



Government of **Western Australia**  
Department of **Mines and Petroleum**

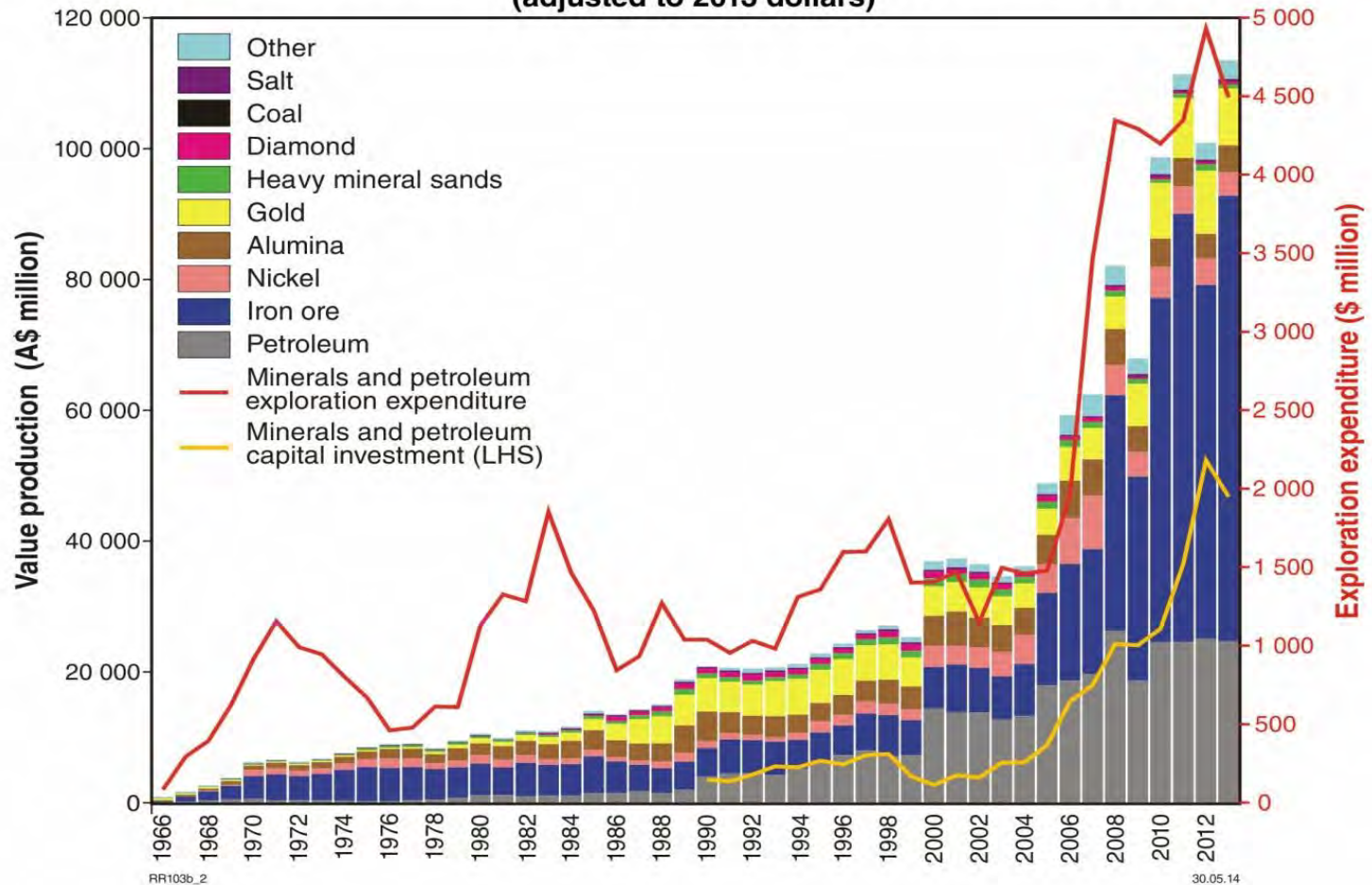
# Get with the Strength – Invest in Western Australia

Rick Rogerson  
Executive Director  
Geological Survey of Western Australia

Japan-Australia Mineral Exploration Investment Seminar, Tokyo 15 Oct 2014

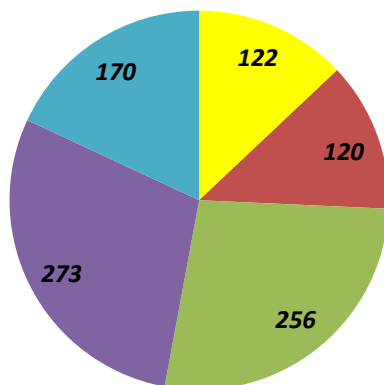
# Proven exploration, production & investment destination

**Minerals and petroleum production value and exploration expenditure (adjusted to 2013 dollars)**



# Gold industry shines

- WA's gold industry is going well despite general shortage of funding for exploration
- Currently 941 projects at various stages of development
- 50 new discoveries in the financial year 2013/14
- New gold province with major resource announced



Total: 941 projects

- Mines operating or under construction
- Pre-feasibility or Feasibility Study
- Advanced exploration
- Exploration
- Early exploration

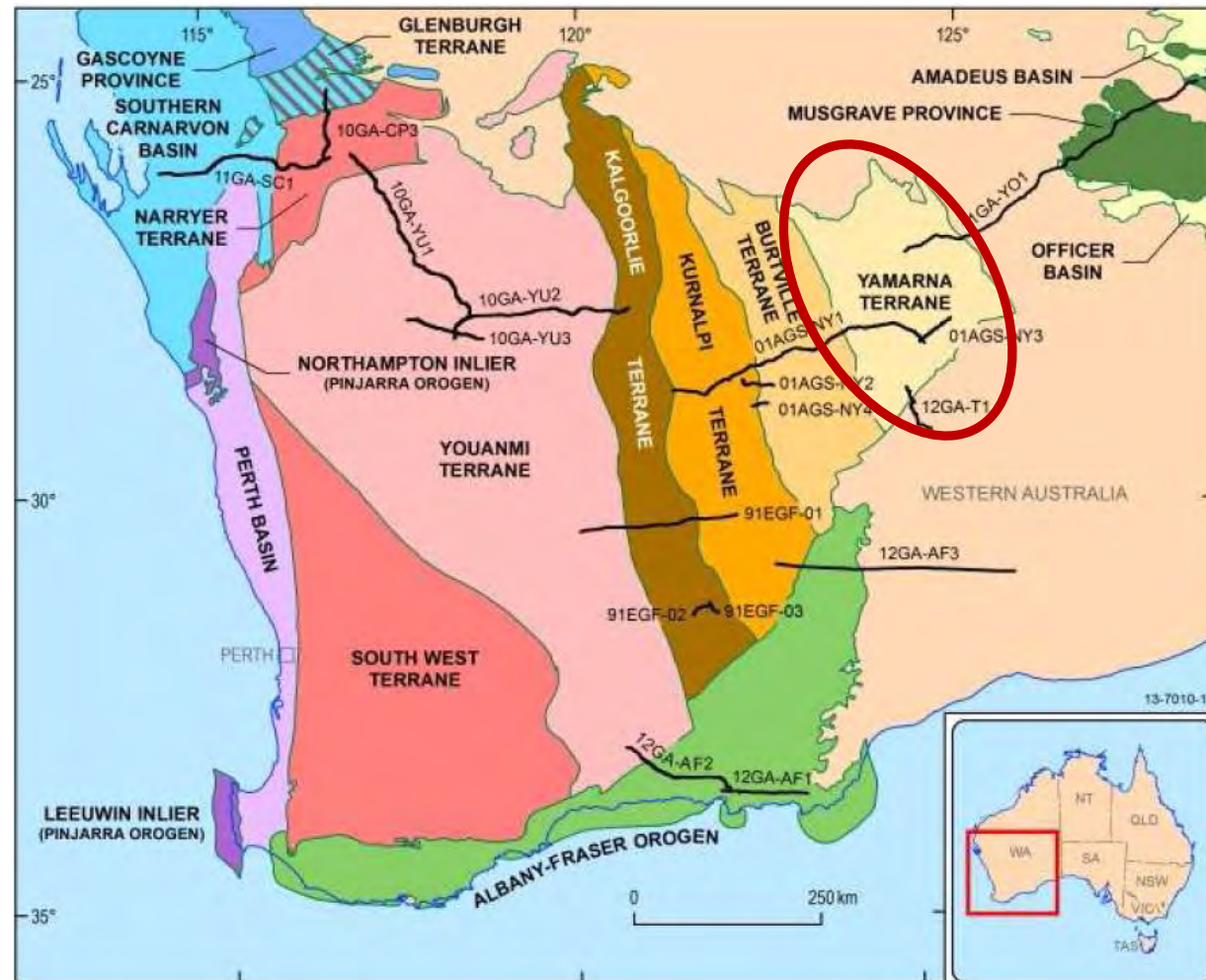
## 50 Au discoveries 2013/14





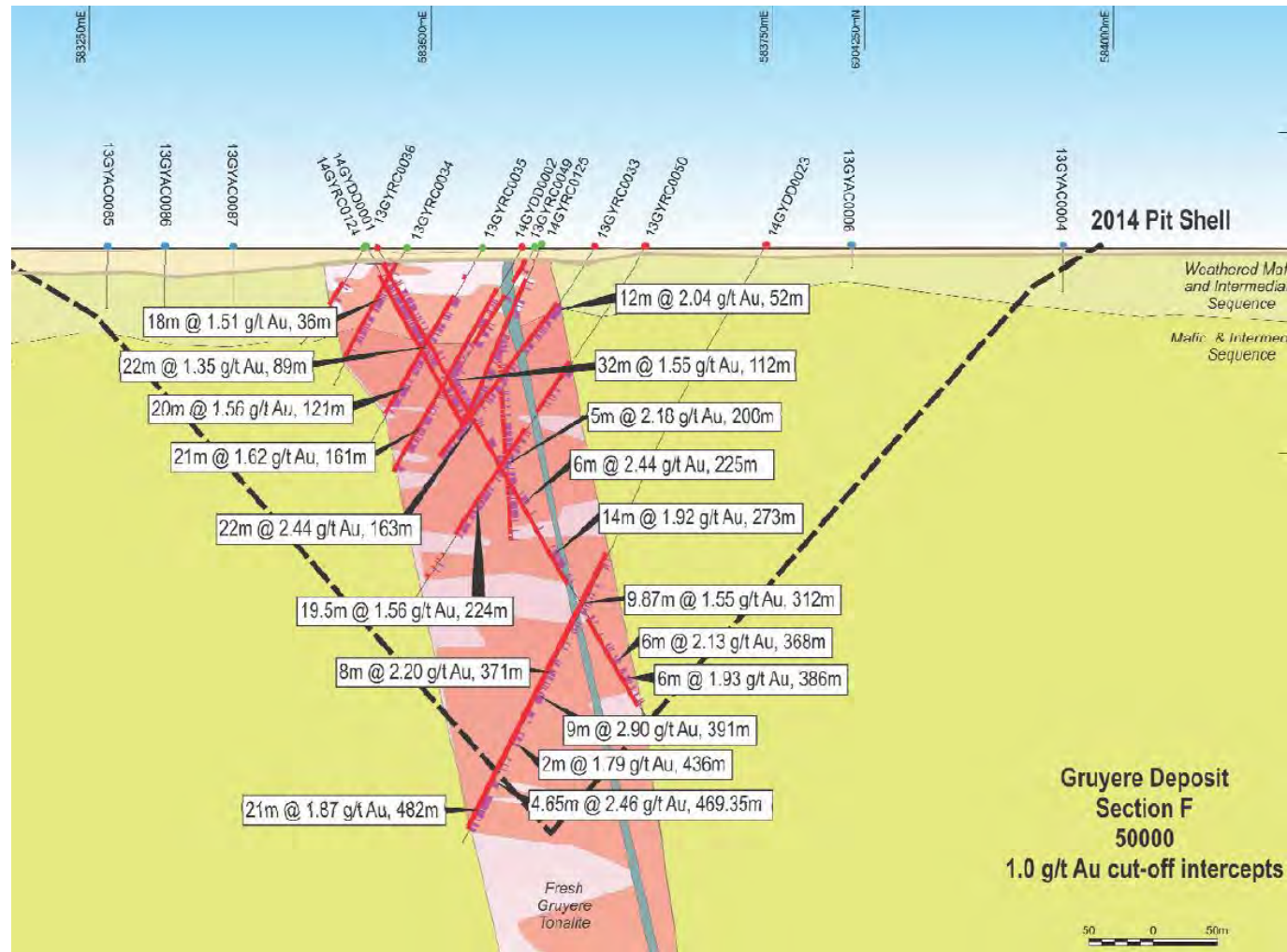
# New gold province discovered in 2012

- In 2013, Gold Road Resources Ltd firmly established the Yamarna terrane (Yilgarn Craton) as a new gold province
- Yamarna terrane is the same age as the Kalgoorlie terrane (greenstones from 2710 to 2635 Ma)
- Gruyere Au deposit discovered in September 2013
- Initial resource announced in early August 2014 of 3.84 million ounces (96.9 Mt @ 1.23 g/t Au)
- Gold Road has JV with Sumitomo in southern part of Yamarna terrane



# Gruyere proves WA's greenfields Au prospectivity

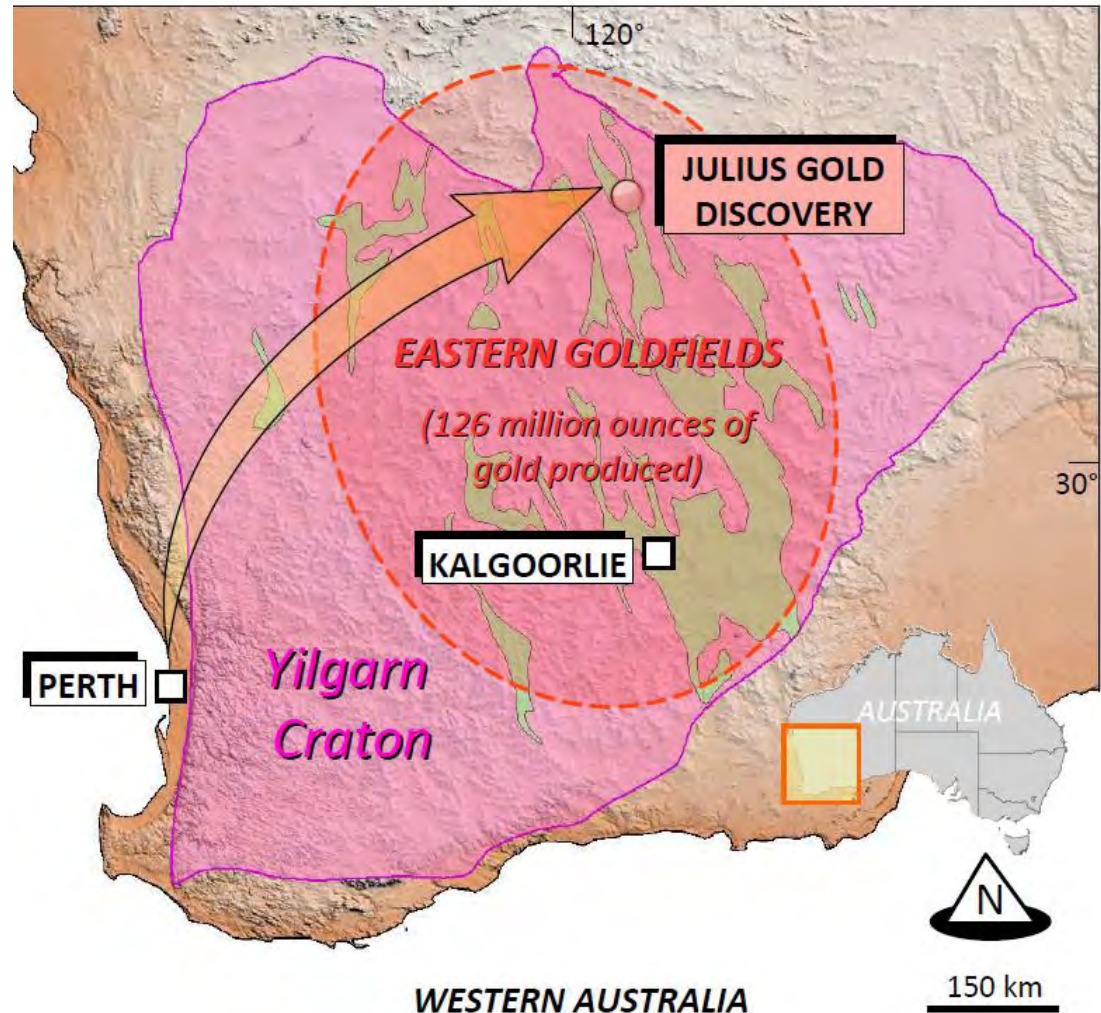
- The Gruyere discovery\* confirms WA's Au prospectivity and that large greenfields discoveries are still being made
- Company hopes to be constructing mine in late 2016
- Note: this project is not available for JV





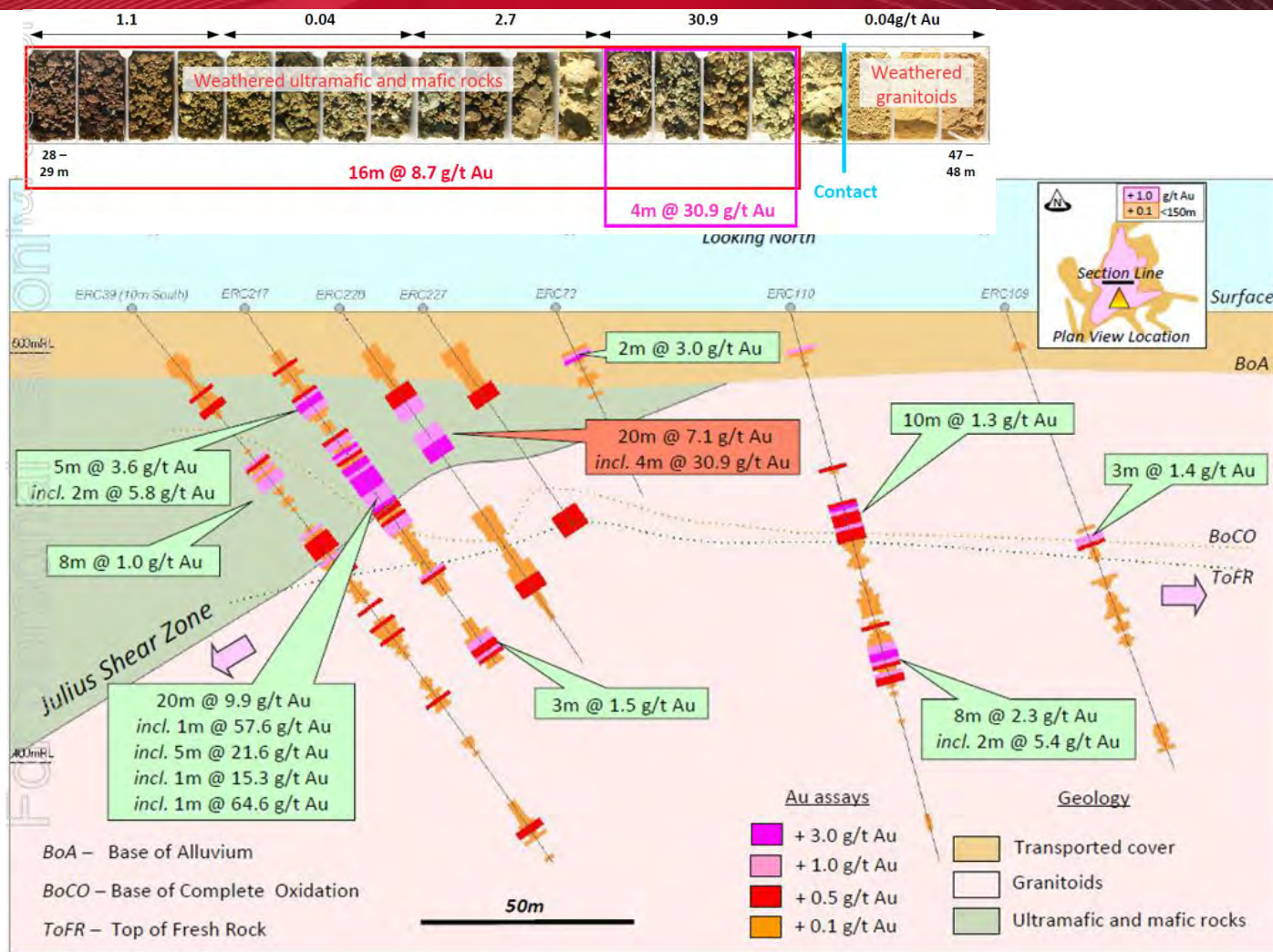
# Julius Au deposit: new deposit model in brownfields area

- Echo Resources Ltd have discovered the Julius Au deposit in the northern Yandal Greenstone Belt (Yilgarn Craton)
- A number of large, well-known mines in the Yandal belt
- Echo is exploring a number of other discoveries near Julius, some of which are marked by bismuth anomalies in soil.



# Julius Au: mineralisation at sheared boundary

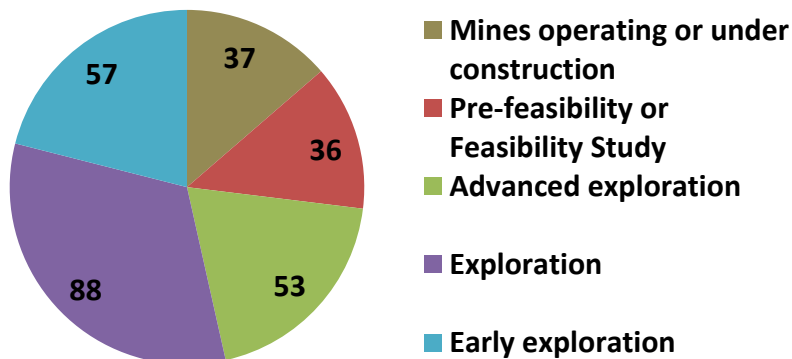
Long, very high grade gold mineralised drill intercepts occur through the sheared boundary between granite and ultramafics and basalts





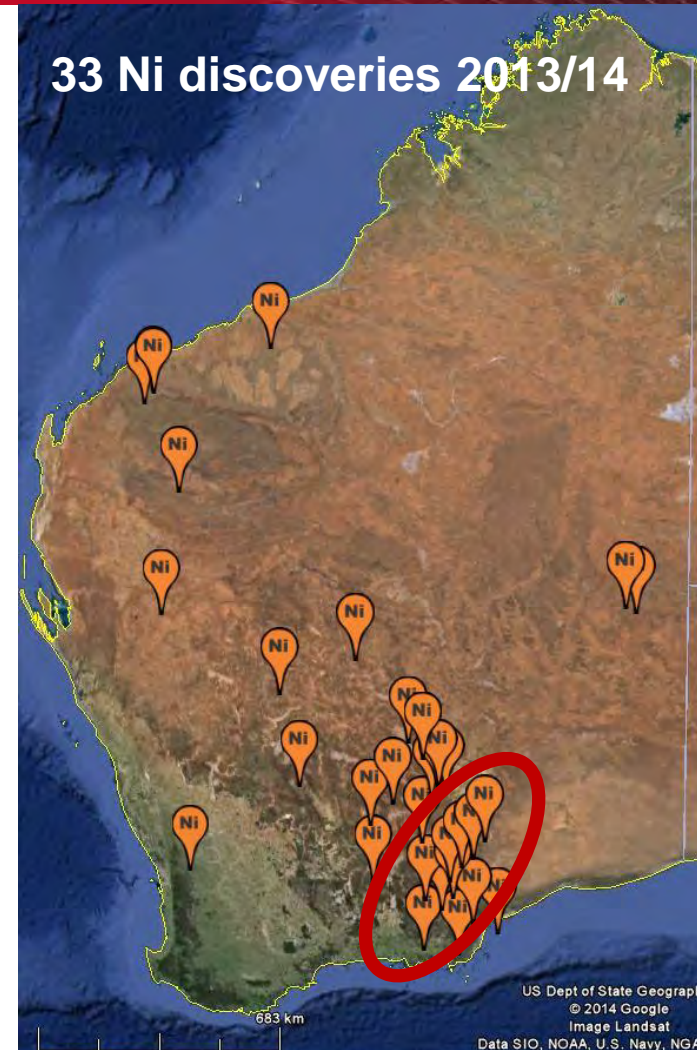
# New beginning for nickel in WA

- In 2012, a new nickel province was discovered under sand in the Proterozoic Albany-Fraser Orogen
- This discovery has sparked a major rush into the area by explorers for Ni, Cu and Pt



Total: 271 projects

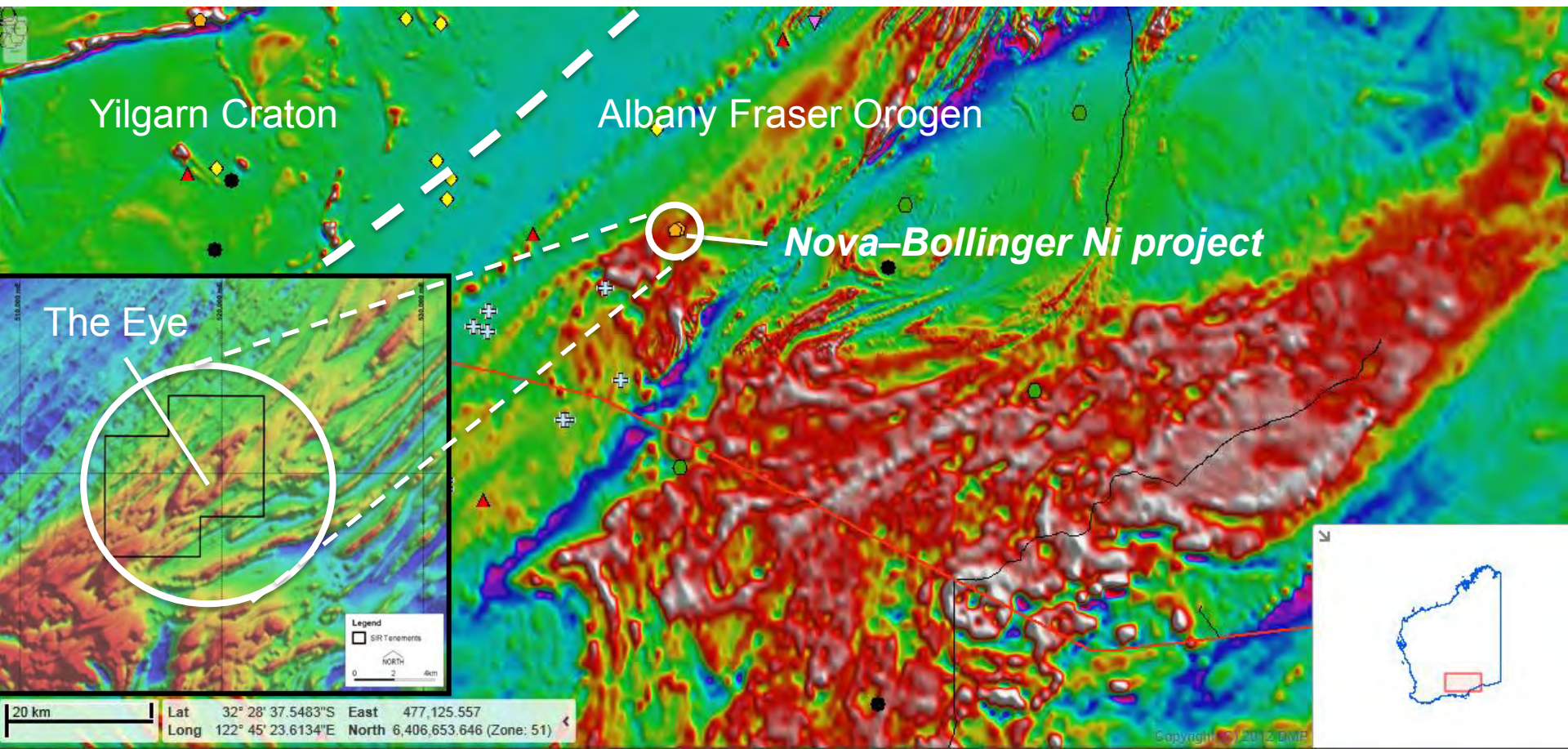
33 Ni discoveries 2013/14





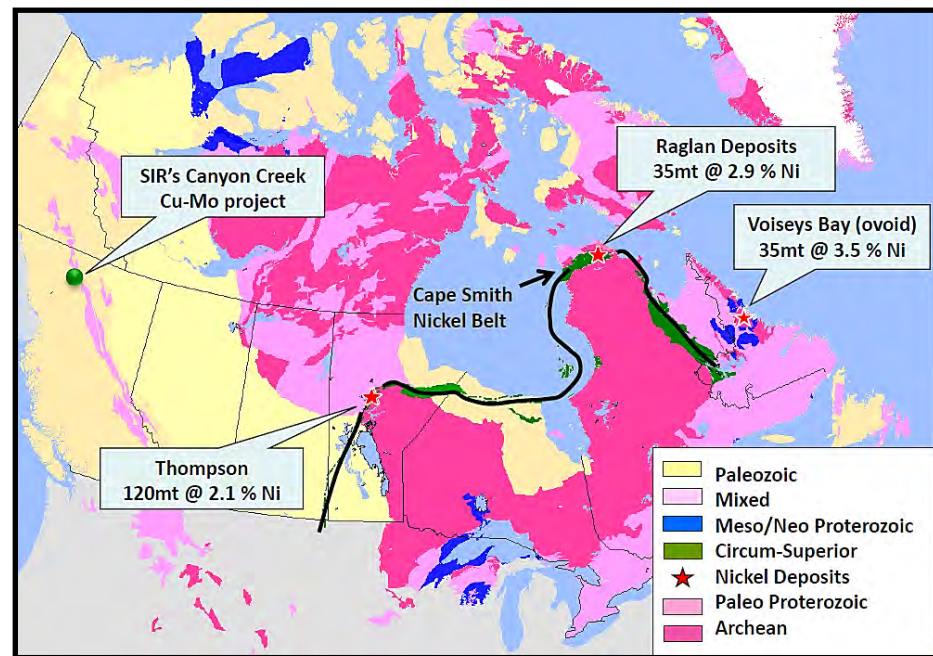
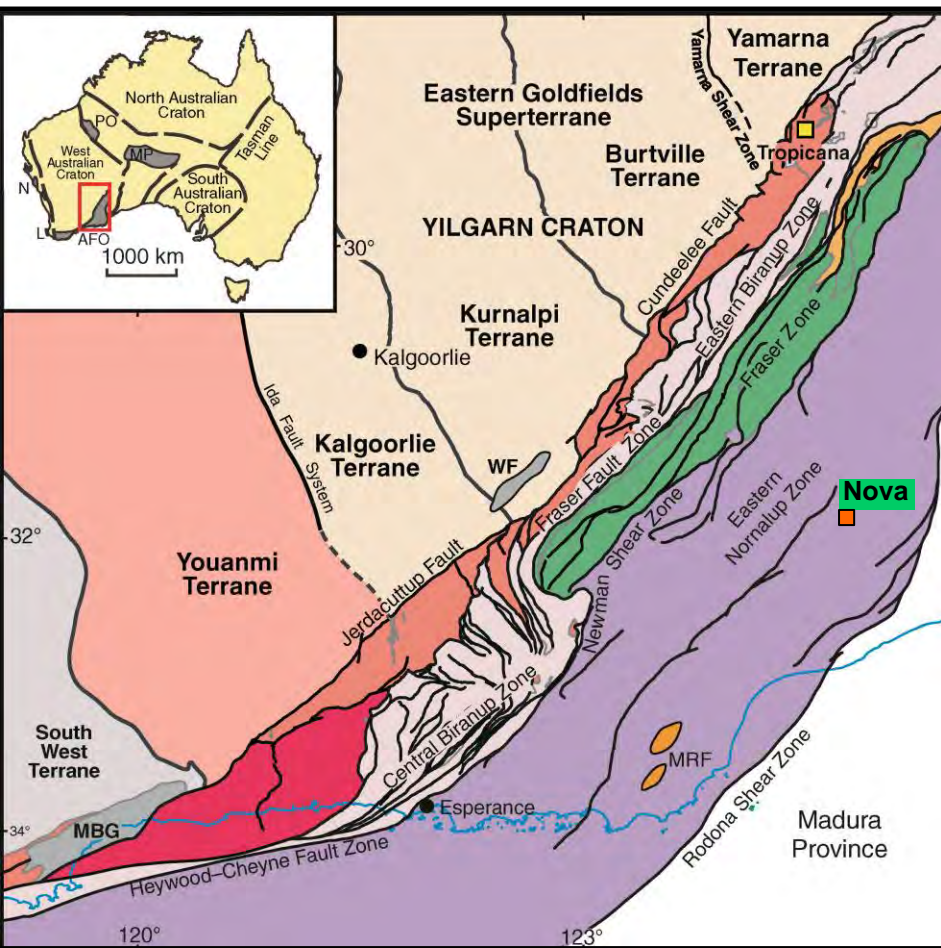
# Nova–Bollinger Ni-Cu discovery marks new Ni province in WA

Sirius Resources Ltd identified the Nova–Bollinger anomaly in high grade metamorphosed ultramafics within the Albany Fraser Orogen





# Albany-Fraser Orogen — Canadian analogue

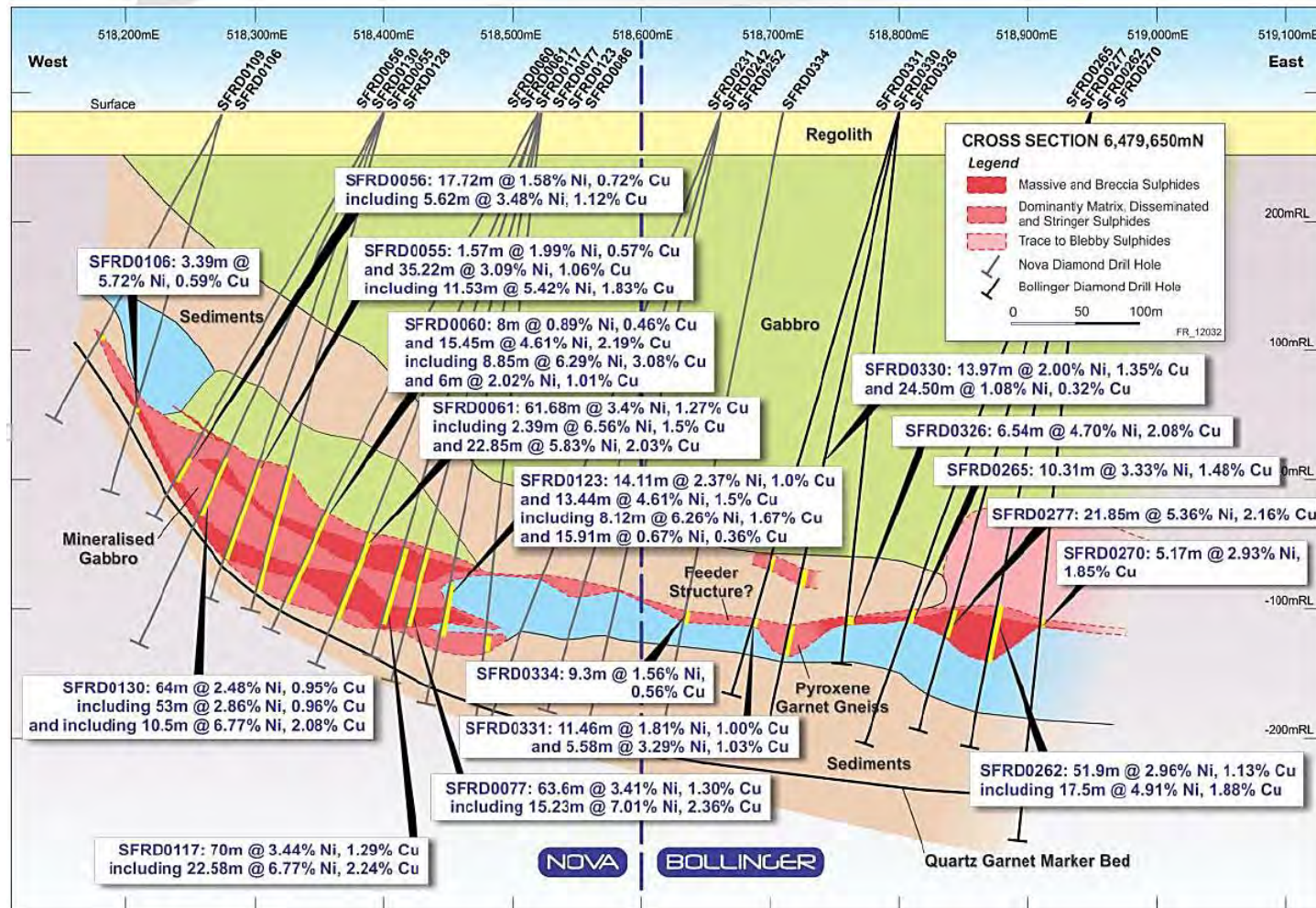


Circum-Superior belt fringes the Canadian Archean craton — hosts a number of World-class Ni deposits, including Raglan, Thompson



# Nova-Bollinger deposit grows with ongoing drilling

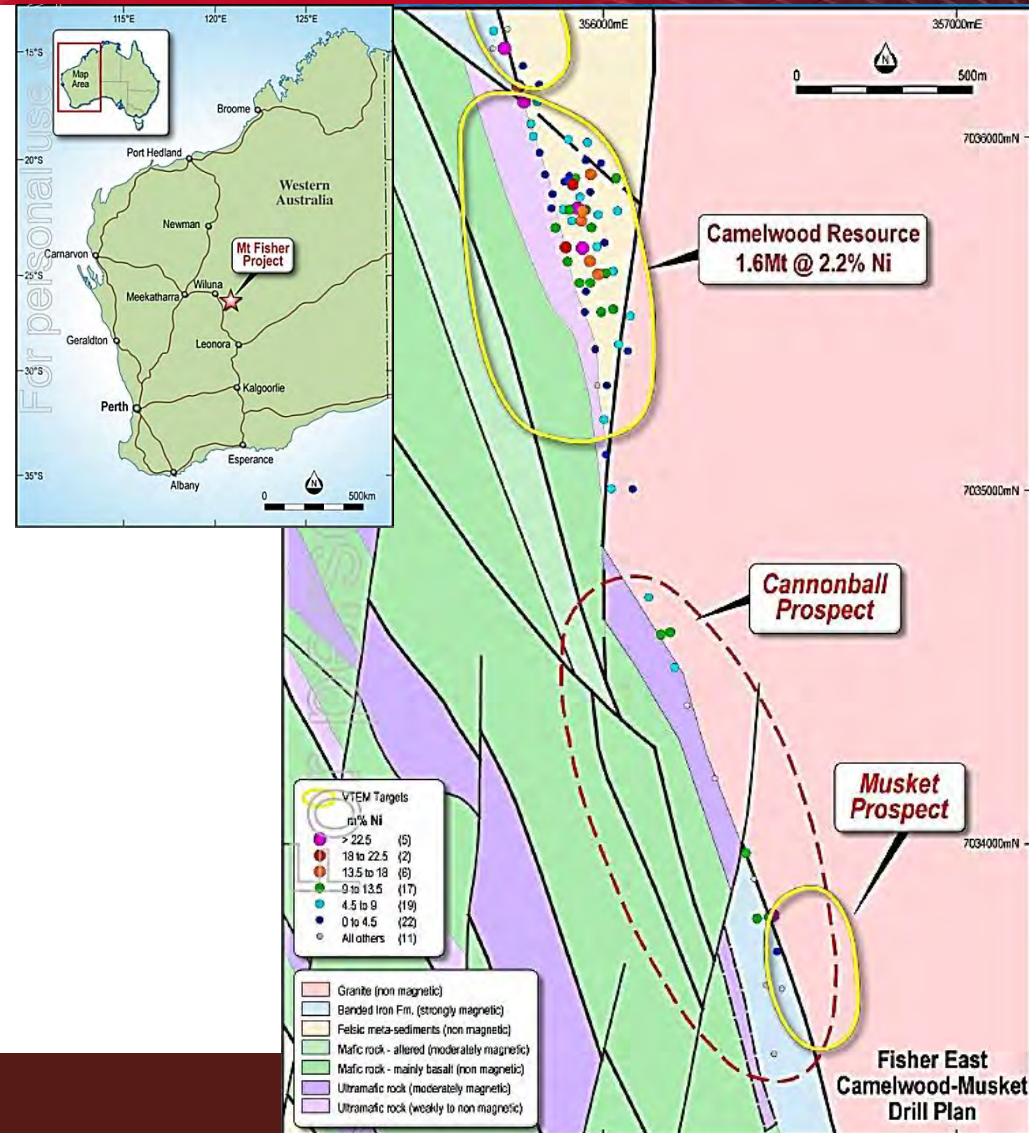
- Probable Ore Reserve 13.1Mt @ 2.1% Ni, 0.9% Cu, 0.07% Co, and growing
- Discovered in July 2012
- Company hopes to commence mining in 2016-17





# Mt Fisher Ni project in northeastern Yilgarn

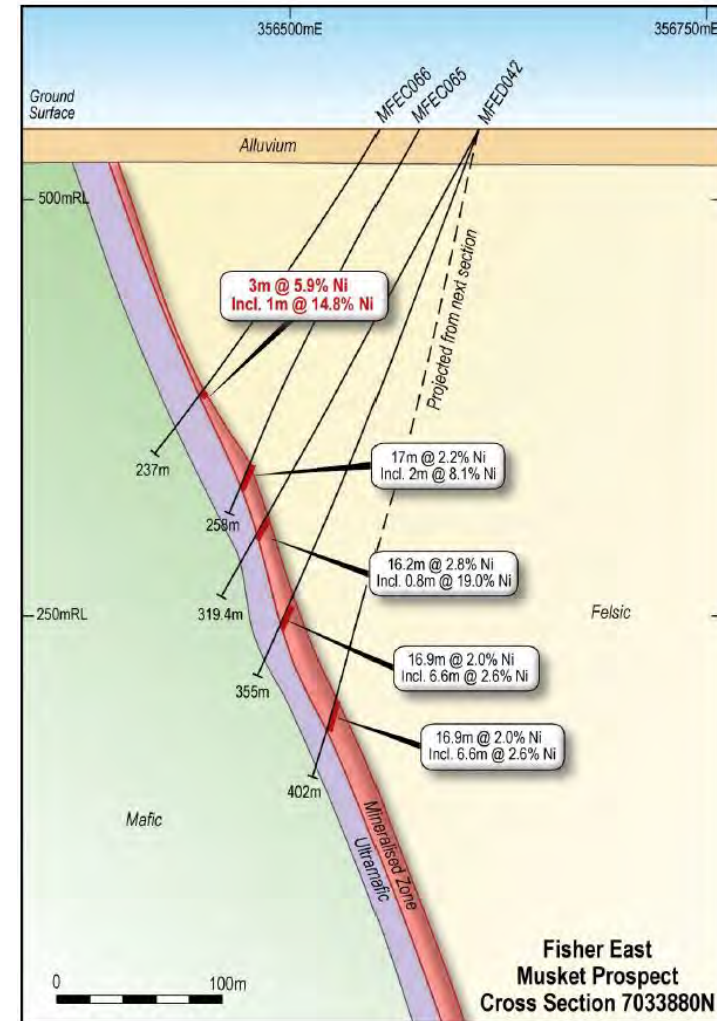
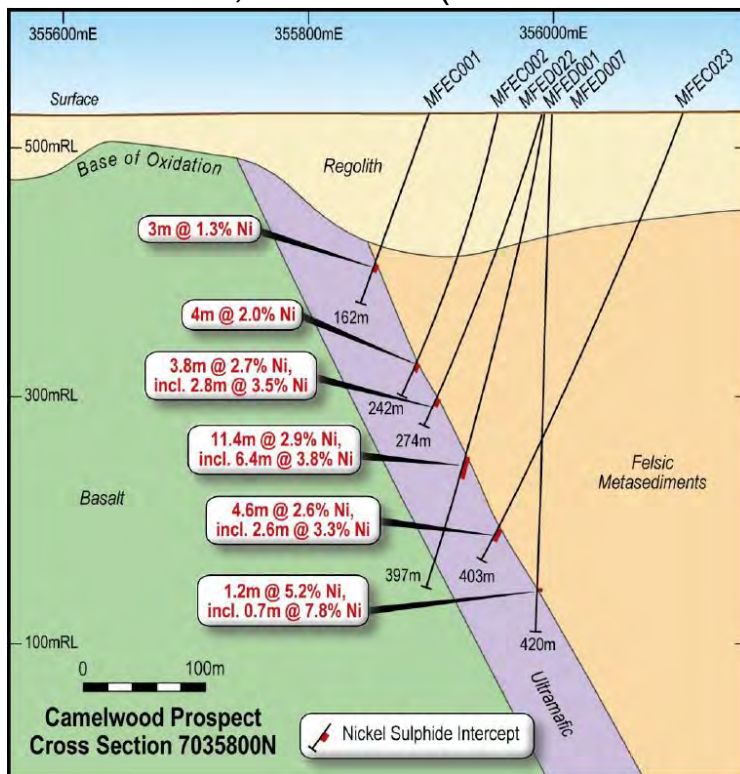
- Archean Mt Fisher greenstone belt in northeastern Yilgarn
- Large part of belt held by Rox Resources Ltd
- New area of Ni mineralisation discovered by Rox Resources in December 2012
- Three major prospects — Camelwood, Cannonball and Musket





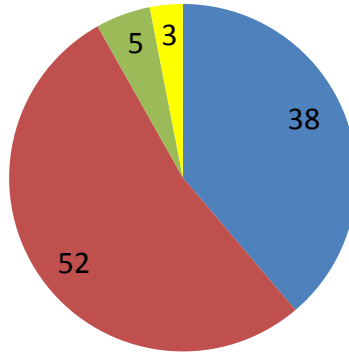
# Camelwood & Musket the most advanced prospects at Mt Fisher

- Classic Archean komatiite-hosted Kambalda style Ni sulfide deposit
- Sulfides occur at basal contact of ultramafic
- Inferred + Indicated Resource for Mt Fisher project: 3.6Mt @ 2.0% Ni for 72,100 t of Ni (52% Indicated resource)



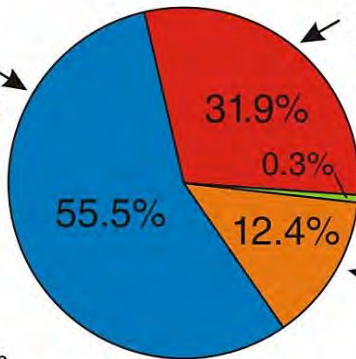
# Plentiful uranium resources

- Total known resources: 234,000 tonnes  $U_3O_8$  (515 Mlbs  $U_3O_8$ )
- Easily-mineable surficial calcrete-hosted resources predominate
- New discoveries being made



■ Early exploration  
■ Advanced exploration  
■ Scoping/Pre-feasibility  
■ Feasibility

**Surficial (calcrete hosted)**  
 Tonnage: 263 Mt  
 Average grade: 490 ppm  
 $U_3O_8$ : 129 Kt (286 Mlbs)

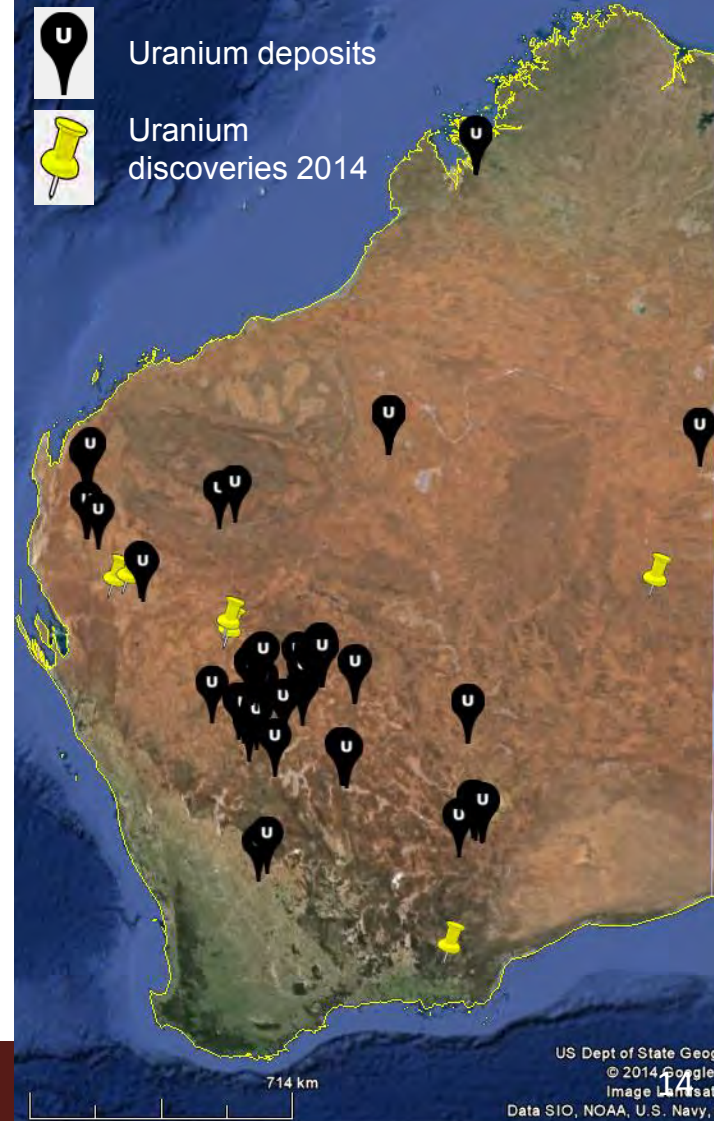


**Roll-front related and sandstone hosted**  
 Tonnage: 161 Mt  
 Average grade: 460 ppm  
 $U_3O_8$ : 74 Kt (164 Mlbs)

**Carbonatite hosted**  
 Tonnage: 5 Mt  
 Average grade: 150 ppm  
 $U_3O_8$ : 0.71 Kt (2 Mlbs)

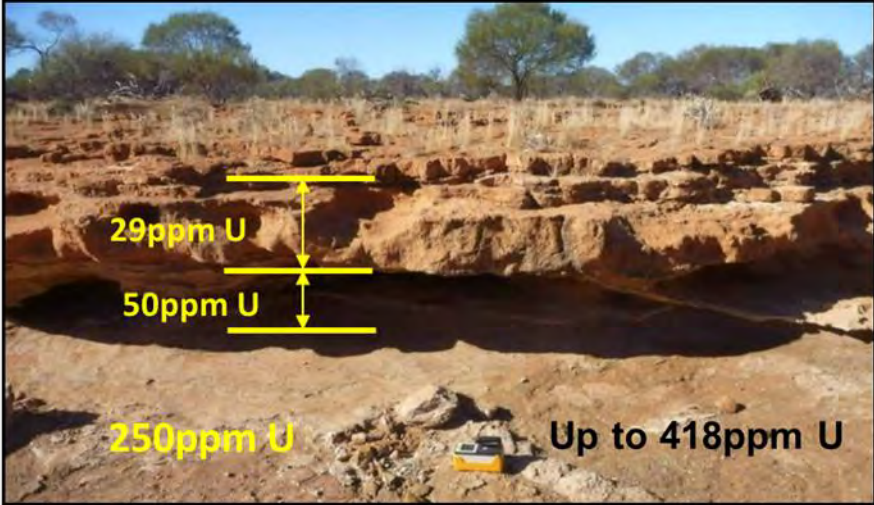
**Unconformity related and vein type**  
 Tonnage: 6 Mt  
 Average grade: 4500 ppm  
 $U_3O_8$ : 29 Kt (63 Mlbs)

Mt – million tonnes  
 Kt – kilotonnes  
 Mlbs – million pounds  
 ppm – parts per million





# Calcrete uranium deposits — easily mineable surface deposits





# HREE potential confirmed at Browns Range

- Production of light rare earth oxides from the Mt Weld deposit began earlier this year
- Now WA is headed towards being a heavy rare earth producer with the beginning of a Feasibility study on Browns Range
- Another promising deposit is at Yangibana

Hydrogen H 1.008																	Helium He 4.0026	
Lithium Li 6.94	Beryllium Be 9.012											Boron B 10.811	Carbon C 12.011	Nitrogen N 14.007	Oxygen O 15.999	Fluorine F 18.998	Neon Ne 20.180	
Sodium Na 22.990	Magnesium Mg 24.305											Aluminum Al 26.982	Silicon Si 28.086	Phosphorus P 30.974	Sulfur S 32.06	Chlorine Cl 35.45	Argon Ar 39.948	
Potassium K 39.098	Calcium Ca 40.078	Scandium Sc 44.956	Titanium Ti 47.88	Vanadium V 50.942	Chromium Cr 51.996	Manganese Mn 54.938	Iron Fe 55.845	Cobalt Co 58.933	Nickel Ni 58.69	Copper Cu 63.546	Zinc Zn 65.38	Gallium Ga 69.723	Germanium Ge 72.63	Arsenic As 74.922	Selenium Se 78.96	Bromine Br 79.904	Krypton Kr 83.798	
Rubidium Rb 85.468	Sr 87.62	Yttrium Y 88.906	Zirconium Zr 91.224	Niobium Nb 92.906	Molybdenum Mo 95.94	Technetium Tc 98	Ruthenium Ru 101.07	Rhodium Rh 102.91	Palladium Pd 106.42	Silver Ag 107.87	Cadmium Cd 112.41	Indium In 114.82	Sn 118.71	Antimony Sb 121.760	Tellurium Te 127.60	Iodine I 126.90	Xenon Xe 131.29	
Cesium Cs 132.905	Barium Ba 137.327	Lanthanum La 138.905	Hafnium Hf 178.49	Tantalum Ta 180.95	Tungsten W 183.84	Rhenium Re 186.207	Osmium Os 190.23	Iridium Ir 192.222	Platinum Pt 195.08	Gold Au 196.967	Mercury Hg 200.59	Thallium Tl 204.38	Pb 207.2	Bismuth Bi 208.98	Po 209	Astatine At 210	Radon Rn 222	
Francium Fr 223	Ra 226	Actinium Ac 227	Lu 174.967	Hf 178.49	Ta 180.95	W 183.84	Re 186.207	Os 190.23	Ir 192.222	Pt 195.08	Au 196.967	Hg 200.59	Tl 204.38	Pb 207.2	Bi 208.98	Po 209	At 210	Rn 222
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		**	89-102															

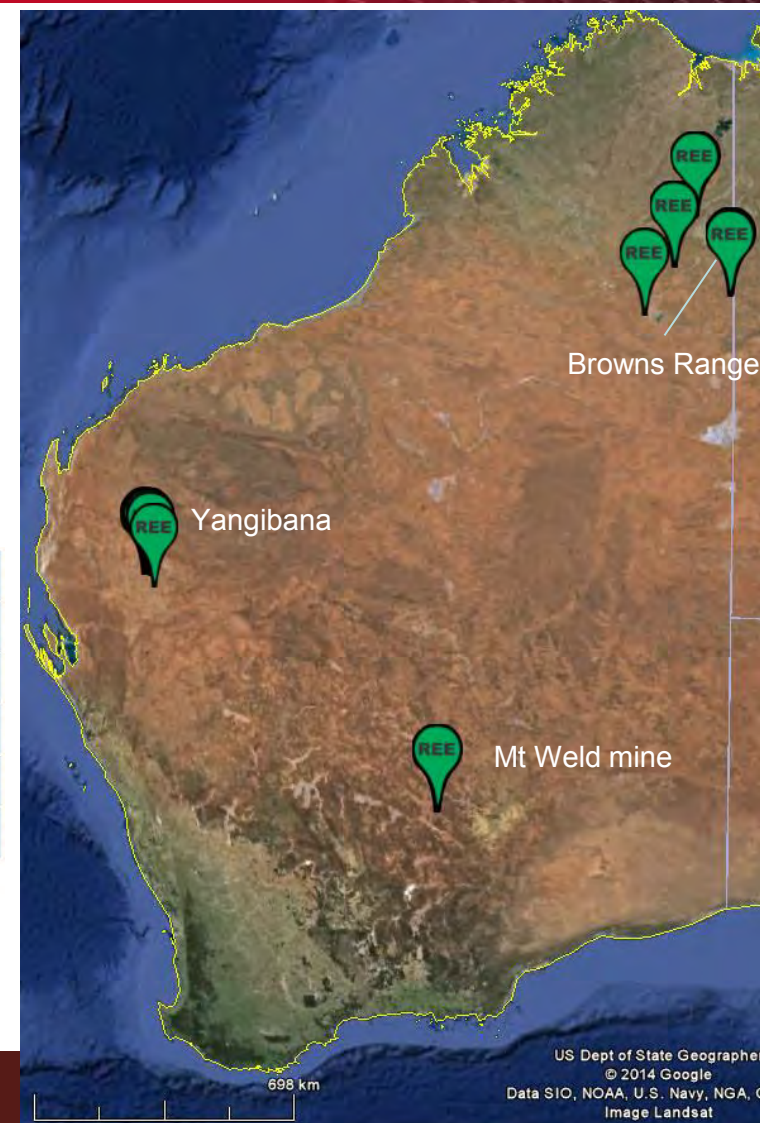
Light Rare Earths  
 Heavy Rare Earths  
 Rare Metals

\*Lanthanide series

La 57 138.905	Ce 58 140.12	Pr 59 140.908	Nd 60 144.24	Pm 61 144.913	Sm 62 150.36	Eu 63 151.964	Gd 64 157.25	Tb 65 158.925	Dy 66 162.50	Ho 67 164.930	Er 68 167.257	Tm 69 168.930	Yb 70 173.054
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\*\*Actinide series

Ac 89 227.033	Th 90 232.038	Pa 91 231.036	U 92 238.029	Np 93 237.048	Pu 94 244.064	Am 95 243.061	Cm 96 247.070	Bk 97 247.070	Cf 98 251.083	Es 99 252.083	Fm 100 257.10	Md 101 258.10	No 102 259.10
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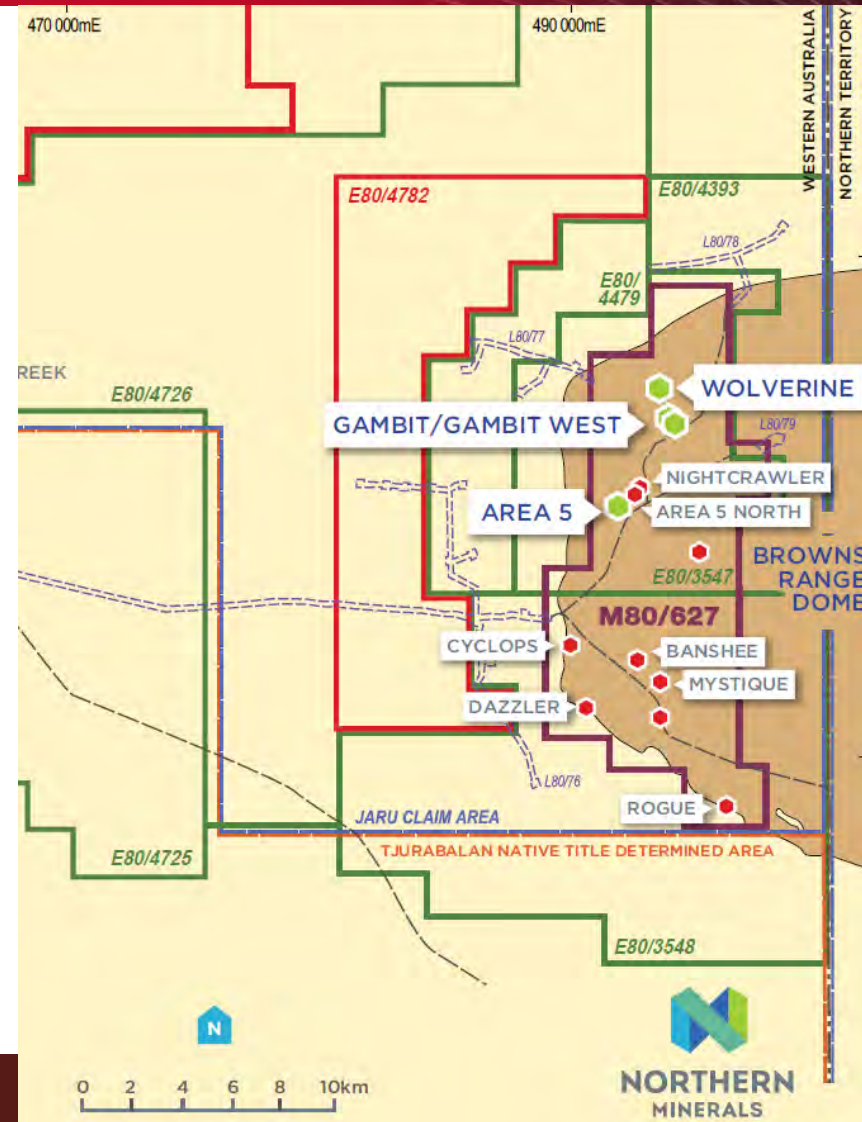
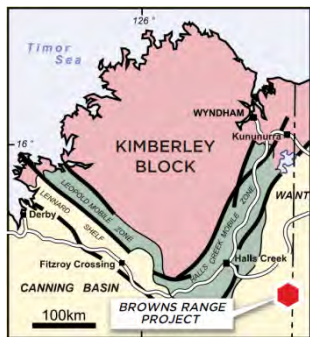


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# Browns Range is a very big hydrothermal system

- Owned by ASX-listed Northern Minerals
- Deposits in veins within Proterozoic metasedimentary rocks
- Breccia-hosted hydrothermal systems dominated by rare earth phosphate mineral xenotime — a rich source of dysprosium and other HREOs such as terbium and yttrium. Mineralisation has exceptionally high HREO to TREO ratio of 84%.



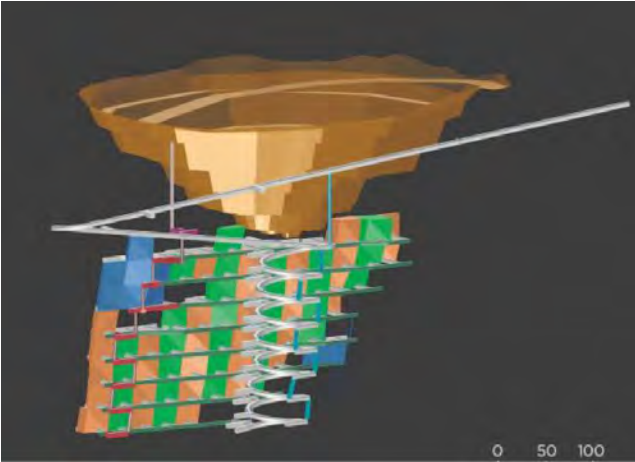
# Browns Range HREE at Feasibility

- Very robust economics revealed by Pre-feasibility study
- Mining lease granted and access agreement signed with traditional owners
- Environmental approvals well advanced
- Offtake agreement negotiations with Sumitomo

Capital cost*	\$AUD 314 million
NPV after tax#	\$AUD 446 million
IRR	33%
Mine life	> 10 years
Payback period	Year 3.3 of operations
Target construction	Begin 2016

# 10% discount rate

Resource Category	Mt	TREO %	Dy2O3 kg/t	Tb4O7 kg/t	Y2O3 kg/t	TREO 000t	Dy2O3 000t
Indicated	4.37	0.72	0.61	0.09	4.07	31.61	2.66
Inferred	2.12	0.77	0.64	0.09	4.25	16.38	1.36
<b>Total</b>	<b>6.48</b>	<b>0.74</b>	<b>0.62</b>	<b>0.09</b>	<b>4.13</b>	<b>47.99</b>	<b>4.02</b>





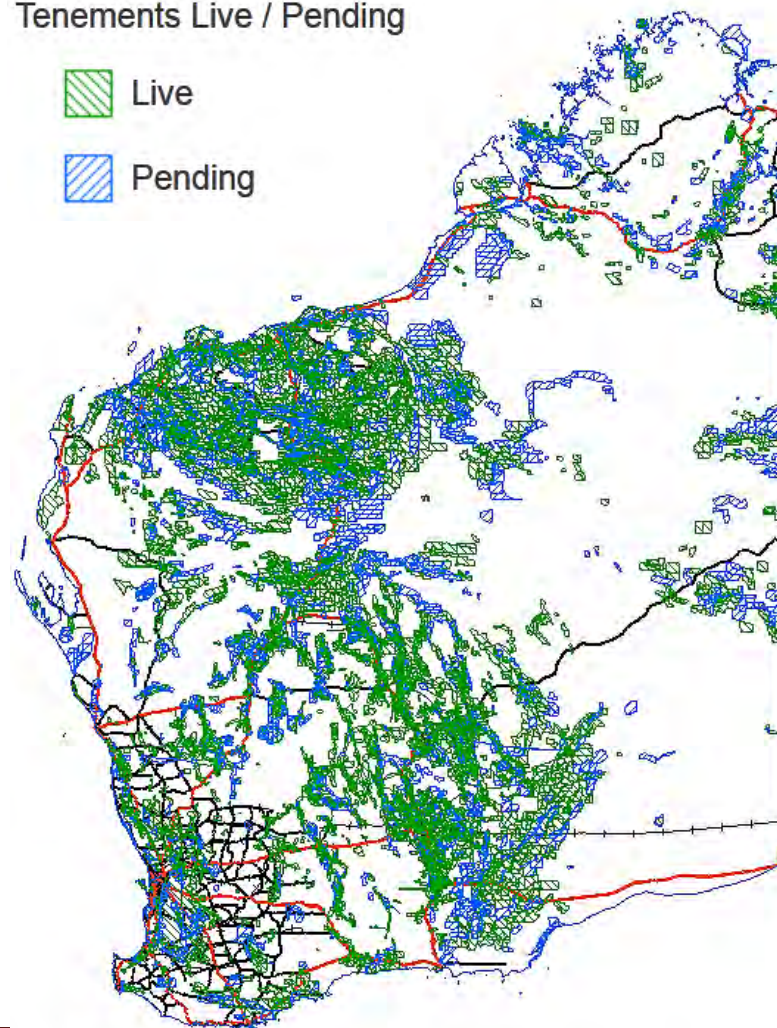
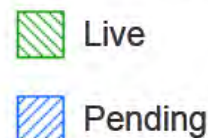
# Many licensees looking for JV partners

- With equity tight, many explorers looking for JV partners
- Many tenements being dropped or reduced in area

## Mineral Tenements 30 June 2014

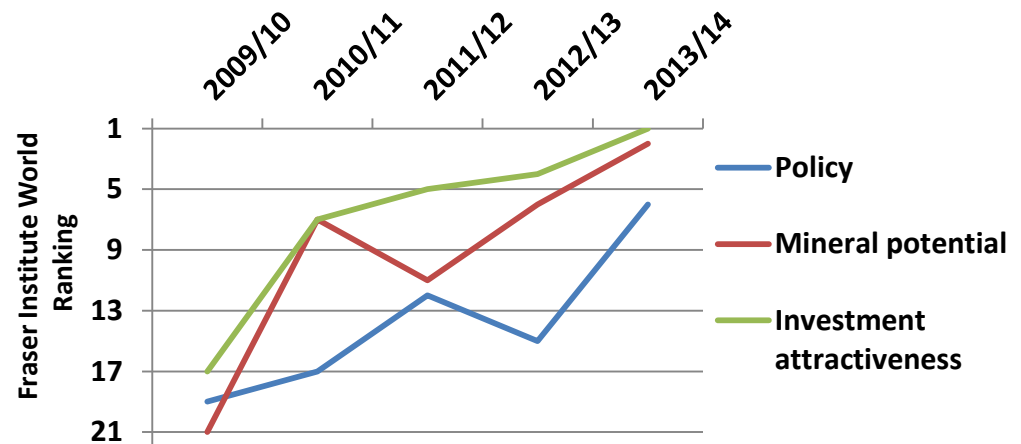
Type	Number	Area (000 ha)
Prospecting Licence	6,588	823
Exploration Licence	5,708	44,830
Mining Lease	6,019	2,400
Infrastructure tenure	3,232	3,171
Other	186	21

## Tenements Live / Pending



# WA ranked highly as resources investment destination

- Western Australia is the top-rated jurisdiction for investment attractiveness this year
- 11<sup>th</sup> in World for quality of geoscience databases



Fraser Institute's Policy Potential Index (Australian States only)

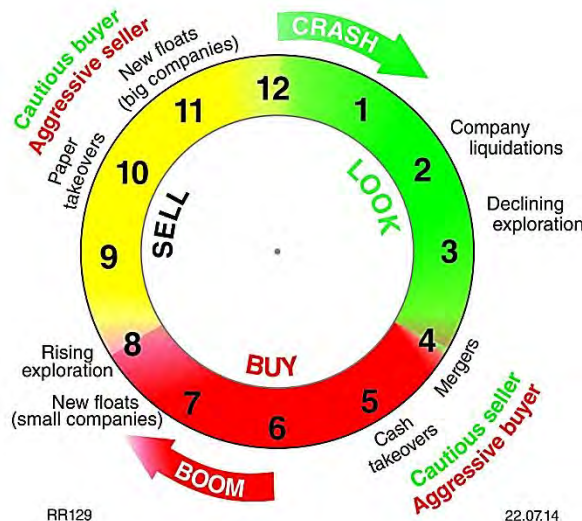
Fraser Institute ranking	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013
1	TAS	WA	SA	SA	SA	SA	SA	NT WA	WA	WA
2	WA	NSW	QLD	TAS	NT	NT	WA	SA	SA	SA
3	SA	SA	TAS	NT	WA	WA	NSW	QLD	NT	NT
4	QLD	TAS	VIC	WA	NSW	NSW	NT		VIC	QLD
..										
7			WA							



# Japanese minerals investment has been long term & well targeted

- Japan is an investor into 27 WA mineral projects, with 16 of these iron ore
- Remaining commodities include uranium, base metals, industrial minerals, heavy mineral sands and recently gold
- Japanese companies also have offtake agreements with a number of projects including rare earths

- In the red zone
- Time to buy!



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# Thank You

- The companies named in this presentation have not indicated to DMP that the prospects mentioned or described are available for joint venture or purchase.
- The projects and prospects mentioned or described should be taken as examples of commodities, mineralization styles or the size of deposits that occur in Western Australia.
- The Government of Western Australia does not endorse the companies, projects or prospects mentioned or described in this presentation.
- Due diligence is recommended before any investment decision.