



# Rare Earths North America 2014

10-11 June, New York City, U.S.A.

## Global Pricing Dynamics of the Rare Earths Industry

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Information of a scientific or technical nature has been prepared with the approval of Andrew Vigar. Mr Vigar has sufficient experience, which is relevant to the style of mineralisation and type of deposit under consideration and to the activity being undertaken to qualify him as "competent persons" as defined in the 2012 edition of the "Australasian Code of Reporting of Exploration Results, Mineral Resources and Ore Reserves". The technical material is generated and prepared by Bridgette Humphries, the company's Senior Geologist, who also has 5 years hands-on experience in the Krucible tenements and resources and is in the process of becoming our competent person. Information of a corporate, industrial or financial nature in this report has been prepared by Allan Branch the company's Managing Director and CEO. For further information please refer to reports and releases to the Australian Stock Exchange together with the Company's website at [www.kruciblemetals.com.au](http://www.kruciblemetals.com.au).



# KRUCIBLE METALS SHORT HISTORY



*Listed in 2007 on ASX:KR, head office in Townsville, Queensland, Australia*

*Share price AUD\$0.053, market cap AU\$5m, 80m shares, 20m options*



*Junior Explorer with tenements mostly in western Queensland*

*Indications of base and precious metals 2008*



*Discovered phosphate in 2009 (Korella)*

**Discovered rare earths in 2010 (Korella)**



**Discovered more rare earths in 2011 (Coorabulka, Yttro)**

*Applied for first mining lease in 2011, granted in 2012*



**Initiated low cost rare earth processing R&D in 2012**

*Sold phosphate assets in 2013, cash reserves \$12m*



**Initiated rare earths pricing analysis in 2013**

**REE anomalism widened at Coorabulka and Valroy in May 2014**



**Commercializing rare earth assets in 2014**





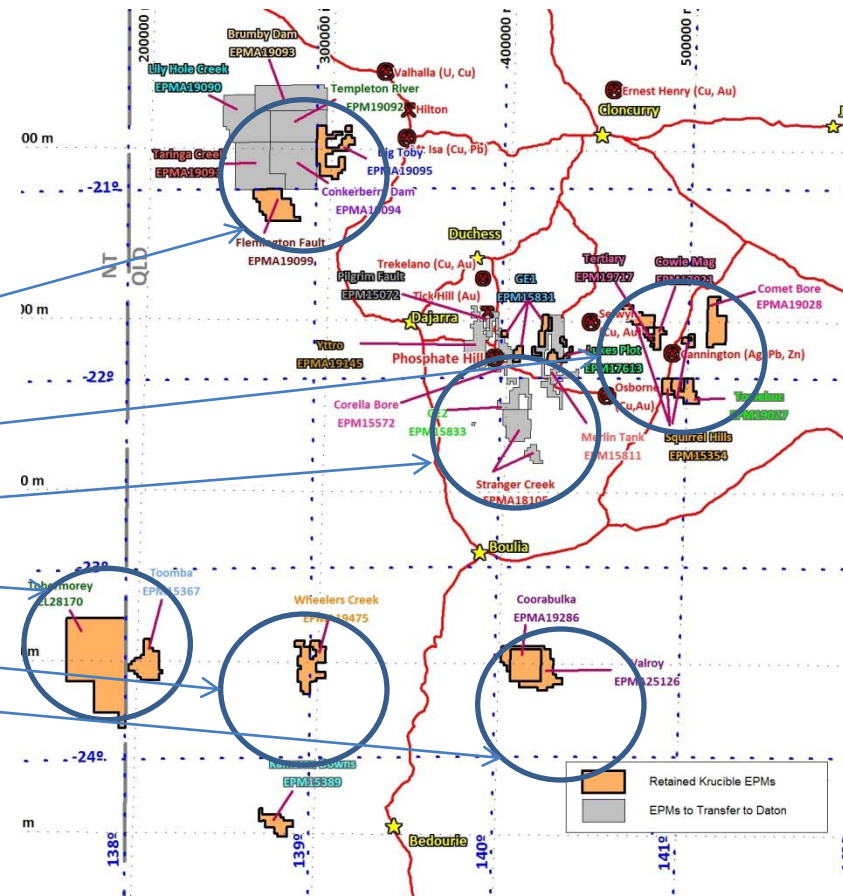
# KRUCIBLE METALS TENEMENTS

Krucible has a number of exploration tenements and applications for tenements in north western Queensland and one across the border in the Northern Territory, concentrated in the areas shown. Principally these are along existing fault corridors and are mostly greenfield sites:

1. Isa West
2. Cannington
3. Phosphate Hill \*
4. Northern Territory
5. Diamantina
6. Isa South

Krucible explores for base and precious metals, but our focus is also on strategic metals like:

1. Rare earths
2. Phosphate
3. Molybdenum
4. Strontium



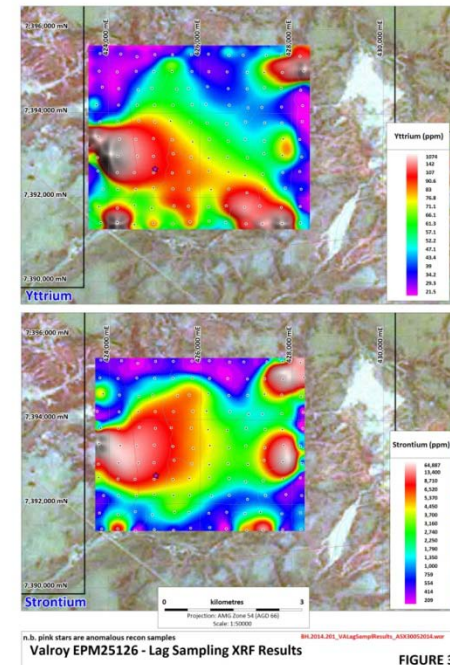
\* First right of refusal joint ventures with Australia New Agribusiness & Chemical Group



# KRUCIBLE METALS RARE EARTH DISCOVERIES

Krucible has made a number of Heavy Rare Earth Element (HREE) discoveries in Queensland, Australia:

1. At the Korella Phosphate deposit Krucible has defined a JORC Code Inferred Resource of 7.03 million tonnes @ 0.93 kilograms per tonne  $Y_2O_3$  (yttrium oxide) at shallow depth (average 30m). (ASX :5 April 2011)
2. Exploration nearby at Yttro has discovered HREE in both Cambrian and Proterozoic aged units up to (in kilograms per tonne) 1.96 yttrium oxide, 2.22 neodymium oxide, 0.66 praseodymium oxide and 0.95 Scandium oxide. (ASX: Annual Report 2012)
3. Krucible has discovered further HREEs at Coorabulka, 300 km SSE of Mt Isa. Sampling has returned values up to (kilograms per tonne) 3.16 yttrium oxide, 4.49 neodymium oxide, 1.07 praseodymium oxide and 0.62 dysprosium oxide over a wide area. Interestingly 0.1% lead and 9.47% strontium were also recorded from this site. (ASX: 13 November 2012)
4. Exploration in May 2014 has extended the rare earths anomalism at Coorabulka and Valroy. (ASX: 6 June 2014)

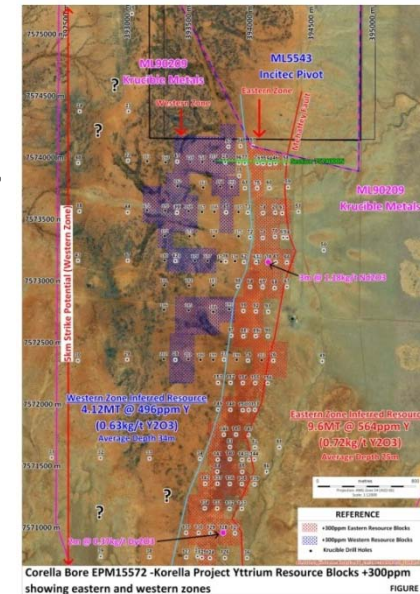
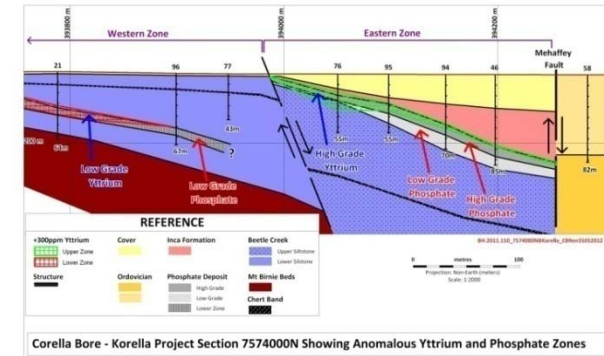




# KRUCIBLE'S KORELLA DEPOSIT

Krucible believes the deposit at Korella is one of the few JORC Inferred HREE resources in Australia and is an uncomplicated mining scenario:

1. Close to infrastructure
2. Shallow sedimentary so easily recovered open pit
3. Granted Mining Lease for phosphate underlying the rare earths, so rare earths are layered in the overburden
4. Metallurgy identified xenotime mineral known to be easier to concentrate than other REE minerals such as monazite
4. Anomalous grades of valuable HREE such as dysprosium (Dy) up to 2m @ 294ppm from 19m (09CBRC-128) and neodymium (Nd) up to 1m @ 831ppm from 13m (11CBRC 161) have also been intersected in drilling at Korella. (ASX: Annual Report 30 October 2012)
6. Krucible sold this tenement in 2013 and retains first right of refusal to a joint venture for rare earth mining



# KRUCIBLE'S COORABULKA DEPOSIT

## Coorabulka EPM19286

Lies to the south of Boulia where Krucible has located strong REE values. Discovered in a 'borrow pit' dug by the council.

Krucible has since discovered further enrichment over 1km west of this pit.

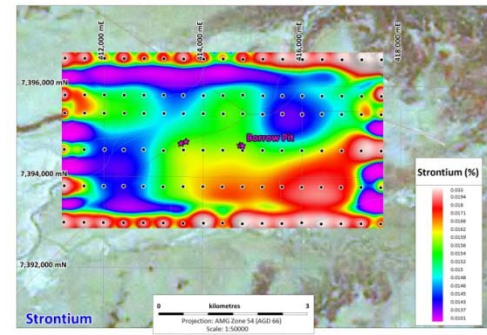
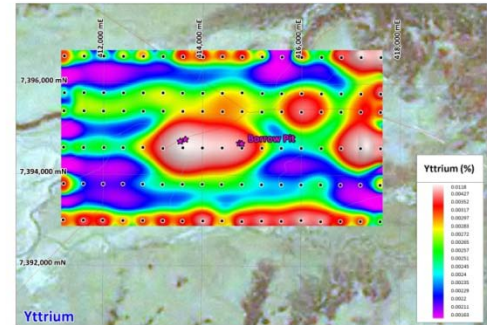
The most anomalous values include:

- 3.16 kg/t yttrium oxide ( $Y_2O_3$ )
- 4.49 kg/t neodymium oxide ( $Nd_2O_3$ )
- 1.08 kg/t praseodymium oxide ( $Pr_2O_3$ )
- 0.62 kg/t dysprosium oxide ( $Dy_2O_3$ )

The area is also anomalous in other elements including:

- 1050ppm lead
  - 9.47% strontium
- (Strontium is used in aluminium alloys)

Bench-top low-cost metallurgical leaching research underway



n.b. pink stars are anomalous rare earth recon samples  
Coorabulka EPM19286 - Soil Sampling XRF Results  
FIGURE 2





## **KRUCIBLE METALS RARE EARTHS PLANS**

**Krucible has successfully discovered and sold its phosphate tenements to enhance its financial position**

**Krucible now intends to commercialise its rare earth discoveries**

**Commercialising the phosphate assets in the current mining environment downturn was difficult and it is expected that achieving a similar result with rare earths will be even more difficult**

**It was immediately clear that understanding the industry, rare earth commodity prices, the geopolitical dynamics, and the various players in the sector, was difficult**

**A review of industry analyst and media reports showed confusion**

**Rare earths was a dilemma**

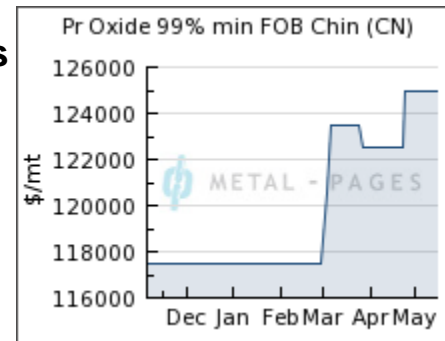
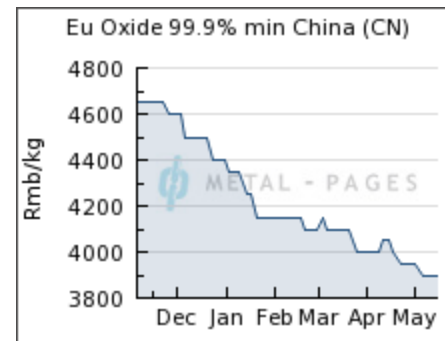
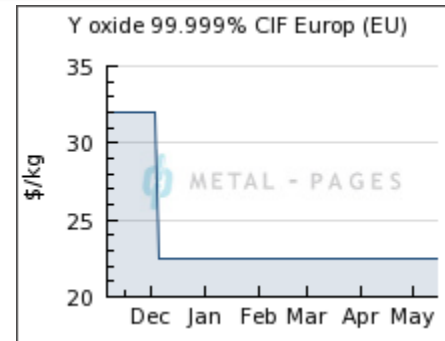




# THE RARE EARTHS INDUSTRY DYNAMICS ARE AN ENIGMA

1. Everyone knows and trusts that rare earths are critical commodities
2. We all know that life as we know it in the technology sector would cease to exist without them
3. Their crucial need in magnets, alloys, LCD's, lasers, transport, alternative energy, defence, space, communications, and so on, is indisputable
4. It is common knowledge that the majority of rare earth mining and processing is based in China
5. We know that China controls its exports and has even refused to supply the key user, Japan
6. We know that China tries to control prices because this is important to its economy
7. And still prices fall defying all supply and demand rules

*"There's something a little strange going on in China's Production of the various rare earth oxides and metals. Something I'm not sure that I understand properly." (Tim Worstall Forbes Oct 27, 2012)*



## **KRUCIBLE METALS RARE EARTHS STRATEGY**

**Because the rare earths prices did not make sense, Krucible undertook a “back to basics” approach to reassessing the dynamics of the rare earths prices, with surprising results**

**Having seen the extensive processing plant at Molycorp’s Mountain Pass, Krucible also embarked in advance with research on low cost processing technology, with the aim of ensuring profits at current low rare earth prices**

**Krucible also negotiated to retain first right of refusal to develop any rare earths on the tenements it had sold in its phosphate asset sale (Korella and Yttro)**

**Krucible has expanded its exploration program at its other rare earth tenement at Coorabulka and Valroy**

**Each of these components is incorporated into a package to attract a joint venture partner or other relationship**

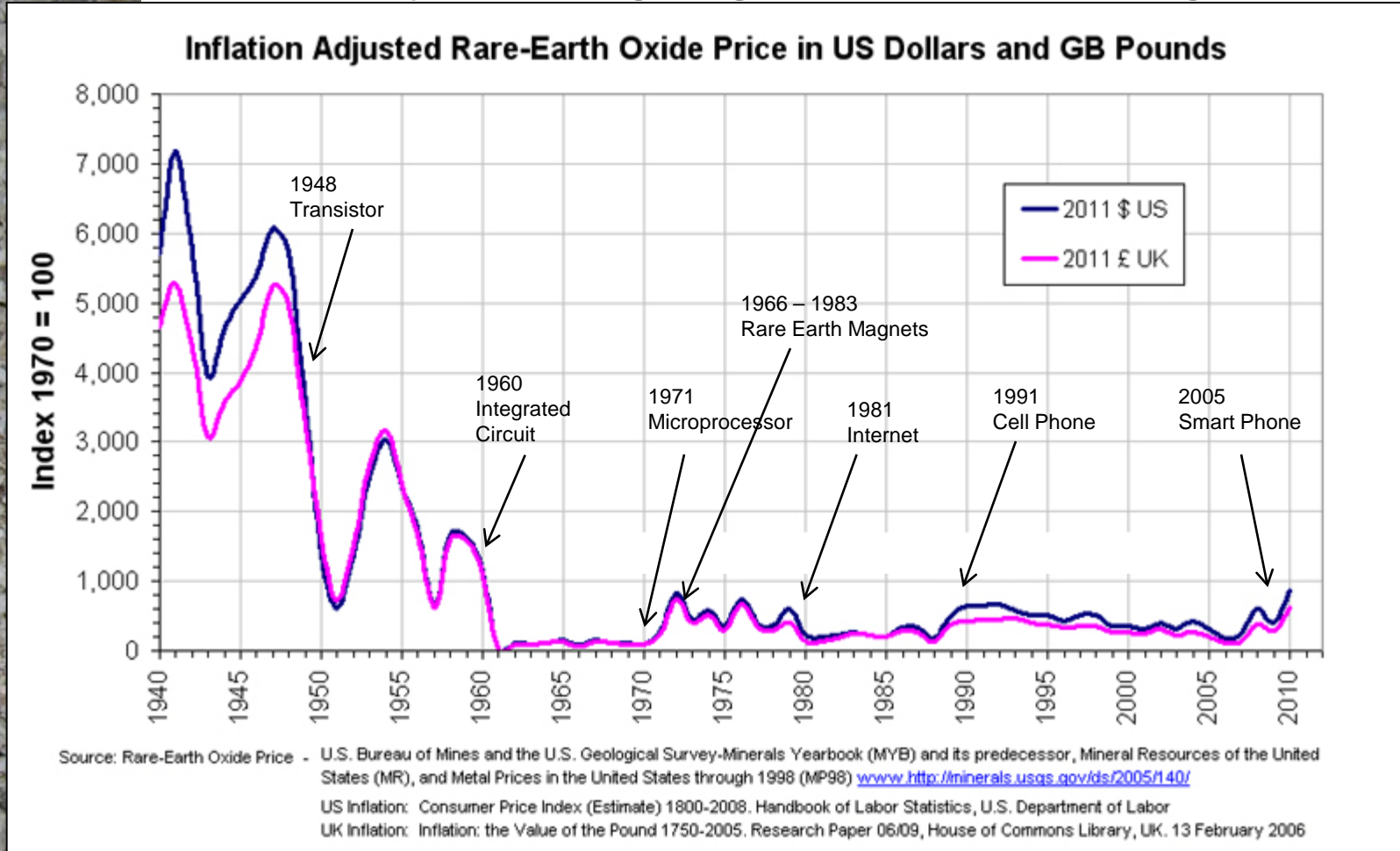
**Krucible is promoting its rare earths activities world wide**





## HISTORICAL RARE EARTHS PRICES

We started by examining long term historical pricing data

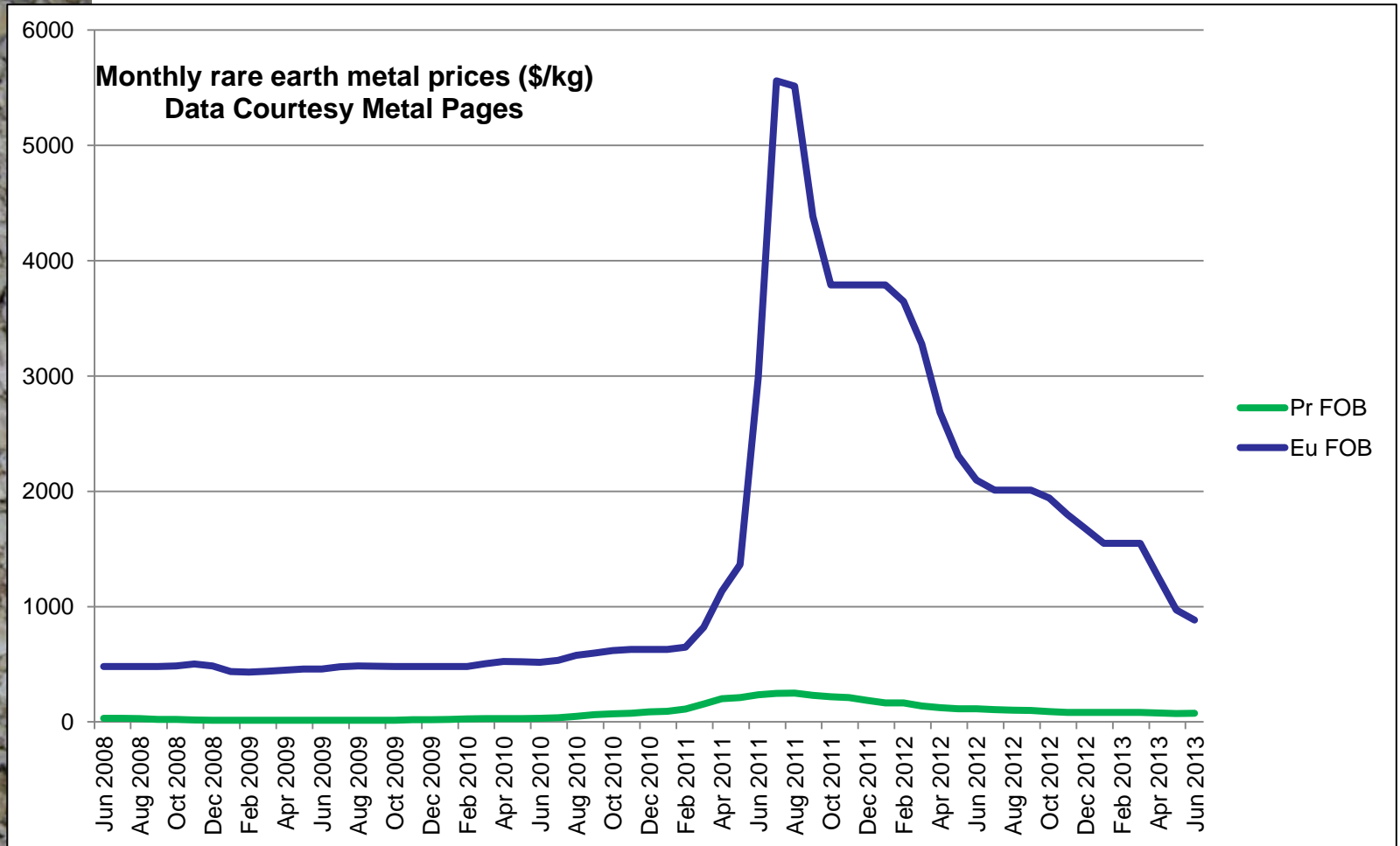


Since the beginning of solid state electronic consumer products, rare earth prices have always been modest



## RECENT RARE EARTH PRICES

Then we looked at the high prices phenomenon of 2011



Which in early 2013 everyone expected or hoped to be resumed, but which was clearly an aberration



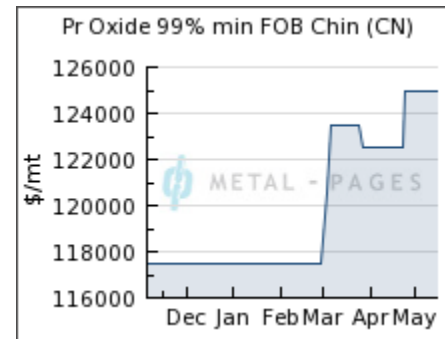
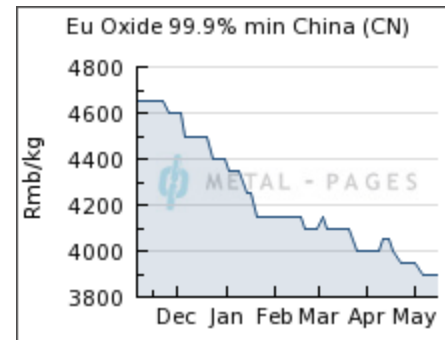
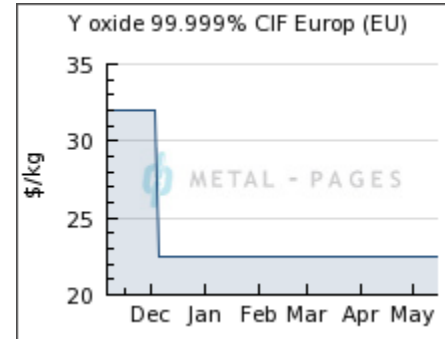


## WHAT KRUCIBLE DISCOVERED WAS SURPRISING

1. Japan is the major user of rare earths, at around 90% of the demand, and China is the main supplier, at around 95% of the global production, so for all intents and purposes that is the market
2. In other words, although rare earths are critical, they go mostly into Japan where they contribute to cheap consumer products,
3. Instead of paying a high price for the raw ingredients, manufacturers will resort to alternative solutions such as different suppliers or different components

*Japan signed an agreement to import 4,100 tons of rare earths a year from India to diversify supply from China for mobile phones and hybrid cars to missile guidance systems*

*GM and Toyota Motor Corp have found a way to make electric cars without rare earths, while Renault has started producing cars with electric motors that do not need permanent magnets*



# RARE EARTH PRICES SUPPLY AND DEMAND ANALYSIS

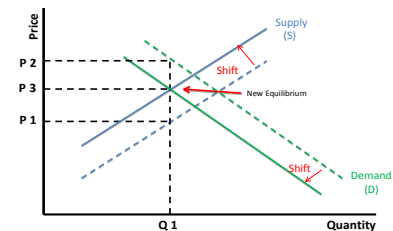
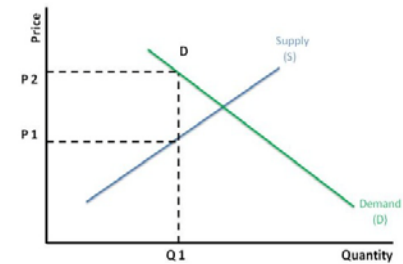
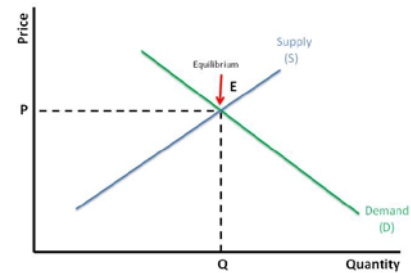
Krucible needed to test this hypothesis.

A hypothetical perfect market is shown in the top chart In February 2013 Krucible examined the rare earths market and analysed the supply and demand dynamics with three fundamental findings:

1. Krucible showed that the rare earths exist in what is an elastic market where the market prices for rare earths are set by the nature of the commodities they are used in
2. Krucible also showed that rare earth market prices will be controlled by users replacing suppliers or the raw materials when and if prices rise too far
3. Krucible also illustrated the evidence that after the 2011 price hikes, this is exactly what the manufacturers have been doing, albeit with the inevitable lag

The net result is pressure holding prices down

See *Krucible Metal's website and ASX announcement 27 Feb 2013.*



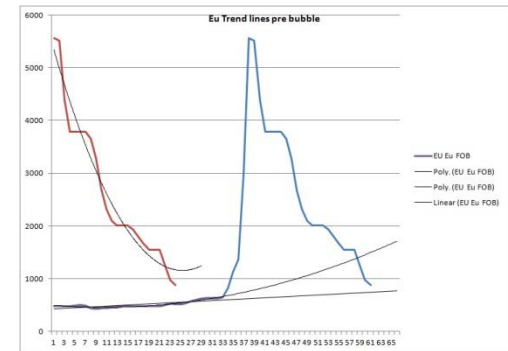
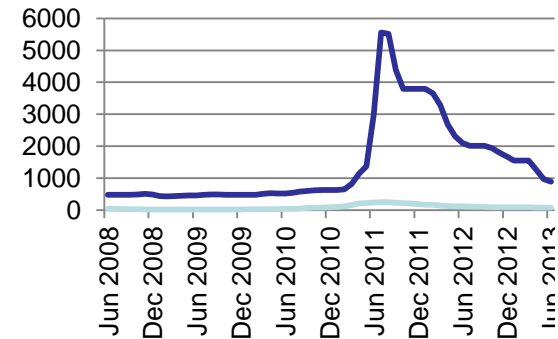


# RARE EARTH PRICES TREND ANALYSIS

Monthly rare earth metal prices (\$/kg). Data Courtesy Metals, Pages

In June 2013, Krucible went further and researched and analysed the recent trends of the rare earths market with three fundamental findings:

1. Krucible showed that the rare earths prices around 2011 were an anomaly, a bubble that collapsed quickly and at prices that will return to pre-bubble levels
2. Krucible also showed that rare earth prices have dropped to below or about where they should be now, so current prices or slightly better should be treated as stable
3. Krucible was able to extrapolate and determine that for some rare earth commodities the prices will naturally double in price over a 4 year growth cycle

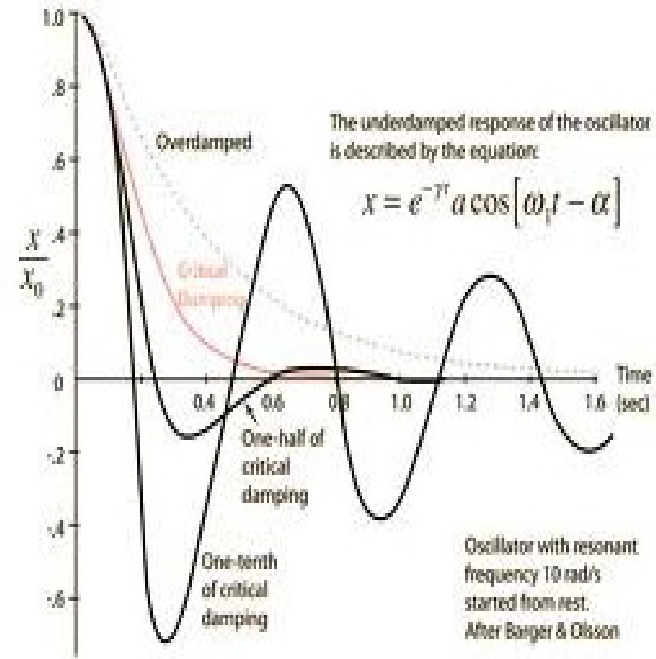
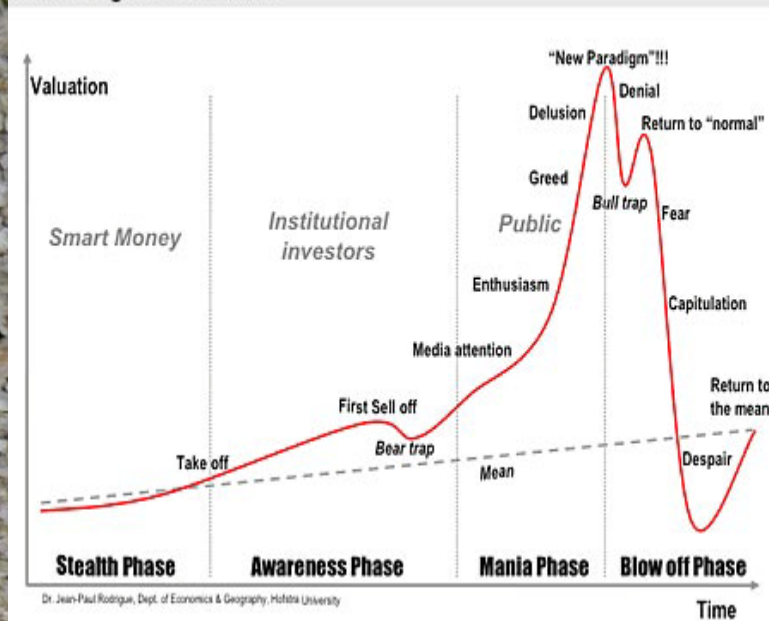


See Krucible website presentation Aug 2013, and Investorintel.com 7 June, 9 June, 15 July 2013.



# RARE EARTH PRICE BUBBLE

Main Stages in a Bubble



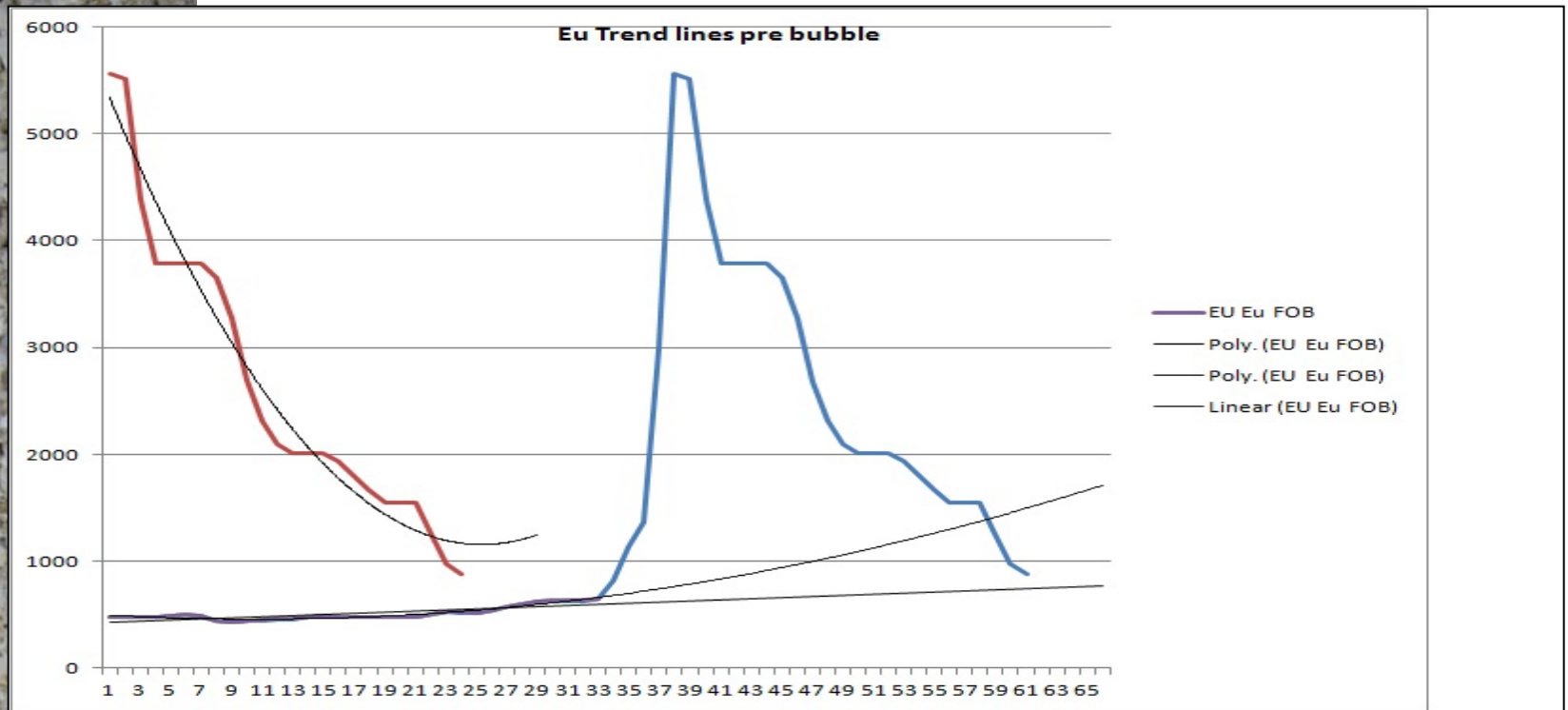
“It is interesting to compare the half-critical damped curve ... with the recovery stage (return to the mean) of the generic economic bubble curve ... which suggests that the recovery from a bubble can be modelled approximately by a damped oscillation. “

<http://investorintel.com/rare-earth-intel/rare-earth-prices-will-do-exactly-this/#sthash.JHZFJN4a.dpuf>





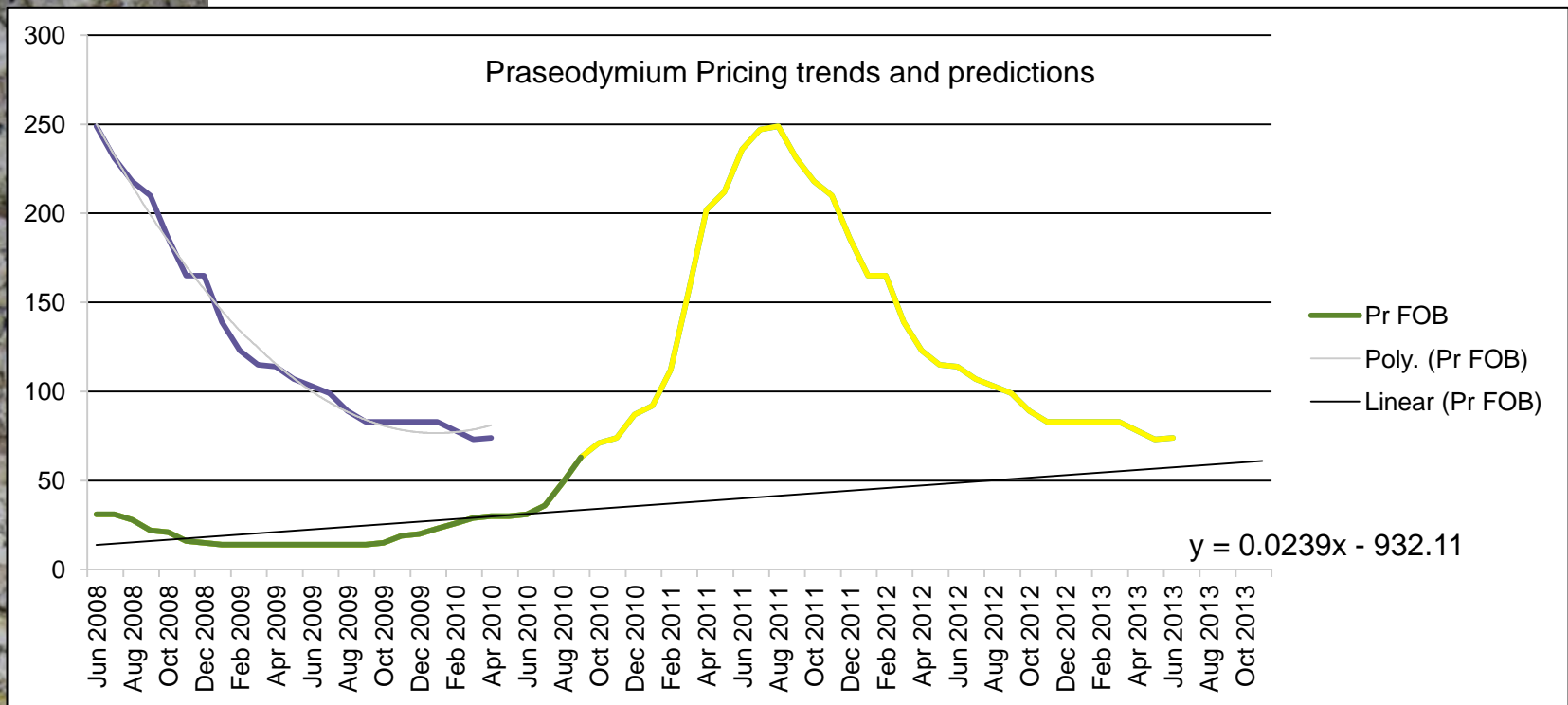
## RARE EARTH PRICE PREDICTIONS, EUROPIUM



**“Europium, a HREE, has dropped below its real value and will settle back to between \$1,200 and \$2,000 per kg by around 8 months ... “** <http://investorintel.com>



## RARE EARTH PRICE PREDICTIONS, PRASEODYMIUM



**“Praseodymium, a LREE, has settled already at \$74 per kg, and will double in price every 4 years...”**

*<http://investorintel.com>*

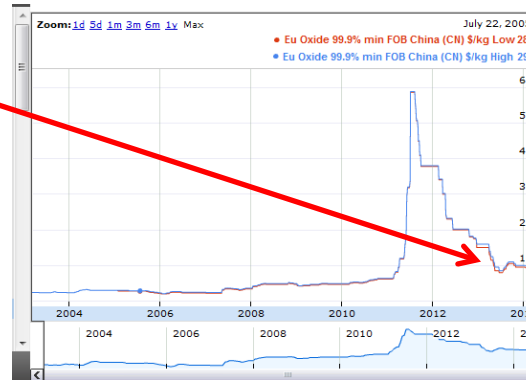


# THE RARE EARTHS PRICE PREDICTIONS: SO FAR?

**“Europium, a HREE, has dropped below its real value and will settle back to between \$1,200 and \$2,000 per kg by around 8 months while praseodymium, a LREE, has settled already at \$74 per kg, and will double in price every 4 years.”**

*Allan Branch June 2013*

*<http://investorintel.com>*





## **KRUCIBLE RARE EARTHS SUMMARY**

**Krucible has a 5 part strategy to commercialise or develop its rare earth discoveries**

- 1. Continue exploring and or acquiring rare earth deposits**
- 2. Continue research and scale-up of innovative low cost processing technology**
- 3. Use results of analysis of global pricing dynamics to contribute to profitable and sustainable business model**
- 4. Promote these components on the international conference circuit**
- 5. Invitation to joint venture or other partners**



# Krucible Metals Ltd



Special Thanks to Metal Pages Ltd for  
Historical Pricing Data Used in this Analysis