



50 years of modern mineral exploration in the Tasmanides

JOHN GREENFIELD

25/8/2022



Introduction

Introduction

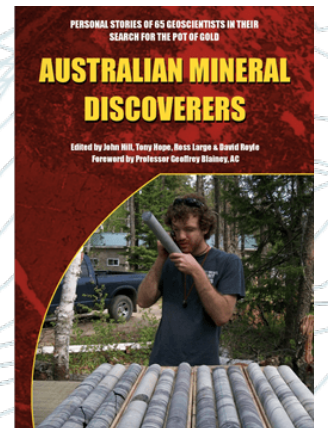
- This talk attempts to cover 50 years of exploration in the Tasmanides.
- The focus is on companies and discoveries, not individuals.
- Also looking at what has changed, and the ebbs and flows of the market in this time.
- Data comes from Geoscience Australia, Geo-surveys, Richard Schodde, Matt Bruce.
- Information has come from references shown in the abstract, ASX & mining archives, company books and websites, SMEDG archives, and google books.
- Recollections and edits have come from the people in **BLUE**. Thank you all.



MIKE BELPERIO
CAMERON CAIRNS
GLENN COIANIZ
GLEN DIEMAR
TIM DOHEY
LINDSAY GILLIGAN
DARREN GLOVER
BEN HARPER
INIA HEPER
BRYCE LORD
TIM MCCONACHY
CRAIG MILLER
PIP SIVWRIGHT
CHRIS ROBINSON
STEVE TURNER



Richard
Schodde

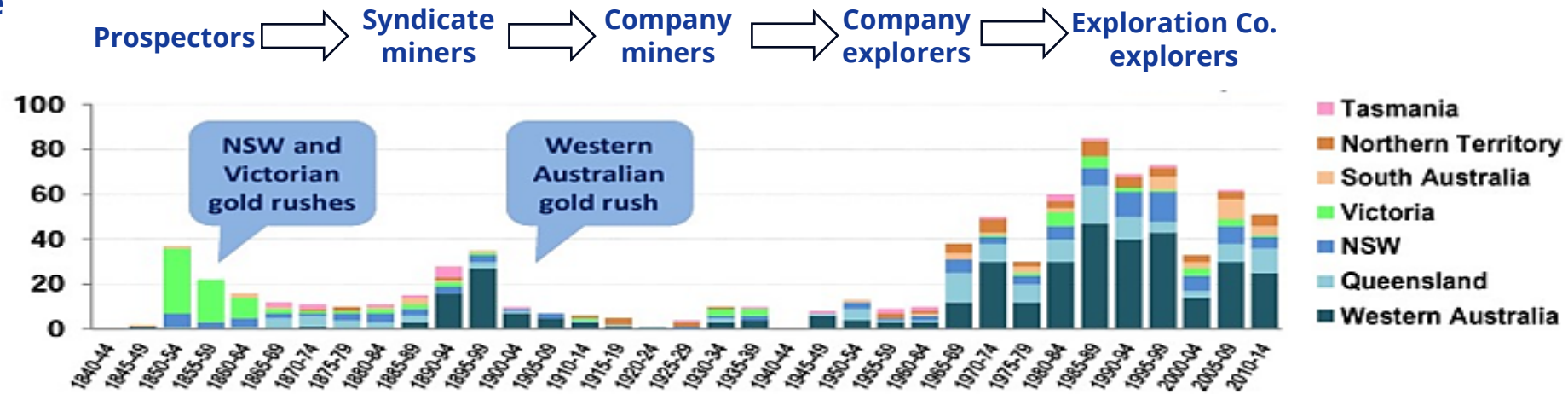


What discoveries?



- 145 economic discoveries in the Tasmanides reviewed here
- Limited to hard-rock gold and base metal deposits (although leeway applied to lateritic Ni±Co±Sc±Pt)
- Discovery here defined as 'maiden resource' but impossible to consistently apply
- 'Discovery drillhole' as definition has as many warts as 'Maiden Resource'
- Nearly all discoveries here are re-discoveries – judgement of economic value applied
- Mineral discoveries are community events: many hands involved before discovery hole.

Who made the discoveries?

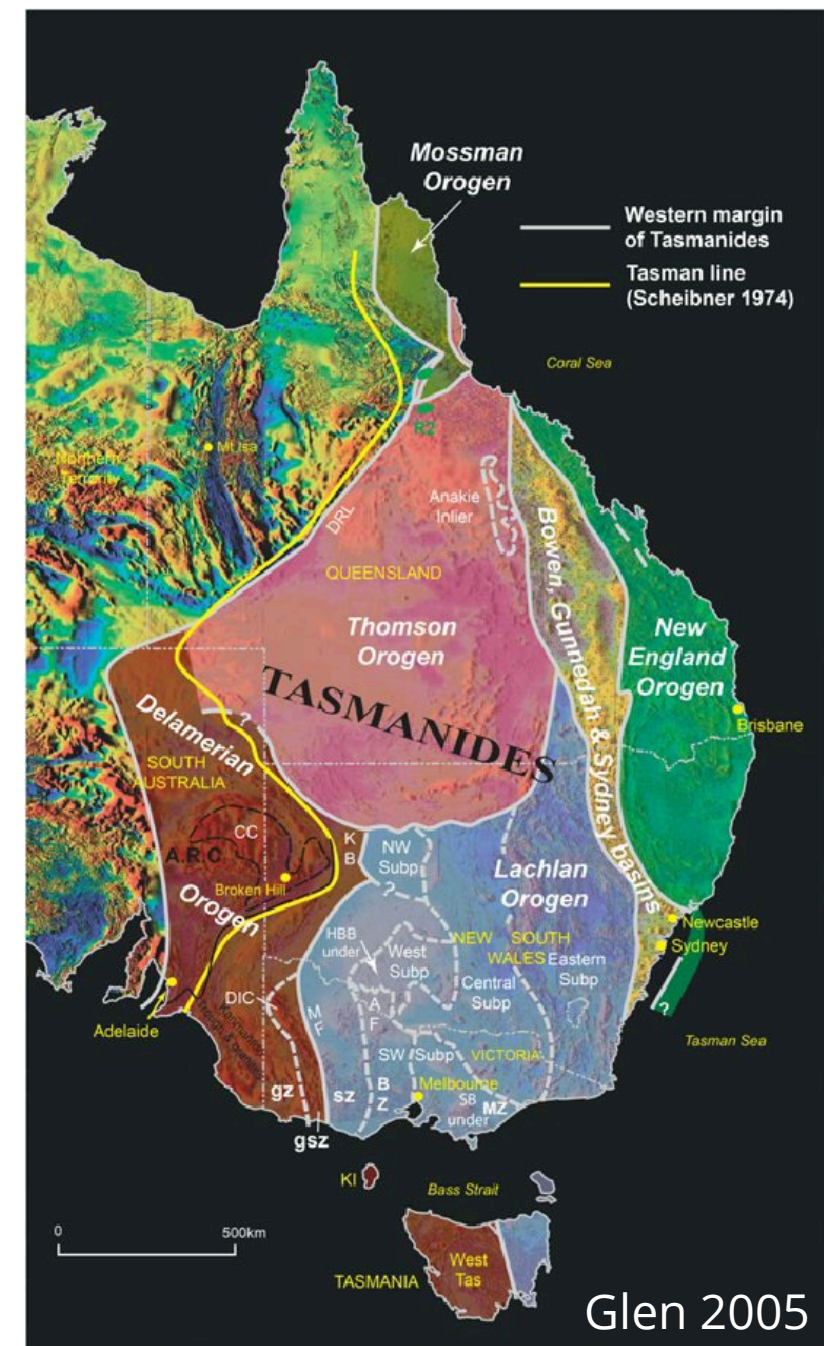
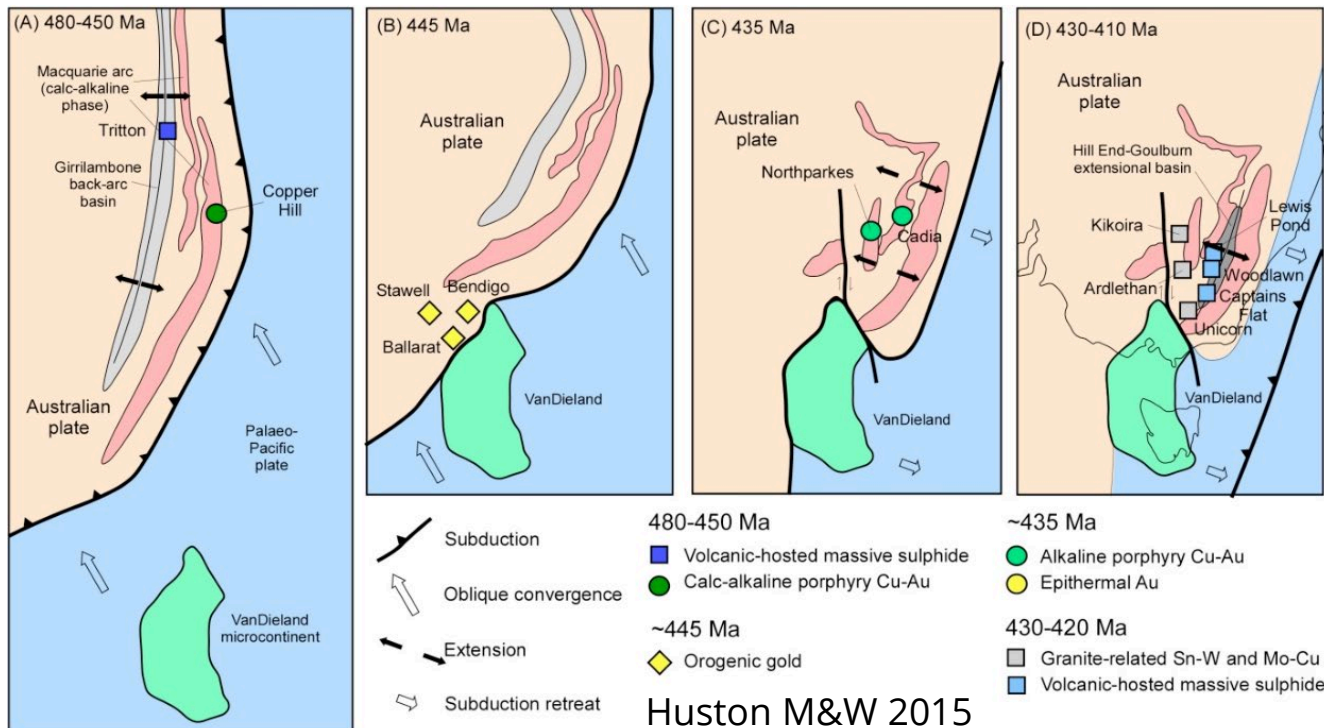


Note: Based on 849 discoveries >= "Moderate" in size, i.e. >0.1 Moz Au, >5 kt U₃O₈, >10 kt Ni, >0.25 Mt Zn+Pb, >0.1 Mt Cu-equiv
Excludes 208 deposits without a discovery date. Excludes satellite deposits within existing camps and bulk mineral deposits

Source: MinEx Consulting © July 2015

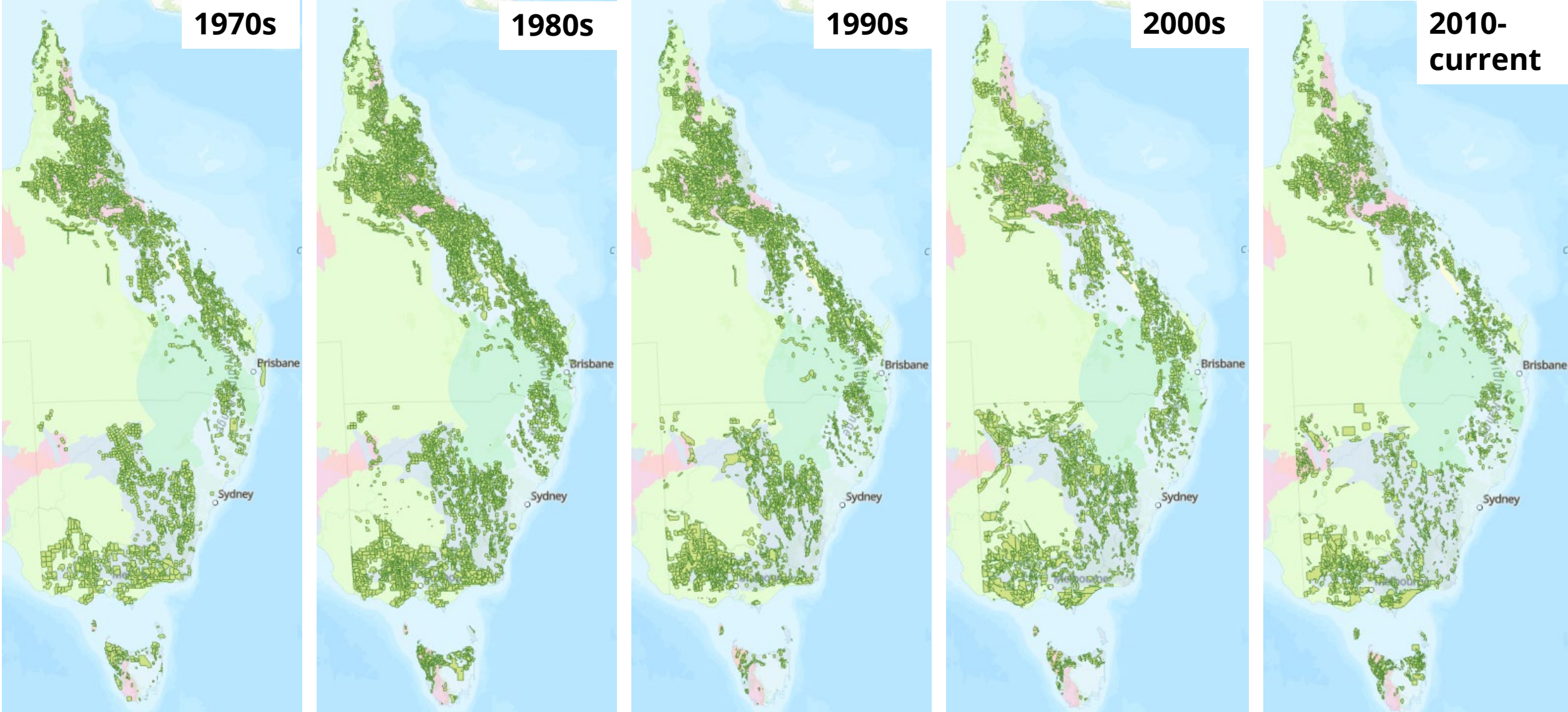
The Tasmanides: living on the edge

- Proterozoic supercontinent Rodinia breaks up between ~800-600 Ma
- Three convergent margin arcs from the Cambrian to Carboniferous
- A jagged Proterozoic plate margin and oblique microcontinent collision resulted in complex deformation and oroclinal folding in the south
- This was great news for gold/base metals making their way up the crust: SE Tasmanides hosts >180Moz Au, >18Mt Cu, >14Mt Pb-Zn.





What's changed in
50 years?



Tenement coverage each decade 1972-2022

Thanks to Qld, NSW, Vic, Tas state Geo-surveys and Matt Bruce

Drilling changes



Early 1970s: mobile RC (Kalgoorlie!) and RAB rigs

Mid-1970s: common use of wireline DDH drilling

1980s: Impregnated diamond bit – drilling further, faster

1990: RC hammer developed – better sample purity

1990s: top drive DDH drilling

1990's: air pressure to the hammer up to 1,500psi available

1998: better directional drilling - rotary steerable systems

2000s: Blowdown valves (RC) – ^ efficiency, sample purity

2010-2022: DET CRC (2010-2018) and MinEx CRC (2019-)
coil tube rig - cheaper, faster and safer scout drilling, plus improved real-time data collection and analytics at the rig.

More

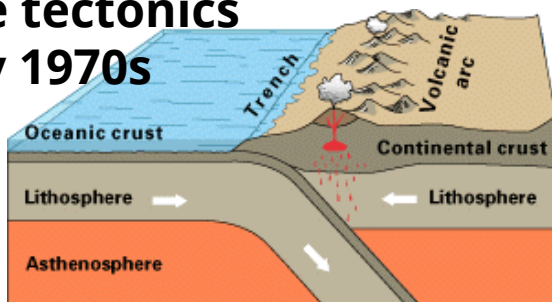
- Mobile
- Powerful
- Precise
- Safer

Mapping, geochemistry, geophysics changes



- **1970s** availability of cheap, high resolution aeromag/rad
 - **1970s** EM and IP techniques become mainstream tools
 - **1990s** GPS receivers and computer power – better accuracy and efficiency of geophysics
 - **2000s** GIS becomes a mainstream exploration tool
 - **2000s** cheap multi-element Geochem, low DLs
 - **2010s** 3D becomes a mainstream exploration tool
- X Decline in geological outcrop/fact mapping
 X Lack of quality petrophysical data
 X Decline in geology/geophysics degrees available at Australian universities.

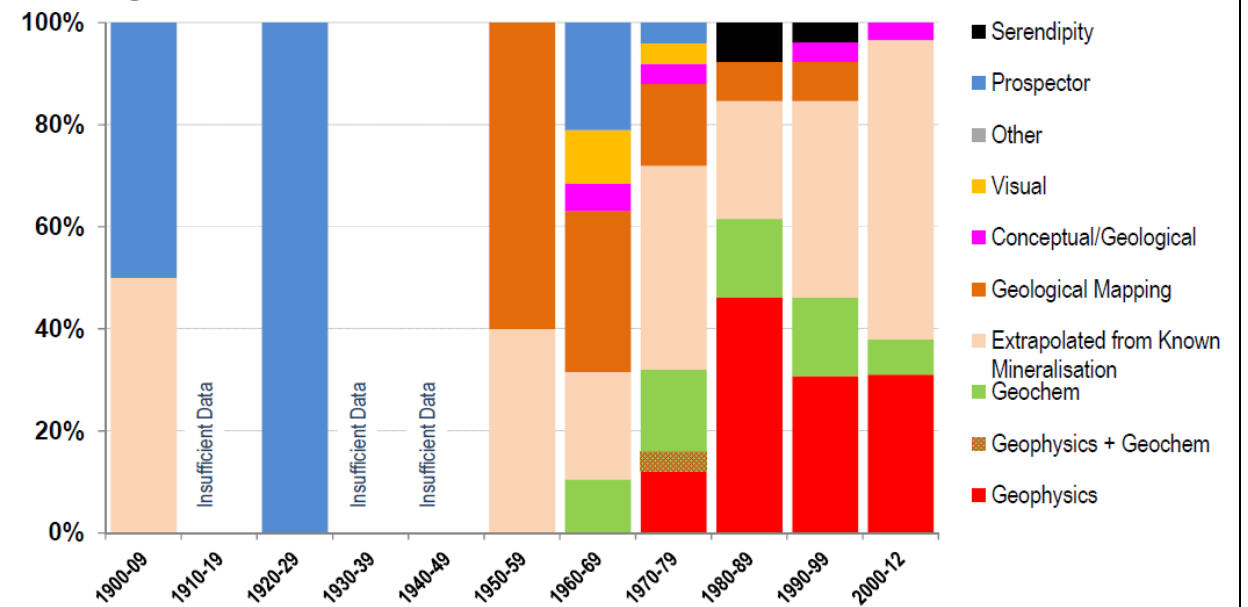
Plate tectonics early 1970s



50 years Tasmanides mineral exploration 25.08.2022

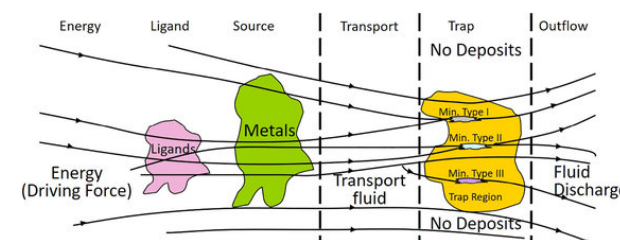
Primary search method used at the project-scale BASE METAL discoveries (>0.1 Mt Cu-eq) in Australia: 1900-2012

Percentage of total discoveries



Note: Analysis based on detailed analysis of 127 Cu+Ni+Zn+Pb projects (out of 185 known discoveries)

Source: MinEx Consulting © November 2013



Mineral systems model 1990s

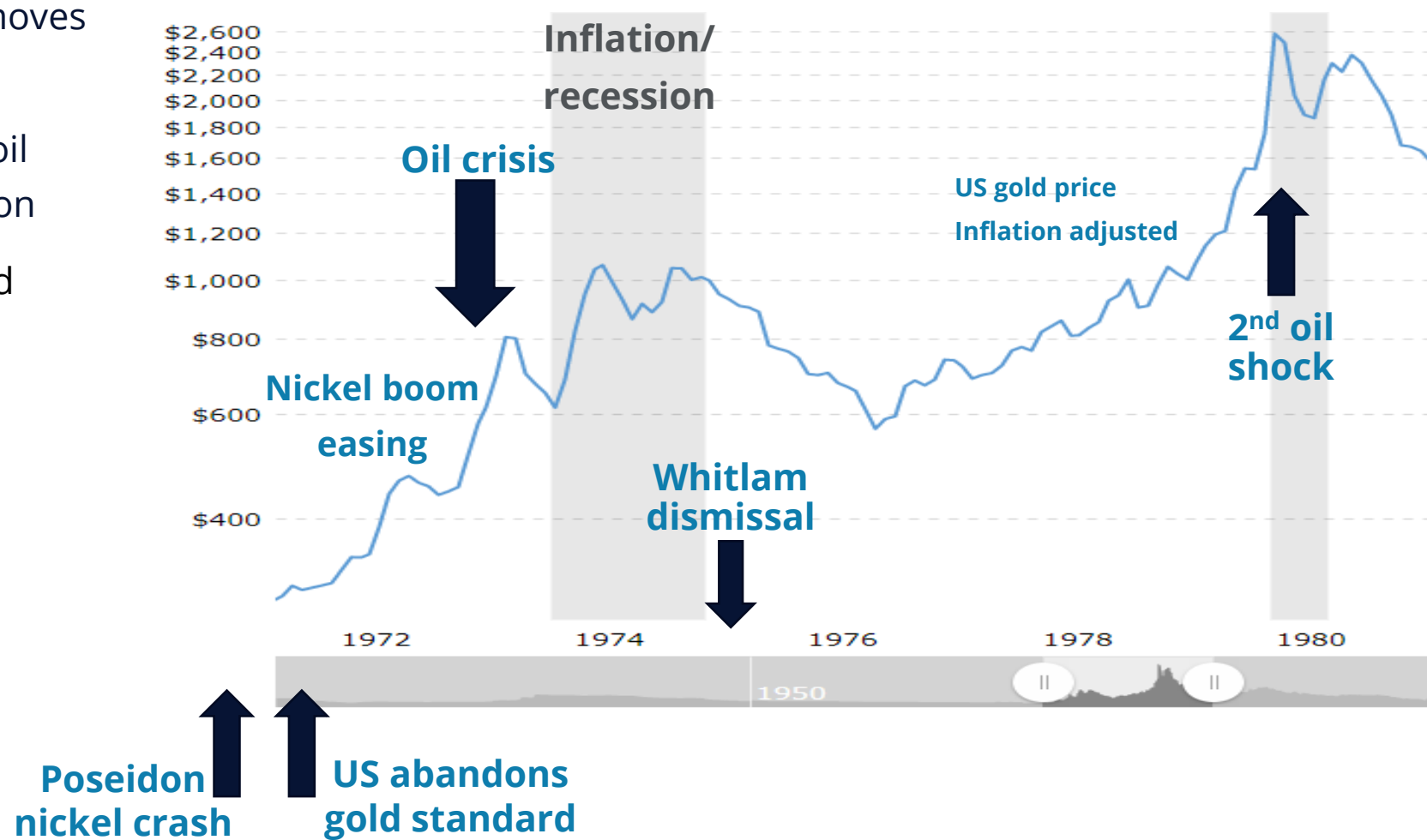
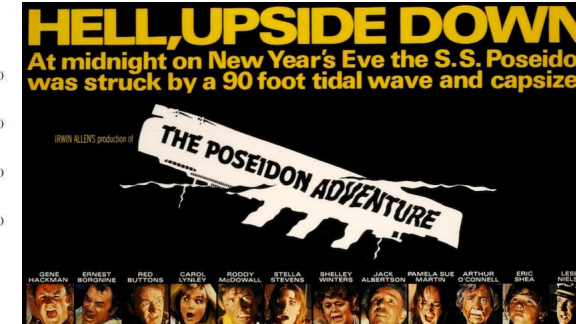
NEWMONT CORPORATION



Discoveries through
the decades:
1970s

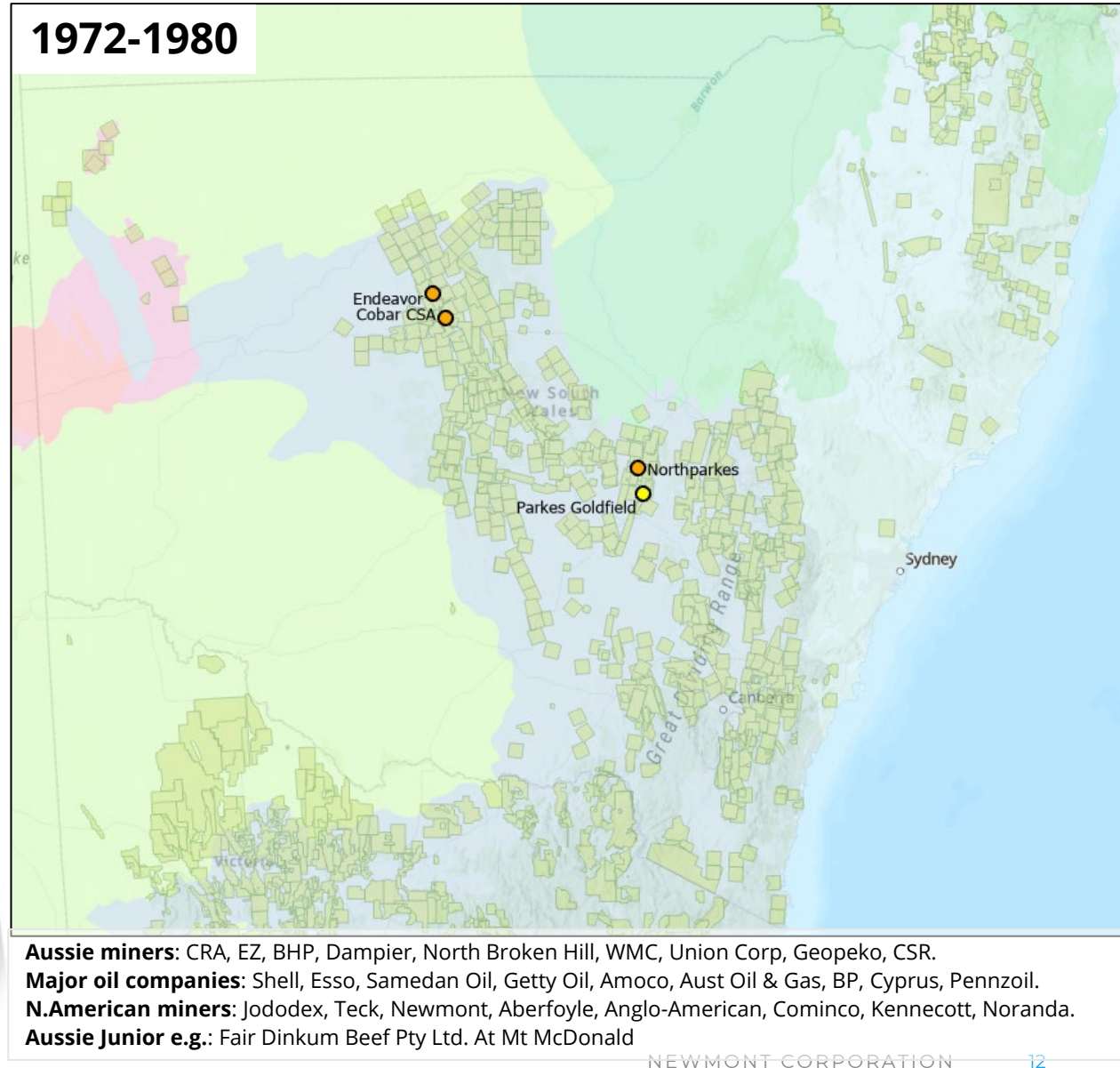
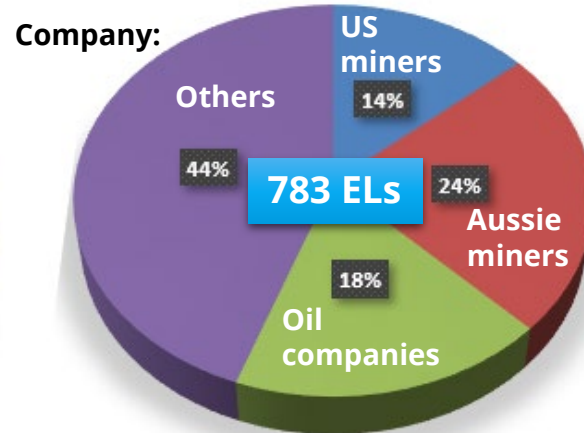
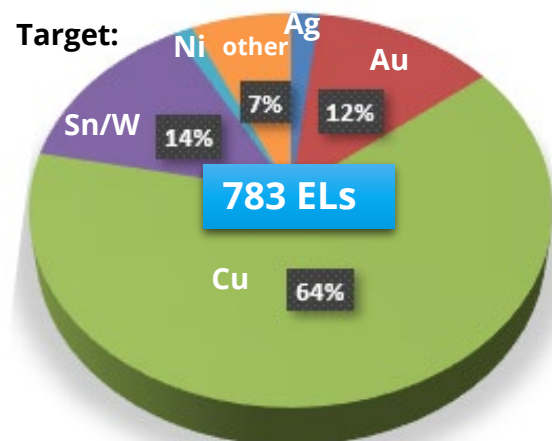
Living in the 70s

- **1970** Easing of nickel boom, but Cu/Zn/Pb strong
- **1971** US dollar de-couples from gold
- **1972** Britain joins EEC- Australia slowly moves trade to Asia (esp. Japan)
- **1973** Saudi oil crisis- leads to recession, oil companies diversify into metal exploration
- **1979** 2nd oil shock sends investors to gold



Living in the 70s: NSW

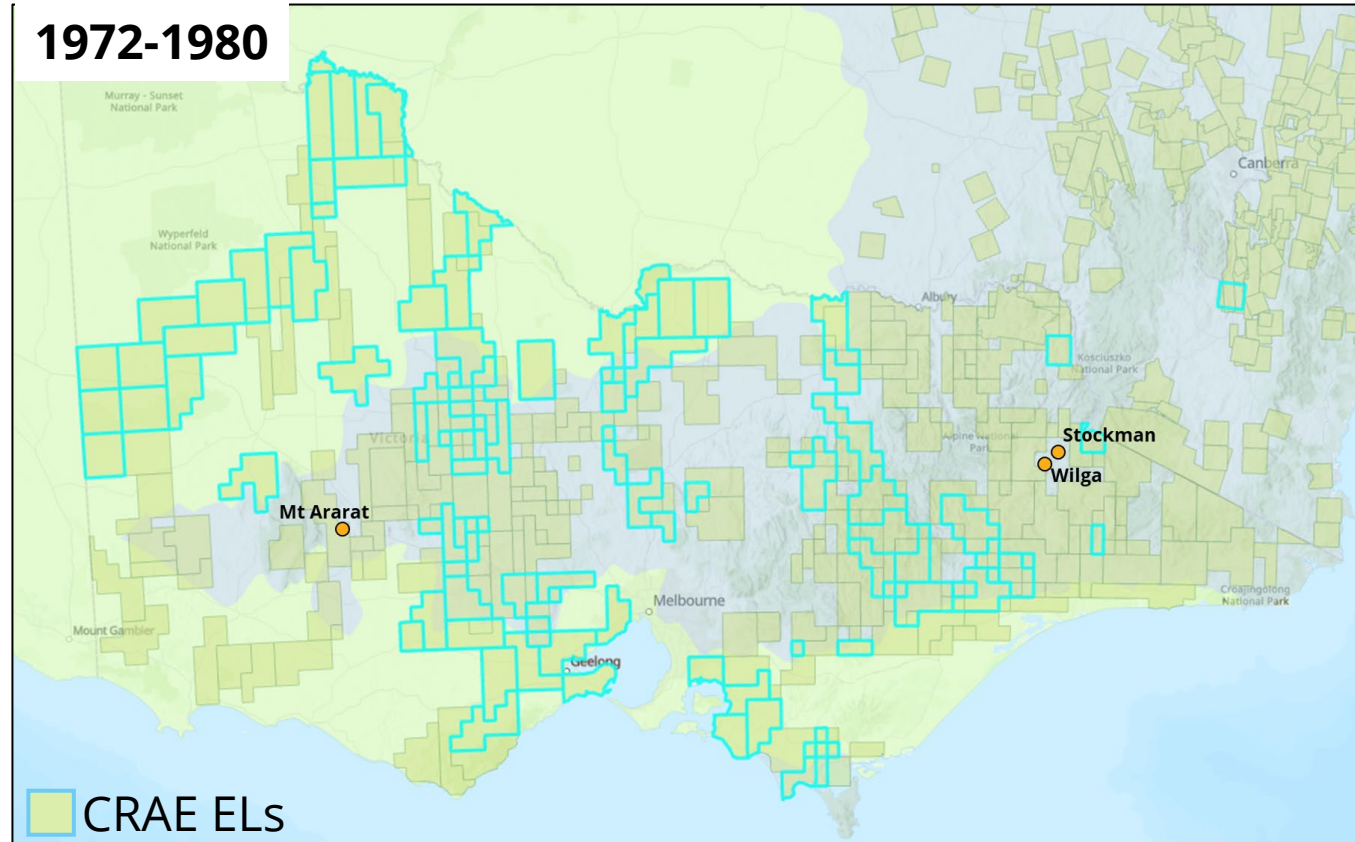
- 783 hard-rock mineral tenements
- Metals sought: 15 Ag, 97 Au, 671 base metal (mostly Cu, Sn)
- **1973** EZ discover blind target Elura using aeromag
- **1976** Geopeko discover Northparkes E26 using scout drilling and recognition of potassic alteration. Further porphyry fingers discovered in **1977** (E22, E27)



Living in the 70s: Victoria



- CRAE with ~50% of ELs pegged, looking for gold, base metals, diamond, coal, heavy mineral sands.
- **1972** Mt Ararat Besshi-style VMS Cu-Au-Zn-Ag discovered by WMC using airborne EM to follow up gossans.
- **1978** Wilga and Stockman (1979) VMS deposits discovered by WMC in the Victorian Alps – southernmost Silurian rift basin. Used stream sediments followed by new time domain moving-loop TEM.



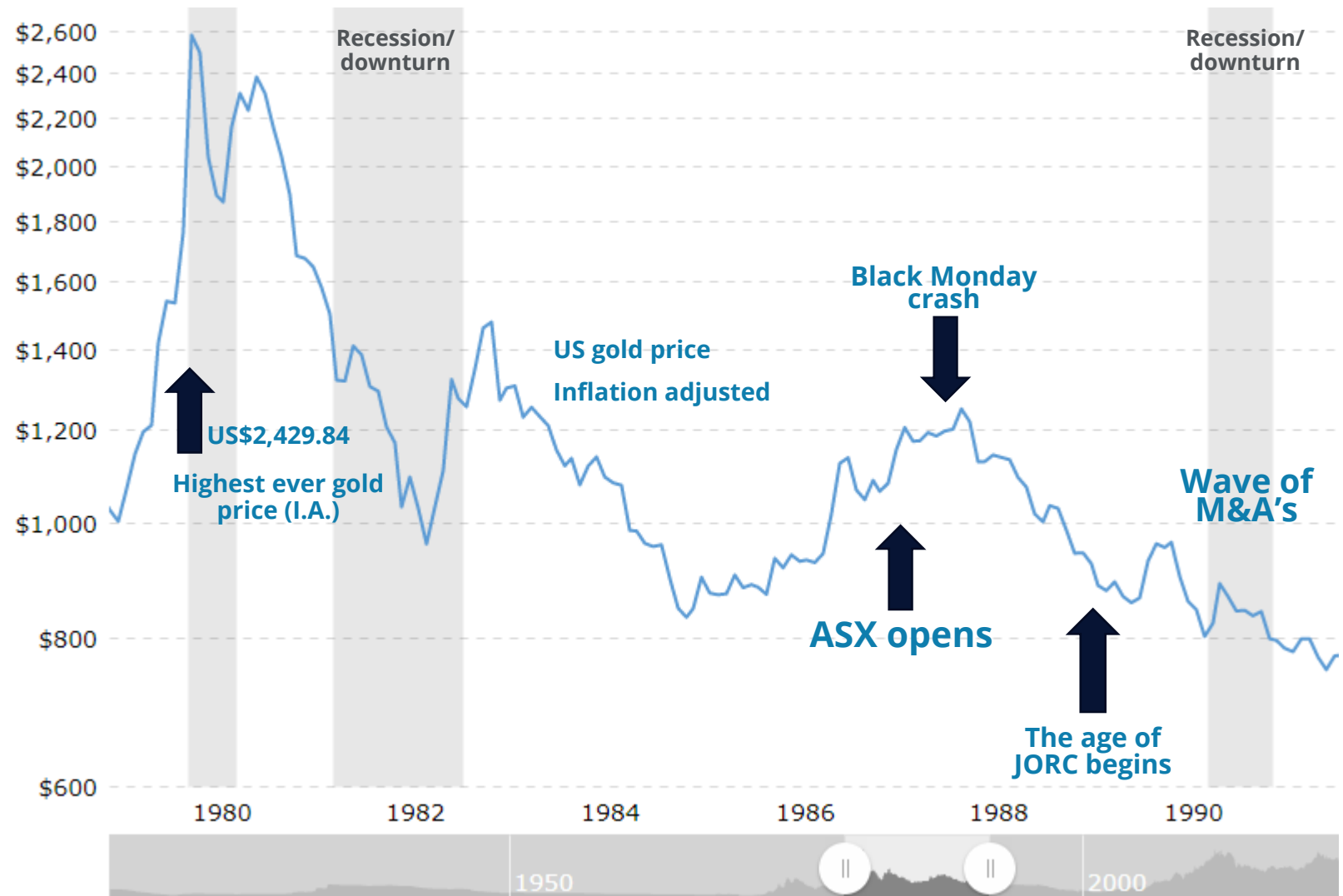
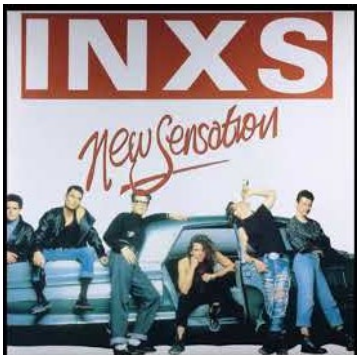


Discoveries through
the decades:
1980s

A new sensation in the 80s: gold



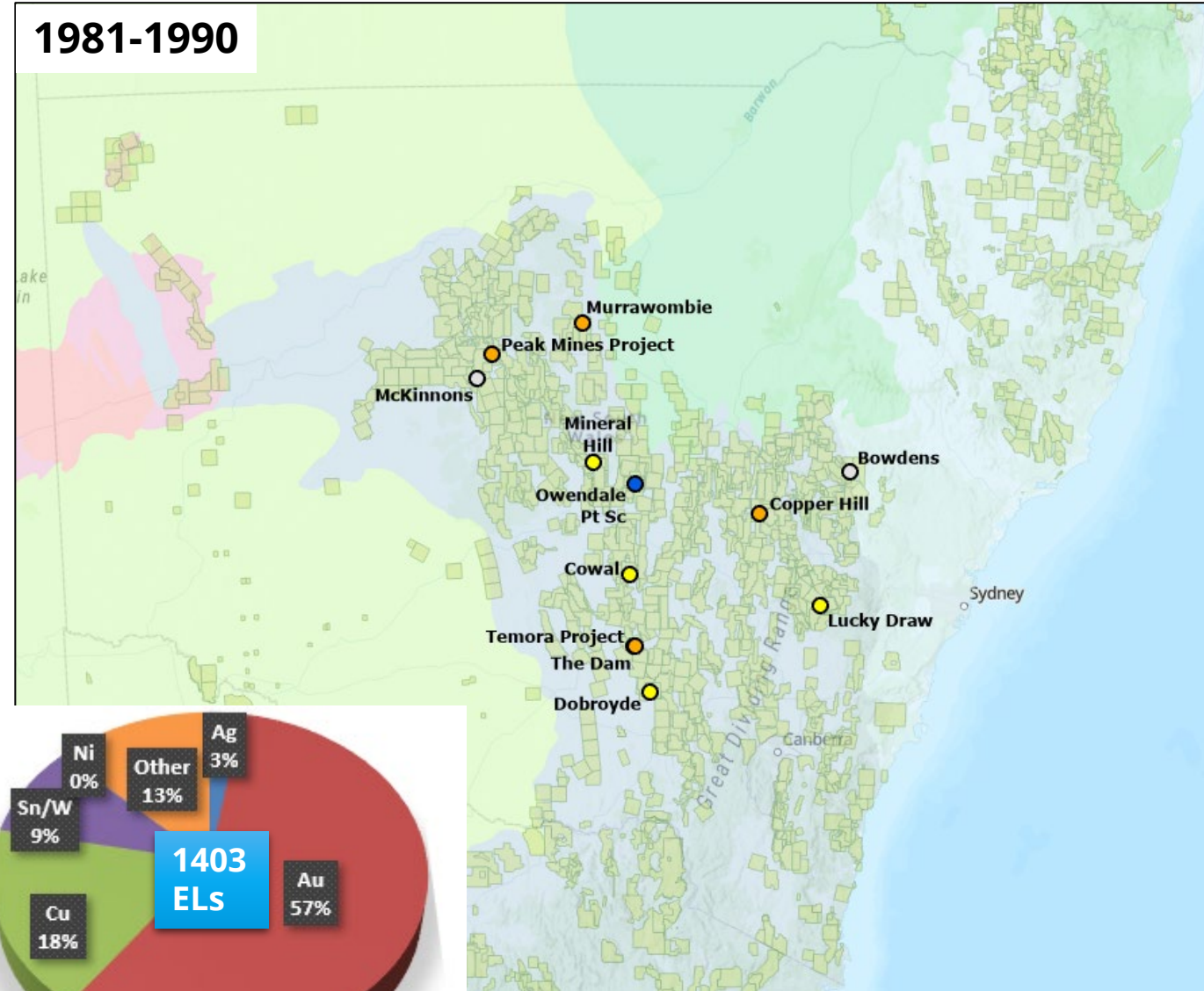
- Carbon-In-Pulp, CI-Leach, CI-circuit technology becomes mainstream
- New open-cut mining technology
- FIFO introduced
- **1987** Australian Stock Exchange Ltd (ASX) formed 1st April- amalgamating 6 capital city markets
- **1987** Black Monday stockmarket crash in 1987, drop in gold price
- **1989** JORC introduced



A new sensation in the 80s: gold, NSW

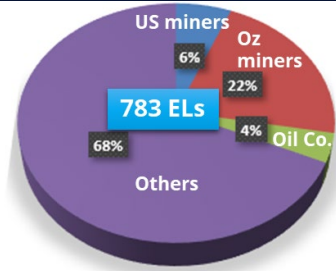
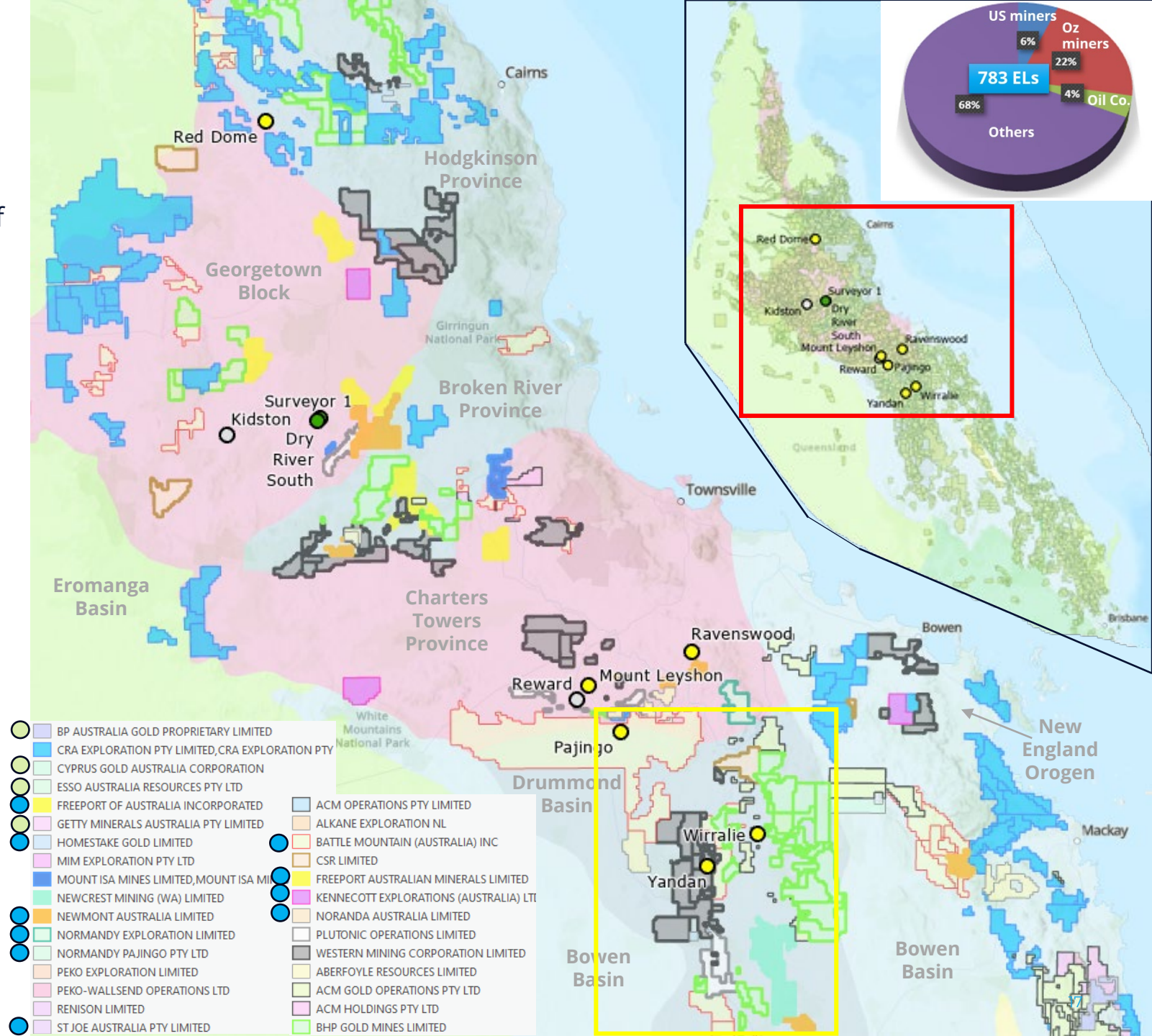
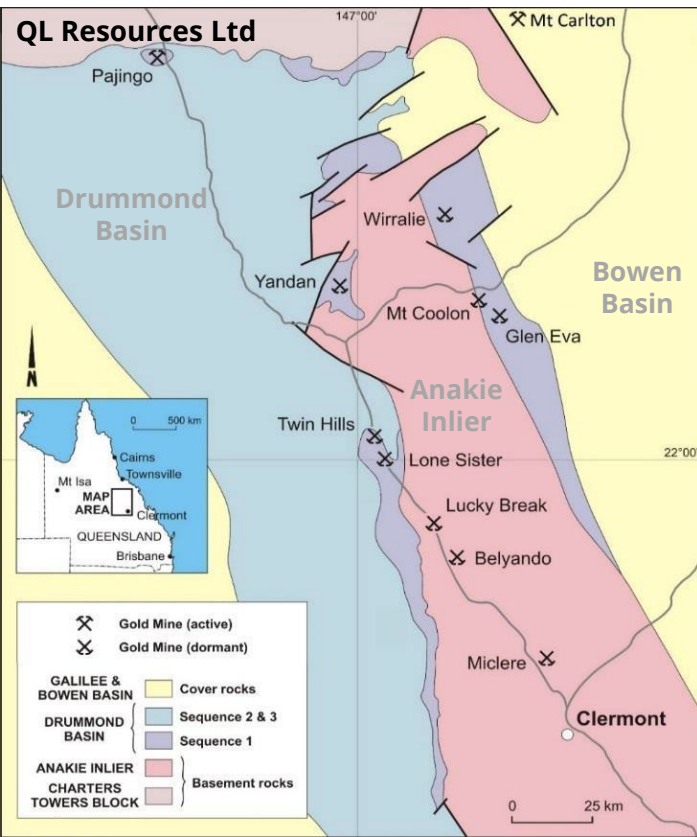


- **1983** Seltrust discovers Gidgingbung
- **1985** Getty Oil discovers Dobroyde using Gidginbung epithermal model
- **1985** RGC discovers Lucky Draw after winning the title in a coin toss
- **1986** strikes in South African mines spike the Pt price. 51 Pt ELs pegged in NSW. Juniors in Fifield Arc and Peel Fault, e.g. Helix, Platsearch, Mumbil
- **1988** discovery of Cowal by Geopeko using Northparkes model
- **1989** CRA discovers Bowdens, drilled out by Silver Standard



1980s: Qld

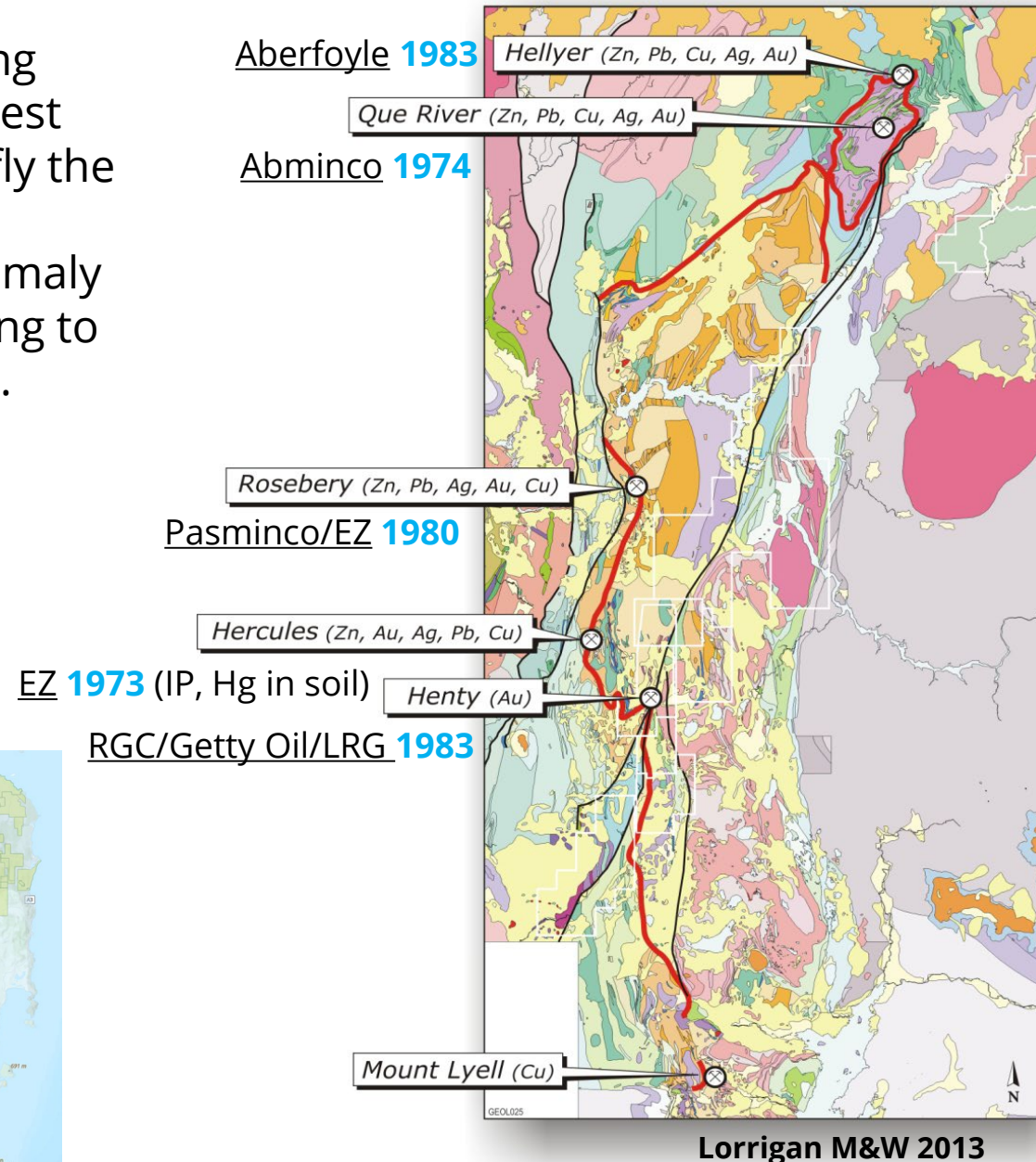
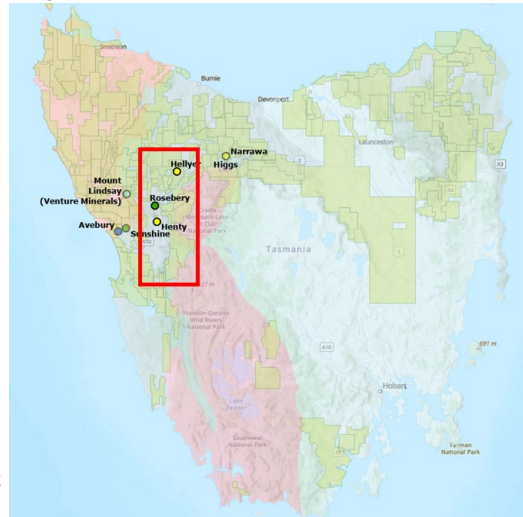
- Charters Towers Province: Outcropping Qtz-gold discoveries by e.g. by Noranda at Mt. Leyshon (**1983**), Carpentaria at Ravenswood (**1987**) and VMS by City Resources at Reward (**1987**).
- Drummond Basin: Pennzoil greenfields discovery of epithermal gold at Pajingo (**1984**), then Wirralie by ACM using stream sed (b>1985), Yandan by WMC using rock-chips (**1987**), and Qtz vein outcrops at Belyando (**1987**) in the Anakie Inlier.
- Avago Resources, Oarsome Resources- best Junior co. names.



1972-2000: Mt Read Volcanics, NW Tassie



- **1974** At Que River, Abminco received encouraging stream sediment results, however dense rainforest prevented follow-up sampling. They decided to fly the area with airborne EM which was a fledgling technique at the time, defining a conductive anomaly over the best stream sediment results and leading to the discovery of the first pyrite-chalcopyrite lens.
- **1997** Allegiance Mining discover Avebury nickel skarn deposit in a Cambrian ultramafic dyke system, deservedly winning the AMEC Prospector of the Year Award in 2007, although the discovery hole (3.9m @ 1.7% Ni) was drilled in 1997 by its then JV partner CRA.





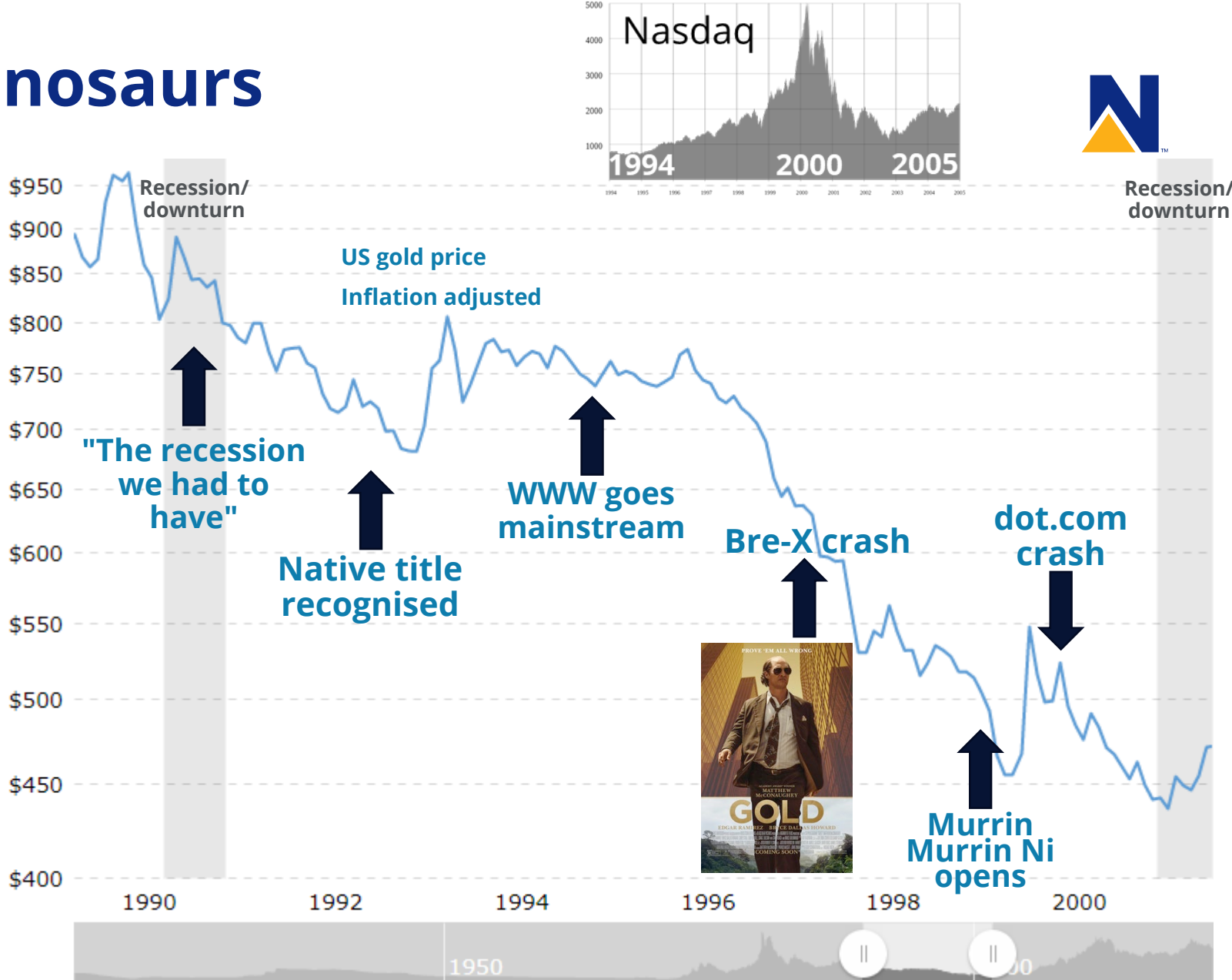
Discoveries through
the decades:
1990s

1990s: Juniors not Dinosaurs

- **Early 1990s** mergers, acquisitions, and spin-offs create a new mid-tier mining sector
- Rise in Junior sector: claims 11/20 Tasmanide discoveries in 1990s
- **1994** Geo-survey exploration initiatives seed the era of collaboration
- **2000** dot.com crash sparks gold sell-off, junior capital drought, end mid-tiers, 40% expl. budget o/seas.



50 years Tasmanides mineral exploration 25.08.2022



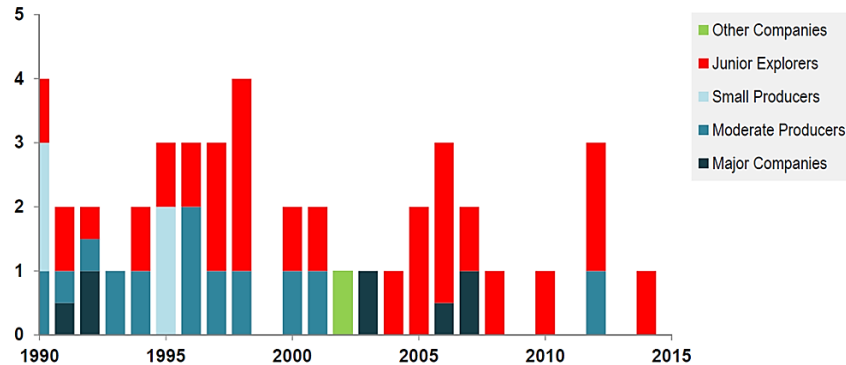
Gold resources go from 2,129 t in 1990 to 4,404 t in 1998, much in oxidised ore. Many lateritic gold deposits were mined in the 1990s

(Australian Mining Industry, 1998-99, ABS Catalogue No. 8414)

1990s: Juniors not Dinosaurs, NSW

- **1993-1996** Newcrest discover Cadia Hill (1993), Cadia East and Ridgeway (1996) showing great persistence gaining the ground, and commitment to deep drilling.
- Gold-rich porphyry discoveries at Cowal, Cadia, Northparkes E48 (North, **1992**), and Marsden (Newcrest **1997**) focus the search for in the East Lachlan.
- Nickel laterite discoveries by Anaconda at Nyngan (1995), and Jervois Mining at Lake Innes (1996) and Young (1998).
- The **2000** dot.com crash led to the loss of Australian mid-tier gold producers via a series of takeovers by North American and South African majors, leaving the risky business of new discoveries to the junior sector.

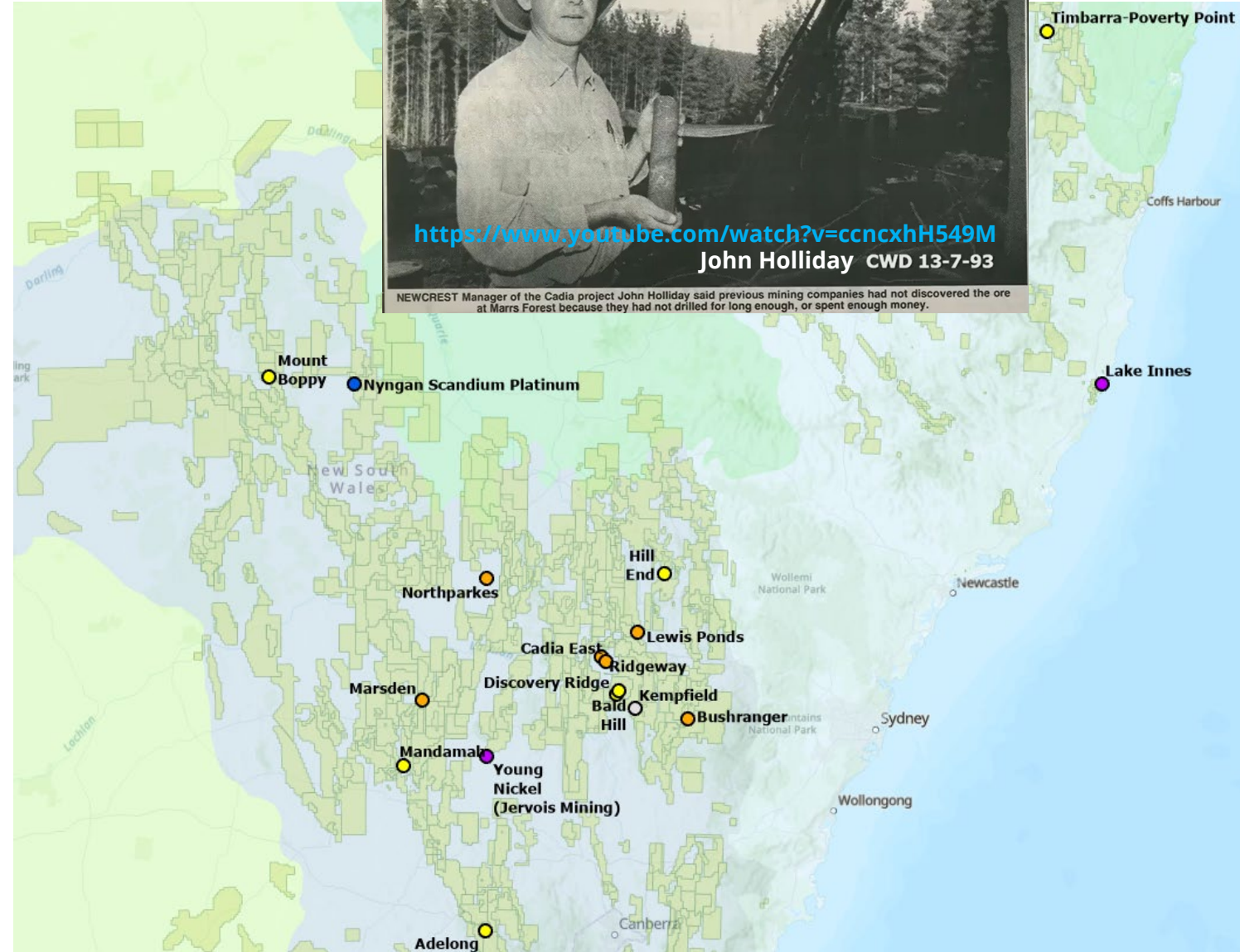
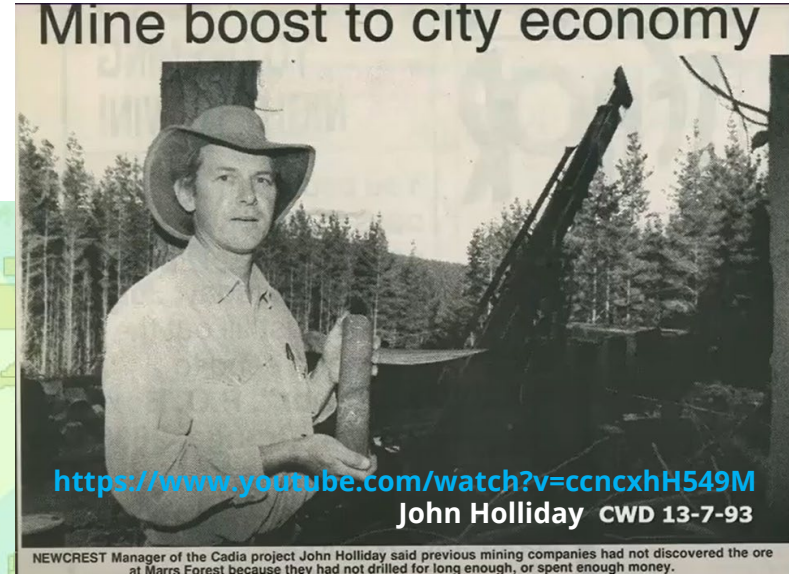
Number of NSW Discoveries



Note: Excludes satellite deposits within existing Camps. Also excludes Bulk Mineral discoveries.

Giant >6 Moz Au, >1 Mt Ni, >12 Mt Zn+Pb, >5 Mt Cu equiv
Major >1 Moz Au, >100 Kt Ni, >2.5 Mt Zn+Pb, >1 Mt Cu equiv
Moderate >0.1 Moz Au, >10 Kt Ni, >0.25 Mt Zn+Pb, >0.1 Mt Cu equiv

Source: MinEx Consulting © June 2015



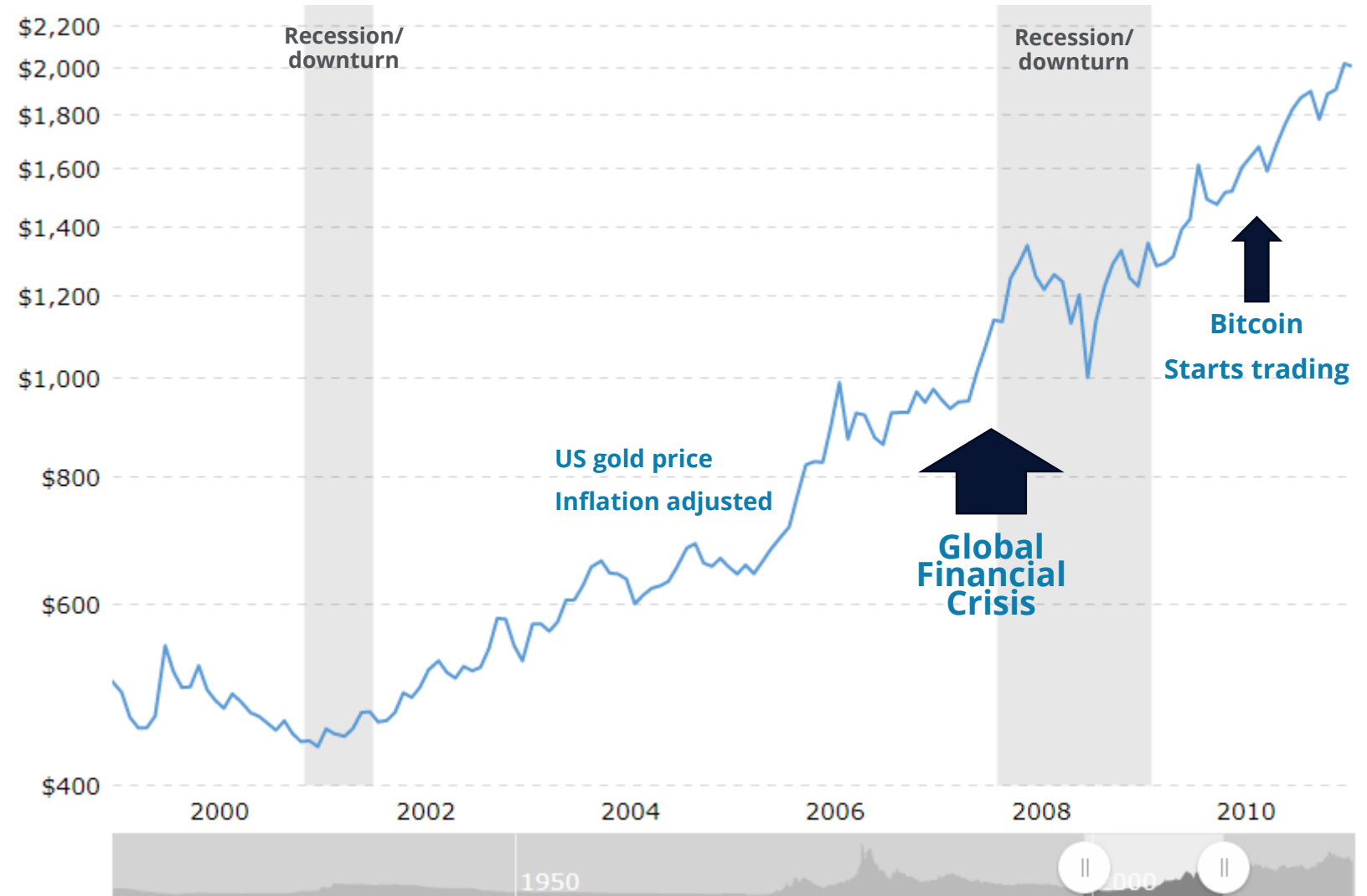


Discoveries through
the decades:
2000s

2000s: lets get the party started

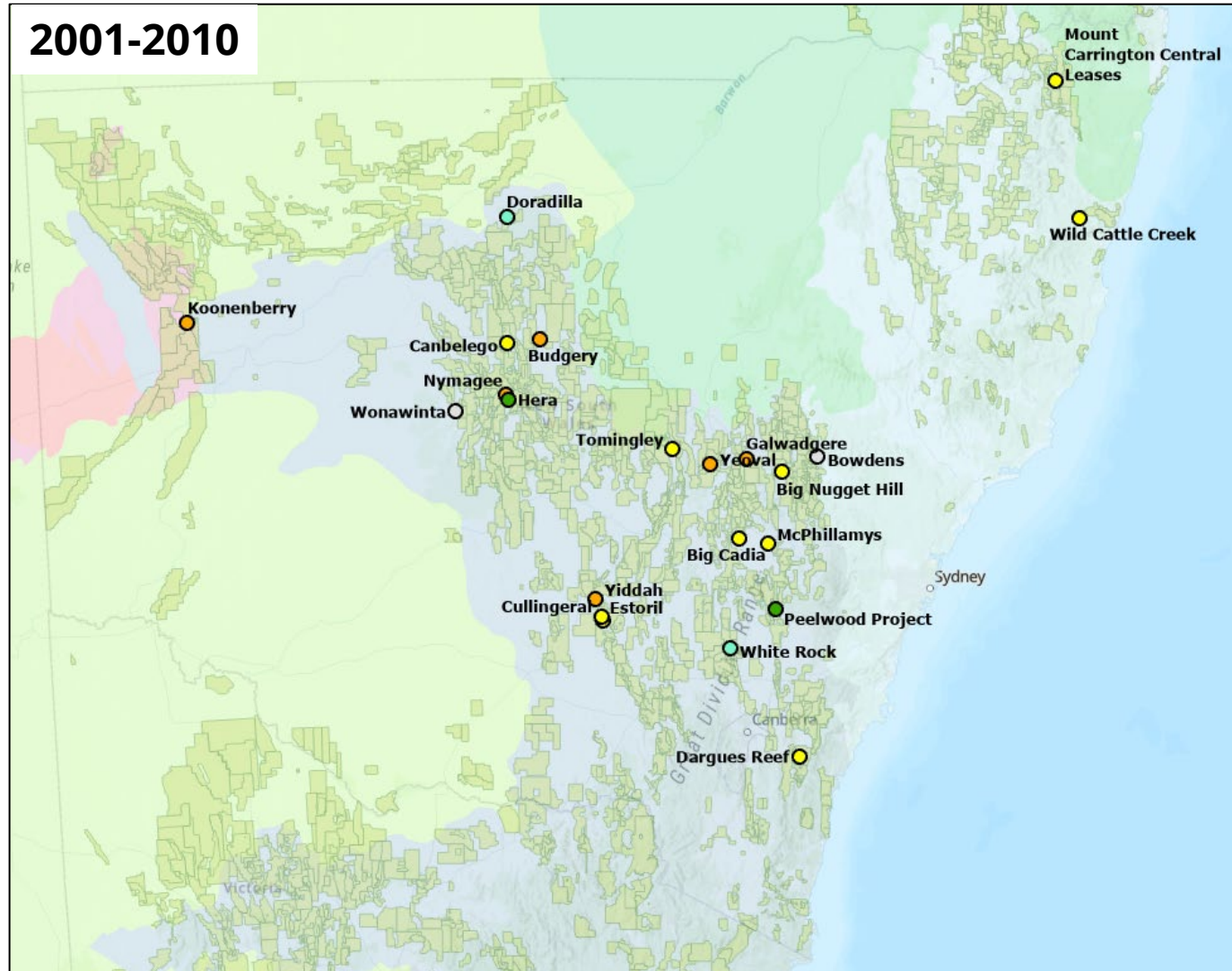


- **2000-2010** China's share of world mineral imports goes from <1% to 42%. Boom!
- Junior sector dominates ASX listed materials companies
- China's continued growth plus increased tin% in solder for electronics manufacturing takes the price of tin from US\$6,500/t in **2005** to ~US\$32,000/t in **2011**.
- **2007-2008** Global Financial Crisis, Party over.



2000s: lets get the party started NSW

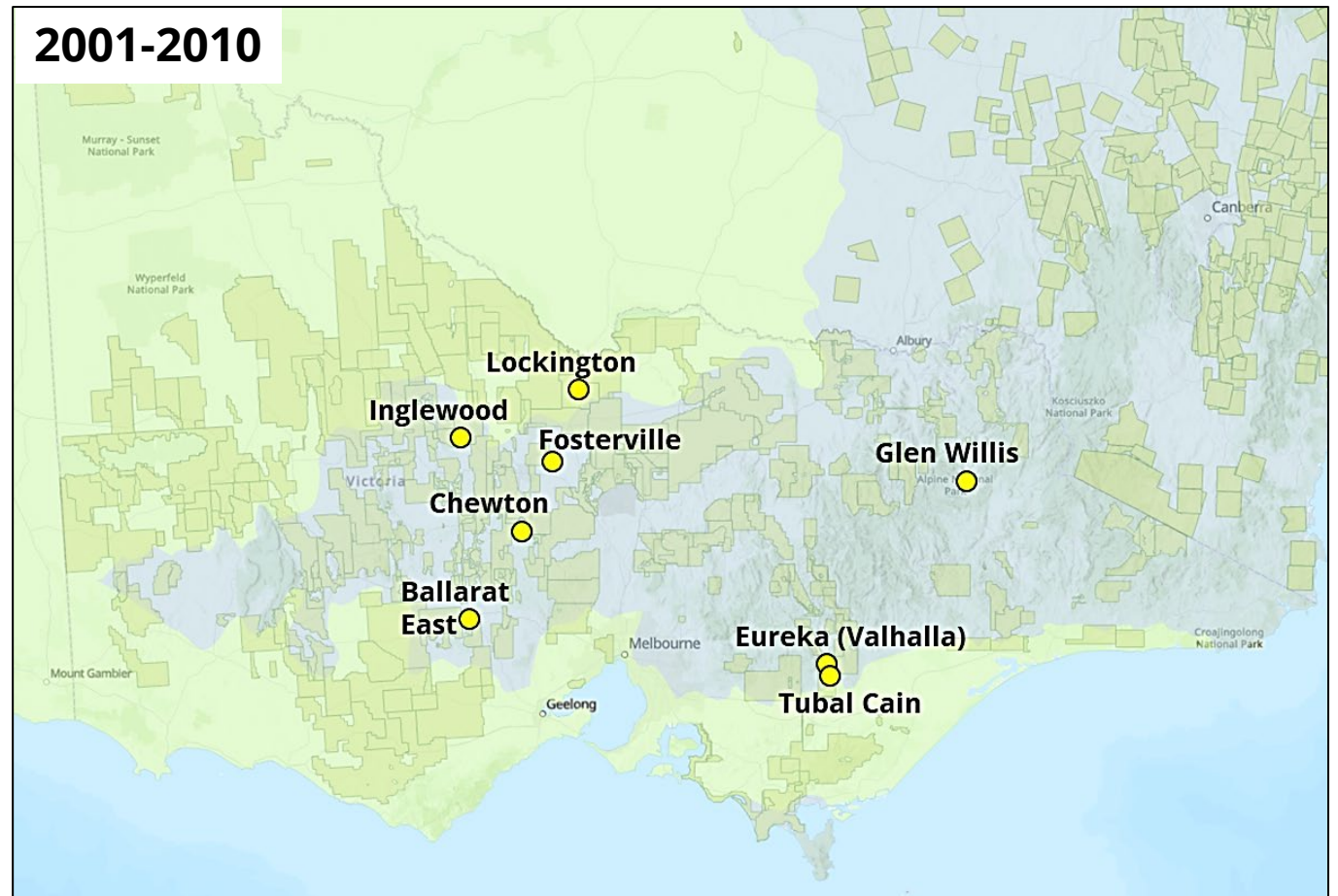
- 1996-2005: Alkane's Peak Hill oxide gold mine ran its course, with the profit going back into the ground, discovering the Tomingley orogenic gold deposit in 2001.
- Newmont and Alkane discover McPhillamys shear-hosted gold deposit after following up Hargraves Resources regoleach gold-in-soil anomalies. After defining the McPhillamys resource in 2010, it was sold to WA mid-tier Regis Resources in 2012, with the proceeds used to develop the open-cut gold mine at Tomingley-just up the road from its Peak Hill mine which was by that time in care and maintenance. ASX shares in Alkane went from 12c in 2000 to \$2.15 in 2011.
- Goldminco (Straits Resources subsidiary) had success in on their Temora project exploring the Ordovician Macquarie Arc belt north of the Gidgingbung high sulfidation epithermal gold mine. Estoril, Yiddah and Cullingerai Cu-Au porphyry prospects were all discovered in the mid-2000s and extended the known Cu-Au porphyry prospectivity south of Cowal gold mine along the Gilmore Fault Zone.
- Release of new aeromag in the southern Thomson Orogen and geological mapping in the Koonenberry Belt opened up this frontier from 2006. Black Range minerals worked up a JORC resource of 5.75 Mt @ 1.03% Cu at the historic Grasmere Beshhi style VMS deposit in the Koonenberry Belt.



2000s: lets get the party started Victoria



- Brownfields gold discoveries near Ballarat (Ballarat East, 2003), Wattle Gully (Chewton, 2008) and Bendigo (Inglewood, 2008).
- Perseverance Corp. defined a sulfide resource at Fosterville in 2001 and starting mining in 2005 using a novel bacterial leaching plant to process the refractory arsenopyrite.
- Gold Fields Australasia used geophysics and soils for a virgin gold discovery of Lockington in 2004, under 40-100m of Murray basin cover north of Fosterville.



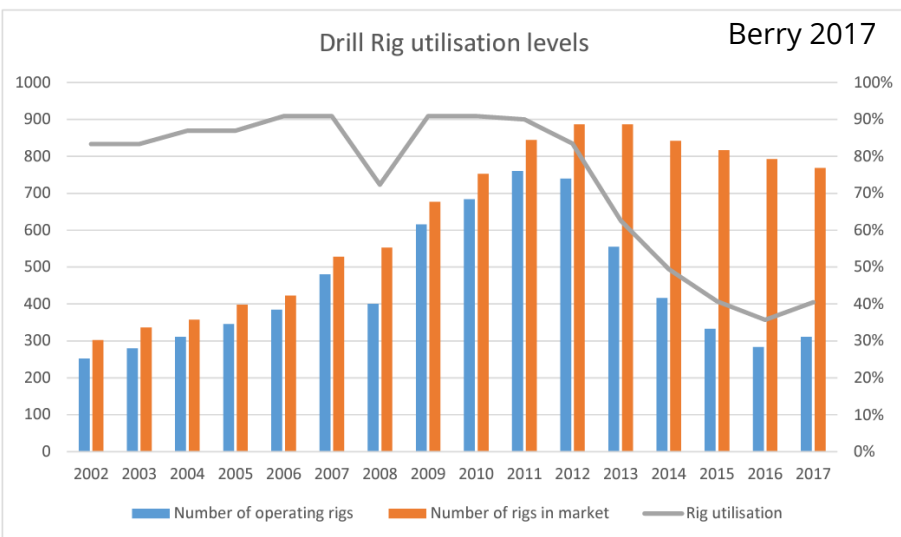
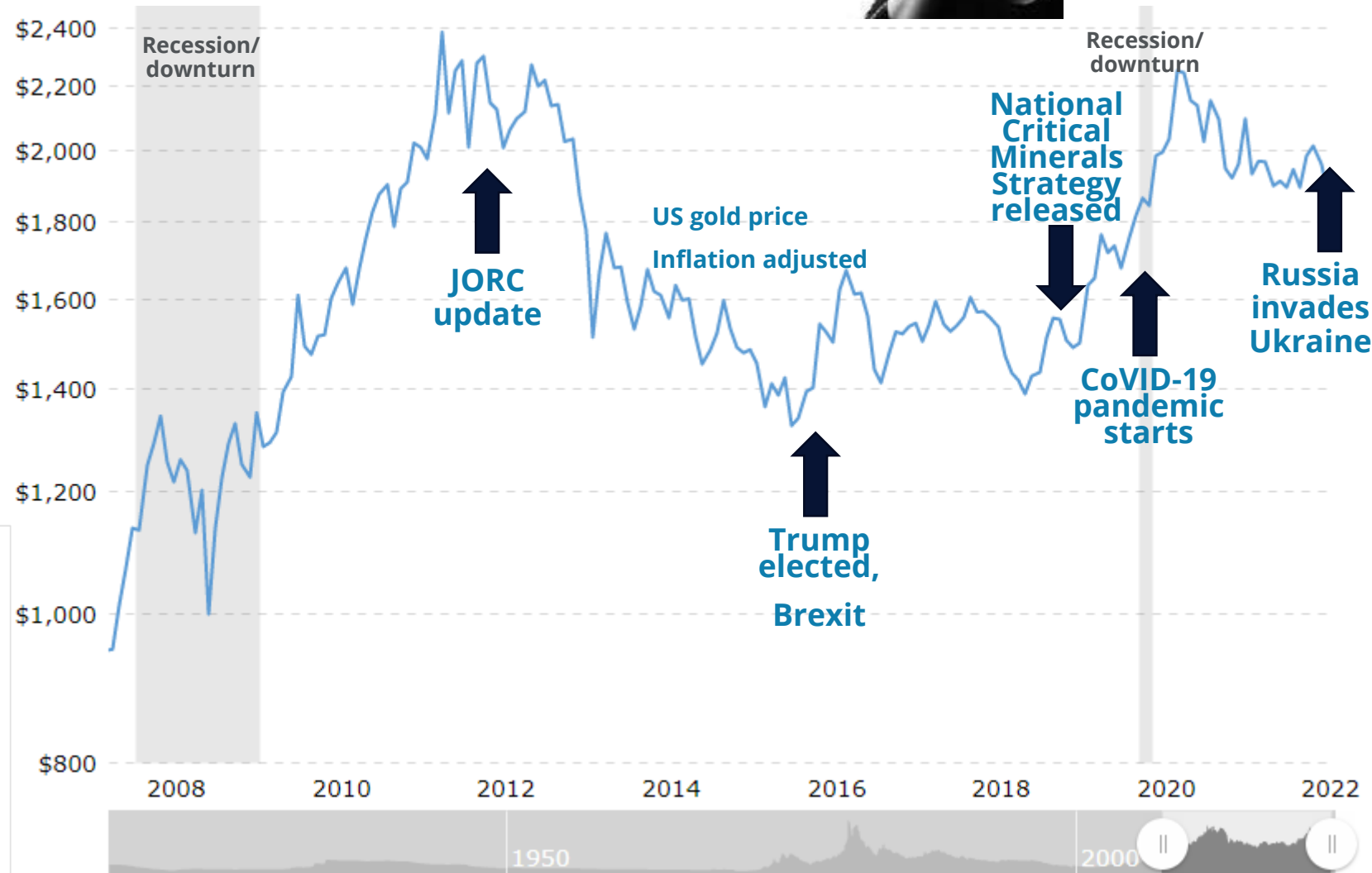


Discoveries through
the decades:
2010s

Rolling in the deeps (2011-2022)



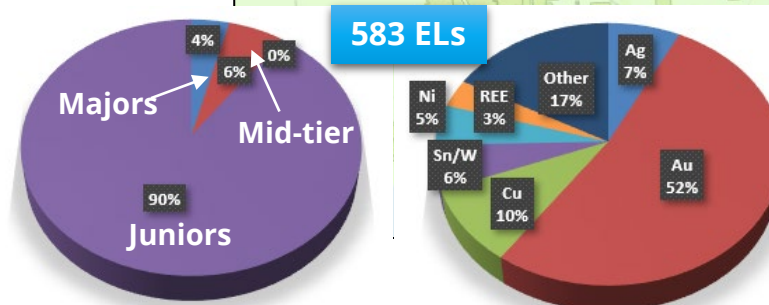
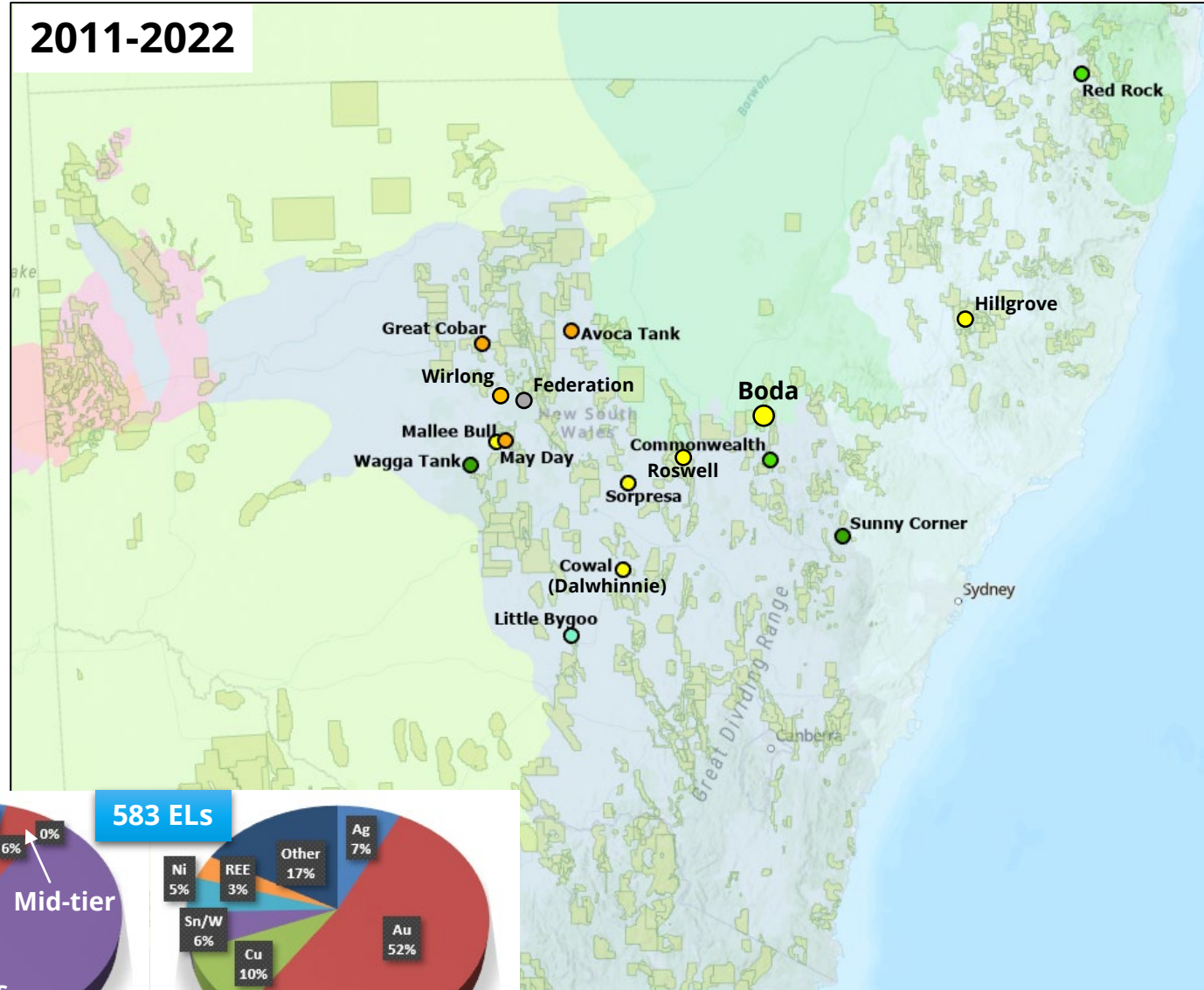
- **2009-11** strong rebound for the mining industry from the GFC, Chinese capital injection into Australian exploration/mining
- Exploration \$ reaches all-time highs but not discoveries
- **2012-2017** stagflation- retreat to brownfields exploration
- **2016** Britain votes to leave the European Union, Donald Trump in office pursuing trade tariffs. Free trade and globalisation on hold. In response the West seeks to secure supply of high-tech metals
- **2020** Australia and USA sign Critical Minerals action plan.
- **2020** Global Covid-19 pandemic- projects on hold, labour supply chains



Rolling in the deeps (2011-2022) NSW



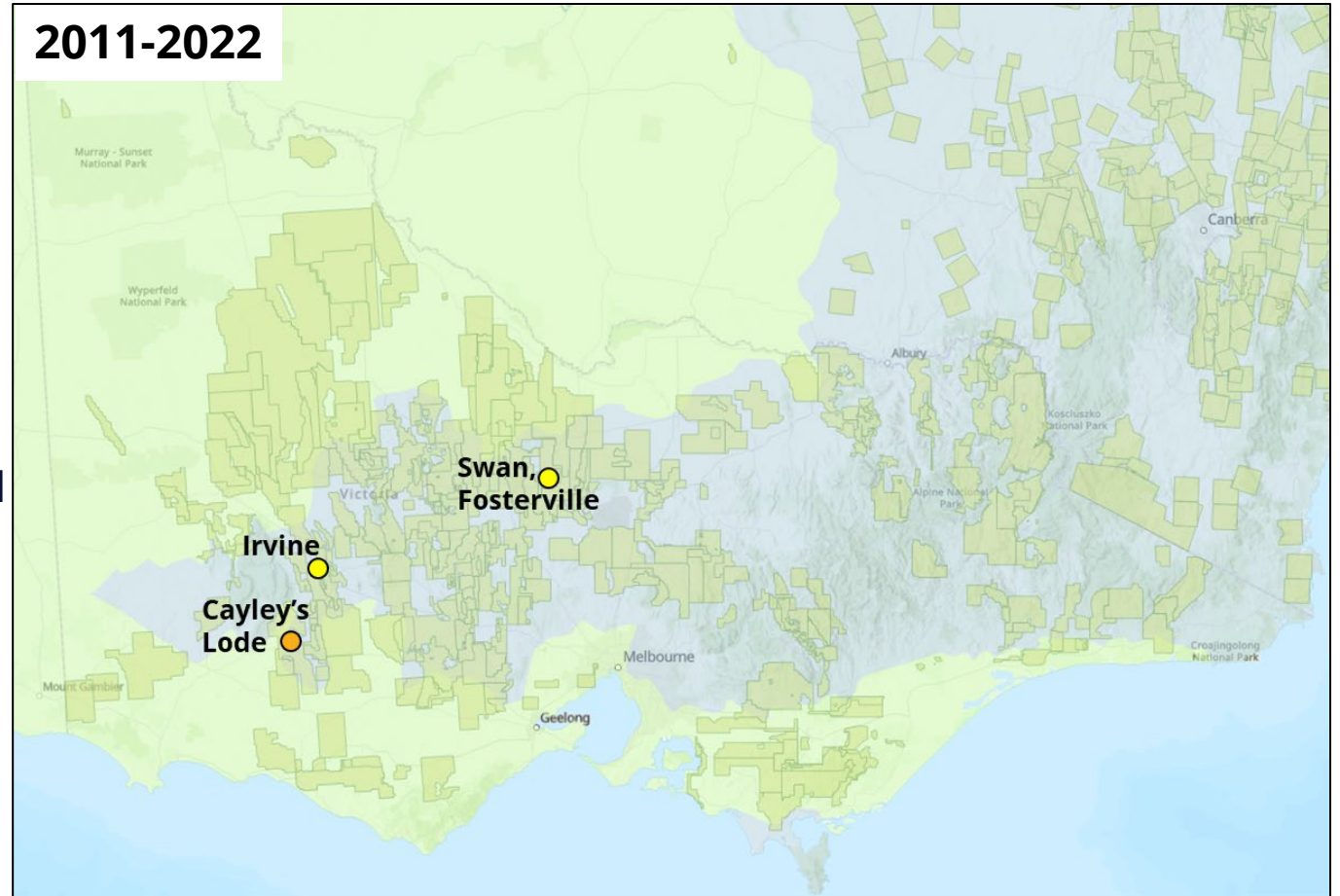
- Peel Mining peg out southern Cobar Basin making discoveries at Mallee Bull (2012), Wagga Tank (2020), May Day (2021) and Wirlong (2021).
- Aurelia Metals discovered base metal-gold rich Federation in 2019, just 10km from their operating Hera mine.
- Alkane Resources find and define southern extensions to their Tomingley gold mine with San Antonio and Roswell (2020).
- Alkane Resources also sink the discovery hole at the Boda porphyry Cu-Au prospect in 2019, and 71km of drilling later defined at 5Moz Au-Cu-Ag inferred resource in 2022.
- Boda discovery and Cadia AISC for gold lures in Anglo American, Anglogold Ashanti, Gold Fields, FMG, Freeport, Newmont into a crowded tenement space in the East Lachlan.



Rolling in the deeps (2011-2022) Victoria



- **2016** Swan Fault Zone discovery at Fosterville (including 8.6m @ 83.1g/t gold) by Kirkland Lake Gold.
- **March 2021** Navarre announced Maiden Mineral Resource at Irvine: 304koz at 2.4 g/t gold hosted on east flank of basalt dome. Found via Mag interp, outcropping gold, followed by AC program.
- **June 2022** Stavelly Minerals Cayley's Lode maiden resource: 9.3 million tonnes at 1.2% copper, 0.2 grams per tonne gold and 7.1g/t silver





**Discoveries through
the decades:
Summary**

Summary



- The gold/base metal discoveries in the Tasmanides since 1972 have created a healthy hard-rock mining industry in eastern Australia.
- The exploration techniques used haven't really changed for 50 years but technology has improved them.

1970s Ni boom easing, local+N.American miners and oil co.'s exploring for base metals.

1980s Rising gold price and activated carbon tech means gold becomes the #1 exploration target.

1990s Juniors become dominant explorers, gold still #1 target, Cadia discovered.

2000s Rise of China, Mining boom, GFC.

2010s Critical metals become a minor hard-rock target.

2020s Boda, Fosterville and Cayley's lode attract exploration boom in NSW and Victoria.

- Discovery rate in 50 years has been very healthy but declined in the last 20 years.
- A new funding paradigm for greenfields exploration is required for the next generation of Tier 1 discoveries.
- BHP's Explor program is an e.g. of support offered to junior critical metal explorers.



: Bloomberg; RBA; Thomson Reuters