



**Dr Gavin M Mudd<sup>#</sup>**  
Env Eng, Monash Uni

**Dr James D Ward**  
SCPES, Flinders Uni

# ***Peak Minerals v Sustainable Mining***

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# Loy Yang brown coal mine, Australia





Courtesy: Nicholson Cartoons ([www.nicholsoncartoons.com.au](http://www.nicholsoncartoons.com.au))

# Sustainable Mining v Peak Minerals?

- Mining a ‘finite’ mineral resources is almost universally accepted as ‘unsustainable’:
  - *yet mineral & metal production is bigger today than ever and still growing*
- Typically two dominant views – “Limits to Growth” (ie. unsustainable) or “technology-markets-demand = solutions” (‘sustainable’)
- Easy to find good evidence for both sides ...

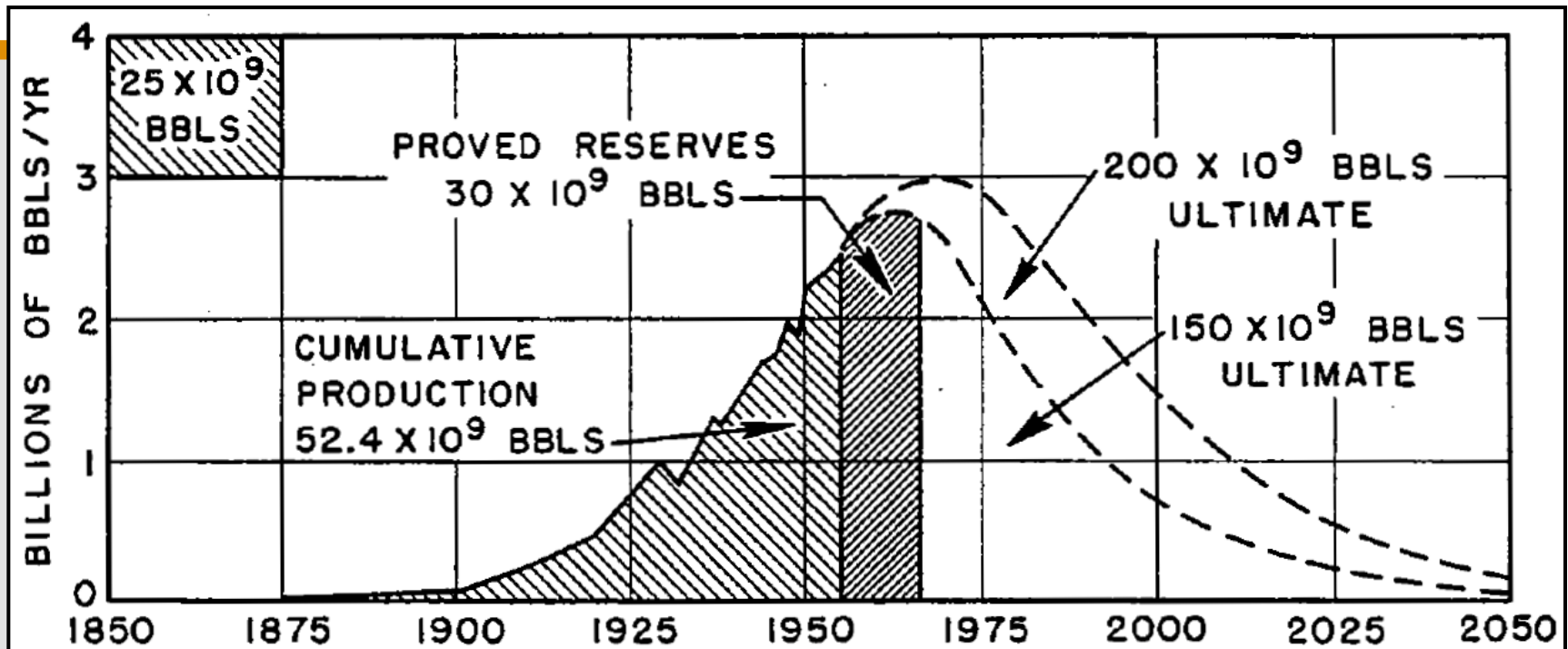
But what about ‘PEAK OIL’ →

**“PEAK MINERALS”** too ?

# PEAK OIL ... '101'

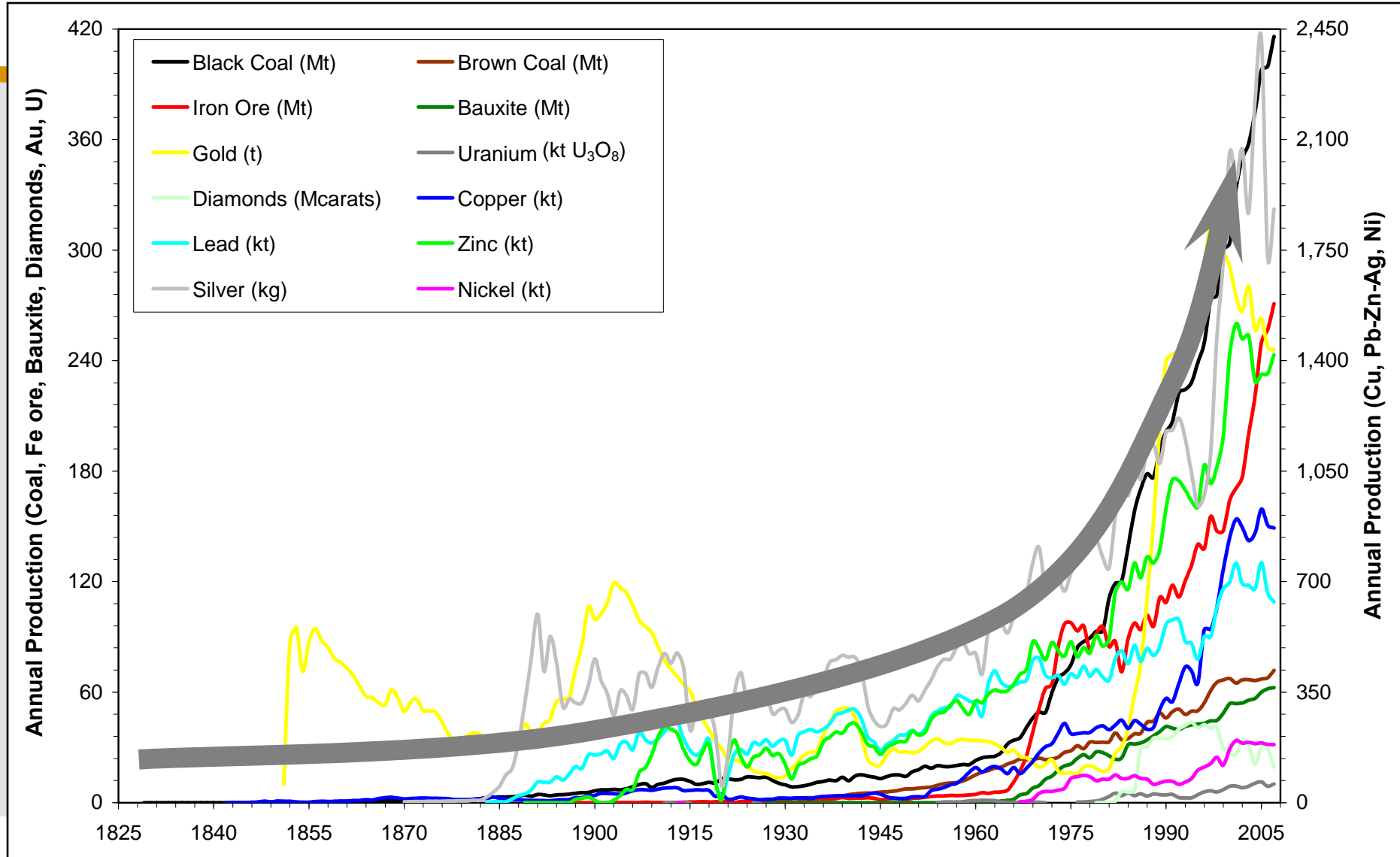
- **Widespread debate about 'Peak Oil':**
  - *will it occur, has it occurred, if not when, or never ...*
- **M King Hubbert first applied systematic analyses of oil production to US mainland in the 1950's – & (correctly) predicted production would peak around 1970**
- **Based on simple assumptions of a finite resource and all oil wells following a basic bell curve : *cumulative country = same***

# Hubbert's (in)'famous' 1956 Curve

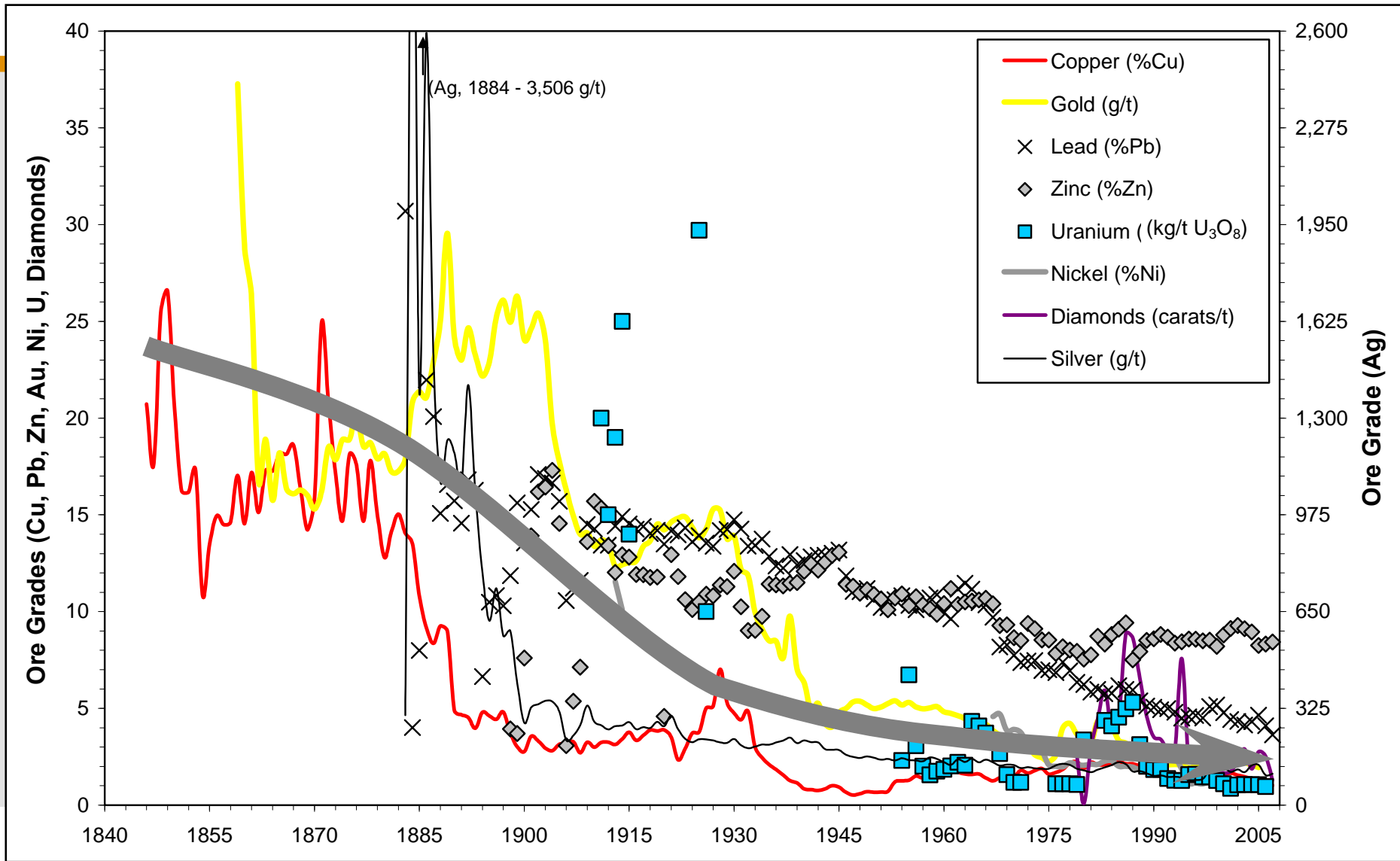
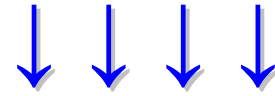


- Hubbert's 1956 prediction of mainland US oil production, including historical data
- *Some key assumptions ... but assumes "finite" oil*

# Production Production Production ...

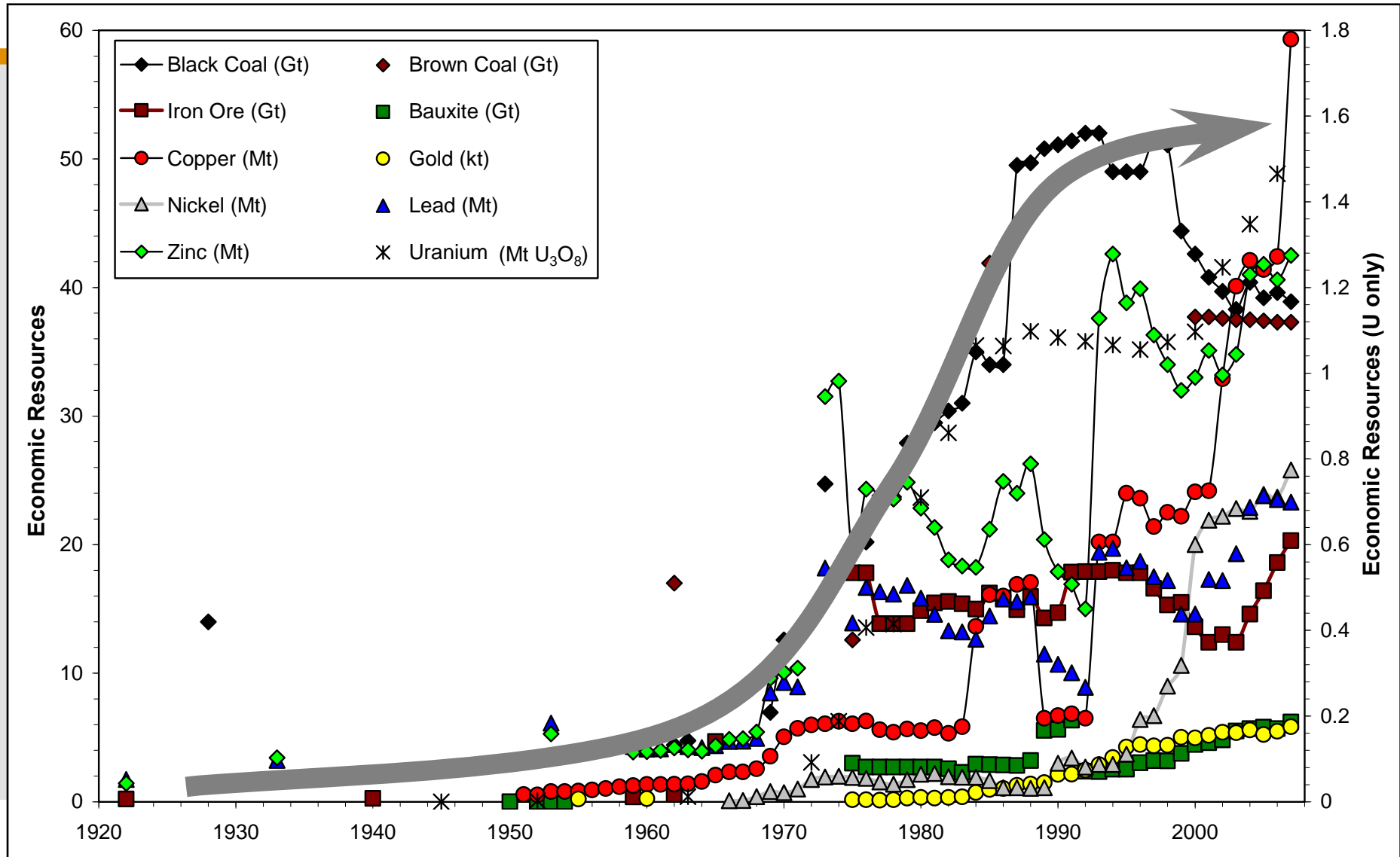


# Trends in Ore Grades ...





# Trends in Economic Resources ...



# Sustainable Mining ...

- Unlike previous mining booms, the current boom is not only unprecedented in scale but is also claimed to be ‘sustainable’
- **But can we assume the patterns of the past will continue into the future –**
  - *ie. can mining a ‘finite’ resource ever troolly be ‘sustainable’ ?????*
- Ultimately, the world may not run out of mineral/metal resources – but energy, water, wastes etc. will lead to limits ...

# Sustainable Mining ...

**Saudi's Ahmed Zaki Yamani:**

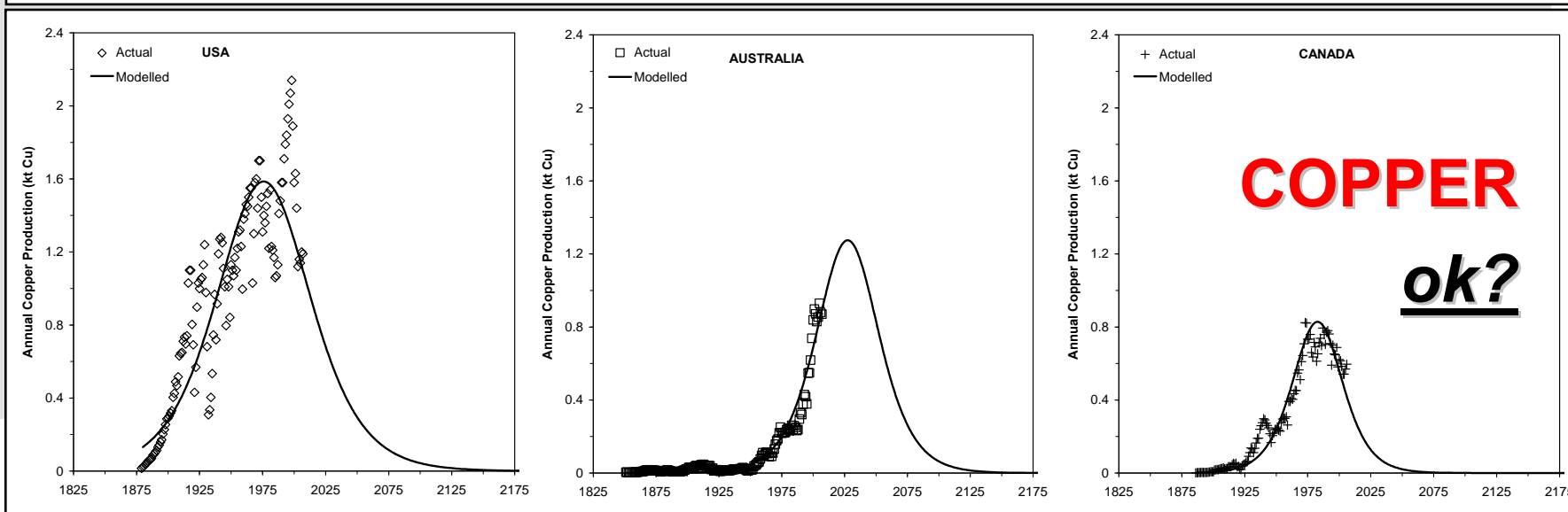
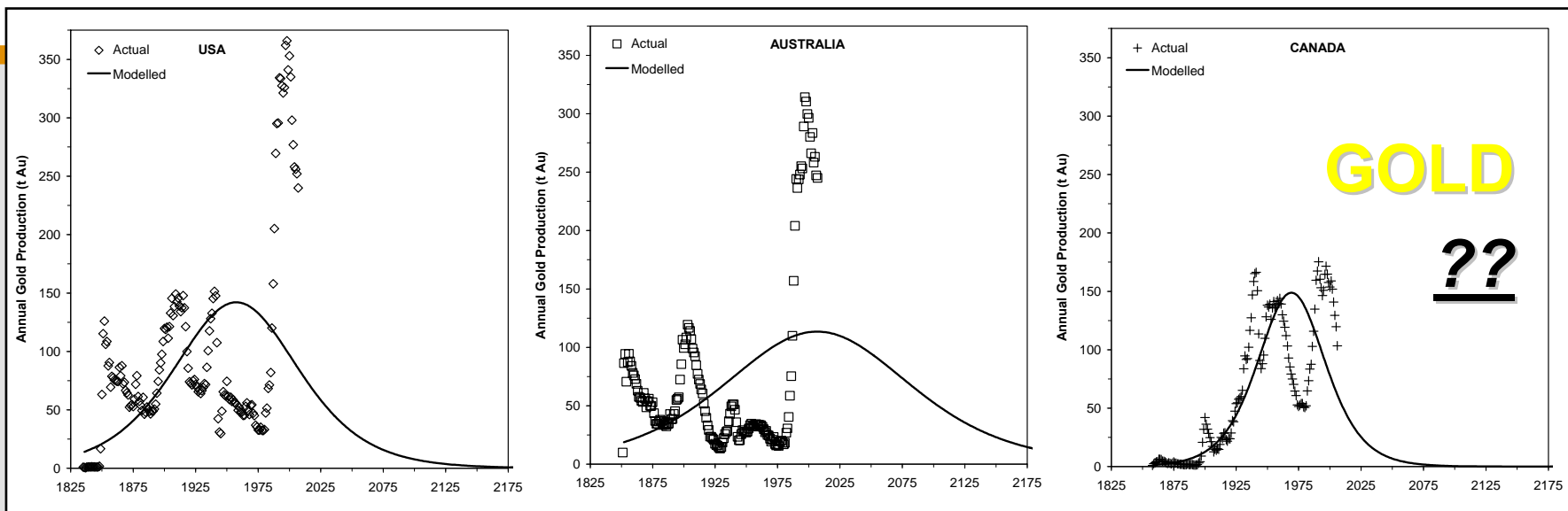
***“The Stone Age came to an end not for the lack of stones and the oil age will end, but not for the lack of oil”***

**(Yamani was Saudi Arabia's Oil Minister from 1962 to 1986)**

# Peak Minerals v Sustainability Limits

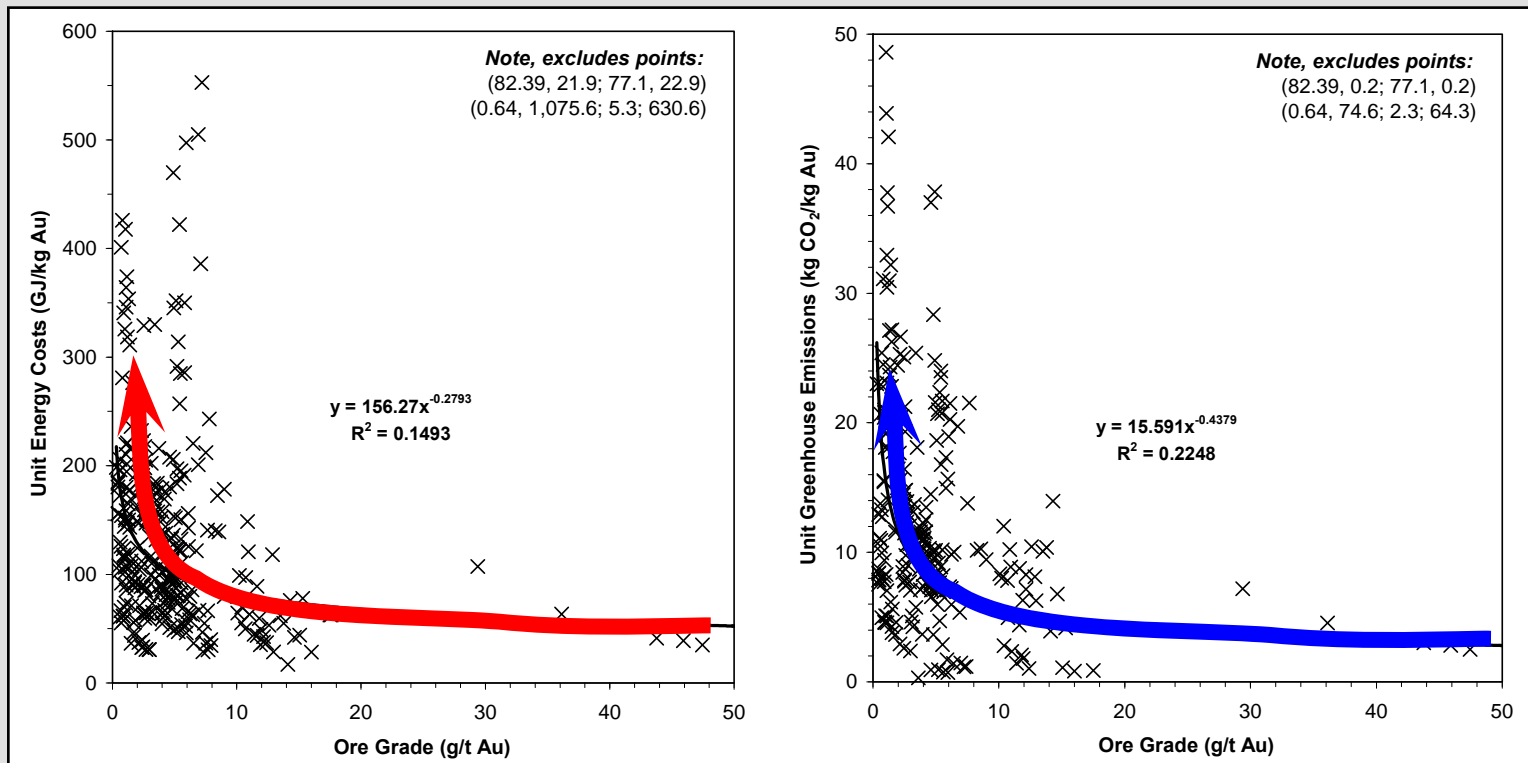
- **Given the urgent multiple prongs of development, population, climate change and environmental degradation, it is clear that the patterns of the past are not sustainable into the future ...**
- **But how do we combine bell curves & sustainability limits ?**
- **Through linking energy, water & costs to mineral production, we can develop scenarios for the future mining industry ...**

# Hubbert Peak Curves: Au & Cu

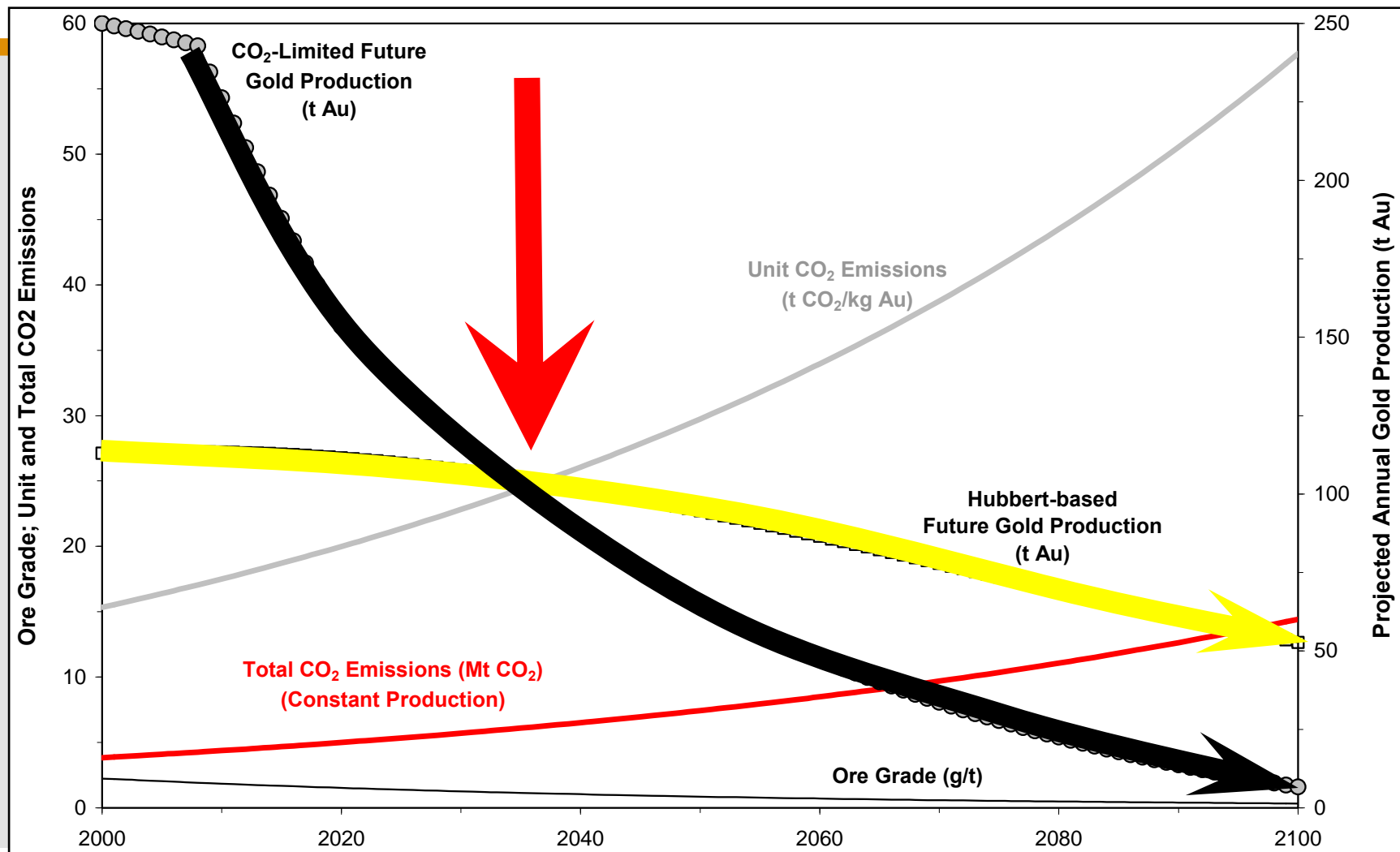


# Gold: CO<sub>2</sub> v Mining

- As gold ore grades decline, there is an increasing environmental cost (GJ, CO<sub>2</sub>, ...)



# Mining Susty Peaks v Troughs ...



# Ongoing Thoughts ... (TI&B?)

- For many countries, there remains reasonably abundant mineral resources, though of gradually declining quality
- To meet future global development demands, mining looks set to continue to grow for some time
- Some key assumptions vary between 'Peak Oil' and 'Peak Minerals' – particularly between minerals & metals ...
- Future impacts of climate change ... ???



# Acknowledgements

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