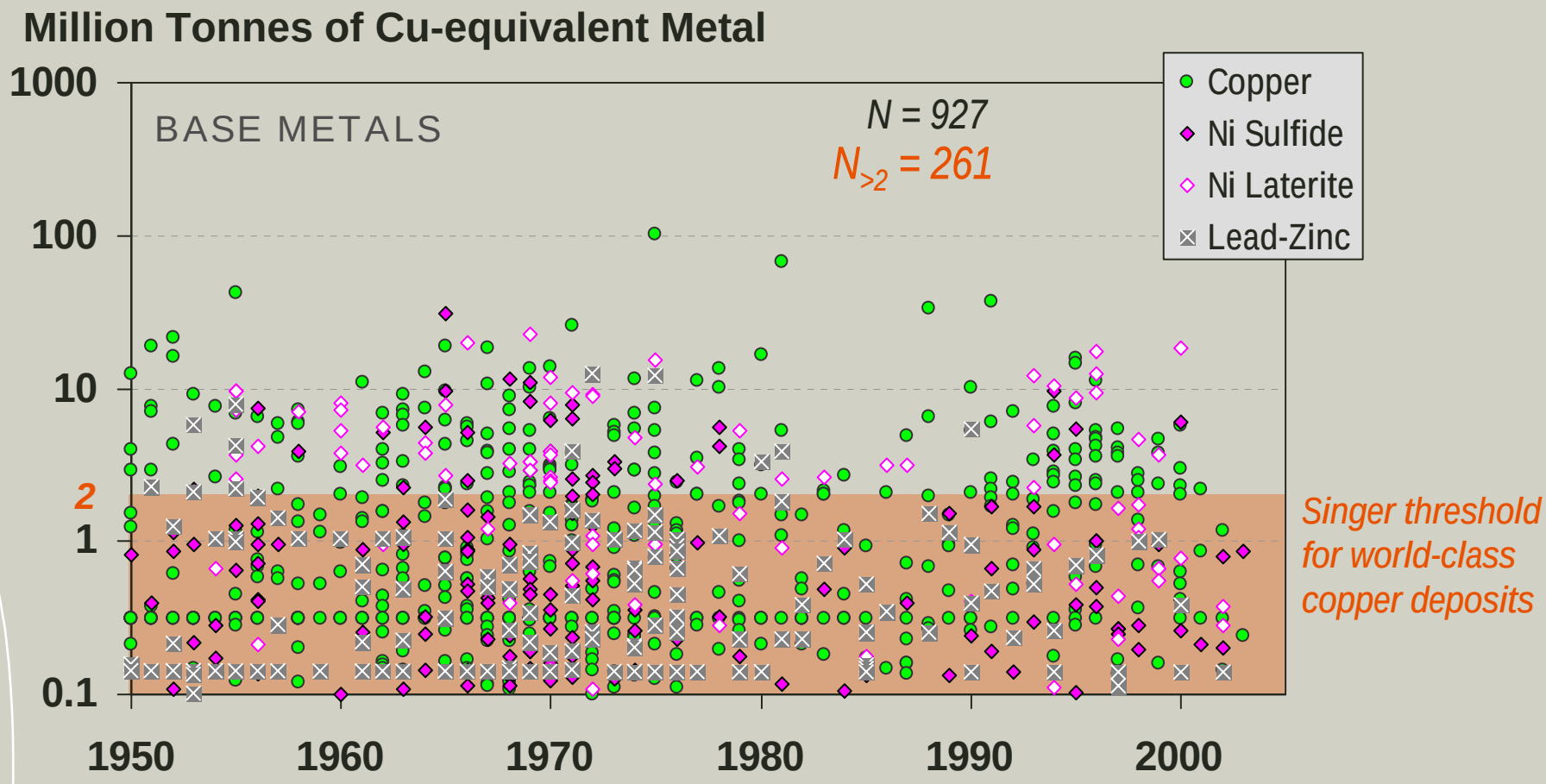
Major base metal deposits discovered in the Western World between 1950 and 2003



Source: WMC June 2005

Assumes 1t Cu = 0.33t Ni = 2.91t Zn = 3.47t Pb

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Definitions commonly used by the industry

- Tom Albanese (2005)

  "Only the largest and highest grade deposits that would make a difference to the company's bottom line".

- Michael Doggett (2004)

  "World-class should be more than just big geologically [and that] there must be an economic consideration"……. "when economics are considered, there is no such thing as a world class mineral deposit. There are only big interesting mineral deposits or world-class mines".

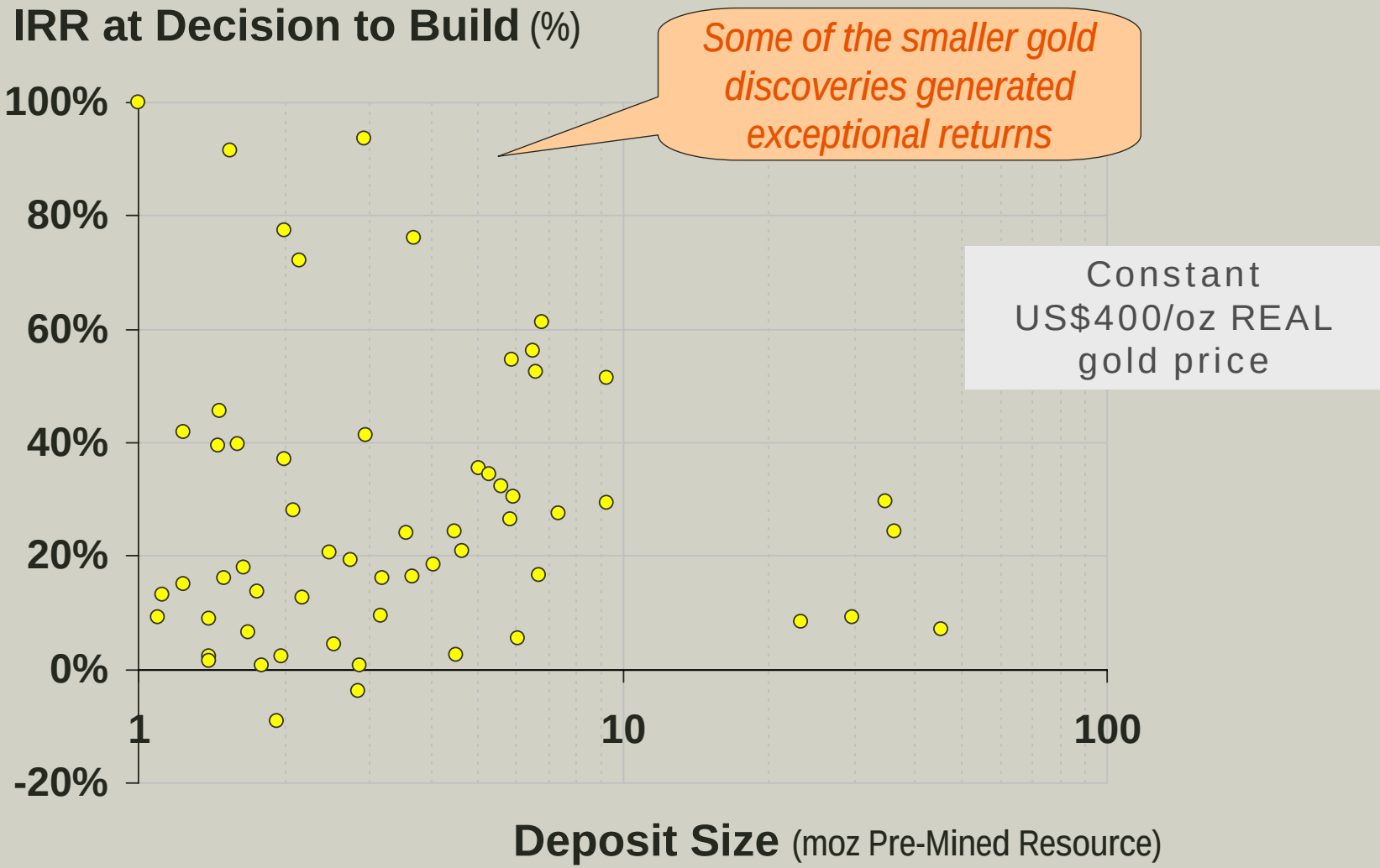
NPV approach
Analysis of the value created from potential world-class deposits

- Use WMC's deposit database – contains information on 115,000 mineral deposits around the world, including discovery history data on 10,000 of these.

- Evaluated the NPV's of 143 significant mineral discoveries made in low-risk western world countries between 1985-2003.
  - 63 gold (>1 Moz)
  - 6 diamond (>3 M carats)
  - 74 base metal (> 0.5Mt Cu-equiv)

Source: Schodde & Hronsky, "Role of World-Class Mines in Wealth Creation" SEG2006 Conference, Keystone May 2006

Returns achieved for major gold discoveries
Gold deposits found in low-risk WW countries 1985-2003



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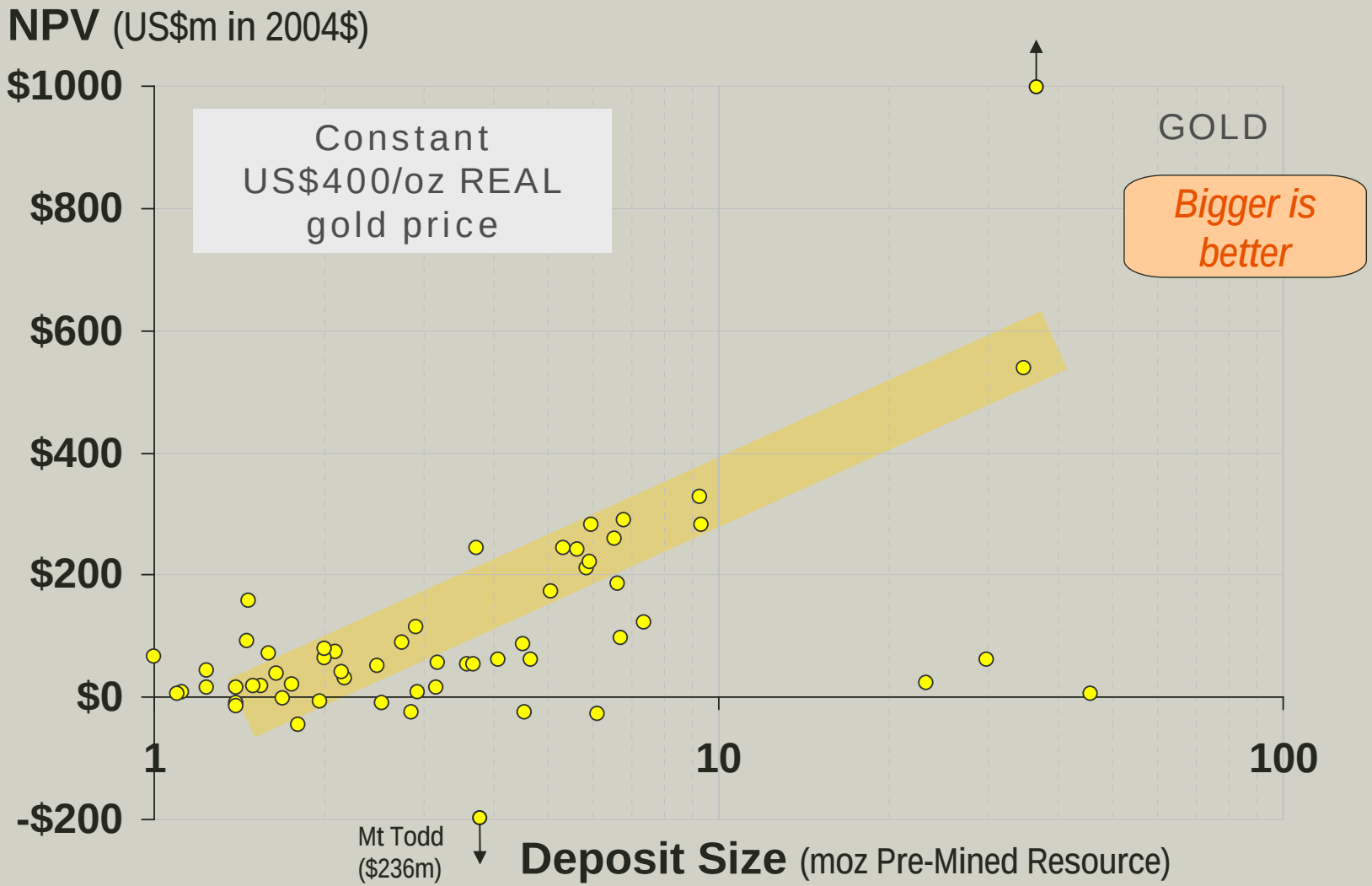
Value of major gold discoveries
Gold deposits found in low-risk WW countries 1985-2003



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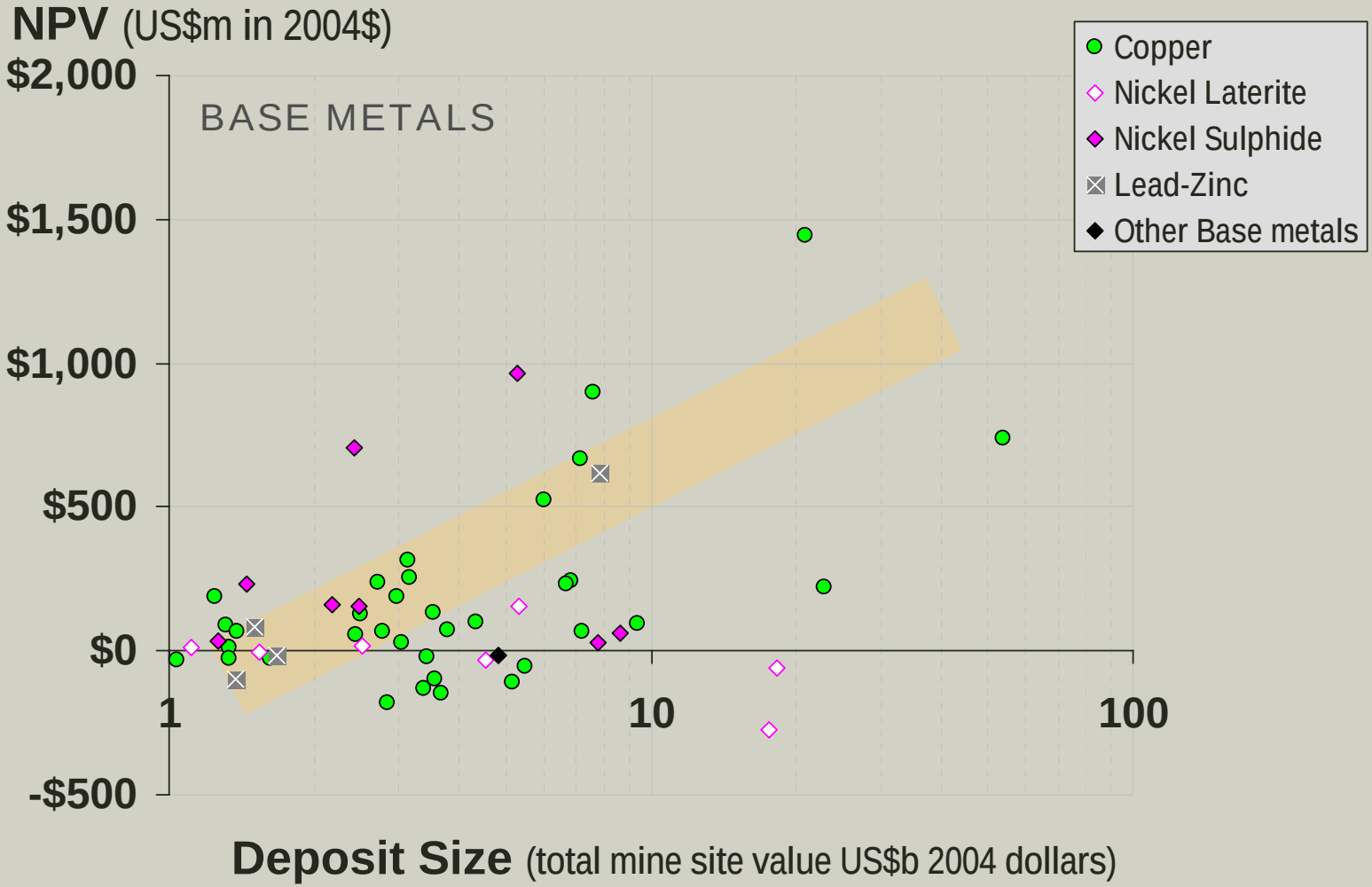

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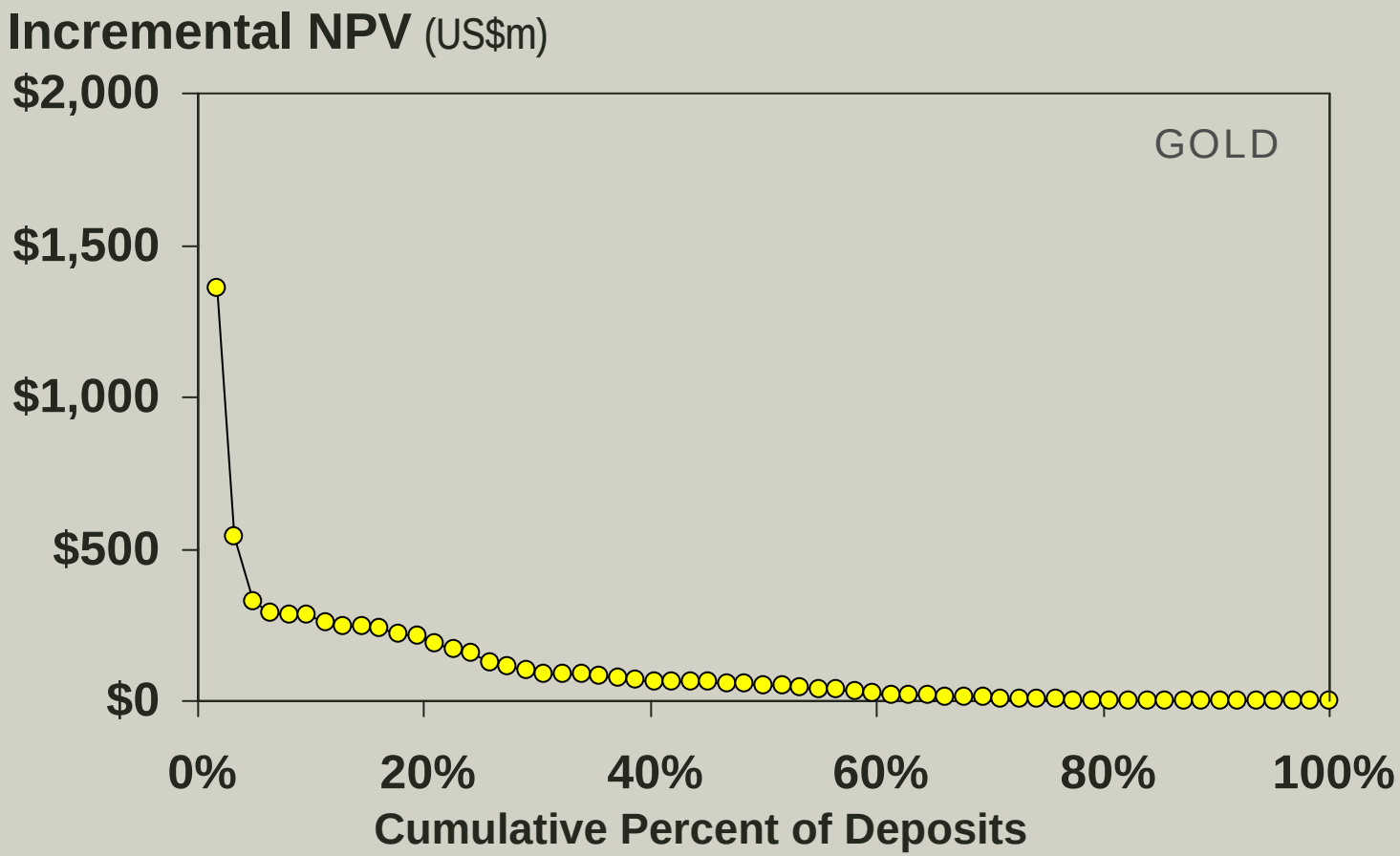
Incremental NPV's of all significant gold discoveries
Gold deposits found in low-risk WW countries 1985-2003

Caution: Assumes zero NPV for uneconomic deposits
Analysis excludes deposits < 1Moz



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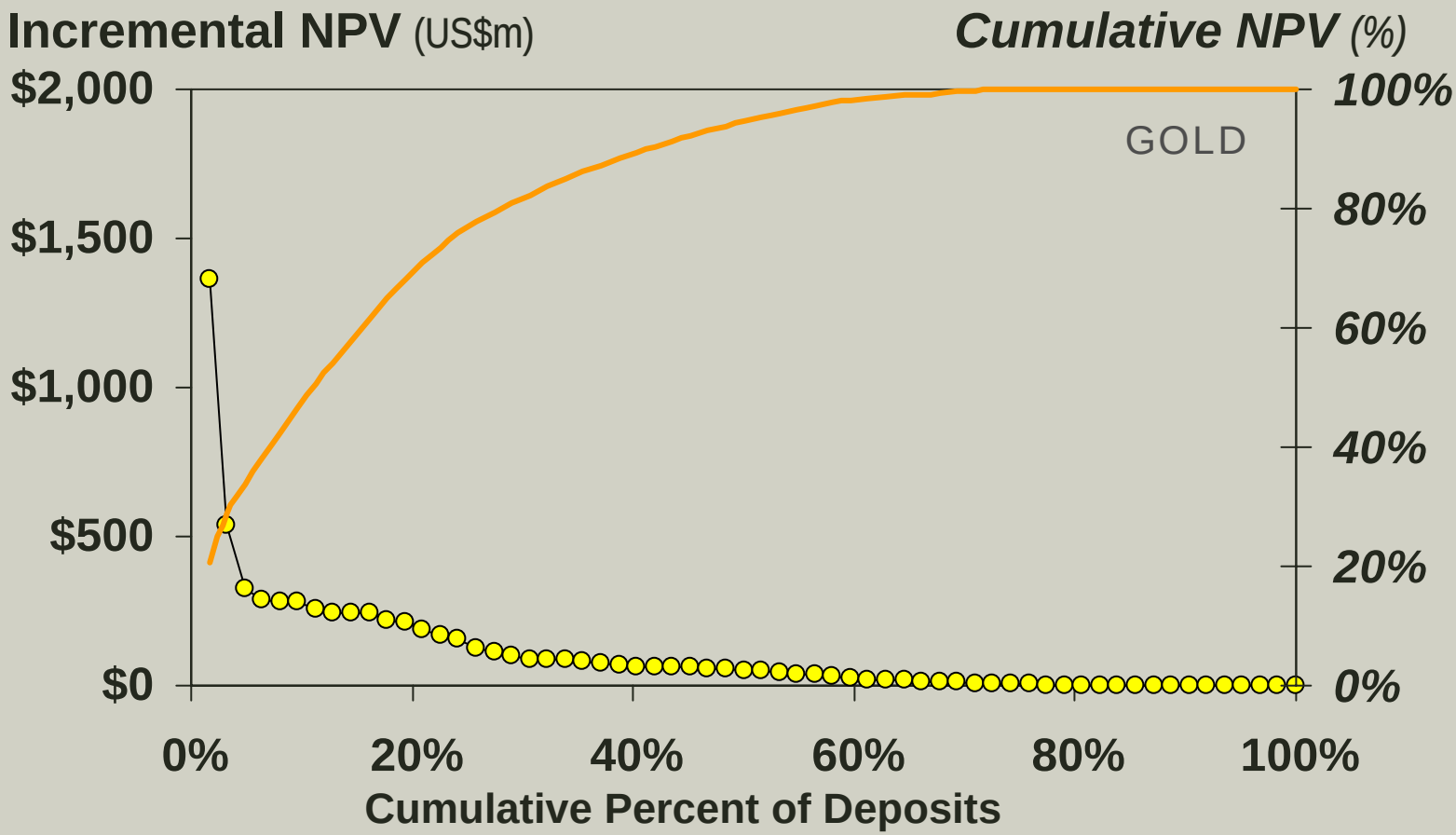

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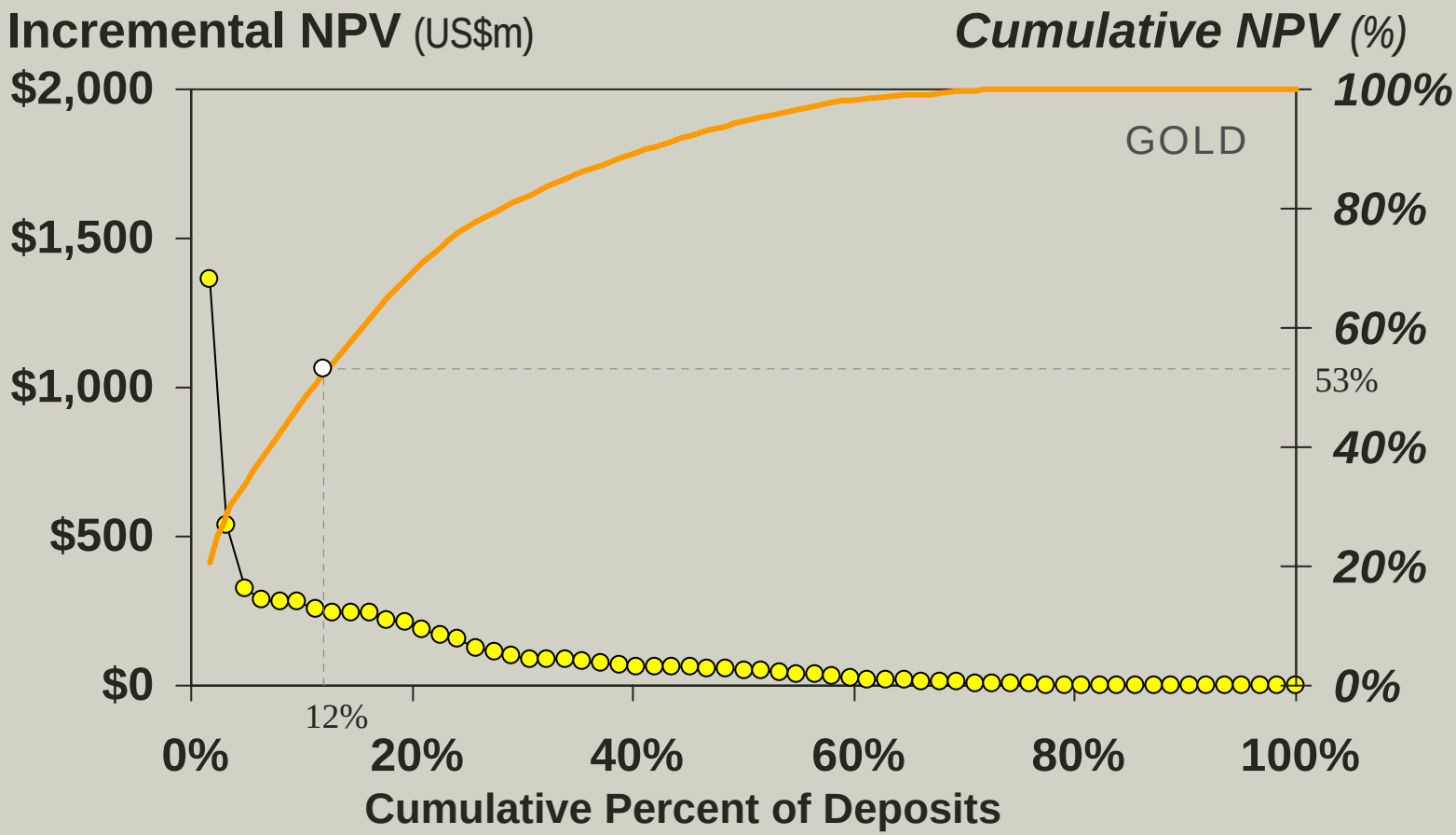

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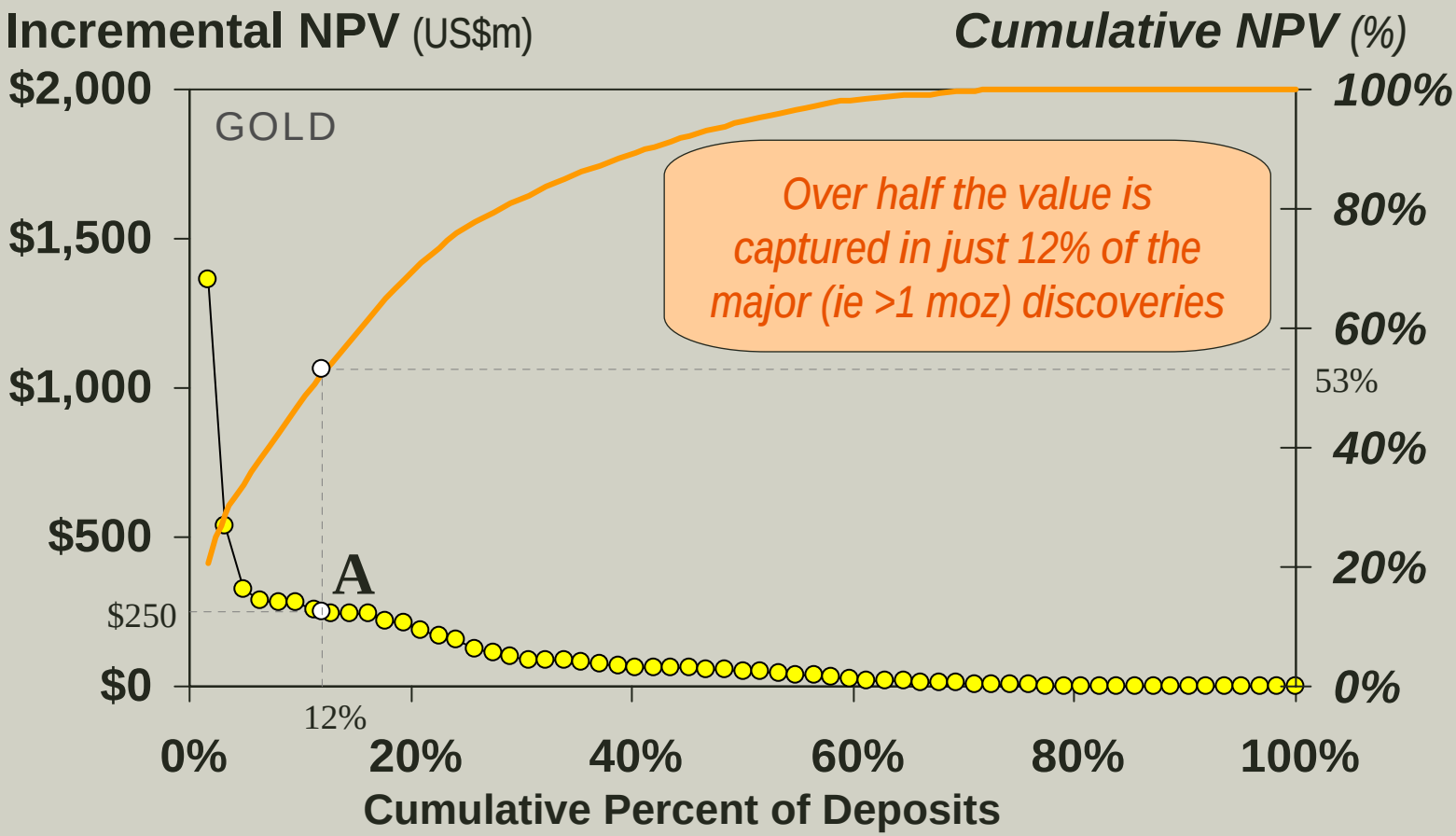

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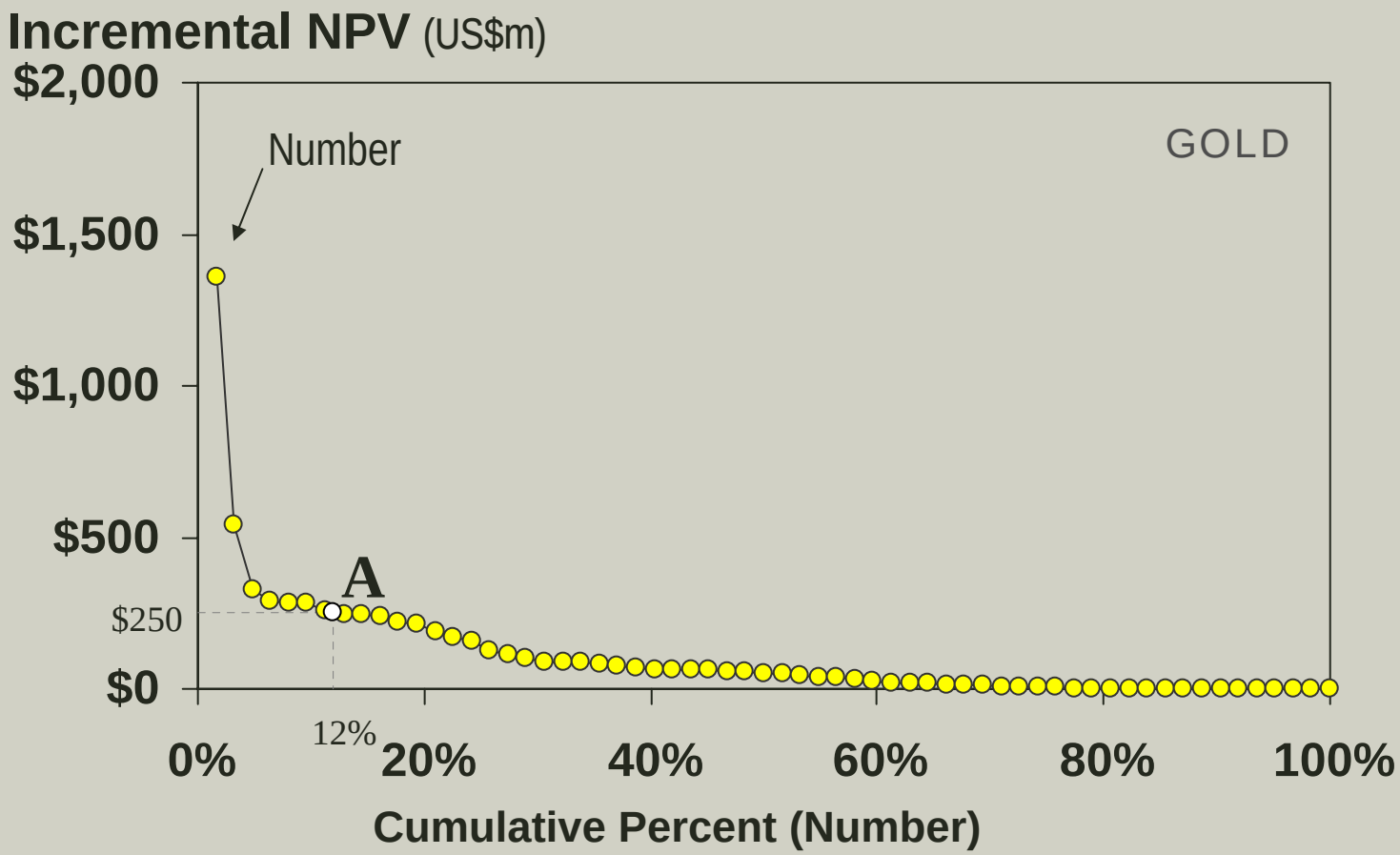

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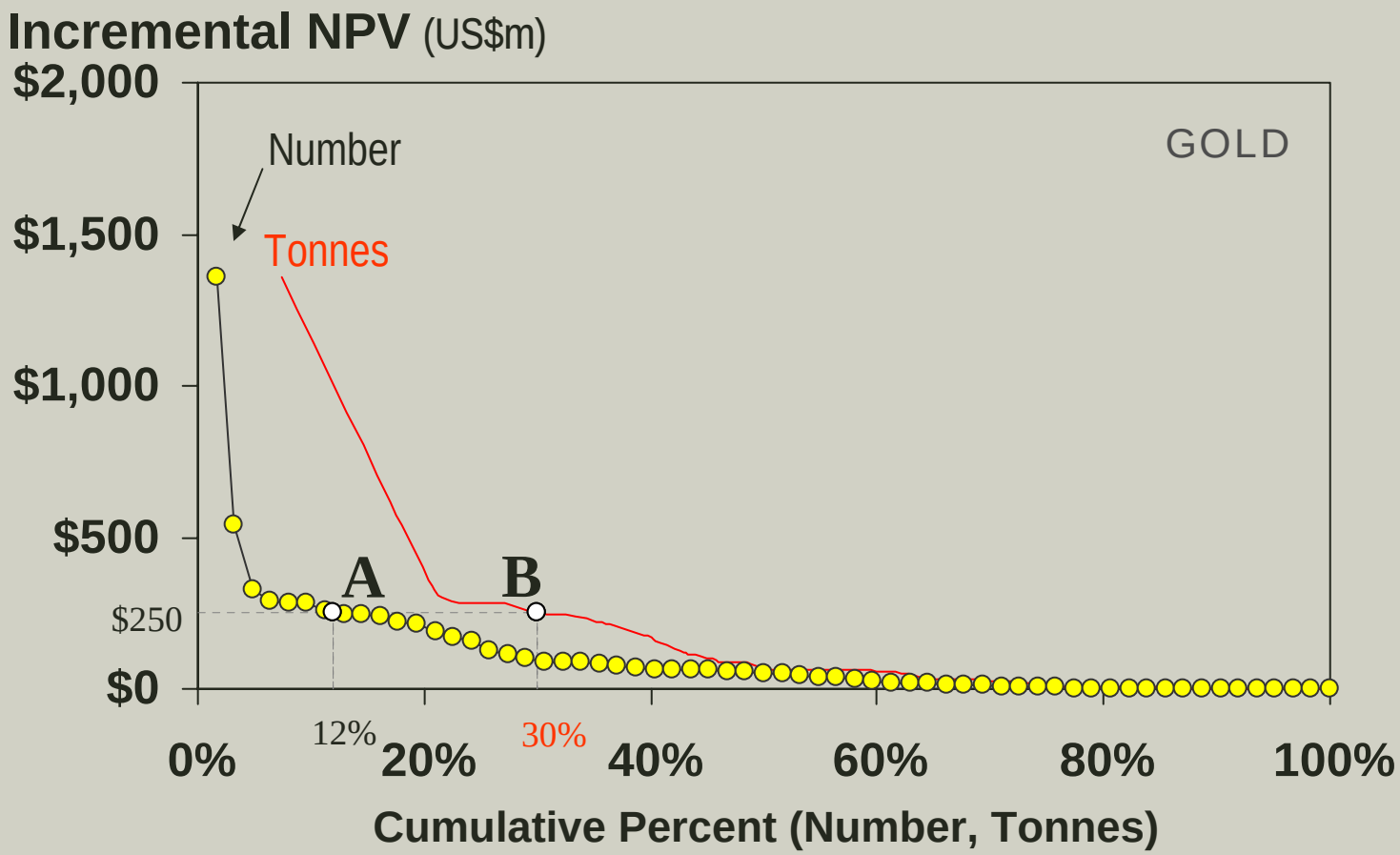

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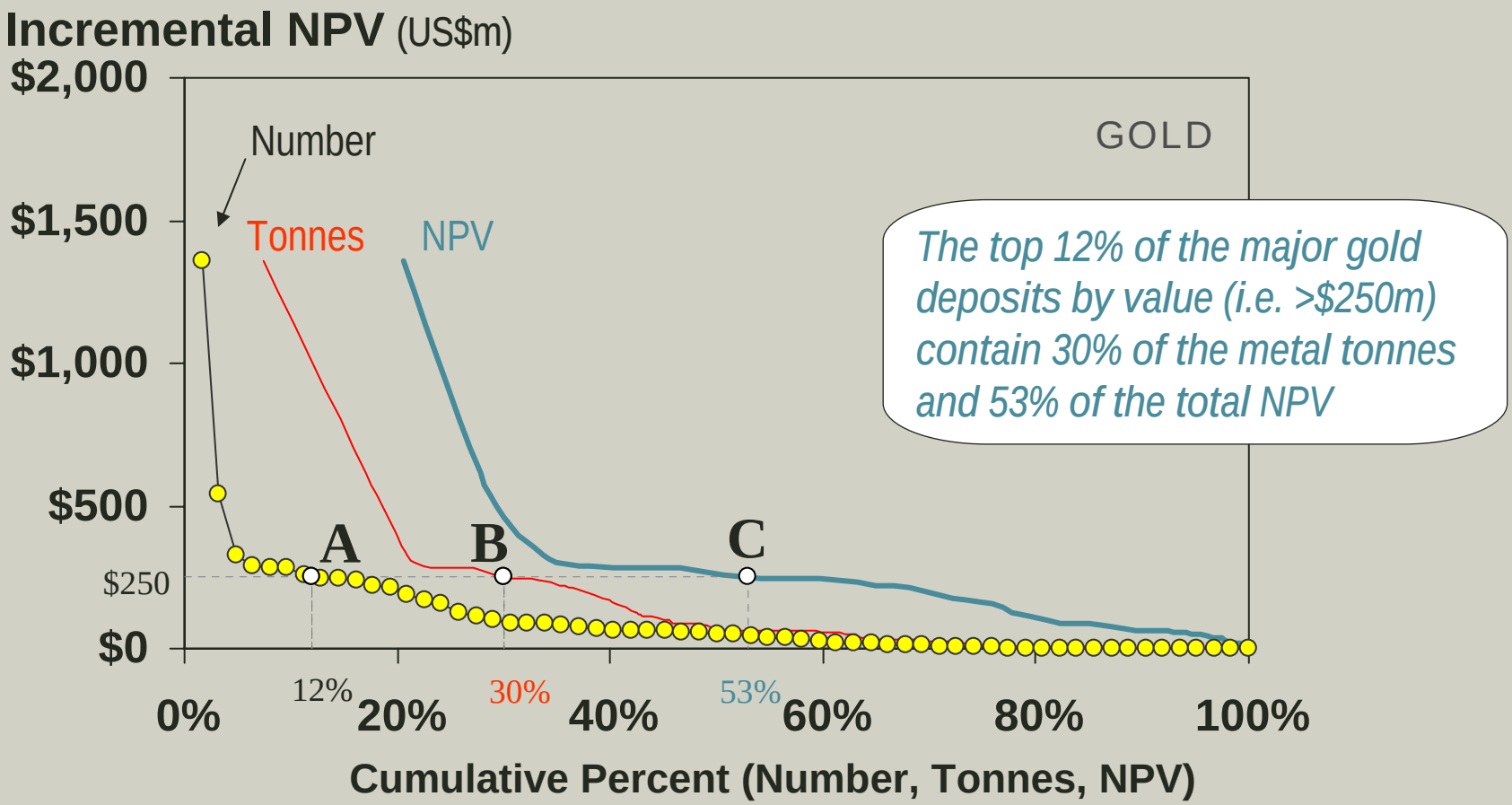

The top 12% of the major gold deposits by value (i.e. >$250m) contain 30% of the metal tonnes and 53% of the total NPV

Source: Schodde & Hronsky May 2006

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Incremental NPV's of all significant base metal discoveries
Base metal deposits found in low-risk WW countries 1985-2003

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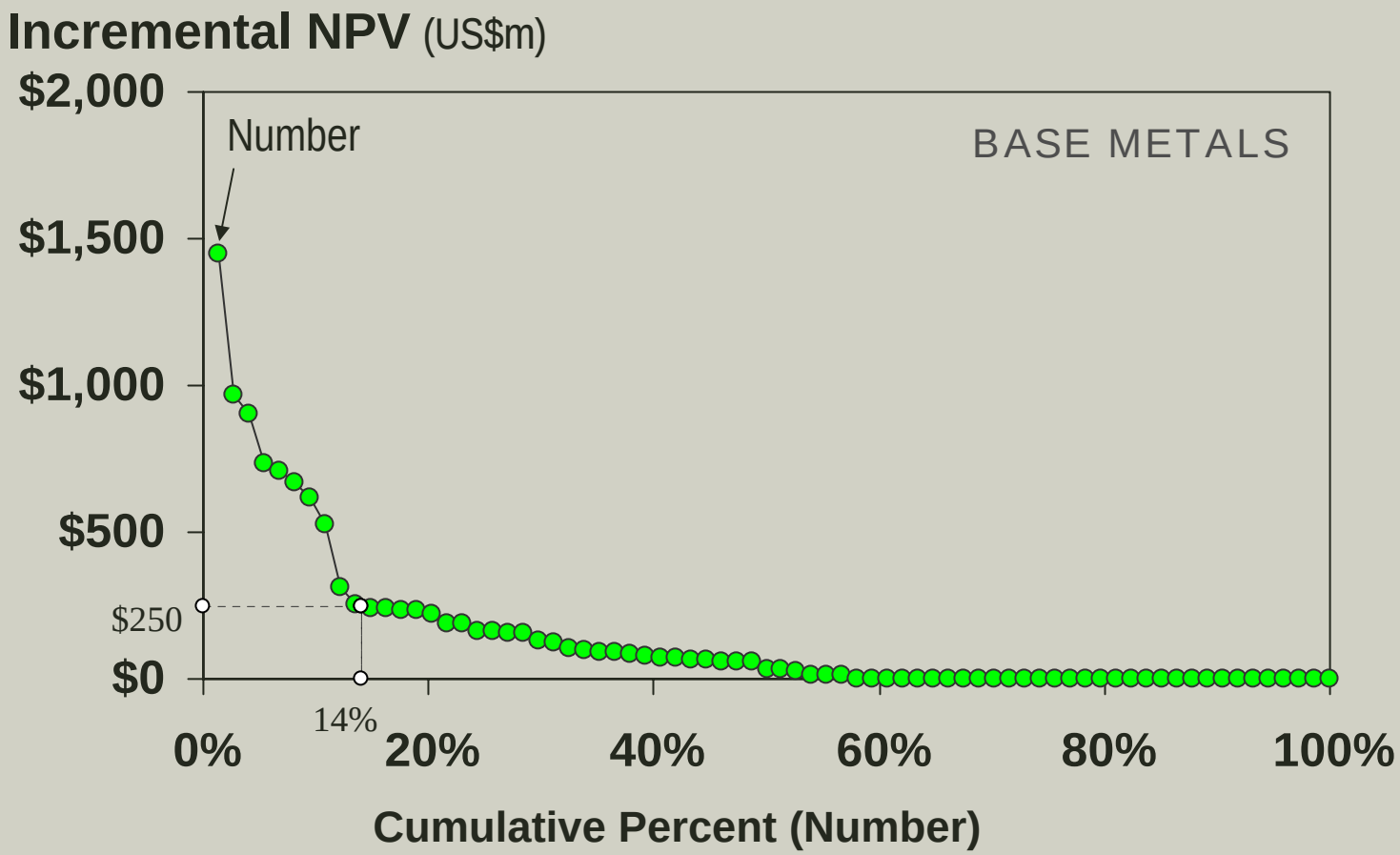
Analysis excludes deposits < 0.5mt Cu-equiv



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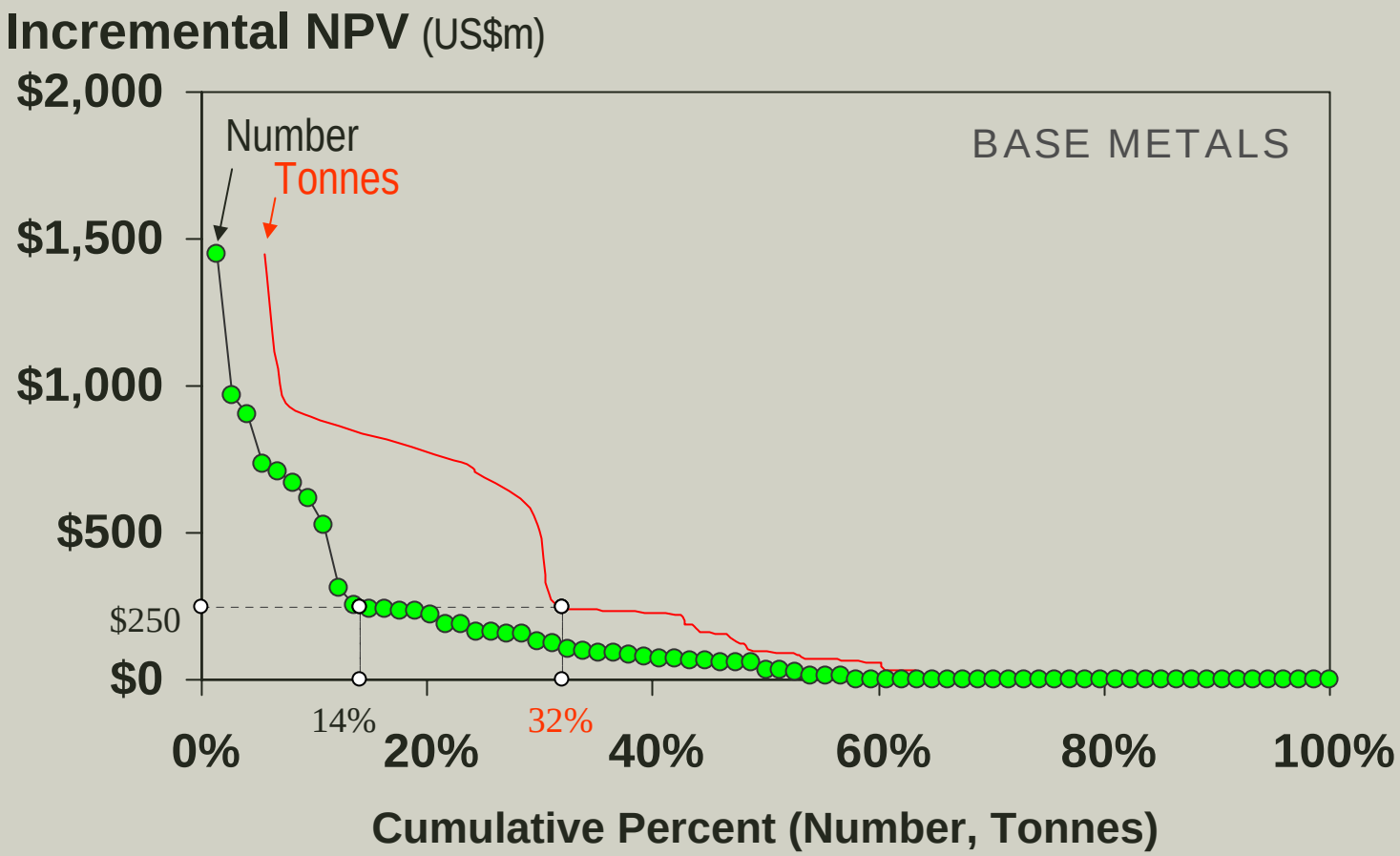

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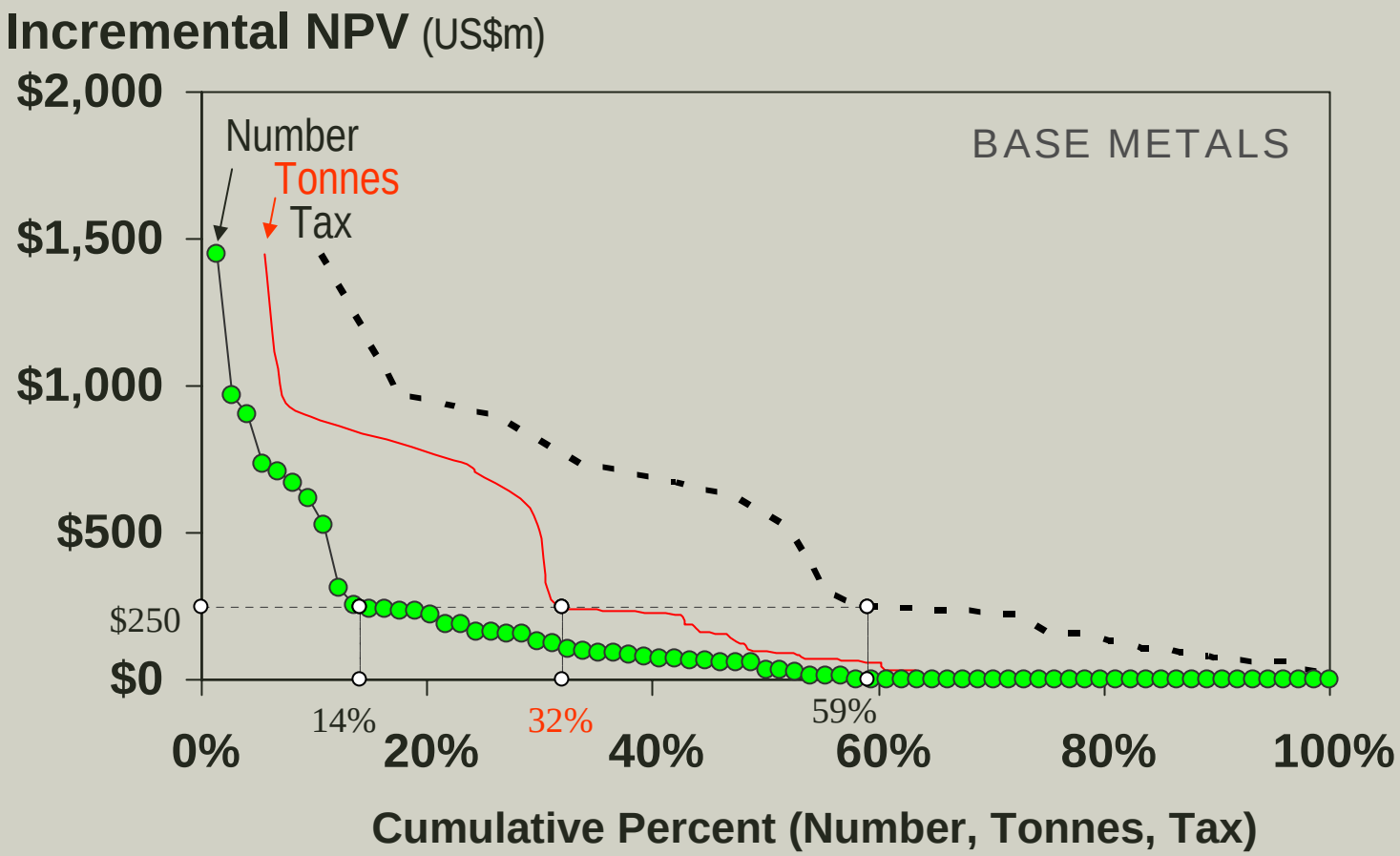

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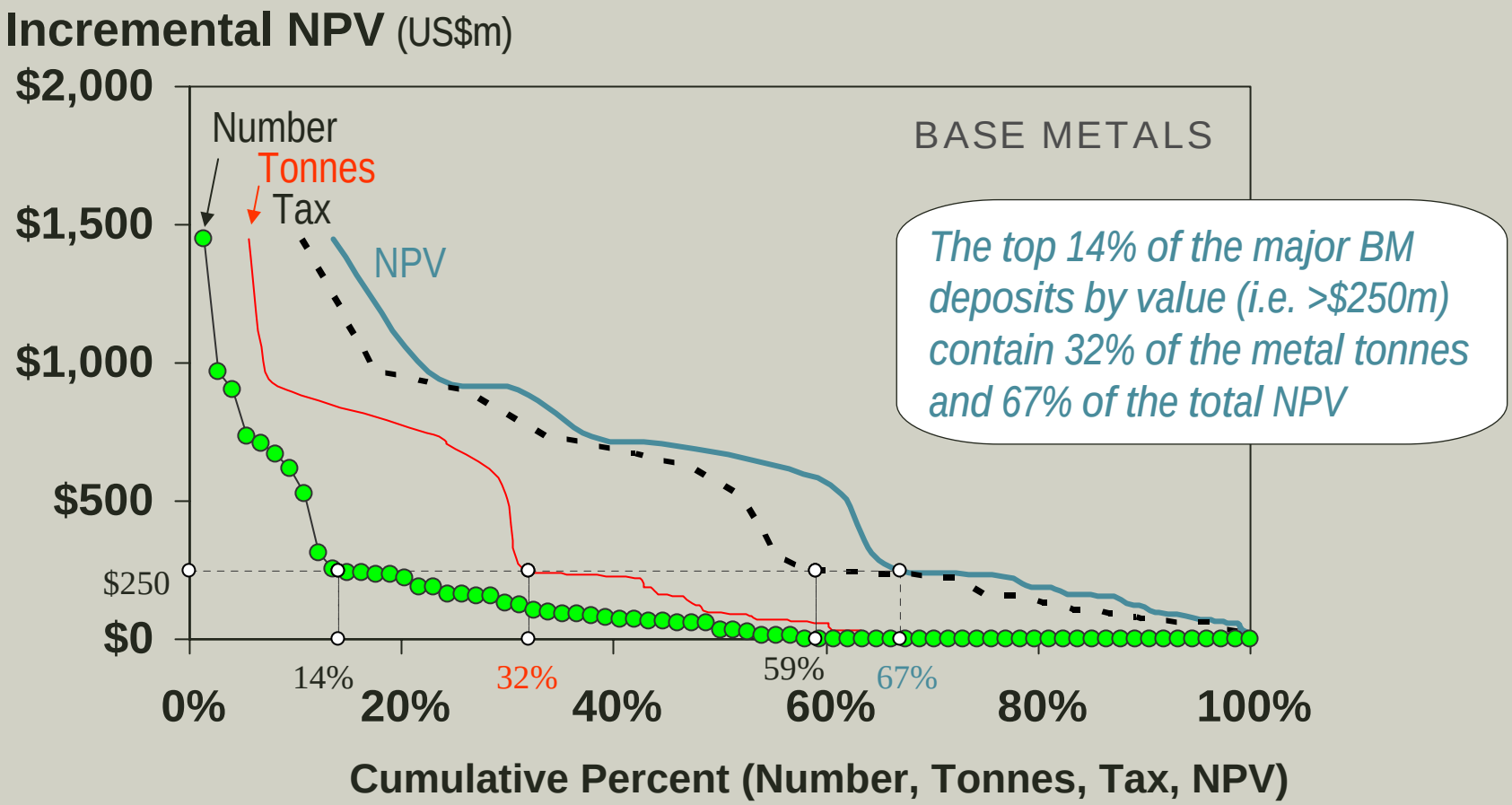

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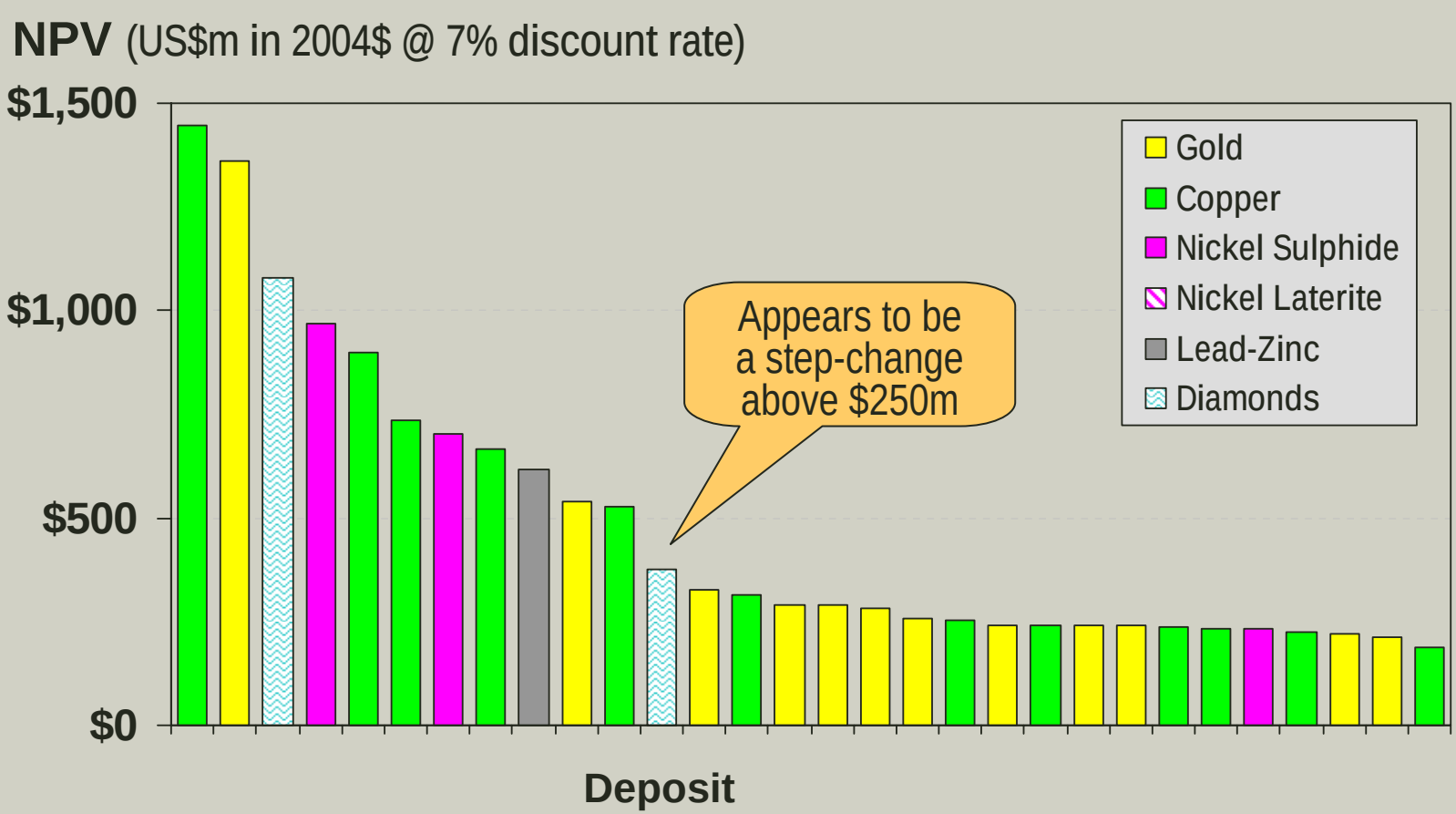
Value of top 30 Discoveries
Deposits found in low-risk WW countries 1985-2003



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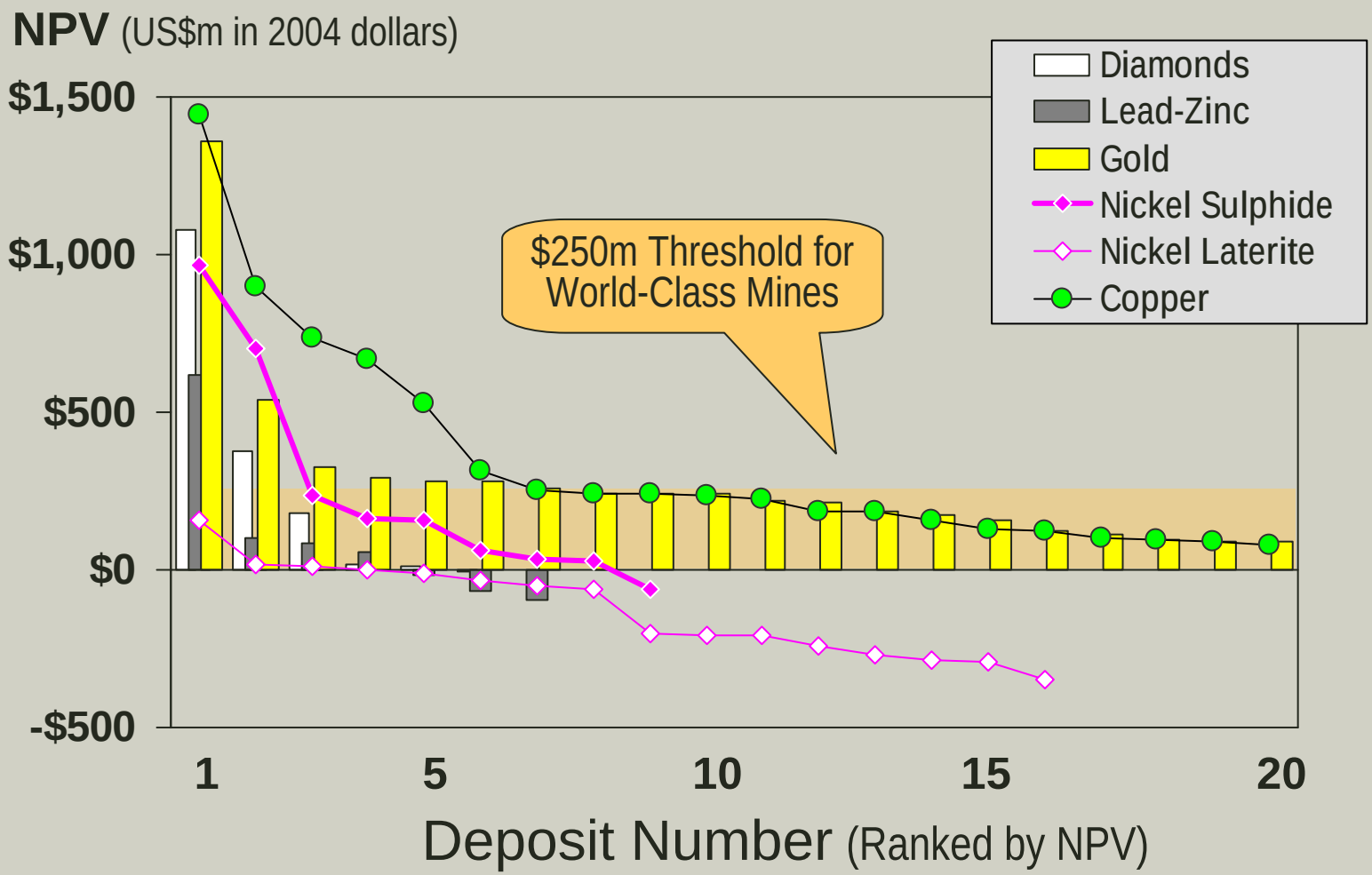
Several commodities exhibit a step-change in value



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Size-frequency distribution .. discontinuity above 6 Moz?

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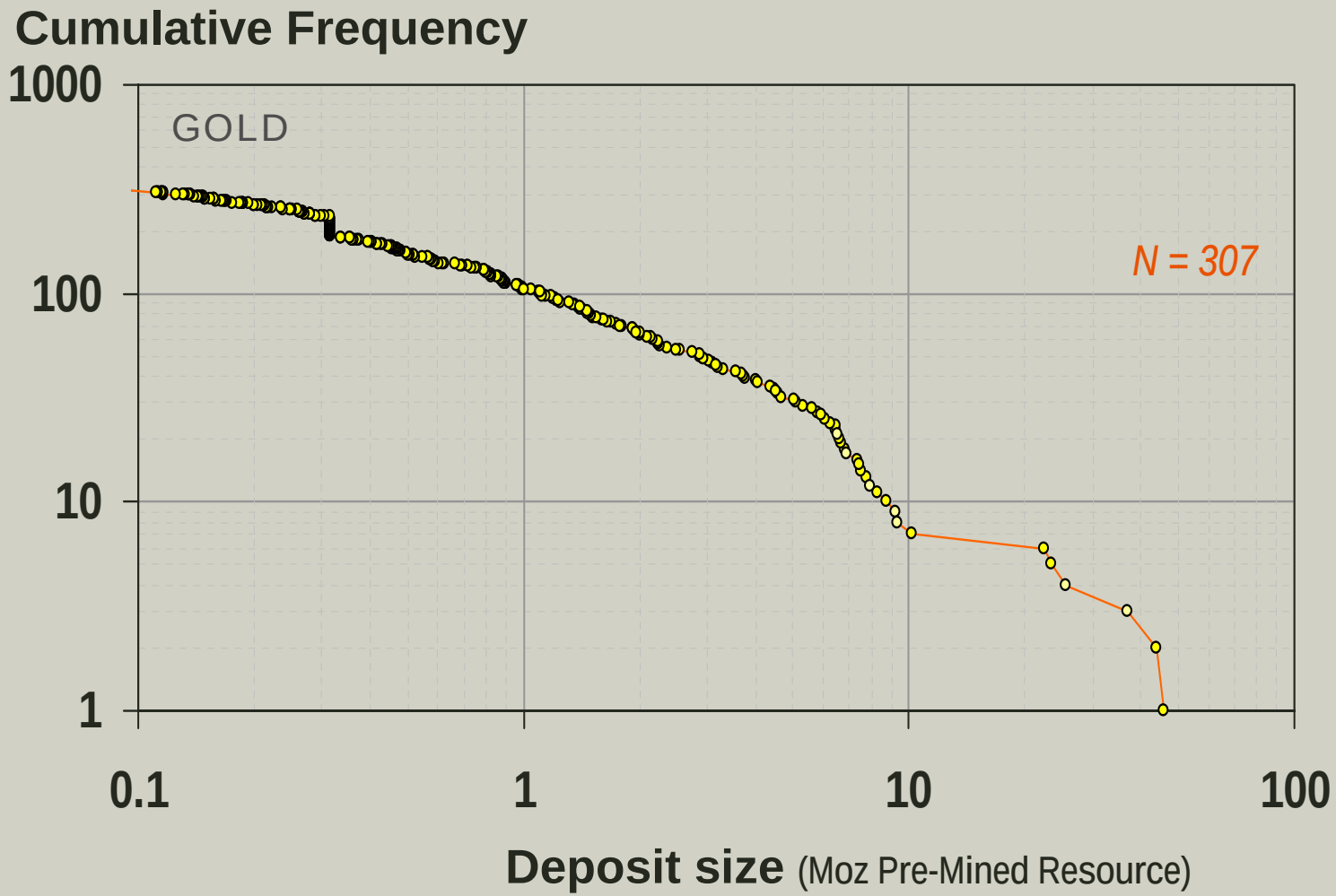

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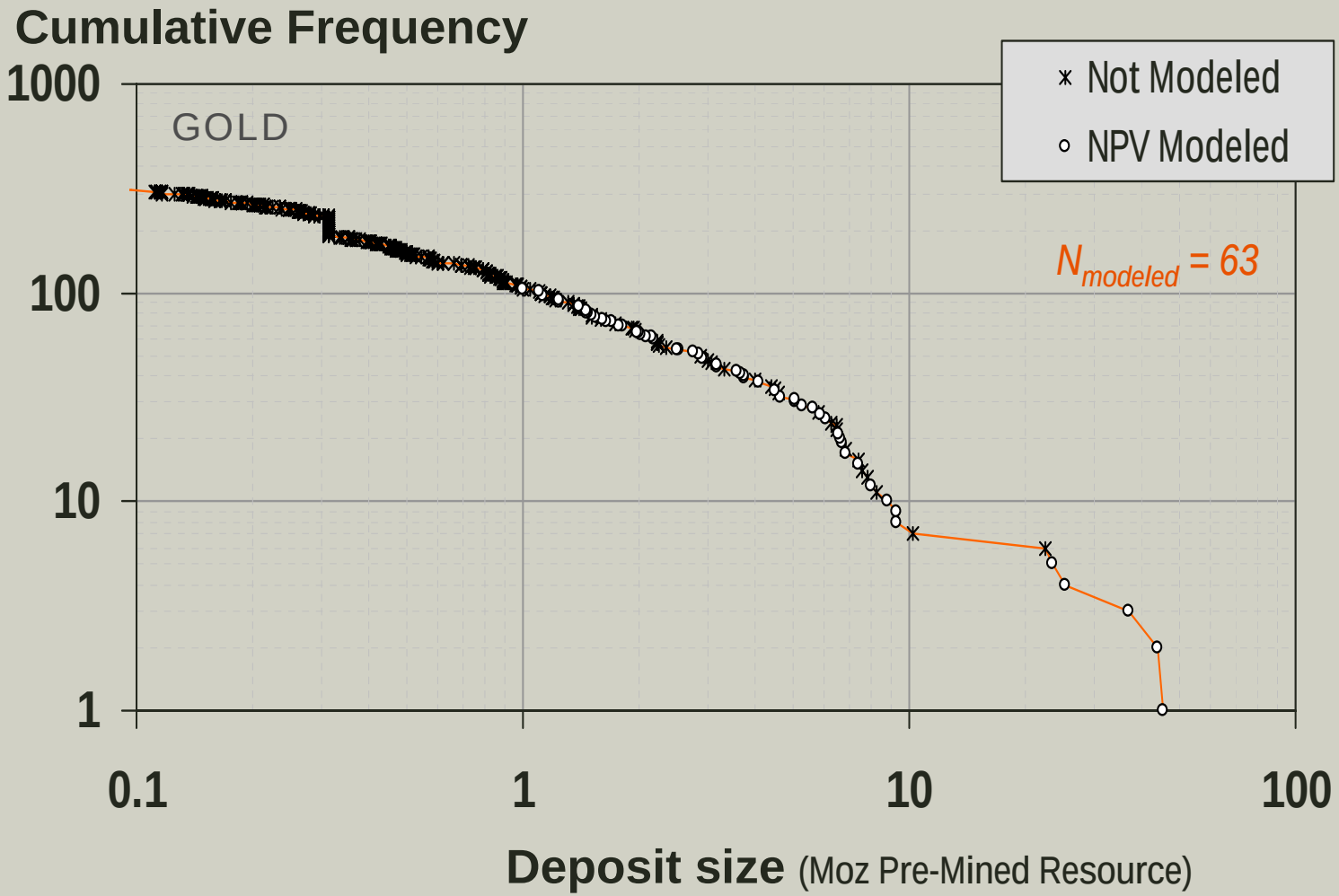

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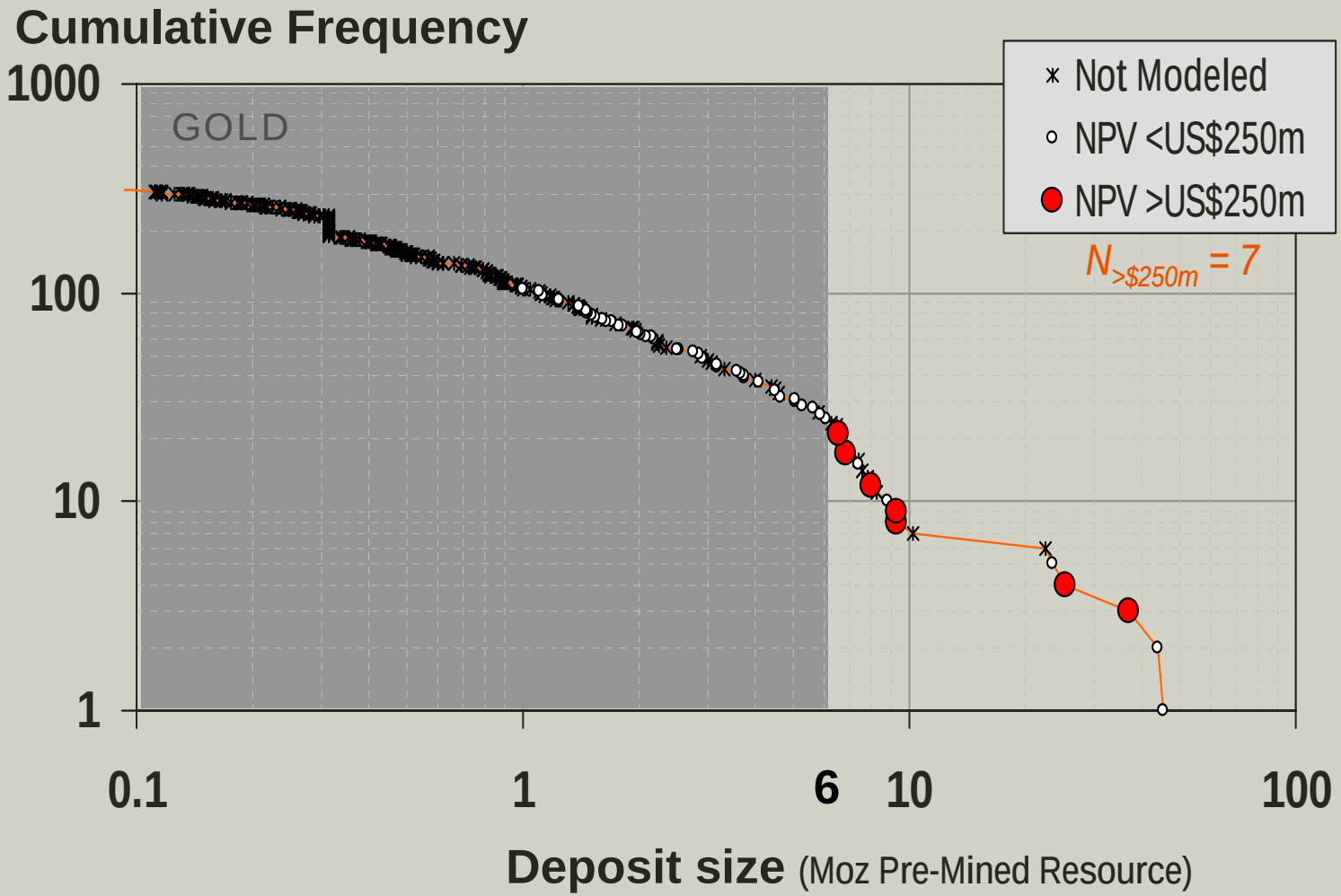

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Size-frequency distribution .. discontinuity above 4 Mt Cu?

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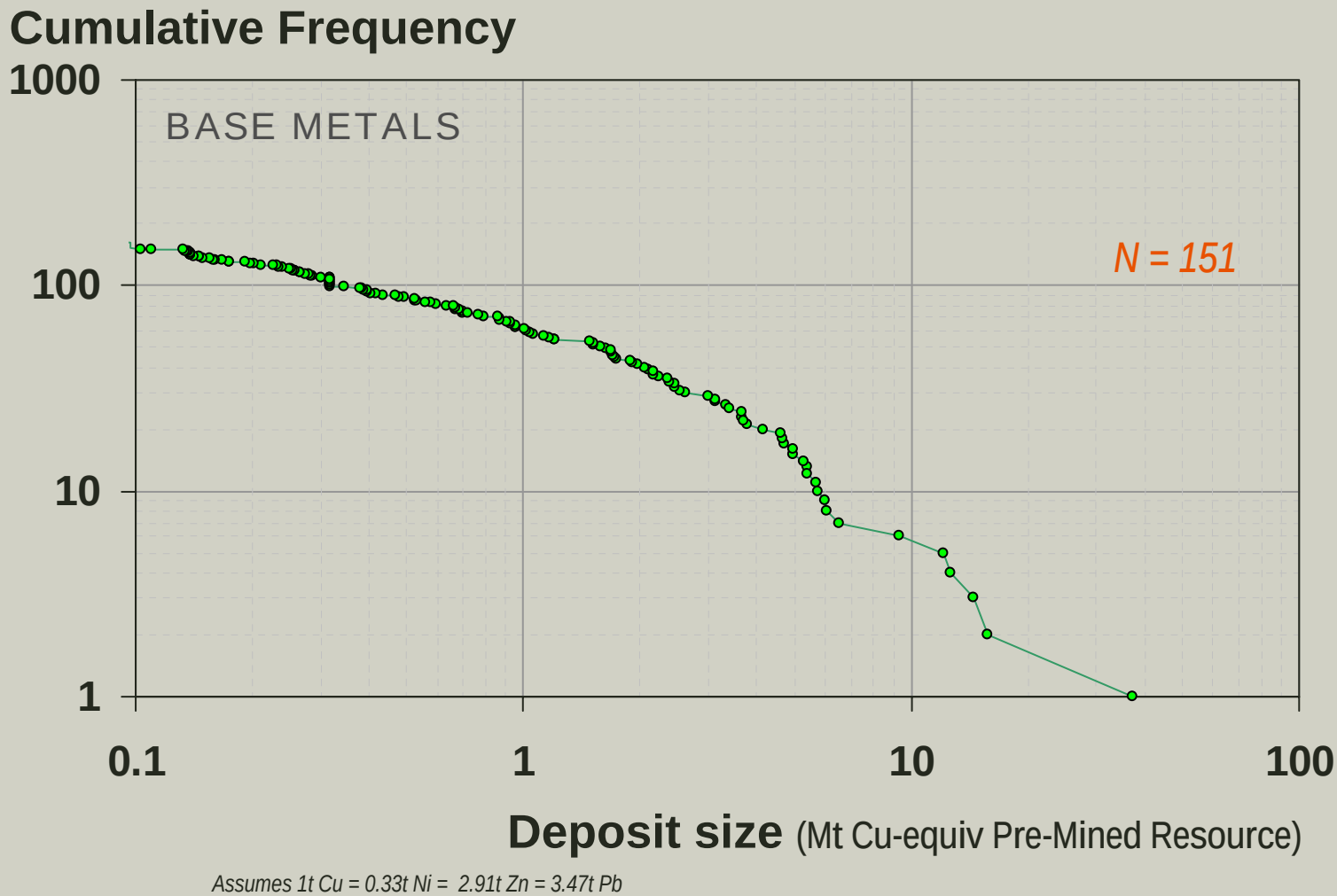

Assumes 1t Cu = 0.33t Ni = 2.91t Zn = 3.47t Pb

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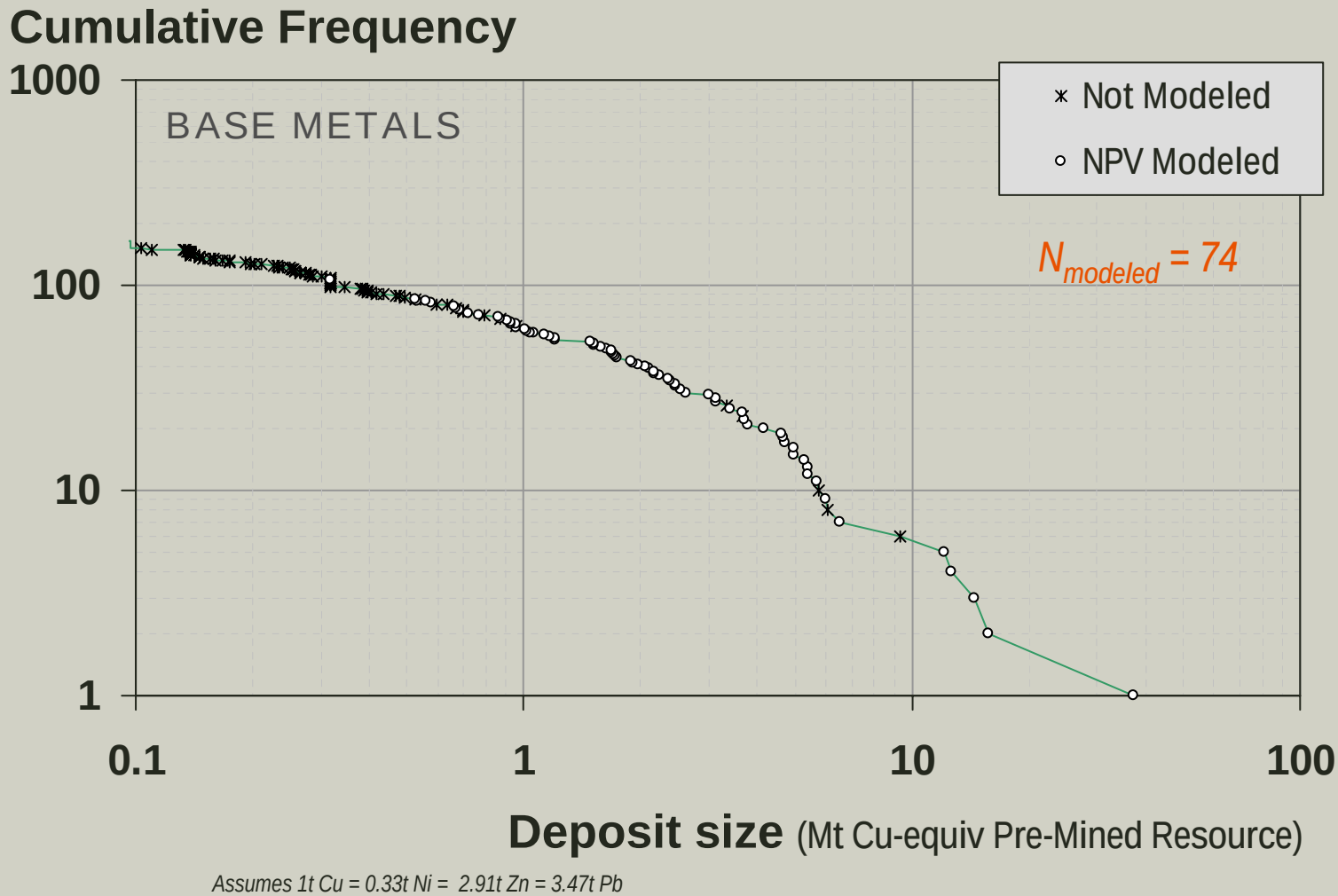

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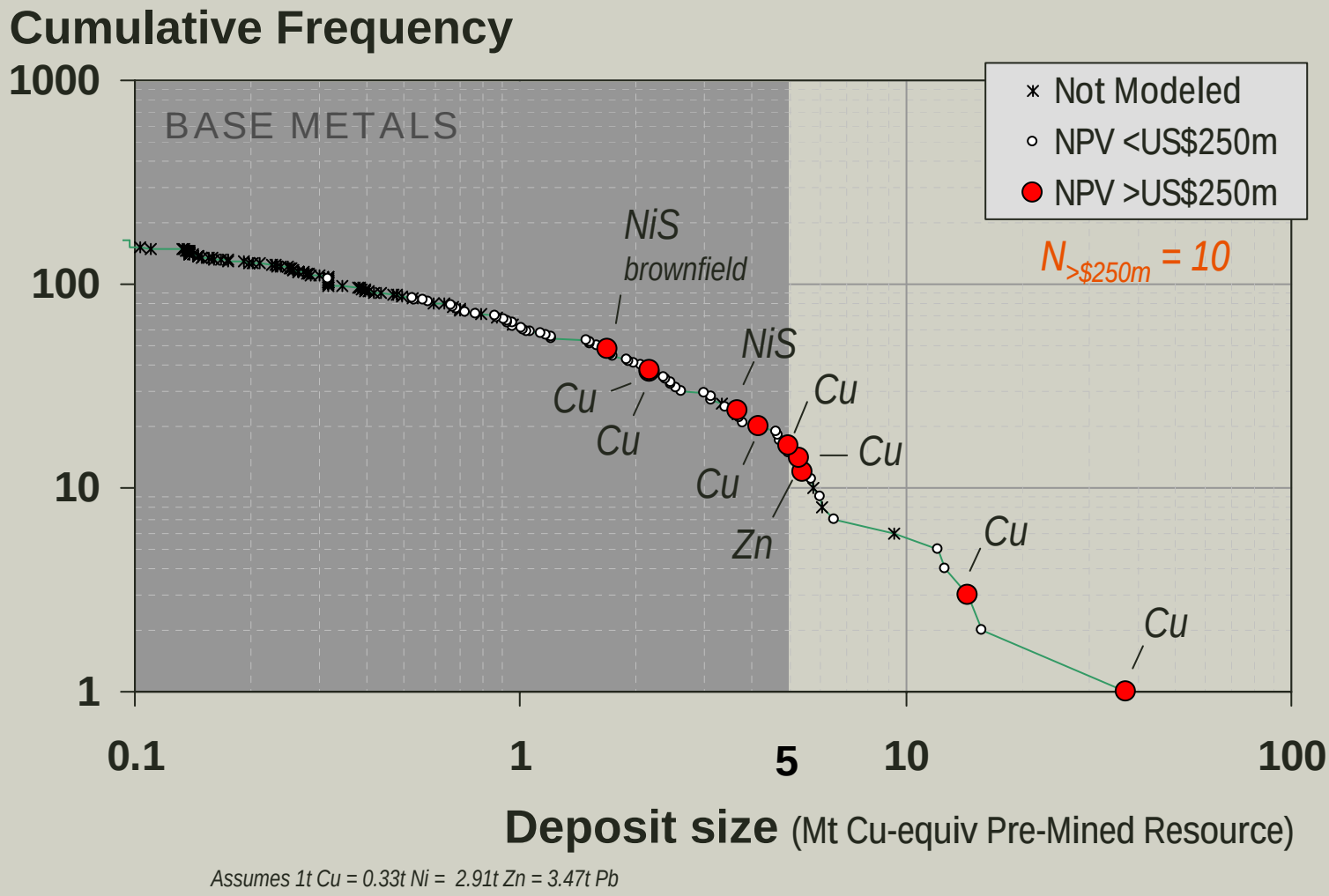

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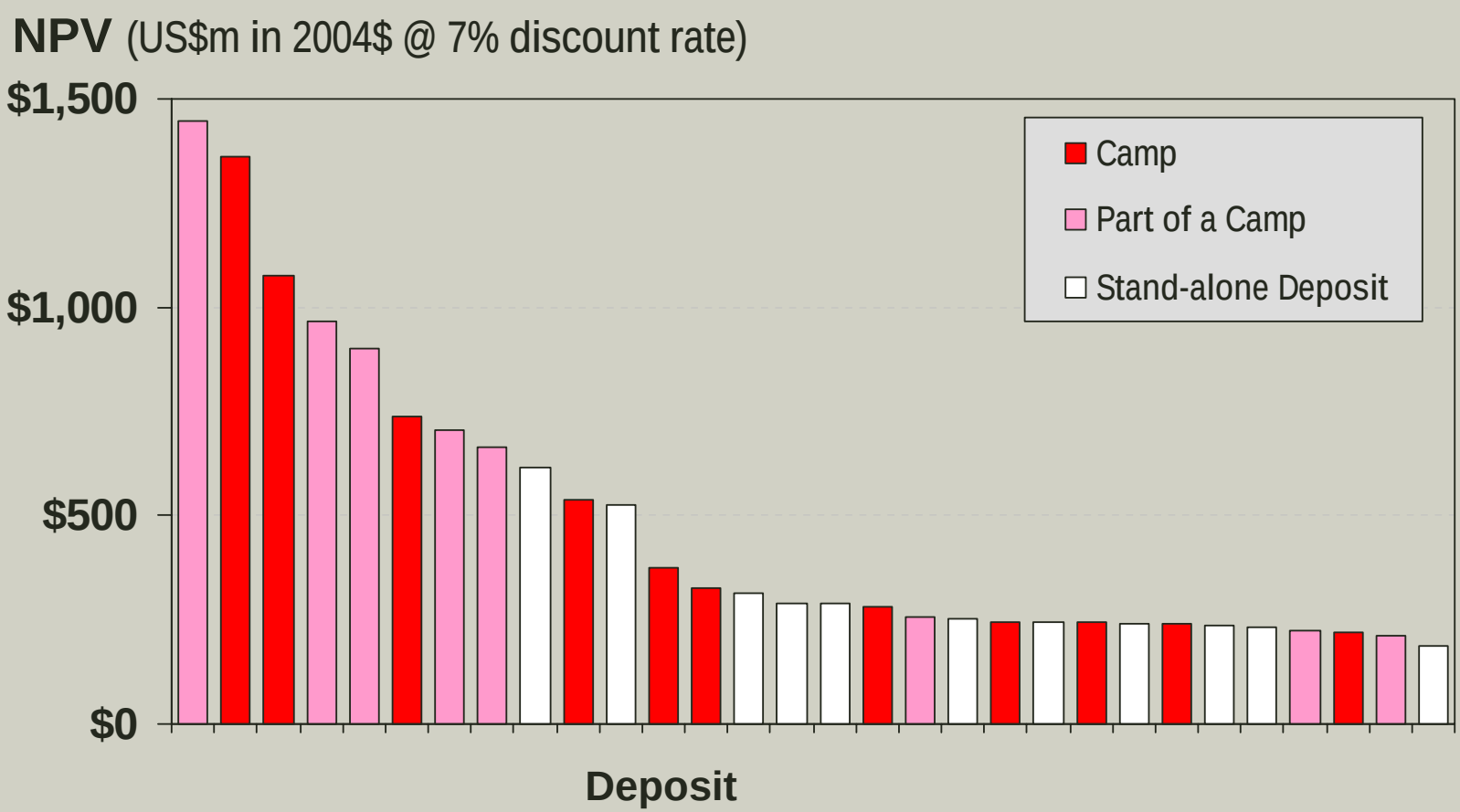
Highest value discoveries are in camps

Value of top 30 discoveries found in low-risk WW countries 1985-2003



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How many world-class discoveries are made each year ?

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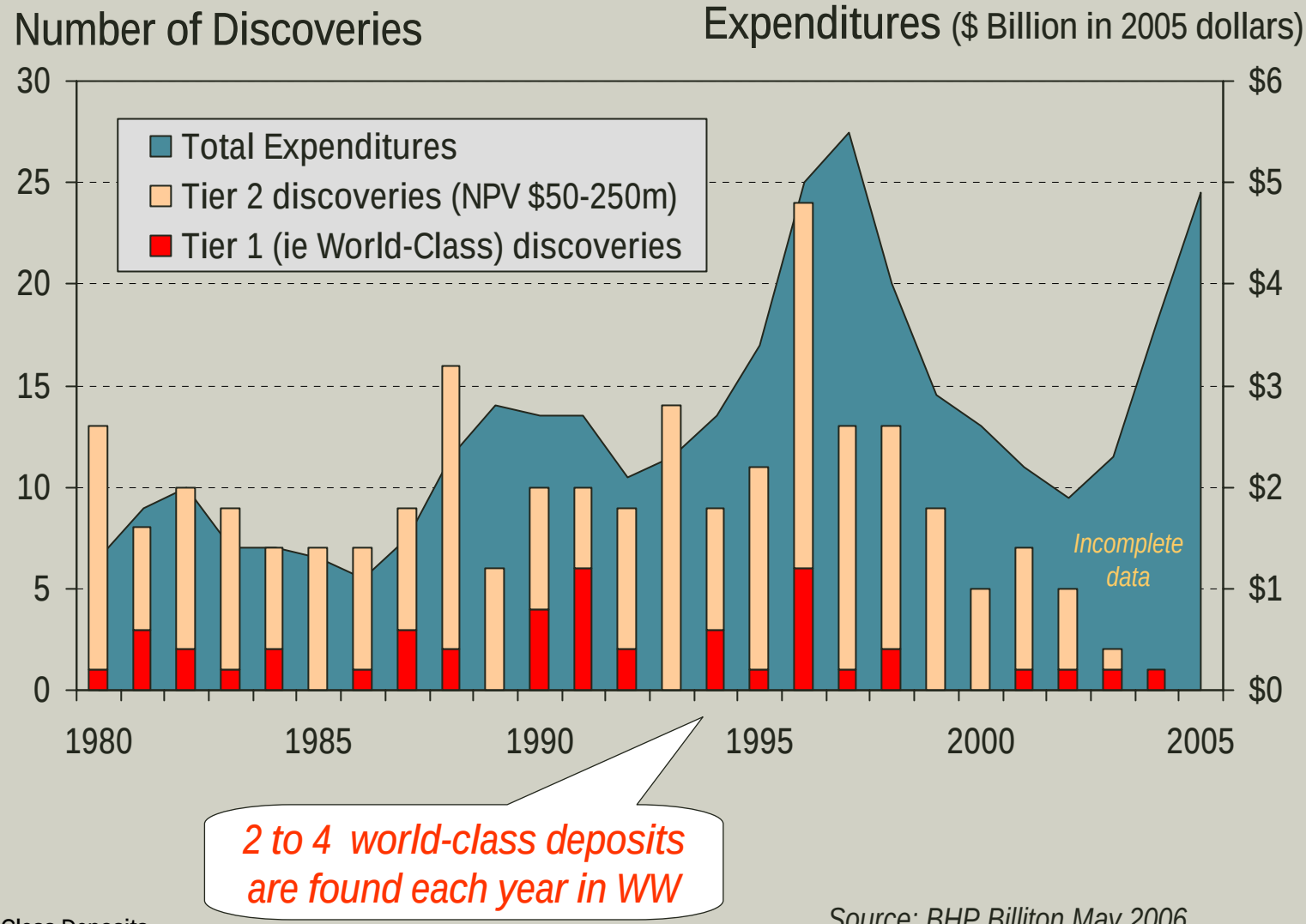
Exploration expenditures and significant discoveries
All Western World : 1980-2005



Source: BHP Billiton May 2006

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What are the special characteristics of a world-class mine ?

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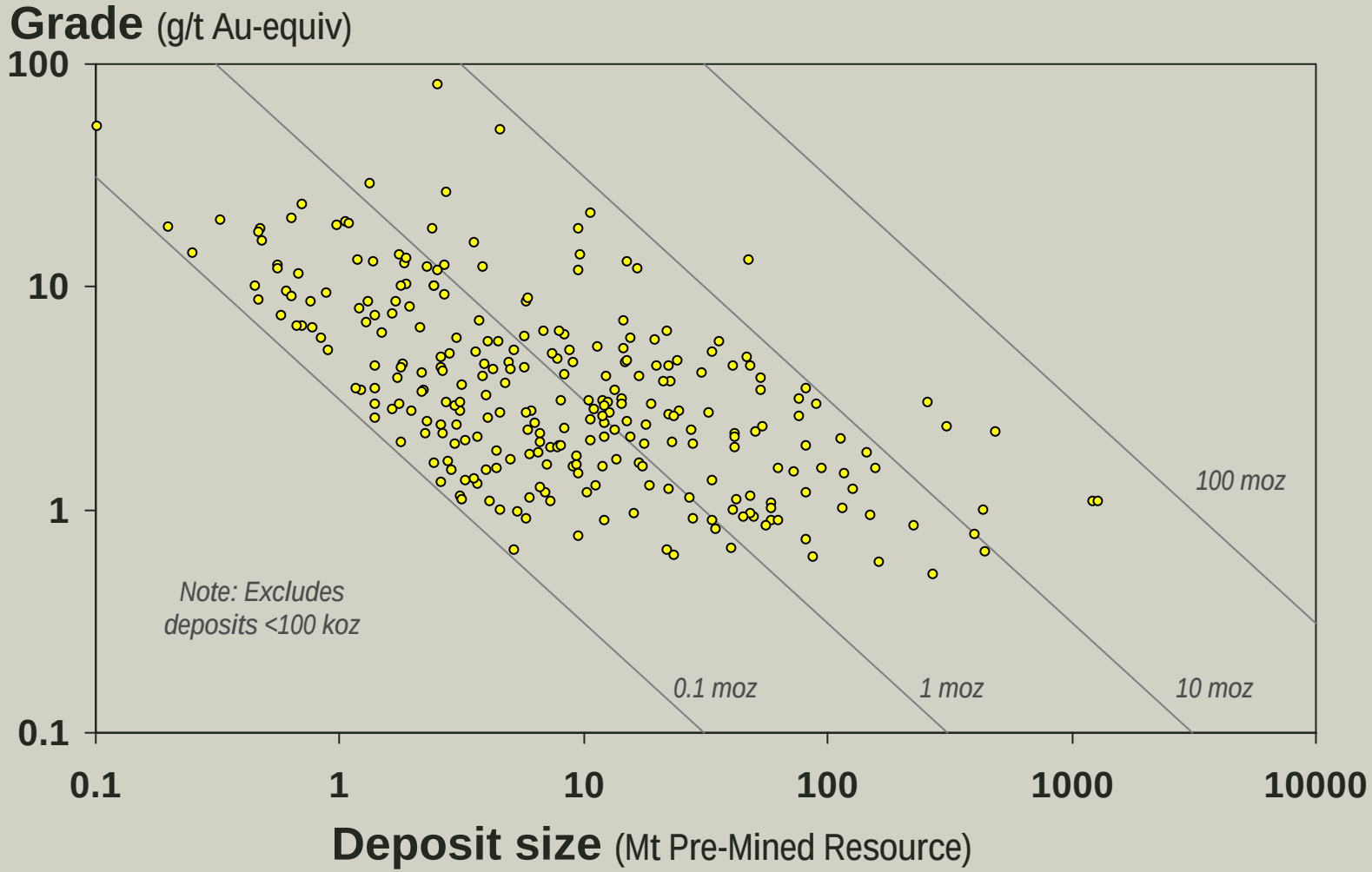
Characteristics of world-class mines

- Big – often the largest in its class
- Long life – resulting in a lasting impact on the industry
- High quality – usually viewed in terms of ore grade, but more correctly in terms of low production cost

Size …. Tonnes-Grade distribution
Gold deposits found in low-risk WW countries 1985-2003



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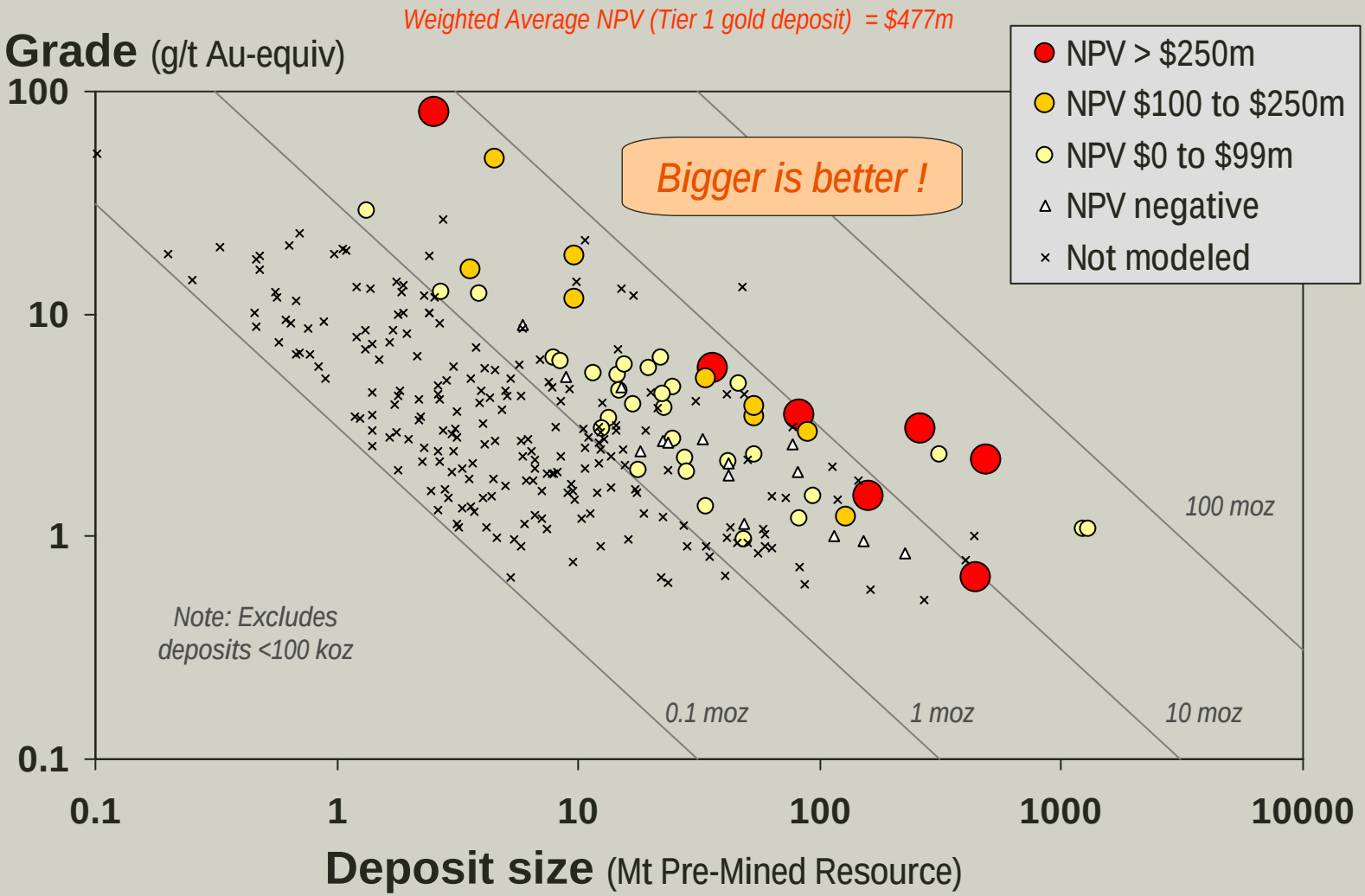
Size …. NPV versus Tonnes-Grade
Gold deposits found in low-risk WW countries 1985-2003



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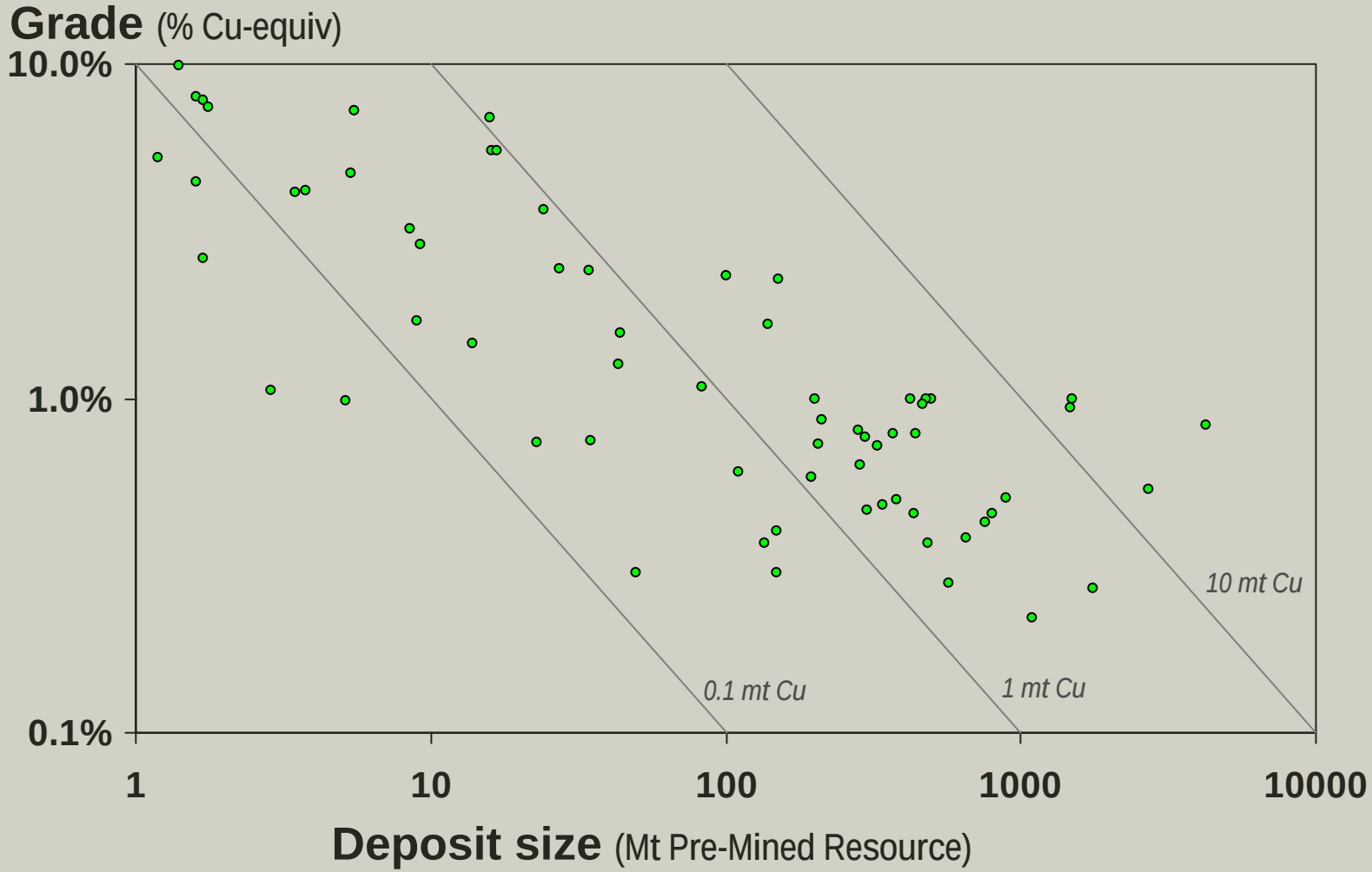
Size …. Tonnes-Grade distribution
Copper deposits found in low-risk WW countries 1985-2003



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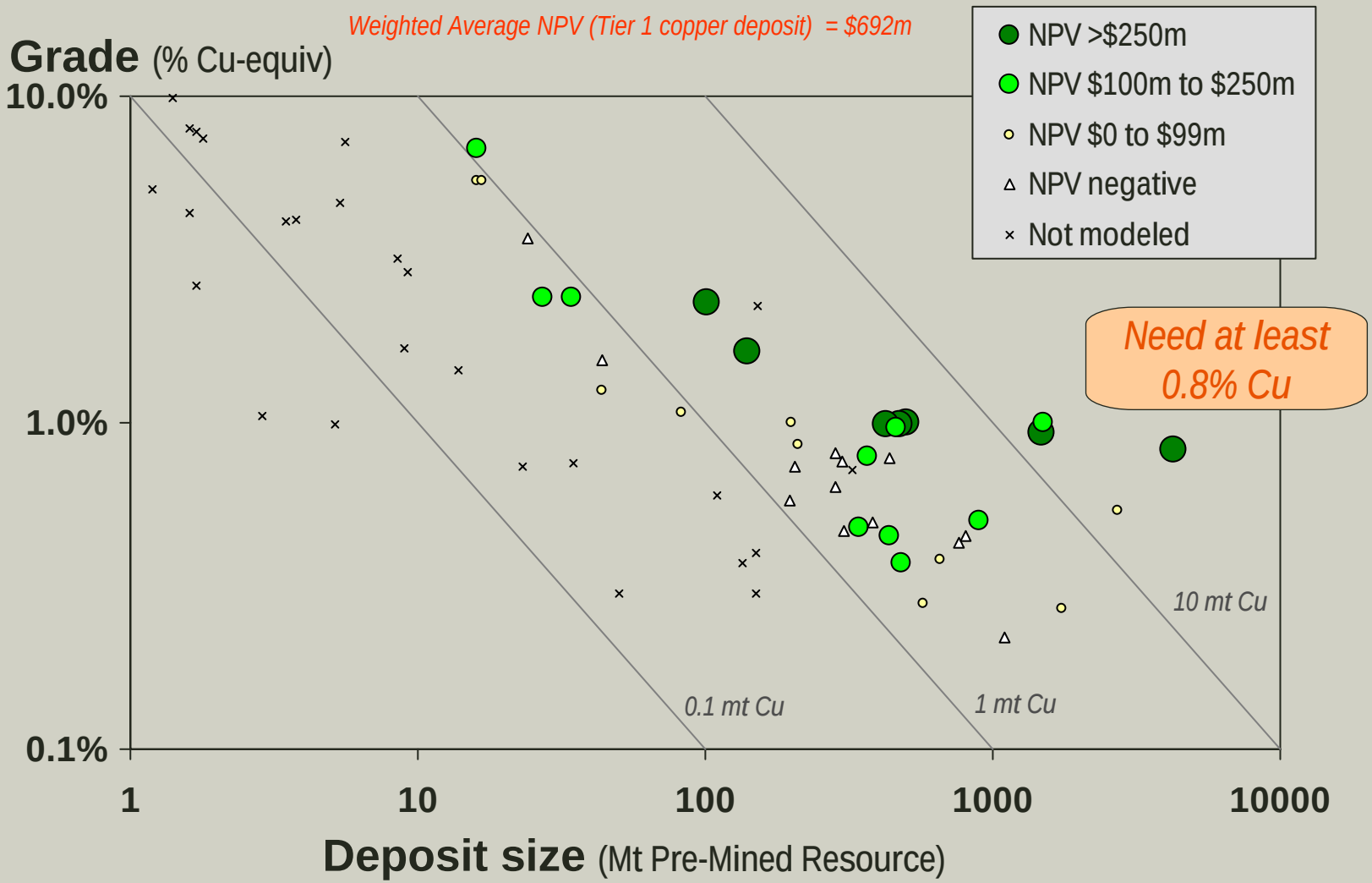

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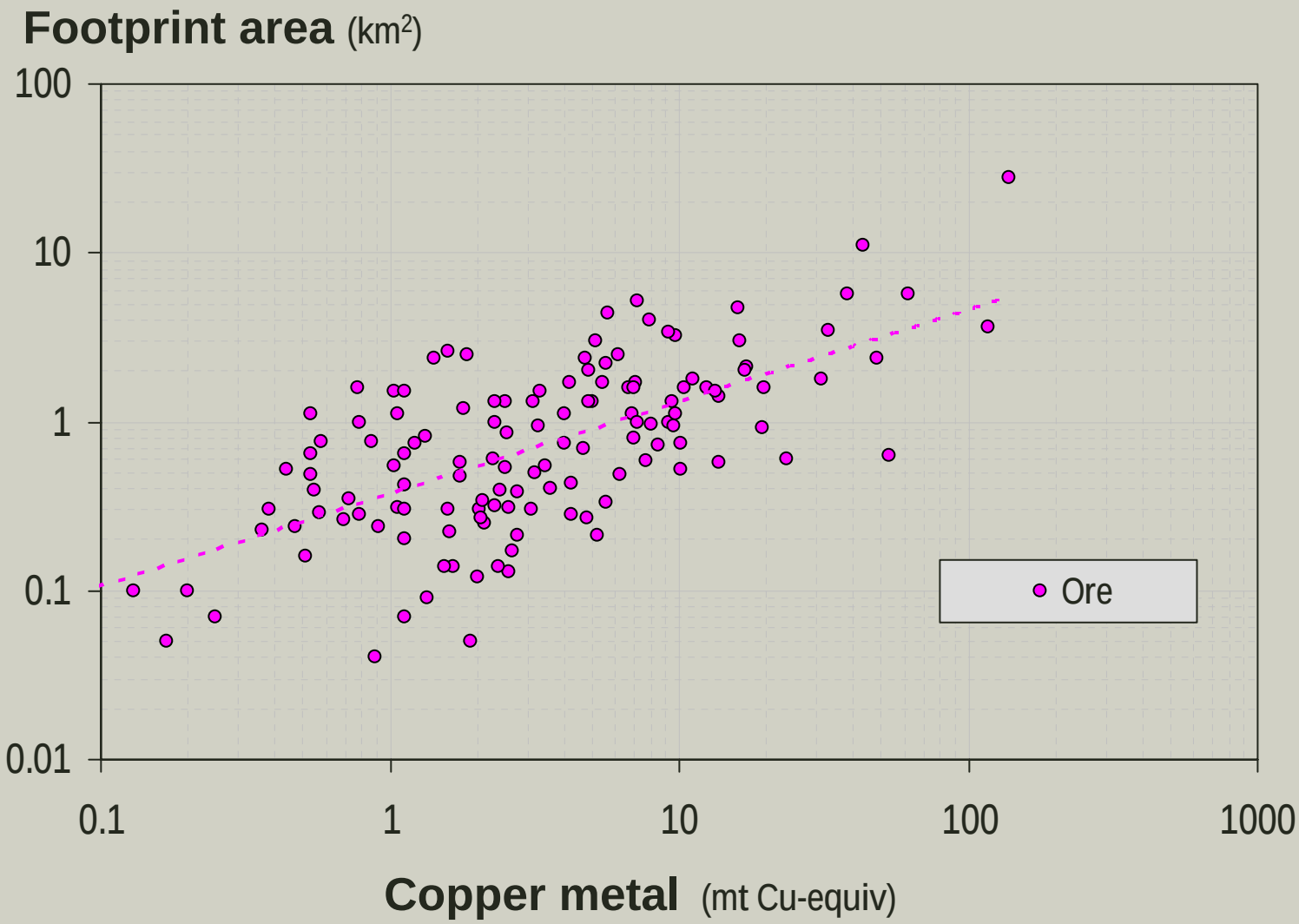
Size of footprint
Porphyry copper deposits



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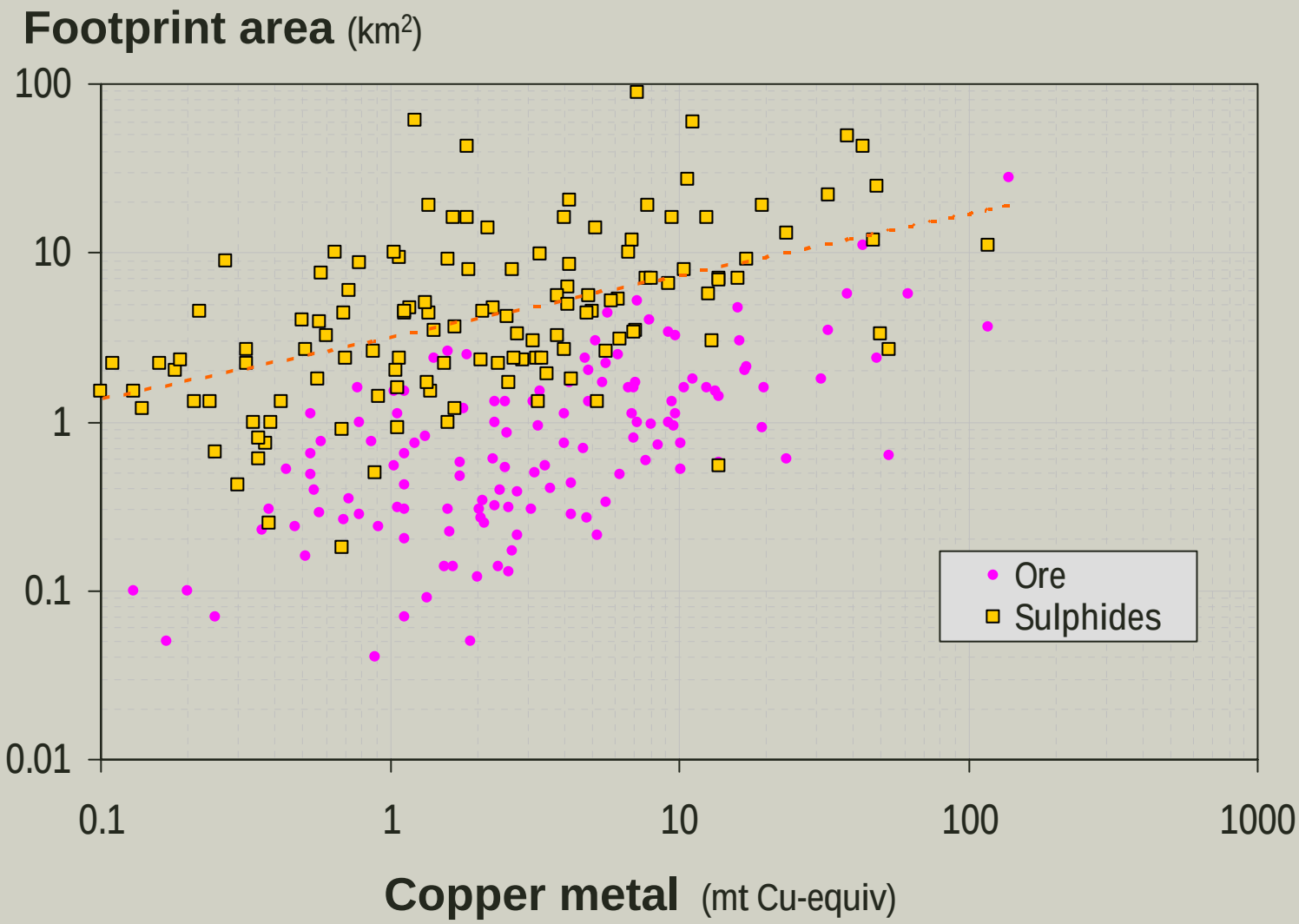

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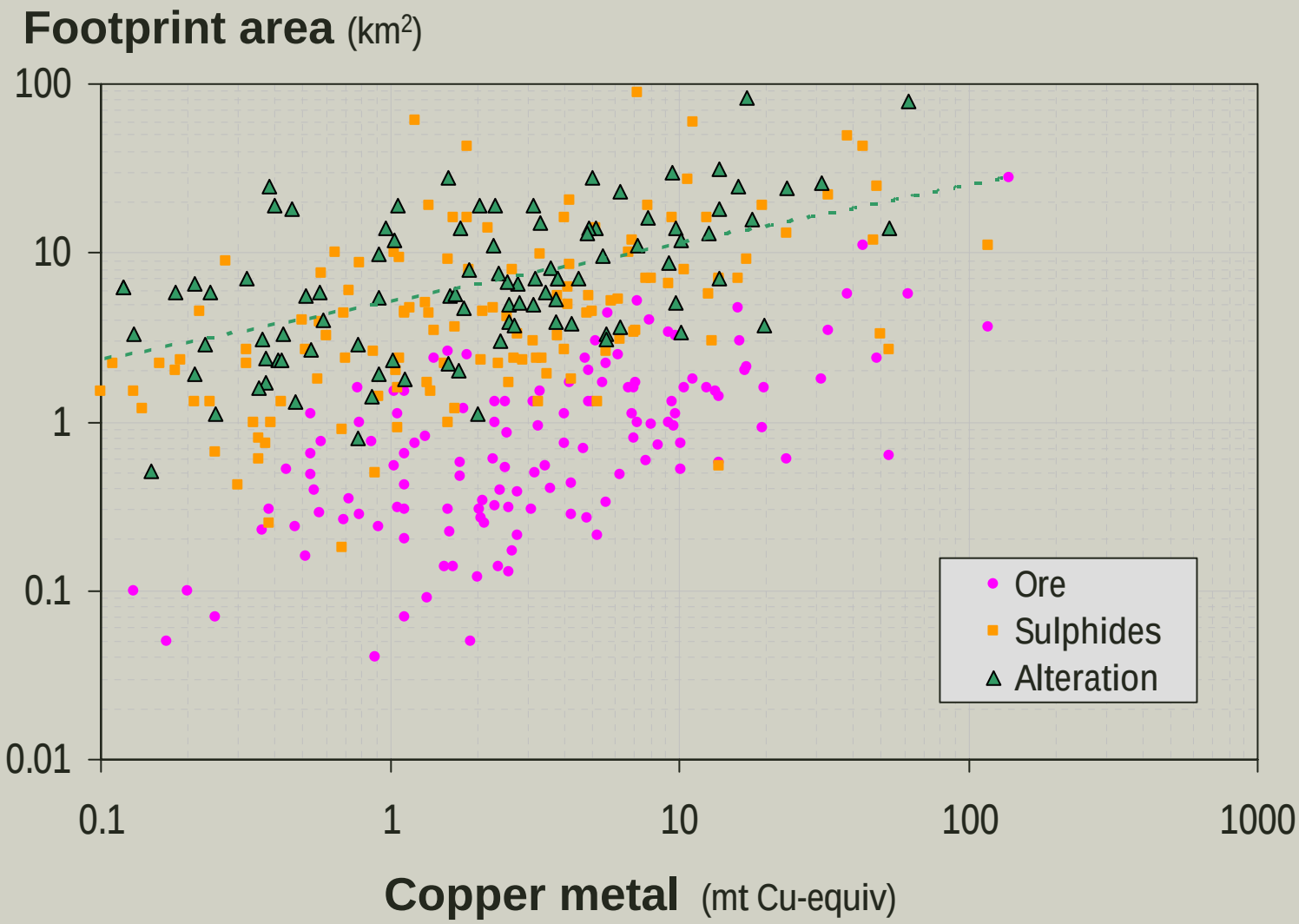

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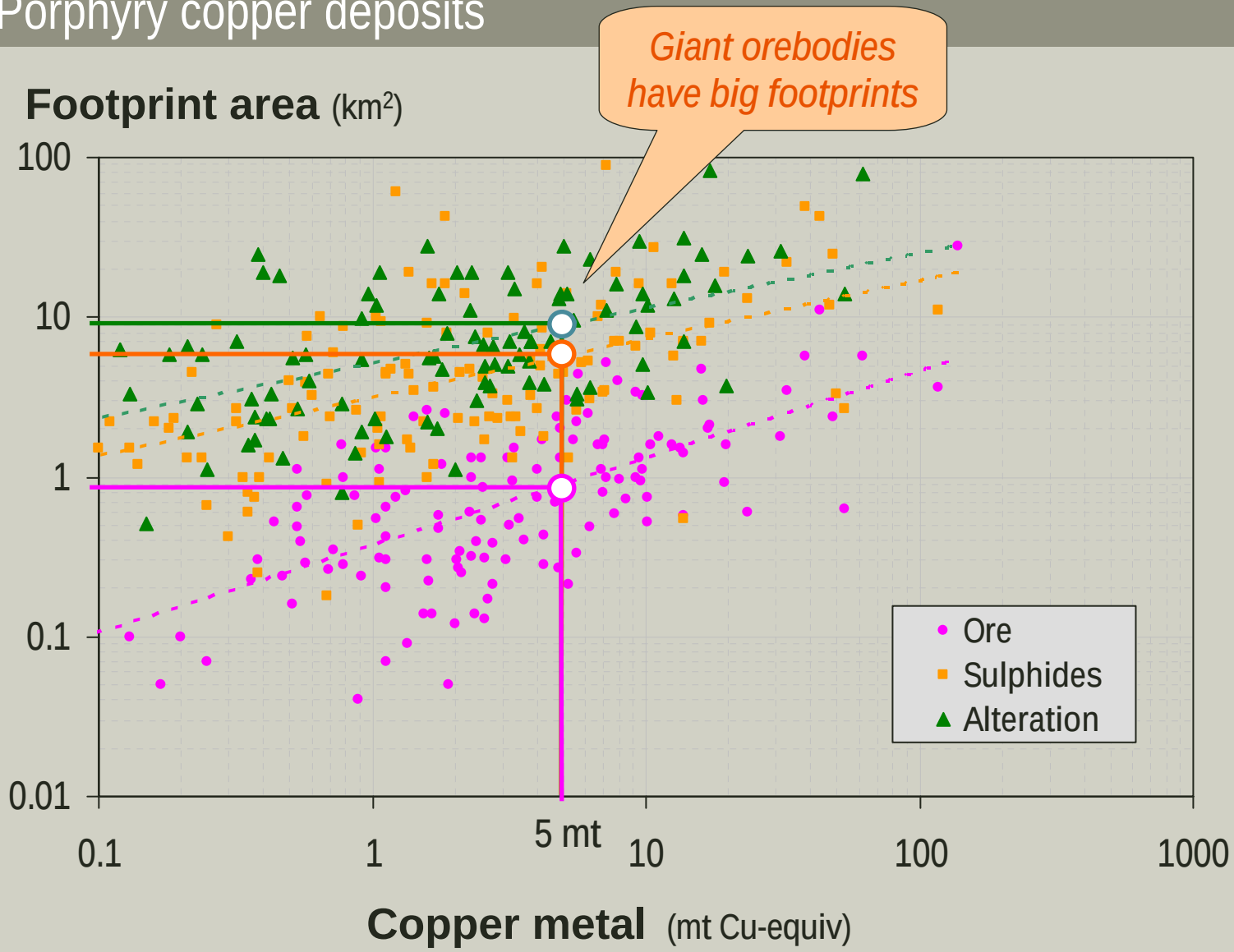

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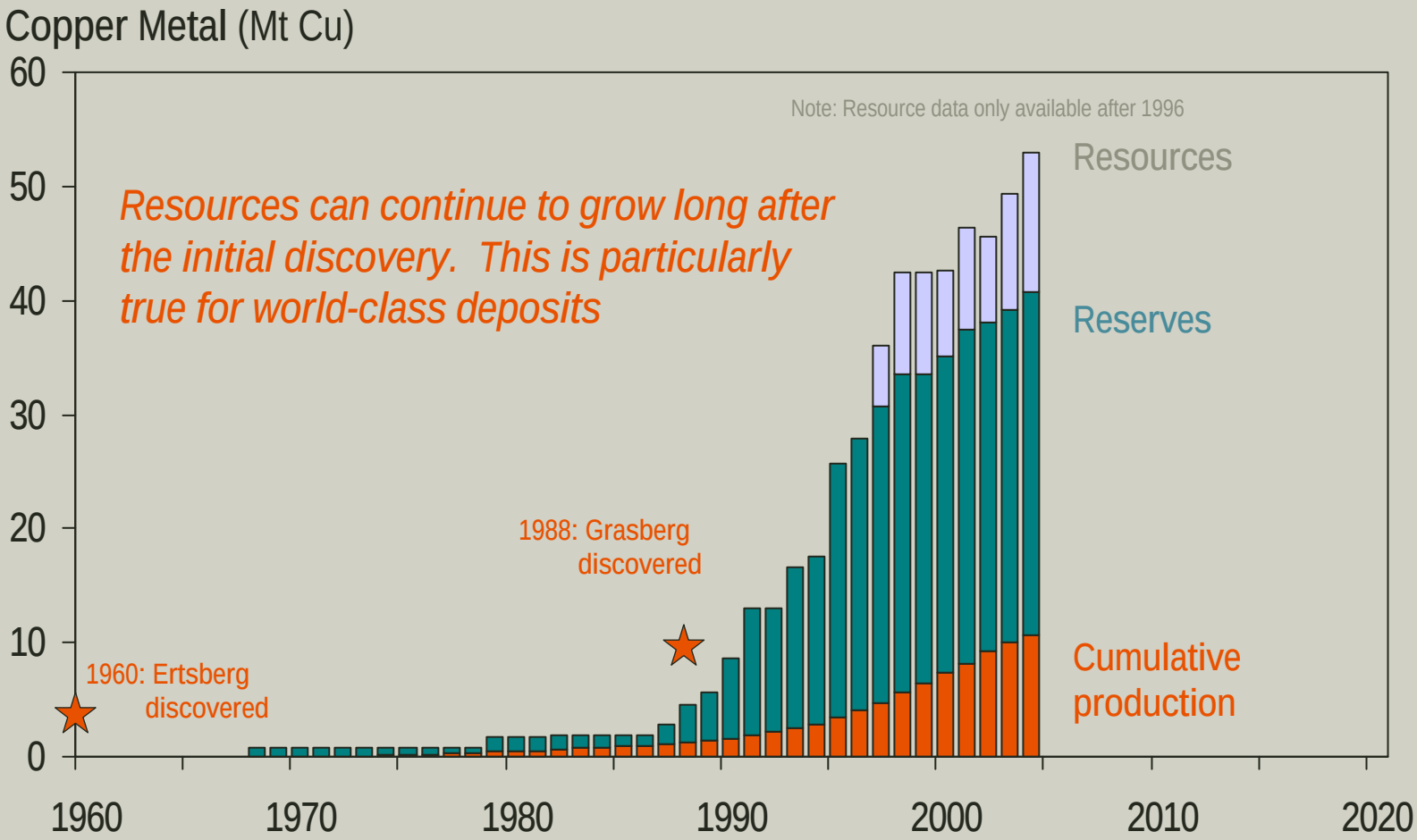
World-class deposits have a high “option” value

Their large size and long life creates the opportunity to:

- Achieve economies of scale in mining and processing. This lowers the cut-off grade & increases the overall resource
  – world-class deposits can “grow” significantly over time !
- Take advantage of market opportunities
  – by quickly expanding the mine during good times
- Invest in developing new technologies
  – which will lower costs and increase the economic resource base

Growth in Resources at Ertsberg-Grasberg Camp



Source: FCX

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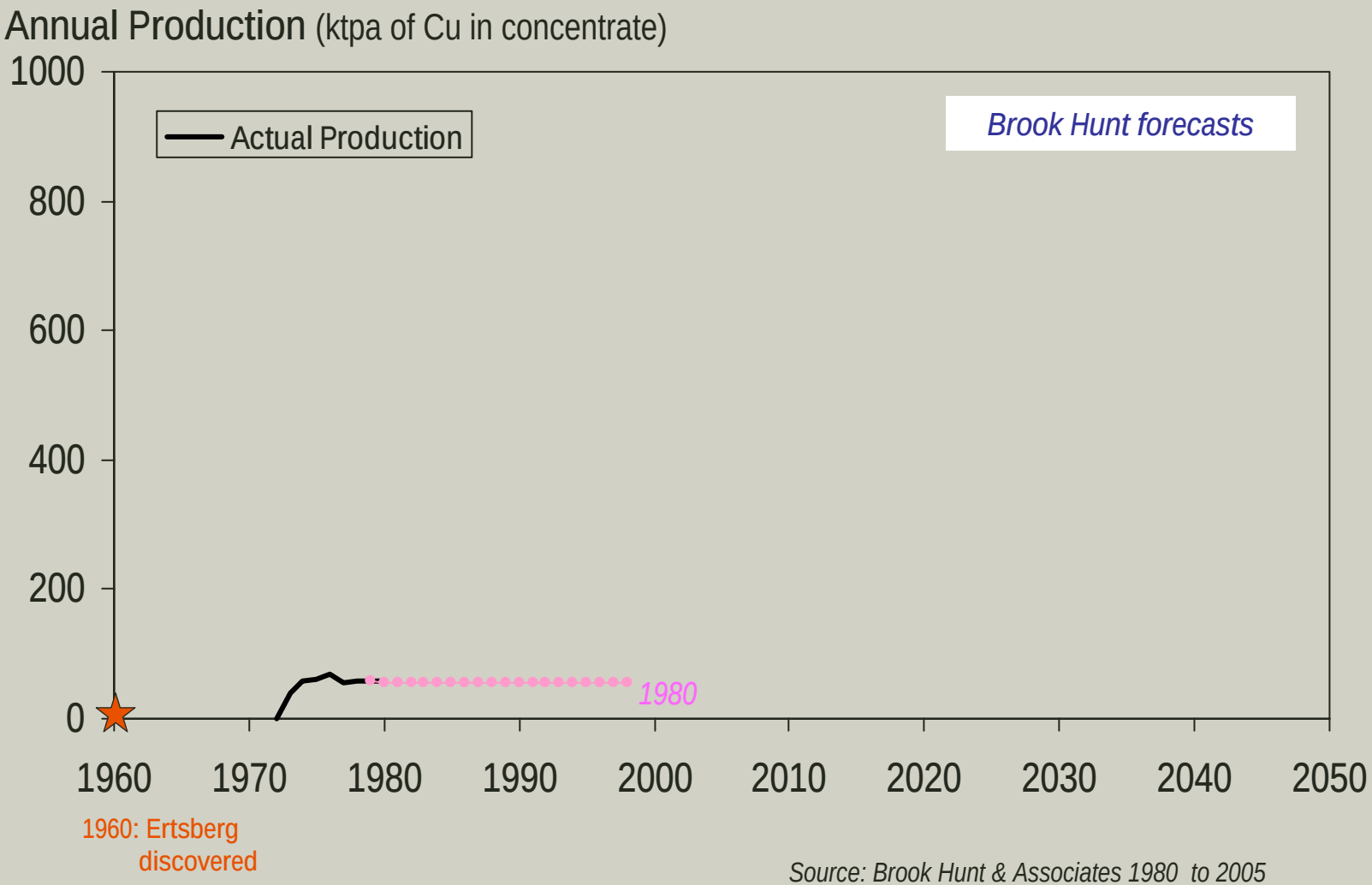
Copper Production From Grasberg Camp
Actual versus forecast



Source: Brook Hunt & Associates 1980 to 2005

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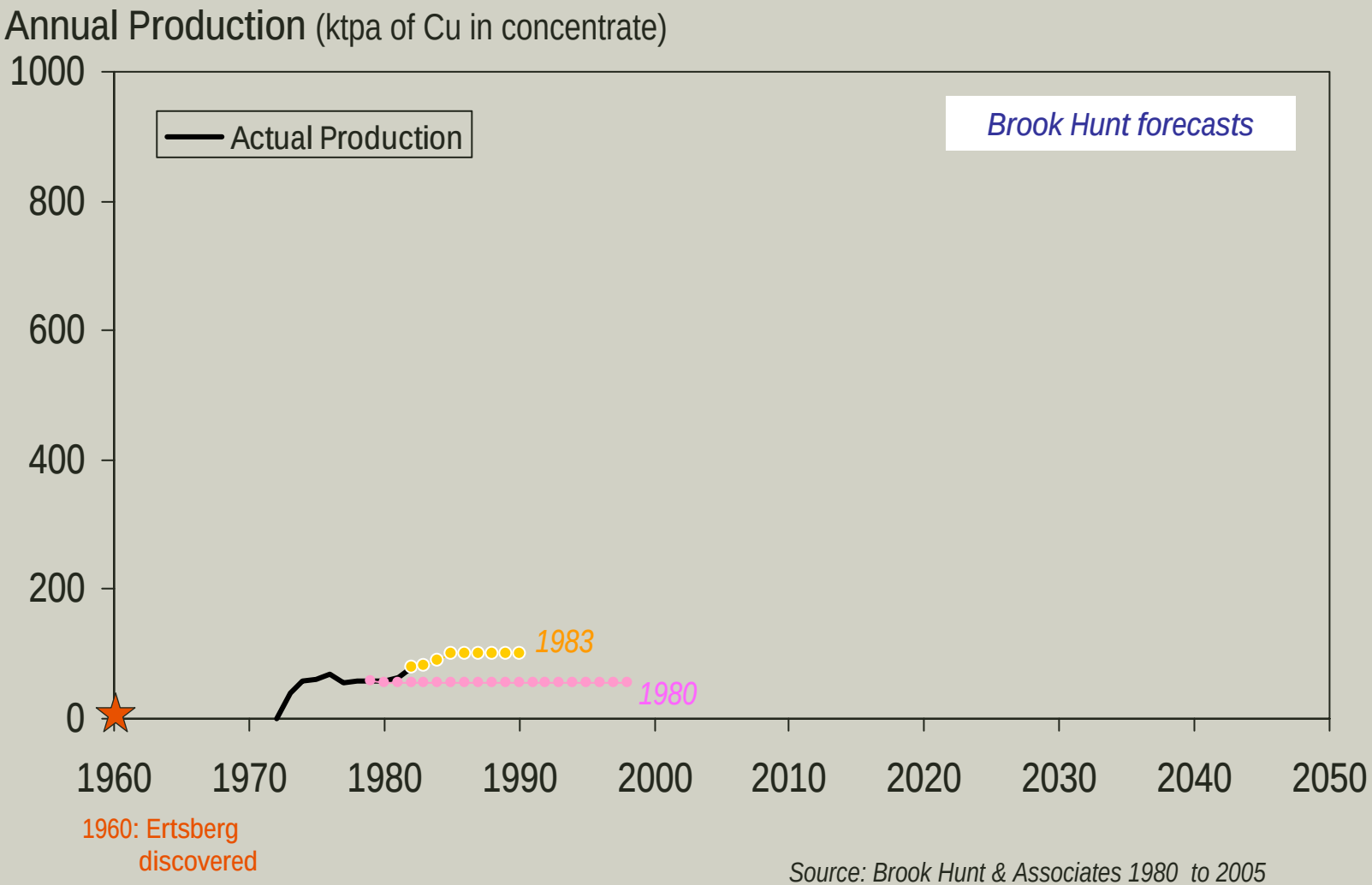

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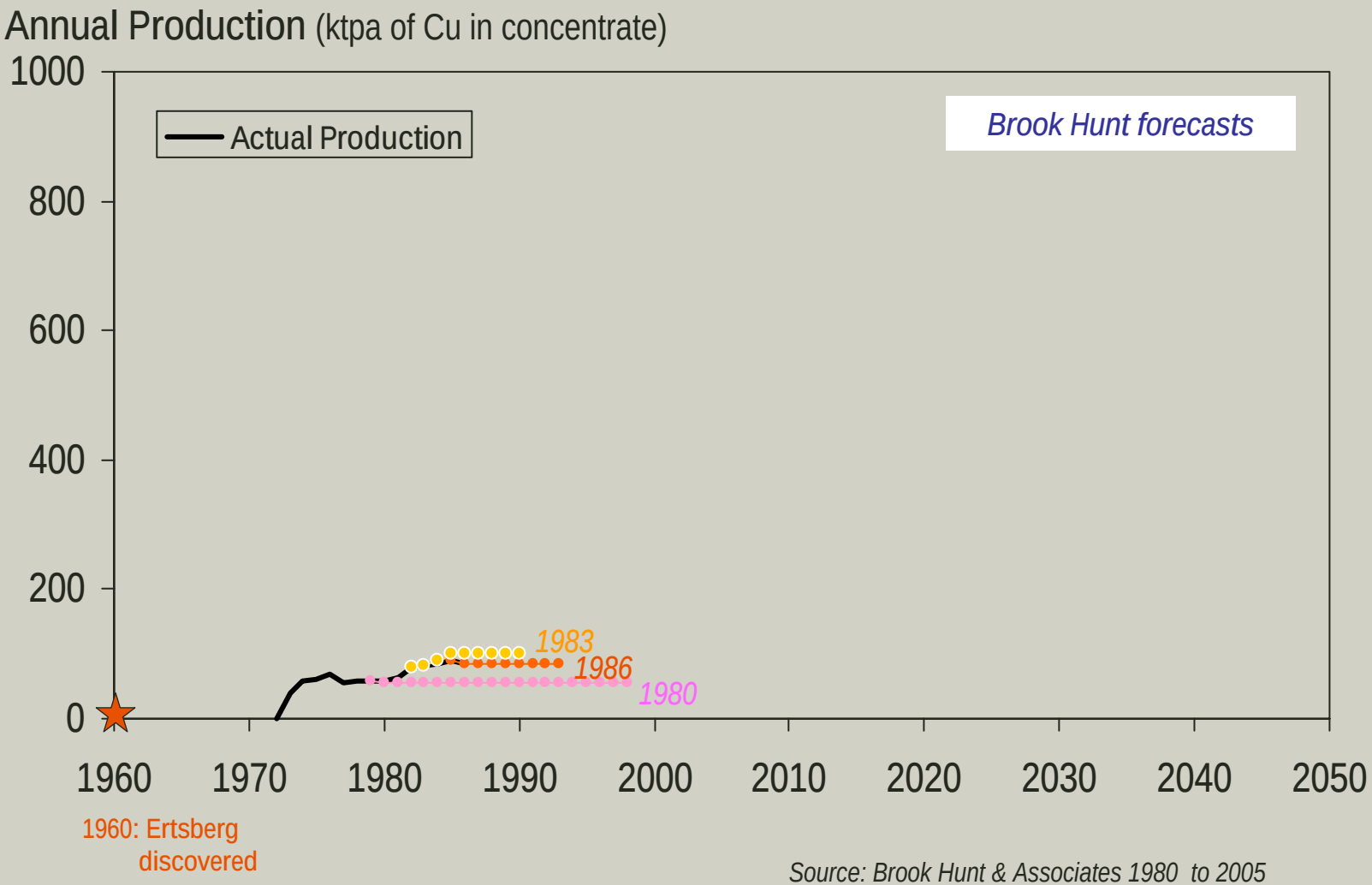

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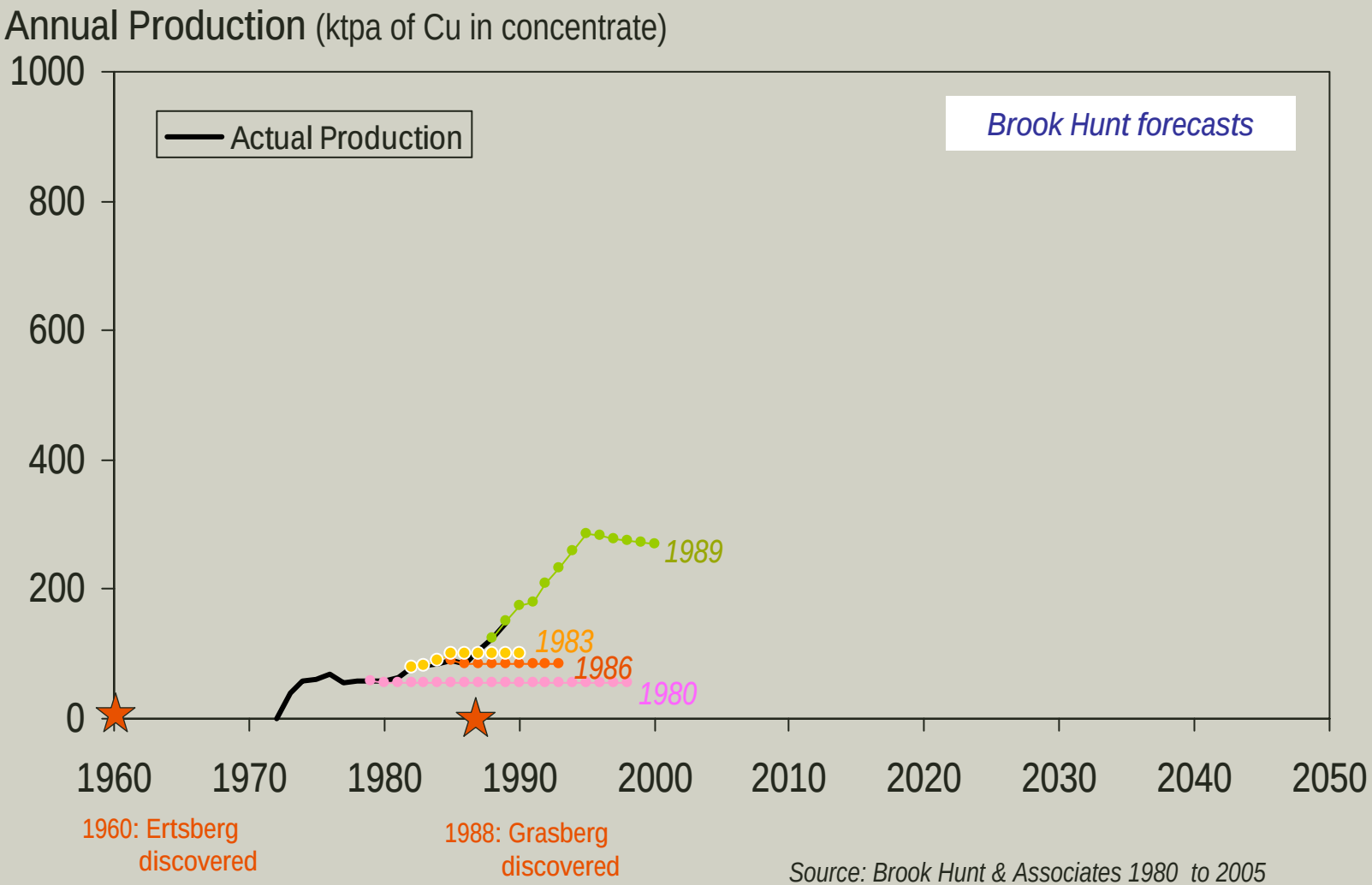

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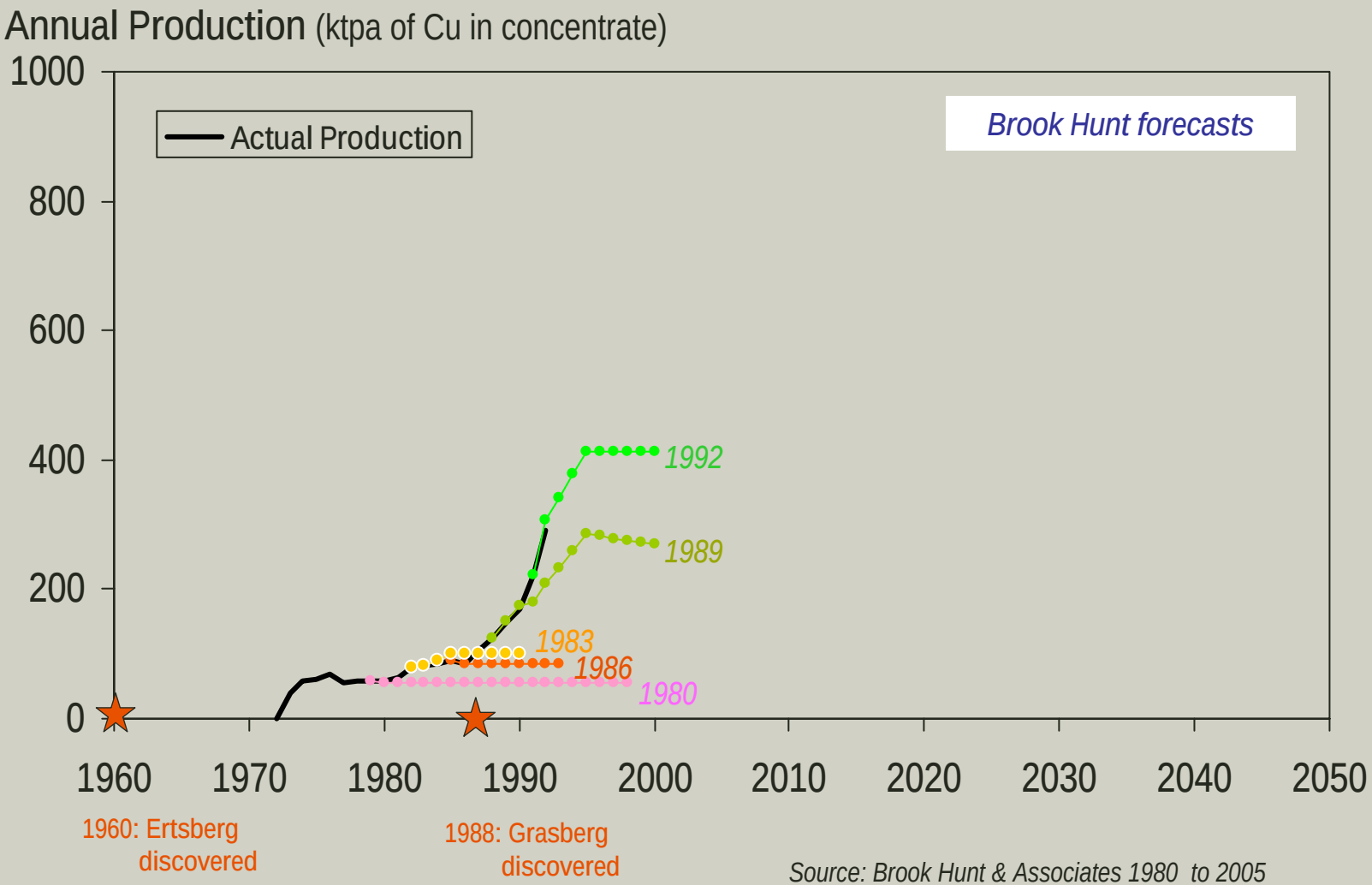
Copper Production From Grasberg Camp
Actual versus forecast



Source: Brook Hunt & Associates 1980 to 2005

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Copper Production From Grasberg Camp
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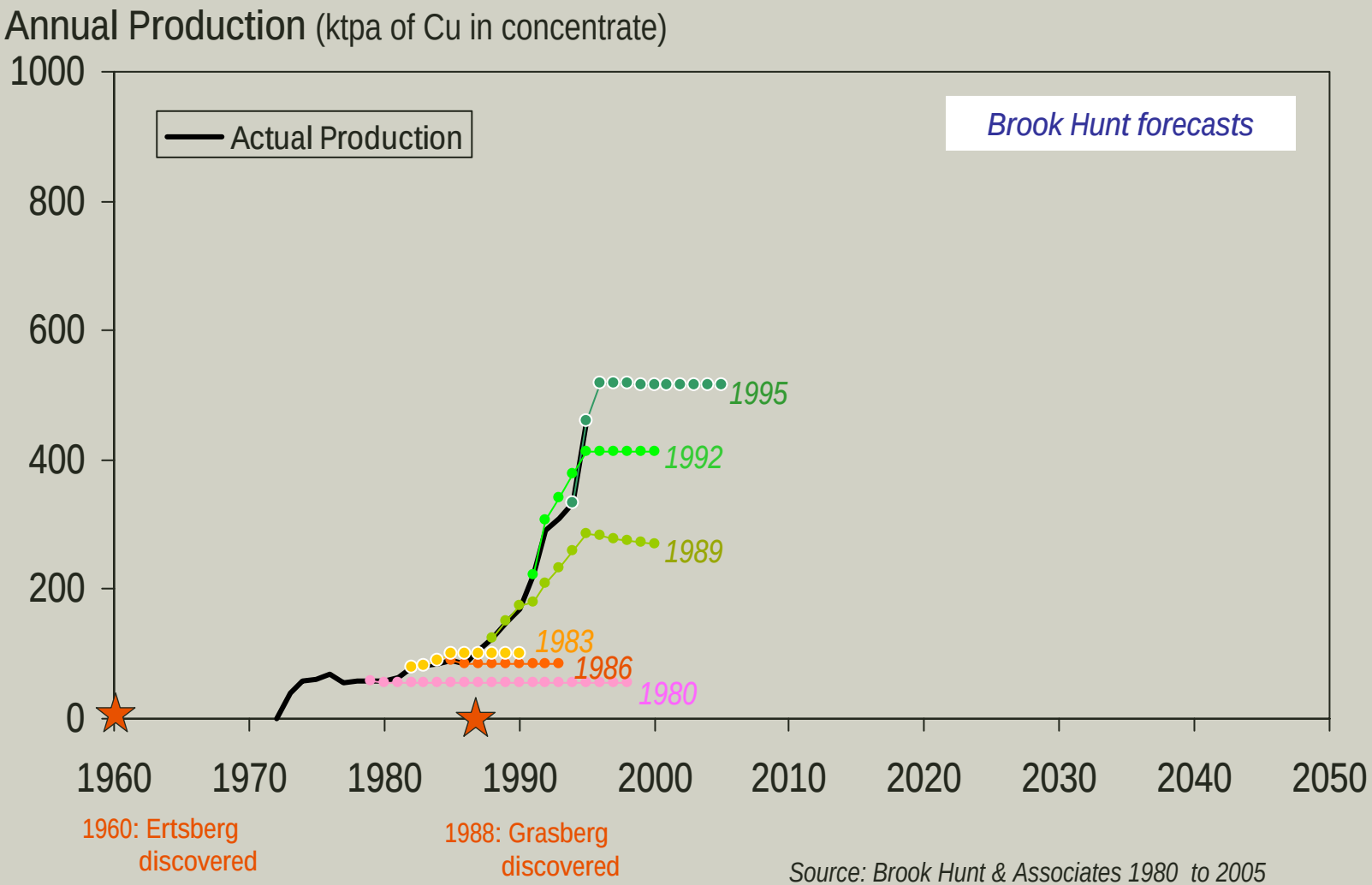

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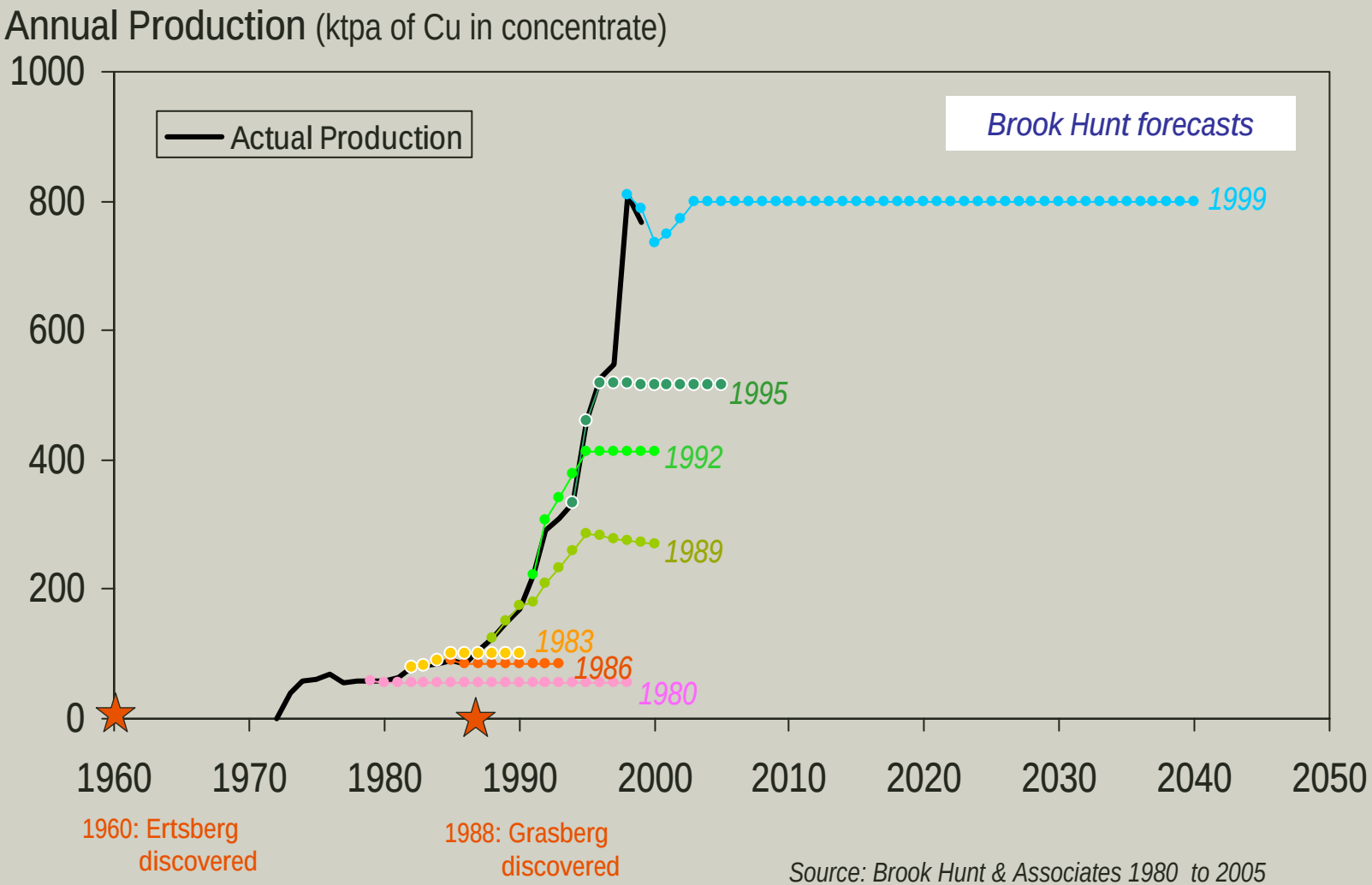

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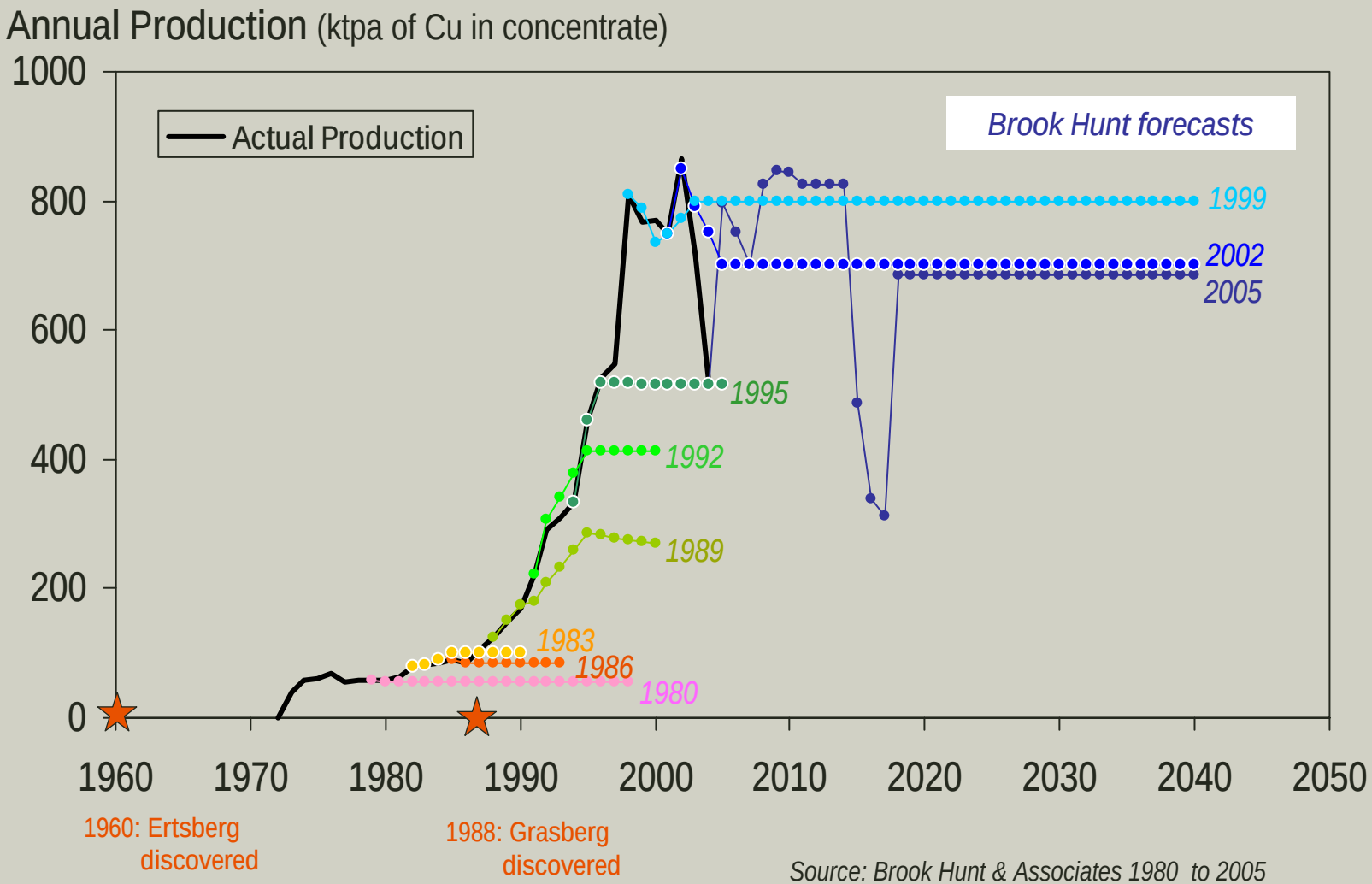

Source: Brook Hunt & Associates 1980 to 2005

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Summary: Ten benefits of world-class mines

1) They generate significant wealth over an extended period of time
2) Help launch major mining companies
3) Create new markets through lower prices (Climax mine for Molybdenum)
4) Encourages further investment in exploration
5) Promotes innovation (flotation, autogenous smelting, synthetic rutile)
6) Stimulates other mines to set up in the area
7) Encourages downstream processing
8) Encourages support industries (Sudbury, Johannesburg, Kalgoorlie/Perth)
9) Assists in the social and political development of the region
10) Potentially lower environmental impact

Conclusions

- World-class mines by definition are “something special”. They produce major benefits to industry and society.
- Better to define them in terms of wealth creation than physical size.
- Deposits with NPV >$250m appear to have different size-frequency characteristics – an artefact of being of being part of a camp?
- To have a reasonable chance of being world-class the deposit needs to contain >6 Moz Au or >4-5 mt of Cu-equivalent (= 1.0-1.3Mt Ni = 10-12 Mt Zn).
- On average 2-4 world-class deposits were found each year in the Western World.
- Economic analysis of 143 major deposits found between 1985-2003 showed that much of the industry’s wealth is captured in a handful of discoveries.
  - For gold: Of those >0.5 mt Cu-equiv, 12% by number had an NPV>$250m. These contained 30% of the metal and 53% of the total wealth.
  - For base metals: Of those >1 moz Au, 14% by number had an NPV>$250m. These contained 32% of the metal and 67% of the total wealth.

Closing note: The importance of world-class mines to society

Is mining a benefit to society?

"What matters is how the [mineral] wealth is transformed into other forms of wealth and income".

Source: Stoekel (1999)

Since much of the minerals industry's wealth is created by world-class mines, the discovery and management of these mines has a critical role in ensuring that the industry makes a positive and lasting impact on society