

# WHERE ARE AUSTRALIA'S MINES OF TOMORROW?

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**Richard Schodde**, Managing Director MinEx Consulting and Adjunct Professor, and  
**Pietro Guj**, Research Professor,  
Centre for Exploration Targeting (CET), The University of Western Australia (UWA)  
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## *Executive Summary*

*Although world mineral exploration expenditure for non-ferrous commodities has been recovering strongly from its low in 2009 and is back on the rising trend which commenced in 2002, Australia has continued to lose ground relative to other global and competitive exploration destinations. Australia's share of global exploration for non-bulk commodities has virtually halved from its peak of 21% in 2002 and it now stands at a mere 12% of the total, while that of Canada, for instance, has increased from 14% to 18% over the same period.*

*Recent Australian Bureau of Statistics figures indicate that Australian exploration expenditure fell during the March 2012 quarter in all states and for all commodities, particularly for iron ore and coal. While the March quarter is generally a period of low expenditure due to climatic reasons, the seasonalised figures still portray a pattern of sluggish investment in exploration. Falls were greater in Queensland and Western Australia, which is probably attributable to the impending introduction of the MRRT and the recent softening of iron ore and coal prices. Given that bulk minerals now make up half of the exploration dollars spent in Australia, a sustained contraction in this sector will have a material impact on employment and service providers in the broader economy. While original exploration expenditure rebounded in the June quarter, in seasonally adjusted terms the declining trend continued with an overall fall of 4.9% largely attributable to Queensland (12.6%) and to a lesser degree Western Australia (1.6%).*

*Of equal concern is the significant seasonalised fall in the amount of drilling carried out in both quarters. While the June 2012 quarter ABS release does not provide a breakup, the March quarter figures indicate that falls were particularly heavy for drilling of "new deposits". As the mantra goes "if you don't drill, you won't discover". A reduced rate of discovery may result in the national mineral inventory being gradually depleted and the Australian mining industry becoming unsustainable in the long run with potentially serious economic consequences.*

*Although the number of small cap IPOs on the Australian stock exchange increased by 10% in 2011 to 92 listings (of which 78 were from junior mining companies), the amount raised was down by 17% on the previous year. The average amount raised by small caps was at its lowest level for five years at \$6.8 million. Sixty nine per cent of all 2011 listings produced average losses of 13% by the year end, which does not bode well for future equity floats. Given that juniors now account for over half of all exploration spend in Australia, difficulties in raising finance will directly translate into reduced exploration activity particularly greenfield exploration.*

*In addition the trend for Australian based companies to devote an increasing proportion of their budget to explore abroad has continued with about half of their funds now being diverted from domestic exploration to jurisdictions such as Africa, Canada and Latin America.*

*Trends in decreasing efficiency and lower discovery rates continued. In spite of the "mining boom" in Australia, there has been, over the last decade, a shift in exploration expenditure from greenfields to*

*brownfields (particularly for bulk commodities) and a gradual decline in the metres of drilling directed to greenfields projects. The ABS figures showing Australia's real exploration spend increasing fourfold over this period mask this critical decline in greenfield exploration, the kind of exploration needed to find large new mines. The fact that a fourfold increase in exploration expenditure in Australia over the last 10 years only resulted in a twofold increase in metres drilled is largely explained by significant real escalation in the cost of mineral exploration in general and in particular of the per-meter drilled cost. The number of discoveries per dollar invested has gradually fallen for all deposit sizes with a virtual absence of recent giant discoveries due to the maturing of some of our exploration terranes, which has forced explorers to drill for concealed and progressively deeper targets.*

*The gradual shift of funding from greenfield to brownfield exploration, while understandable in terms of short-term profitability, is worrying as in the long-run the decrease in sizeable greenfield discoveries will make it hard to counteract the depletion of the national resource inventory thus imperilling the sustainability of the Australian mining industry. It is estimated that in the absence of new discoveries and mine extensions, based on current reserve and resources, about half of Australia's non-bulk commodities mines would be exhausted in between 7 and 18 years.*

*The challenge for industry is the fact that, on average, it takes 7 years to convert a discovery into an operating mine. Consequently, to be sustainable in the longer term, the mining industry needs to continuously build up a strong pipeline of projects at or close to the development stage. This, in turn, is only possible on the basis of an active and successful minerals exploration sector.*

*On balance it is possible that the Australian mineral exploration investment for non-bulk commodities may be peaking and that the sector may now be entering a period of contraction. This may not be appreciated by the Australian public at large or by some of the politicians because it is masked by a perception that mining is in a phase of significant boom. While of course, this is true with regard to the frantic rate of development and construction of a long pipeline of committed multi-billion dollars resources projects, it is far from being the case for the mineral exploration industry which is experiencing mounting technical and financial pressures.*

*Maintaining, ideally increasing, the mineral resources inventory should not be an exclusive concern of industry but also a key objective of government because of the broad economic consequences that would arise if the Australian mining industry were to become unsustainable besides from the direct consequent reduction in royalty and tax revenue, and the many other social and economic dividends.*

## **Introduction**

The paper primarily reviews the latest available mineral exploration statistical information provided by the Metals Economics Group (MEG), by MinEx Consulting and the Australian Bureau of Statistics (ABS) (2012). It also reviews the survey of mining companies' perceptions released by the Fraser Institute (McMahon and Cervantes, 2012), which provides a ranking of various countries based on their attractiveness to mineral exploration and development investment based on a range of criteria. The data in these recent reports are interpreted to provide a snapshot of the current state of play for the Australian mineral exploration sector and to highlight emerging trends both internationally and domestically.

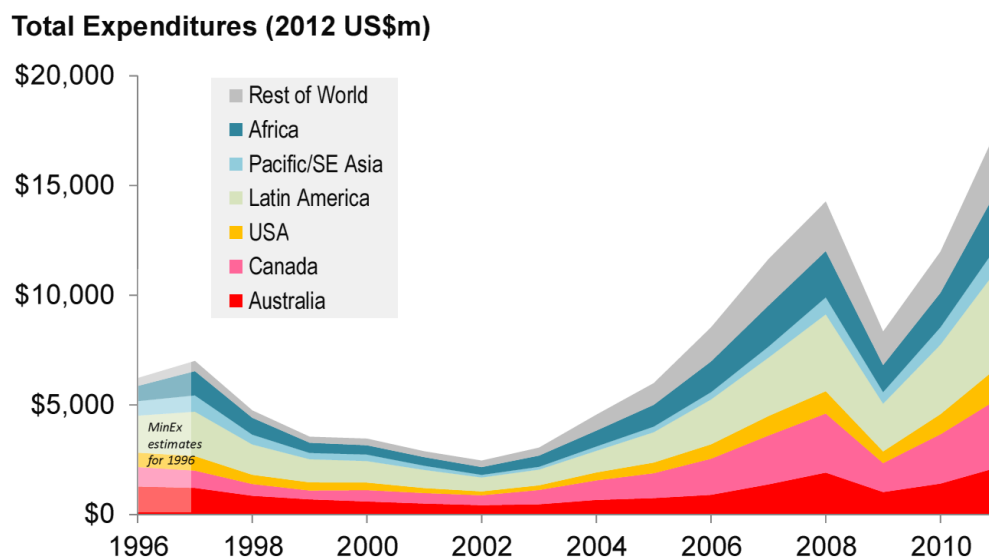
## World exploration expenditure

World exploration expenditure for commodities other than bulk minerals (i.e. iron ore, coal, bauxite) and uranium, totalled US\$17.6 billion in the year ending in December 2011<sup>1</sup>. Figure 1 displays how total exploration expenditure in constant 2012 US\$ continued its recovery path from the trough of 2009 and is now back on the rising trend which commenced back in 2002. While, in absolute terms, more money is now being spent on exploration in Australia than the previous peak back in 2007, our relative share of the global expenditures has actually gone backwards. As shown in Figure 2, Australia's share global (non-bulk) exploration expenditure has steadily drifted down from a peak of around 21% in 1996 to around 12% in 2011. By contrast Canadian exploration expenditure grew over the same period from 14% to 18%. If Australia had kept its market share, then current expenditures in Australia would now be 75% higher.

As will be discussed later in the paper, due to cost inflation, the recent rise in expenditures may not be a good indicator of the industry's overall level of activity. This is better measured in terms of the amount of drilling done and number of discoveries made.

**Figure 1 - World exploration expenditures by Region: 1996-2011 (2012 US\$ million)**

(Source: © Metals Economics Group)

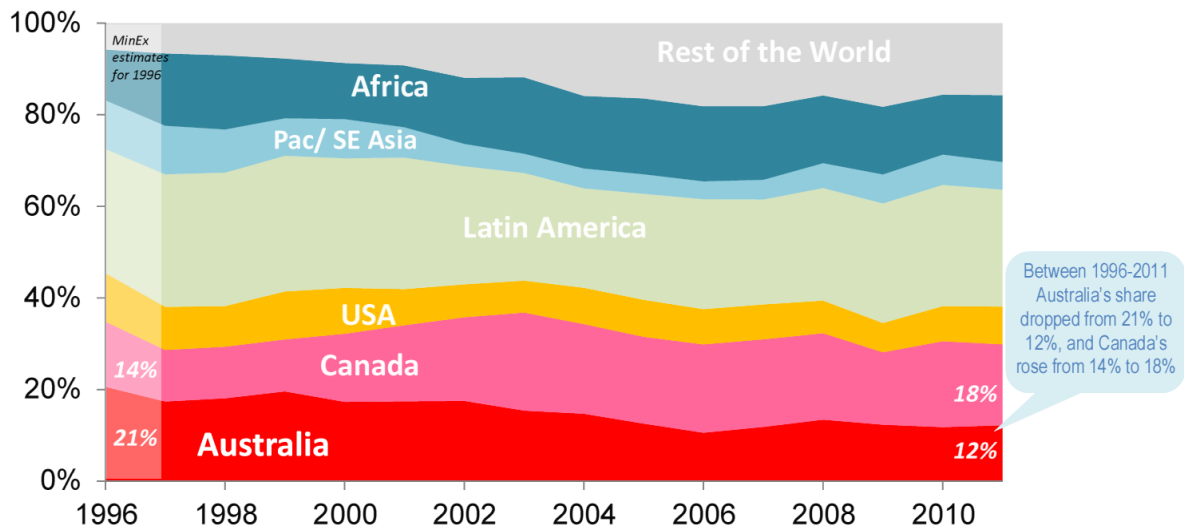


**Figure 2 - World exploration expenditures 1996-2011: Percentage of total spent by region**

(Source: © Metals Economics Group)

<sup>1</sup> Although not covered in the MEG annual surveys, the authors estimate that global expenditures on bulk mineral exploration was ~US\$2 billion in 2011

### Percentage of Total Spend



### Trends in the commodity breakup of Australian exploration expenditure

Figure 3 provides a breakup of Australian exploration expenditure on all commodities including bulk commodities and uranium while Figure 4 provides the same breakup as a percentage of total expenditure.

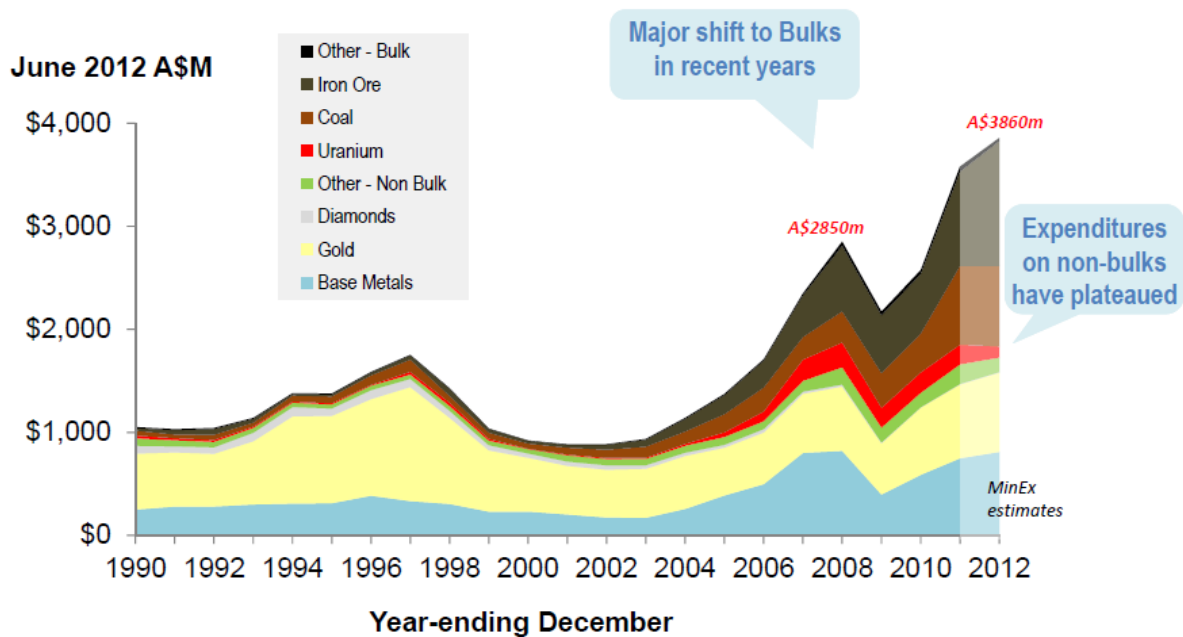
Both figures clearly display how expenditure on iron ore and coal has rapidly increased over recent years, growing from about 9% in 2000 to an estimated 52% of total Australian exploration expenditure in the current year. By comparison exploration for all other non-bulk commodities has remained relatively flat in the last few years. So, while in a general sense, employment has been strong and the service providers<sup>2</sup> been kept very active, their future is now largely driven by the health of the bulk mineral sector.

The recently released report of the Australian Bureau of Statistics for the March 2012 quarter, however, indicates that “original” (i.e. non-seasonalised) exploration expenditure fell in every state and for every commodity relative to the previous quarter by 15.1% (or -\$156.3 million) to \$876.1 million. The largest fall was in Queensland (down 22.4% or -\$57.5 million), followed by Western Australia (down 7.9% or -\$41.8 million). This may reflect the fact that, on a commodity basis, falls were particularly heavy for iron ore and coal. This downward trend may be in part a reaction to the then impending introduction of the mineral resource rent tax (MRRT) on these commodities, reinforced by softening iron ore and coal prices. At the time of writing (August 2012), the CFR price for 62% Fe fines had tipped below US\$90 per tonne with predominantly sluggish medium-term forecasts. This will have a direct impact on the level of exploration activity going forward.

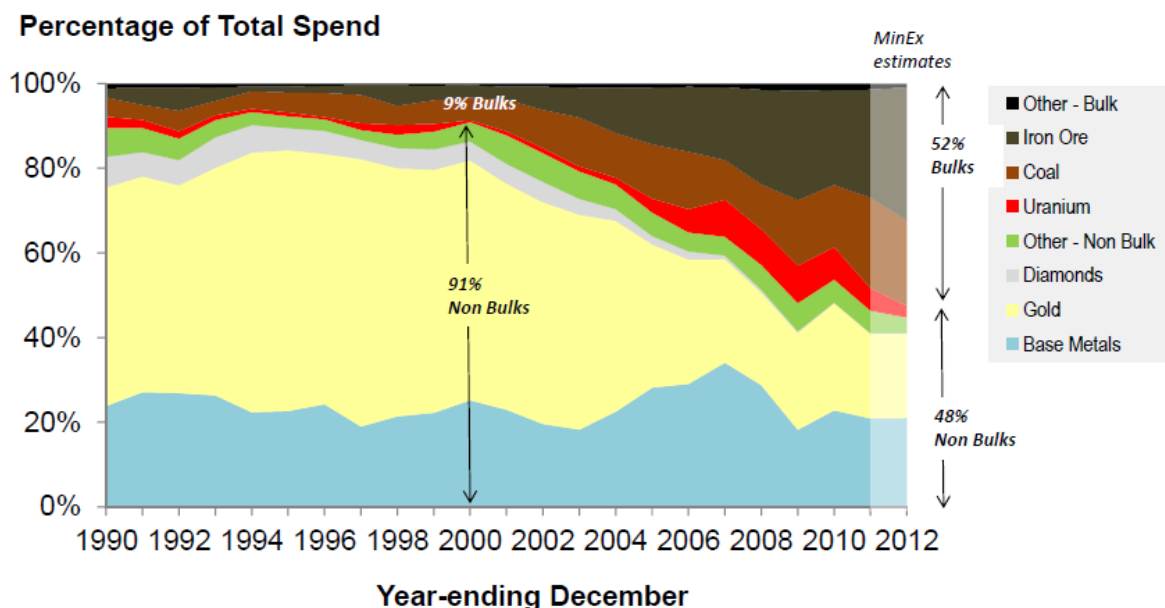
**Figure 3 - Exploration expenditures in Australia by commodity type**

(Source: ABS Cat No. 8412.0)

<sup>2</sup> Service providers include; geological and engineering consultants, software providers, geochemical and geophysical contractors, drilling companies, analytical laboratories, heritage and environmental surveyors



**Figure 4 - Exploration expenditures in Australia by commodity type as a percentage of total**  
 (Source: ABS Cat No. 8412.0)



While it is true that the March quarter typically represents a seasonal low in Australian exploration expenditure primarily for climatic reasons, the ABS March report indicates that the falls incurred in the last quarter are abnormally high relative to those observable in the corresponding March quarters in the previous three years. This interpretation appears to be re-enforced by the recently released ABS figures for the June 2012 quarter. While original exploration expenditure rebounded in the June quarter, in seasonally adjusted terms the declining trend continued with an overall fall of

4.9% largely attributable to Queensland (12.6%) and to a lesser degree Western Australia (1.6%), where exploration for iron ore and gold recovered somewhat

On balance we believe that exploration expenditure in Australia may have peaked in the December 2011 quarter and may be entering into a period of contraction. This interpretation is reflected in the projected annual expenditure for 2012 displayed in both Figures 3 and 4.

This trend which, as we will see later, is attributable to a number of causes, has been to some degree masked from public and political perception by the persisting booming conditions in terms of multi-billion-dollar investments in the development and construction of mining projects, in some cases of massive scale, and by a healthy pipeline of committed future projects.

### **Comparing Australian exploration expenditure and drilling trends**

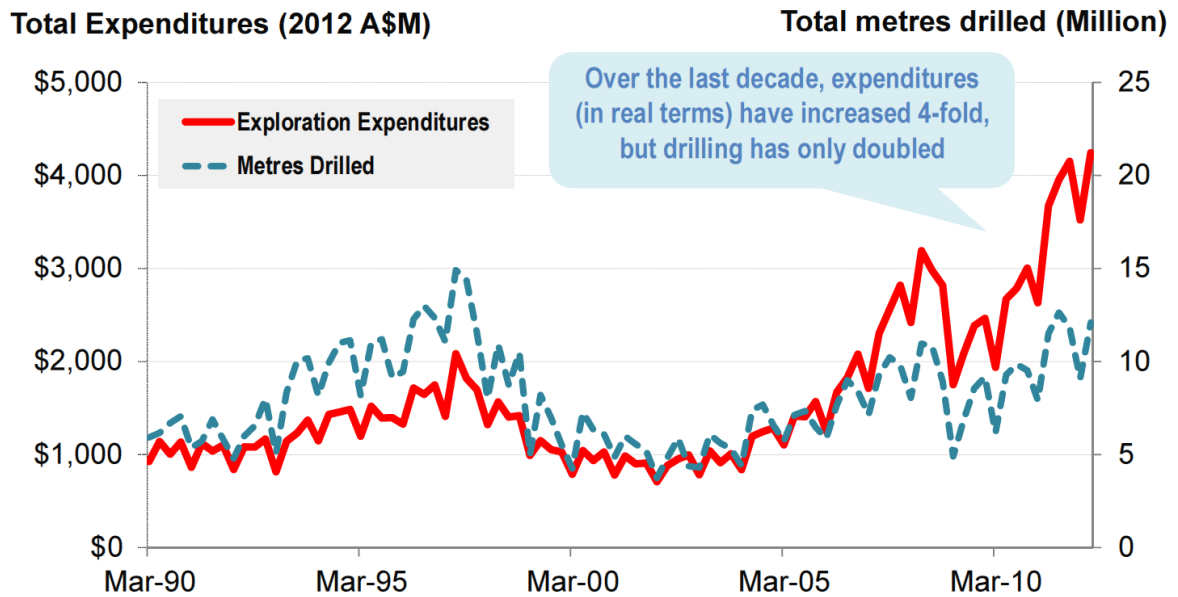
Drilling is the acid test of mineral exploration. It is the culmination of every exploration project and the means by which mineral discoveries are made or ground is sterilised. One may validly argue that the maximum value in the mining cycle is added in relative terms by the first mineralised intersection. Drilling is also fundamental in the delineation of new resources to maintain or ideally increase the national mineral resources inventory and in determining the degree of confidence in their quantification/classification.

Thus it is fortunate that the ABS collects quarterly statistics about the amount of drilling carried out in Australia and whether drilling is directed to discover or test “new deposits” or to better delineate and quantify “existing deposits”.

Figure 5, however, clearly portrays a worrying situation whereby a fourfold increase in real investment in exploration over the last decade was not matched by a commensurate increase in the total metres drilled, which has only doubled over the same period.

#### **Figure 5 - Australian annual exploration expenditures and drilling: March 1990-June 2012**

Note: Data is reported on an annualised basis (Source: ABS Cat No. 8412.0)



To the extent that exploration expenditure figures are in constant 2012 dollars, there appears to be a serious gap in the efficiency of our exploration programs. This may be due to a number of possible causes, including:

- Real escalation in average drilling costs,
- The higher unit cost of having to drill deeper targets (Figure 6),
- Real escalation in the cost of other necessary exploration activities relative to the cost of drilling, and
- Possible regulatory or other impediments to drilling.

Table 1 and Figure 6 suggest that, while gradually deepening, exploration in Australia is still primarily conducted at relatively shallow depths and this creates a concern that this search space may be becoming somewhat depleted.

**Table 1 - Average depth of cover for Greenfield and Brownfield Discoveries (in metres) in Australia: 1950-2012** (Source: MinEx Consulting © August 2012)

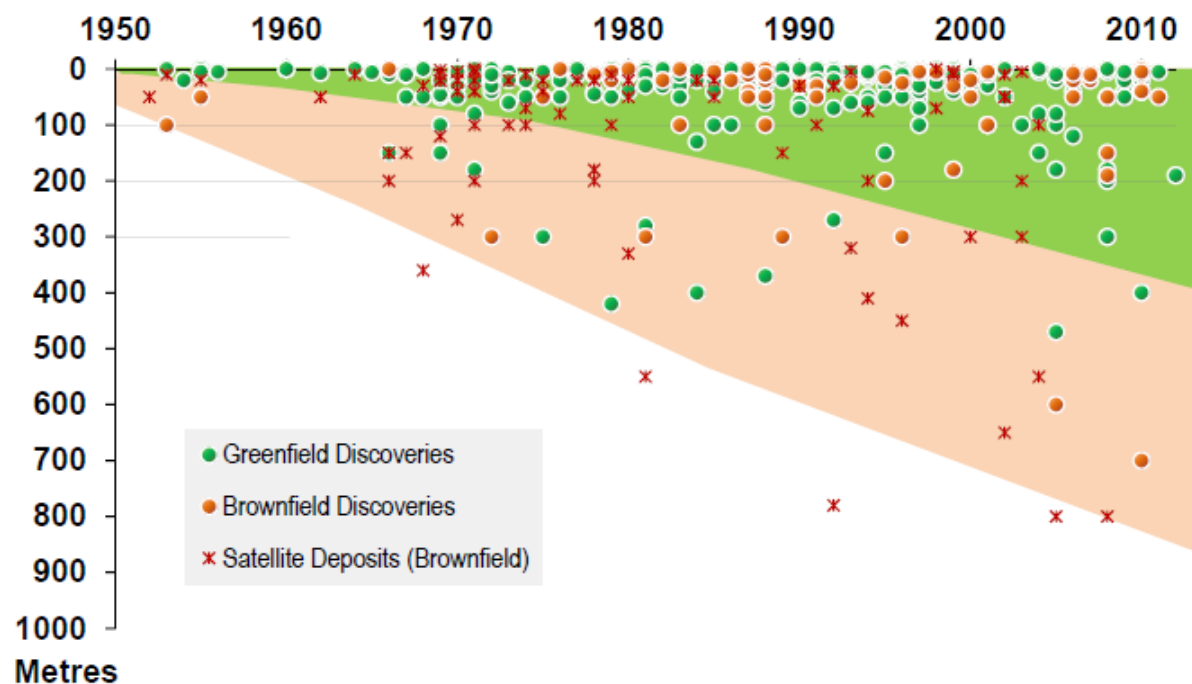
	1950-59	1960-69	1970-79	1980-89	1990-99	2000-12
Greenfield	5	35	45	52	27	64
Brownfield (including satellite deposits)	46	86	66	77	114	185

Irrespective of the causes there is clear evidence of deterioration in the efficiency of exploration which can only result in a lower rate of productivity in terms of metal discovered per dollar invested.

**Figure 6 – Depth of cover on mineral discoveries (1950 – 2012)**

Note: Satellite deposits supply ore to a central mill within an existing camp

(Source: MinEx Consulting © August 2012)



This deteriorating trend is likely to continue as the ABS March 2012 statistics show that the total 2.272 million metres actually drilled during the quarter (equal to 9.088 million metres on an annualised basis) represent a 23.1% decrease relative to the corresponding figure for the December 2011 quarter. This was well in excess of the seasonal difference between drilling in the December 2010 and the March 2011 quarters which amounted to 16.9% and is likely to represent a real fall of around 6%. The ABS figures for the June 2012 quarter indicate that, although drilling rebound in the quarter with emphasis on “new deposits”, total metres drilled recorded a a seasonalised fall of 1.1%. Unfortunately the ABS release as of 3 March 2012 does not provide the necessary breakup for the original and seasonalised figures for the various categories of drillings, which prevents a more in depth analysis at the time of writing.

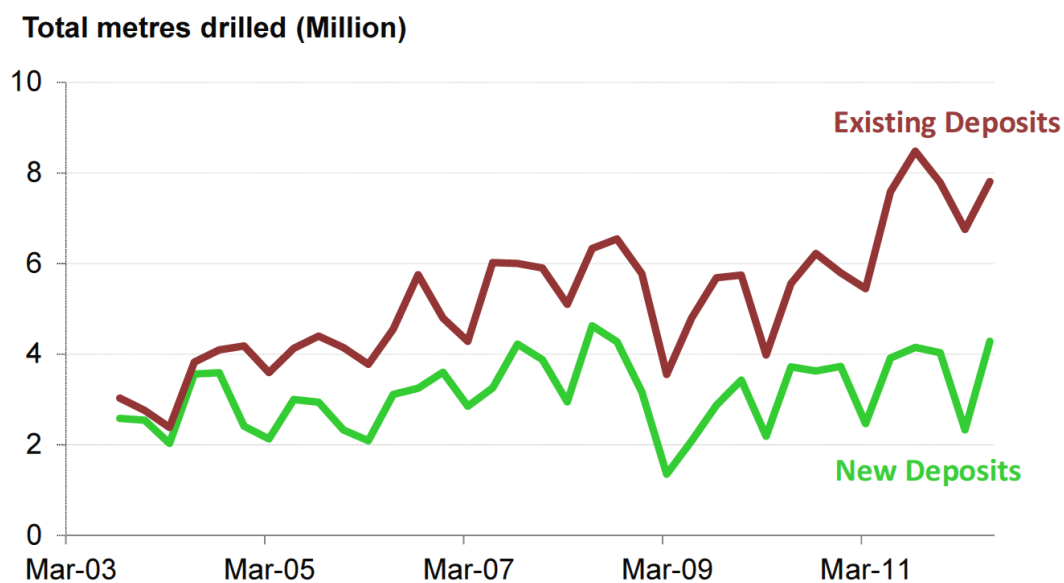


The general declining trend in drilling is supported by data from Boart Longyear (the world’s largest contract drilling company) that reports that while its drill rig utilisation remains fairly steady, its products order backlog for drilling consumables (which are sold to the general exploration industry) peaked in July 2011 and have fallen by about 30% in the June Quarter 2012 alone. It should be qualified that these results refer to international as well as Australian domestic sales.

Another worrying trend is that the proportion of drilling directed to “new deposits” has been falling relative to that of “existing deposits” as shown in Figure 7. The marginal contribution made to the resources inventory by mine site drilling is generally relatively insignificant. Similarly resource delineation drilling, while increasing the level of confidence in the resource classification, does not add to the metal inventory and indeed may in some case reduce it.

**Figure 7 - Level of exploration drilling in Australia: Sept 2003-June 2012**

Note: Data is reported on an annualised basis (Source: ABS Cat No. 8412.0)



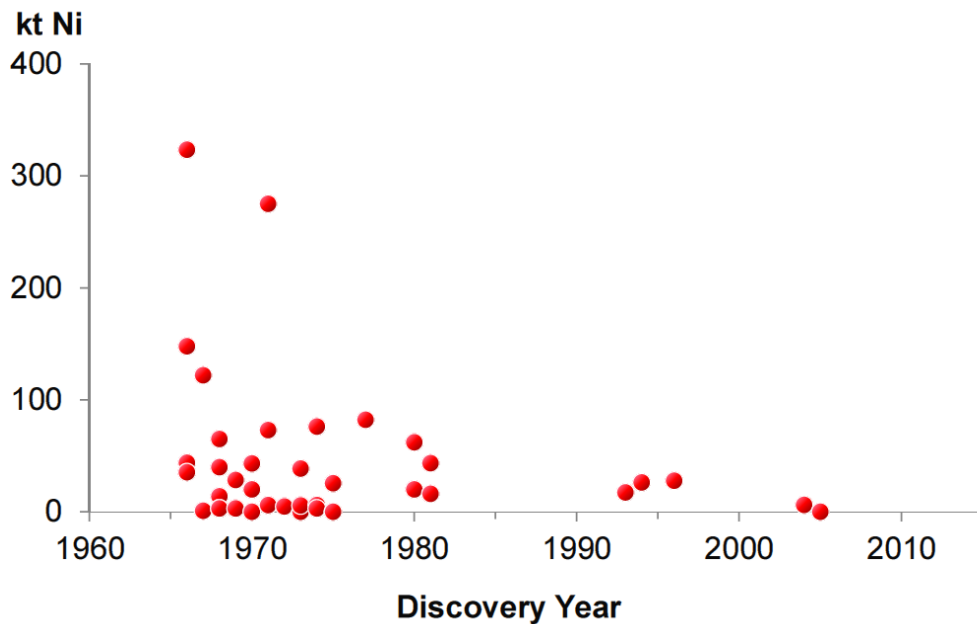
## Greenfield versus brownfield exploration

In many cases, larger deposits tend to be discovered in the earlier greenfield stages of the exploration history of a geological terrane. This is because, by and large, the larger deposits have more extensive and therefore more easily detectible footprints. An example is Figure 8 that plots the size of successive discoveries against their respective date of discovery for the Kambalda nickel exploration camp in Western Australia.

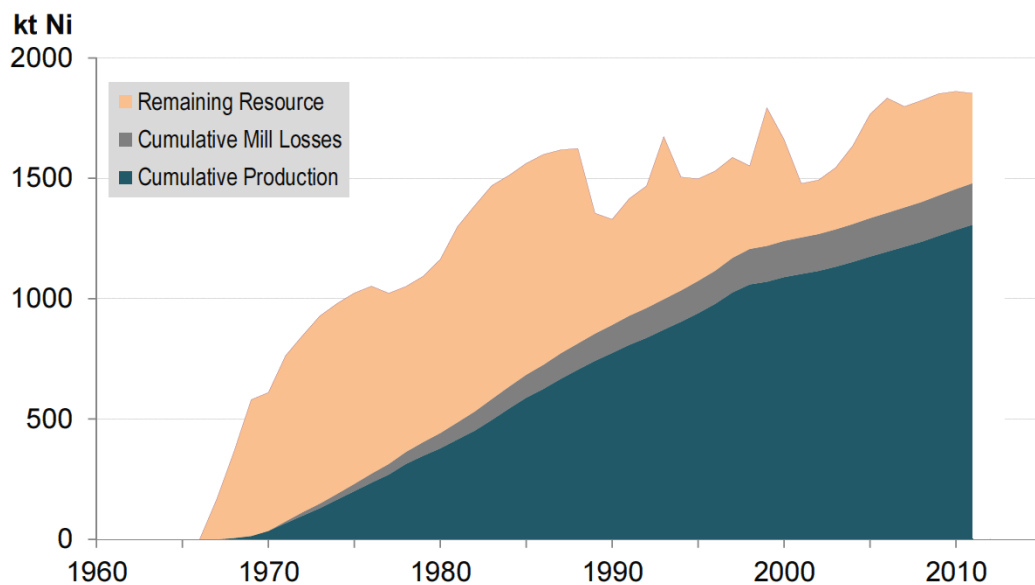
As a consequence, on average, brownfield discoveries in mature terranes, while more probable, are likely to make a less significant contribution to the metal inventory than greenfield ones, both on a per dollar spent and on a per metre drilled basis.

Obviously, as Figure 9 illustrates, it becomes progressively very difficult for the resource inventory of a company to grow if it has to rely on successive brownfield mineral discoveries in the same terrane and its ultimate survival would depend on discovering or being an early entrant into a new nickel camp as a result of Greenfield exploration.

**Figure 8 – Size distribution of successive nickel sulphide discovery in the Kambalda Nickel Camp**  
 (Source: MinEx Consulting © August 2012)



**Figure 9 – Difficulty in maintaining a resource inventory in a maturing exploration terrane. Historic Resources and cumulative production for the Kambalda Nickel Camp**  
 (Source: MinEx Consulting © August 2012)



The terms greenfield, brownfield and mine site exploration as defined by Bartrop and Guj (2009) are frequently used in exploration literature. Greenfield exploration targets areas of conceptual potential where, however, the particular type of target is currently not or poorly represented and there is a relative paucity of mining infrastructure. Brownfield exploration, by contrast is carried out in terranes where the type of mineralisation targeted has already been discovered and where there is a reasonable level of existing infrastructure. Mine site refers to exploration conducted within a relatively close radius from an existing operation and attendant mining infrastructure.

MEG's classification of exploration stages includes three categories: grassroots, late stage/feasibility and mine site. The MEG's classifications straddle to some degree the greenfield and brownfield exploration boundaries.

An attempt has been made in the following illustrations to achieve a degree of consistency by splitting MEG's grassroots category into its greenfield and brownfield components by company type. The authors notionally assume that all of the expenditures by the majors and half of the junior companies' expenditure are directed to greenfield exploration, with the balance devoted to terranes that would be classified as "brownfields".

Reconciliation with the ABS' definition of "new deposits" and "existing deposits" is harder as the latter straddles the brownfield-mine site boundary.

Alarming the ABS' statistics show that exploration for "new deposits" fell by 23.2% (or -\$75.0 million) in the March 2012 quarter, that is to say at roughly twice the rate of the fall experienced on "existing deposits" exploration at 11.5% (or -\$81.3 million). This represents a real fall of around 5% in seasonally adjusted terms and continues the undesirable downward trend in the search for new deposits.

## Junior versus major explorers

The MEG's statistics categorise mineral exploration companies into four categories, namely:

- **Major** – a company with adjusted annual non-ferrous mining-related revenue of US\$500 million or more, which is considered to have the financial strength to develop a major mine on its own.
- **Intermediate** – a company with at least US\$50 million in annual non-ferrous revenue but less than the \$500 million major-company threshold.
- **Junior** – the main criterion for inclusion is that the company's principal means of funding exploration is through equity financing, although some companies may have limited revenues below the intermediate-company's threshold of US\$50 million. This category includes mainly pure explorers but also many aspiring producers that have not yet reached the "intermediate" threshold.
- **Other** – made up of Government-funded exploration programs. It also includes private and industrial companies. Relatively little exploration (2% of total) is conducted by this category.

Figure 10 provides a breakup of Australian mineral exploration expenditure for non-bulk commodities and excluding uranium, from 1996 till 2012 in terms of company types. As discussed above, exploration for non-bulk commodities in Australia represents approximately 48% of the total. The graph shows how real expenditure by majors has remained relatively constant over the period with the growth being provided almost exclusively by intermediate and more particularly junior companies.

**Figure 10 – Australian mineral exploration expenditure for non-bulk commodities and excluding uranium by company types (1996 – 2012)**

(Sources: ABS and © Metals Economics Group, Corporate Exploration Strategies 2011)

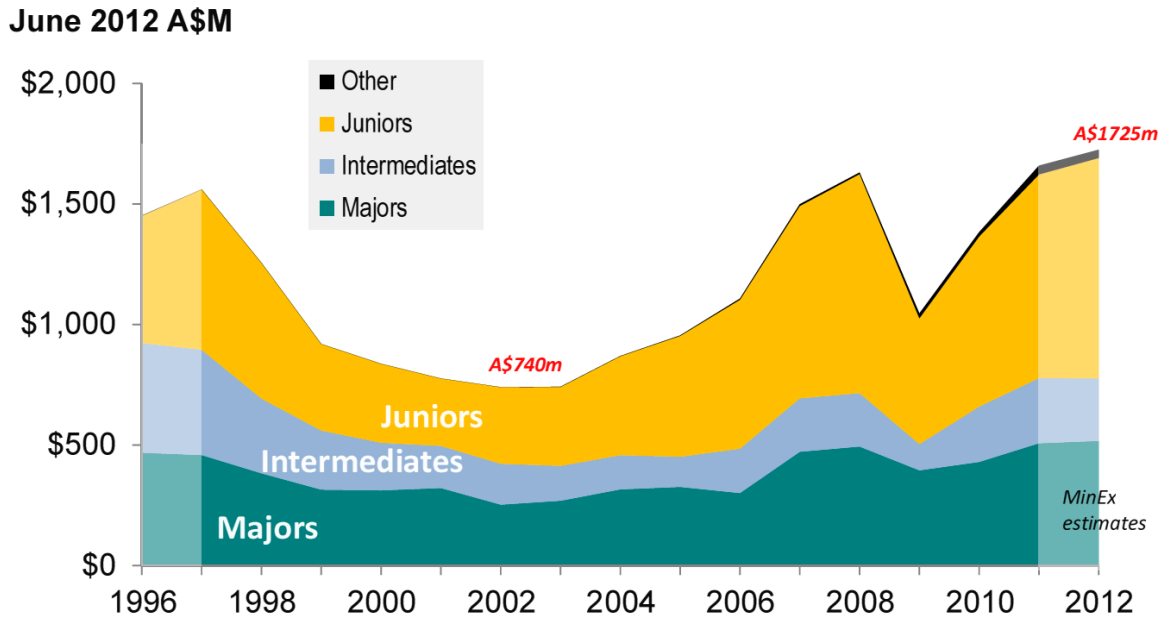
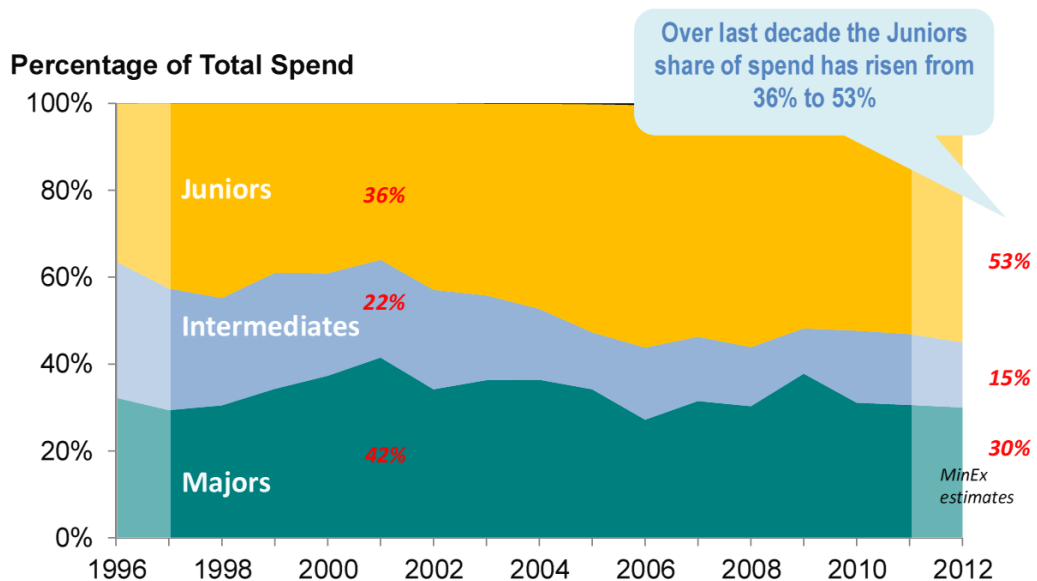


Figure 11 conveys the same message in percentage terms. The graph clearly shows how over the last ten years the proportion of exploration by junior companies rose from 36% to 53%, while that of intermediates fell from 22% to 15% and of majors from 42% to 30%.

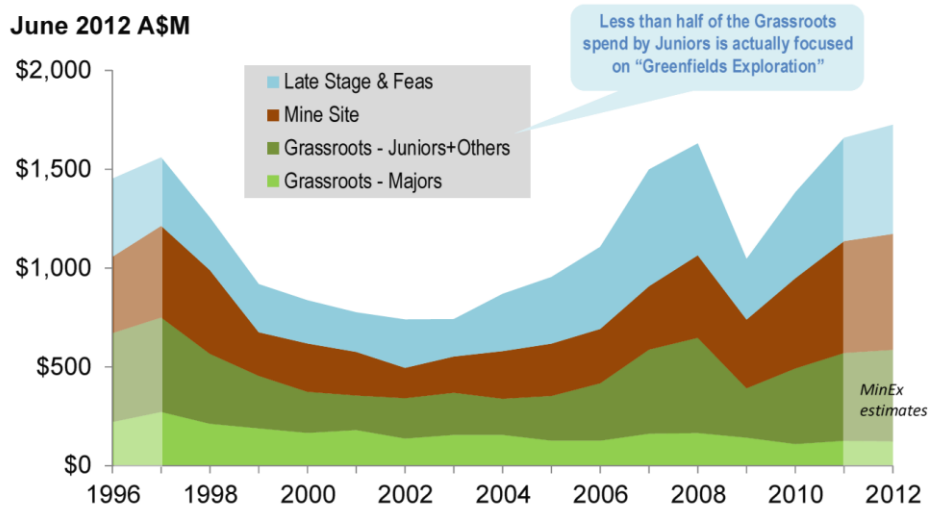
**Figure 11 – Australian mineral exploration expenditure for non-bulk commodities and excluding uranium by company types as a percentage of total (1996 – 2012)**

(Sources: ABS and © Metals Economics Group, Corporate Exploration Strategies 2011)



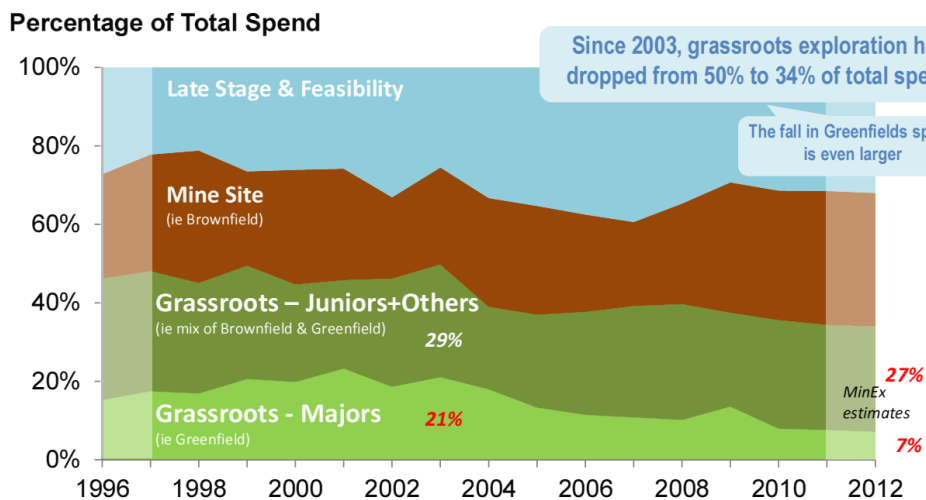
**Figure 12 – Australian exploration for non-bulk commodities and excluding uranium by project stage (1996-2012)**

(Sources: ABS and © Metals Economics Group, Corporate Exploration Strategies 2011)



**Figure 13 – Australian exploration for non-bulk commodities and excluding uranium by project stage as a percentage of total (1996-2012)**

(Sources: ABS and © Metals Economics Group, Corporate Exploration Strategies 2011)



The breakup of Australian exploration in terms of stages is provided in Figure 12, which shows how much of the growth in recent years is attributable to mine site and late stage exploration associated with feasibility studies.

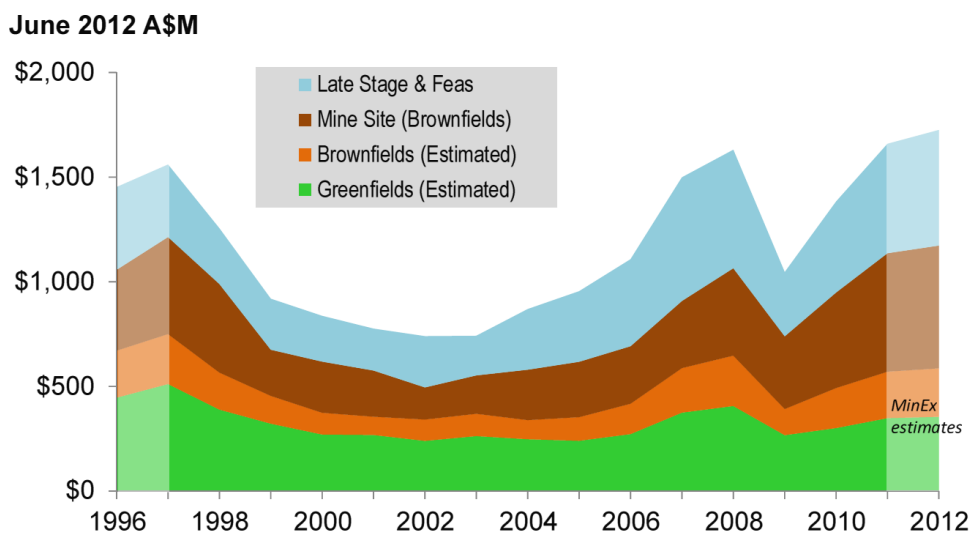
By contrast, grassroots exploration as a percentage of total expenditure has been declining since 2003 from about 50% to the current level of 34% (see Figure 13). In this context it must be remembered that MEG’s grassroots definition includes a component of brownfield exploration and that purely greenfield exploration will constitute significantly less than 34% of total. As discussed later, this is significant – as it adversely impacts on the industry’s long term sustainability.

Figures 14 and 15 show the authors' estimates of the overall trend in domestic exploration expenditures by all Australian companies for non-ferrous minerals and excluding uranium broken down by greenfields and brownfields exploration. It is assumed that the whole of the majors' grassroots expenditure and half of the juniors' is on greenfield projects. The figures suggest that the overall share of greenfield expenditures in Australia has dropped from 35% to 21% in the last decade.

As already mentioned, this significant decreasing trend in greenfield exploration is worrying because maintenance of the mineral inventory to counteract mining depletion is quantitatively very dependent on the discovery of giant and major ore bodies typically found in the course of greenfield exploration.

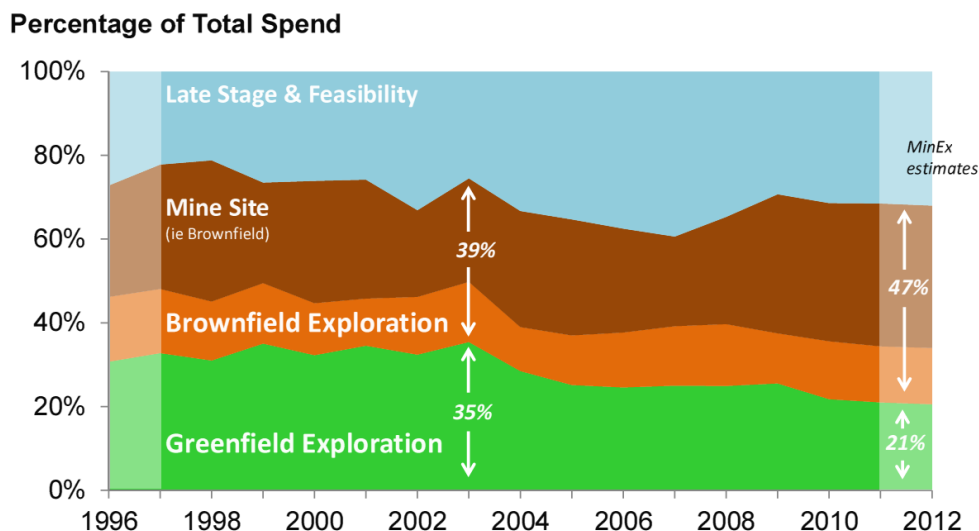
**Figure 14 – Breakup of Australian exploration for non-ferrous minerals excluding uranium**

(Sources: ABS and © Metals Economics Group, Corporate Exploration Strategies 2011)



**Figure 15 - Breakup of Australian exploration for non-ferrous minerals excluding uranium as percentage of total (1996-2012)**

(Sources: ABS and © Metals Economics Group, Corporate Exploration Strategies 2011)



## How is Australia faring in terms of discovery rates?

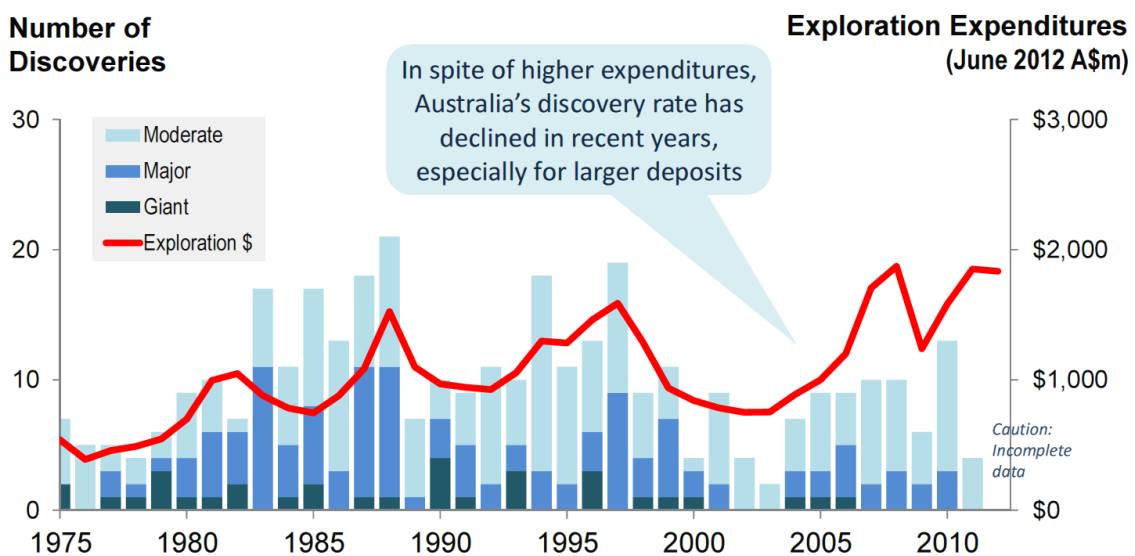
Figure 16 compares the number of discoveries over the period 1975 till 2011 with the total exploration investment in real 2012 Australian dollars. Discoveries and expenditures exclude bulk minerals such as coal, iron ore and bauxite. Discoveries are categorised as:

- “Moderate”: >100koz Au, >10kt Ni, >100kt Cu equiv, >5 kt U<sub>3</sub>O<sub>8</sub>
- “Major” : >1moz Au, >100kt Ni, >1mt Cu equiv, >25 kt U<sub>3</sub>O<sub>8</sub>, and
- “Giant” : >6moz Au, >1 mt Ni, >5mt Cu equiv, >125 kt U<sub>3</sub>O<sub>8</sub>

The graph of Figure 16 shows how in the mid-80s and mid-90s there has been a good positive correlation between increases in exploration expenditure and increased rate of discovery. By contrast increased exploration expenditure in recent years has been paired with a significantly reduced rate of discovery characterised by an absence of giant deposits and a paucity of major ones. While it is true that discoveries to some degree should lag exploration investment, and that it does take time to delineate and report a new discovery, this pattern seems to defy the statistical variability of discovery rates and points towards a discontinuity in the rate of discovery.

**Figure 16 – Comparison of exploration expenditure and mineral discoveries for non-bulk commodities including uranium (1996-2012)**

(Sources: ABS and MinEx Consulting © August 2012)

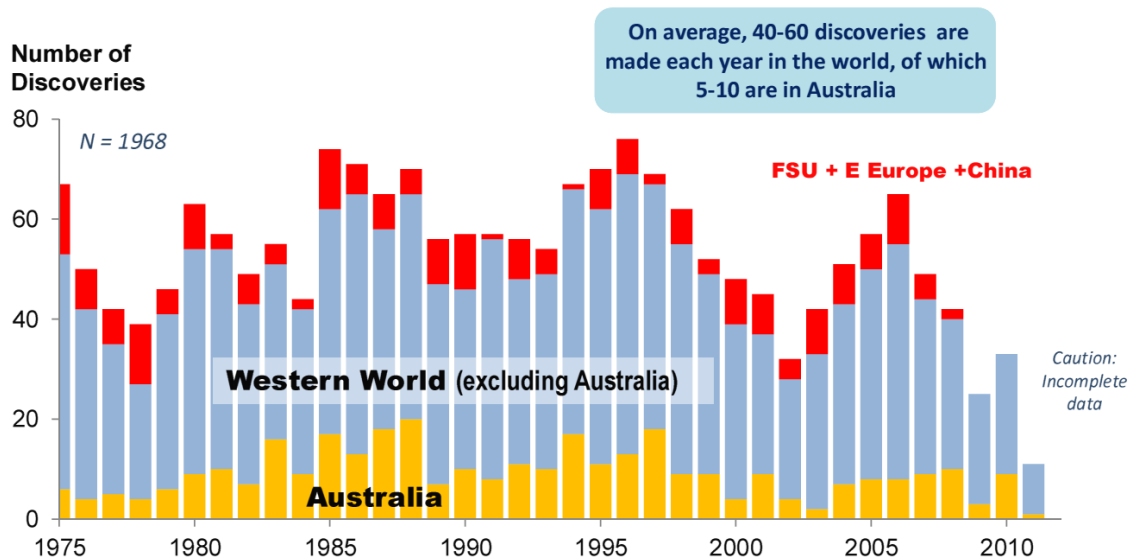


Asides from the issue of the real increase in the cost of exploration and drilling already discussed, one of the main causes of this decrease in the rate of discovery is the progressive maturing of Australia as an exploration area relative to less mature regions such as Africa, South America and parts of Asia. In this light it is more appropriate to compare, as in Figure 17, Australia's exploration performance with that of more mature jurisdictions in the rest of the western world, in the former Soviet Republic and in China.

Table 2 shows how until recently Australia's track-record in terms of making moderate and major discoveries has been good. By contrast, as highlighted at the bottom of Table 2, it is getting very expensive to make a giant discovery in Australia. This is one of the reasons driving minerals exploration by Australian companies to less mature regions, particularly Africa. At last count there were some 325 Australian based companies operating about 850 projects (45 of which operating mines) worth around \$40 billion in 42 out of 54 African countries.

**Figure 17 – Australia's performance in terms of mineral discoveries compared with the rest of the Western World and the former Soviet Union plus China (1996-2012)**

(Source: MinEx Consulting © May 2012)



**Table 2 – Australia's performance in terms of mineral discoveries and unit cost of discovery by deposit size over the last three decades** (Source: MinEx Consulting © May 2012)

Period	No of Discoveries in Aust / WW	Australia's share of Discoveries	Australia's share of WW Exploration Expenditure	Cost per Discovery (US\$2011m)	
				Australia	Rest of WW
<b>Moderate Discoveries #</b>					
1980-89	125 / 520	24%	17%	\$55m	\$85m
1990-99	116 / 559	21%	19%	\$70m	\$79m
2000-10	73 / 412	18%	13%	\$126m	\$189m
<b>Major Discoveries #</b>					
1980-89	65 / 260	25%	17%	\$106m	\$171m
1990-99	49 / 313	16%	19%	\$165m	\$133m
2000-10	25 / 220	11%	13%	\$367m	\$329m
<b>Giant Discoveries</b>					
1980-89	10 / 55	18%	17%	\$688m	\$742m
1990-99	13 / 87	15%	19%	\$622m	\$475m
2000-10	3 / 44	7%	13%	\$3056m	\$1564m

# Note: Includes discoveries from the larger size range.

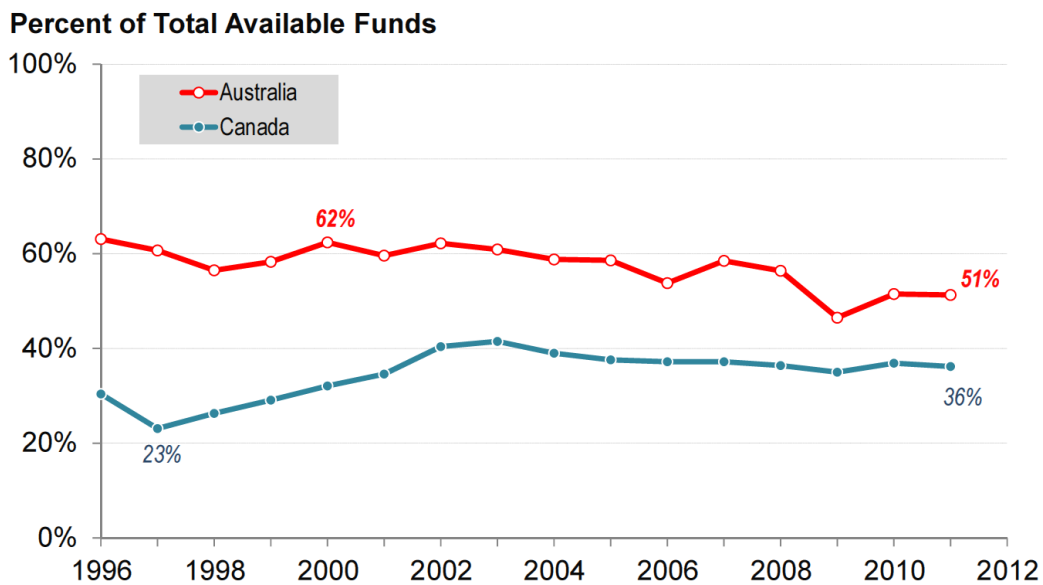
Unlike Canadian companies which, while strongly foreign orientated, have nonetheless maintained a steady rate of domestic exploration investment (around 36%), Australian companies, which were



originally primarily orientated towards domestic exploration, have been steadily moving their focus offshore. In the last ten years the proportion of their exploration funds deployed domestically has fallen from around 62% to 51% and this downward trend is expected to continue (Figure 18). An opinion survey conducted by Scope Systems at the Africa Downunder Conference, recently held in Perth, "... found 86 per cent of delegates expected investment in Africa by Australian mining companies to either increase slightly ( 41.9 per cent) or increase significantly (44.2 per cent) over the next 12 months" (Sas, 2012).

**Figure 18 – Percentage of Australian and Canadian exploration investment devoted to domestic exploration (1996-2012)**

(Source: © Metals Economics Group, Corporate Exploration Strategies 2011)



### Availability of equity funds for exploration is getting tight

Equity funding is the blood for mineral exploration. Even the exploration budget of relatively profitable mineral producers appears to be a function of the degree of availability of equity funds and market sentiment. Exploration is often considered a discretionary item of expenditure rather than a critical necessity to their sustainability. Financial markets have become very tight with the advent of the Global Financial Crisis and continue to be spooked by persistent financial instability in the Euro zone. Compounding this are concerns over the future growth prospects for China and related consequences in terms of demand for Australian metals.

Although the number of small cap IPOs on the Australian stock exchange increased by 10% in 2011 to 92 listings (78 of them from junior mining companies (Trench, 2012)), the amount raised was down by 17% on the previous year (HLB Mann Judd, 2012). The average level of funds raised by small caps was at its lowest level for five years at \$6.8 million. Sixty nine per cent of all 2011 listings produced average losses of 13% by the year end, which does not bode well for future equity floats.

Our frequent contacts with junior companies and their representative bodies confirm a picture of great difficulties in raising equity with consequent higher levels of dilution of ownership and mounting financial pressure.

As it is likely that these unfavourable market conditions will persist over the immediate and possibly mid-term future, one can expect that exploration companies will go into a cash conservation mode thus contributing to a contraction in exploration activities.

## **How sustainable is the mining industry in Australia?**

The Australian exploration trends towards lower efficiency, decreasing discovery rates, shift of focus from greenfield to brownfield and mine site exploration and, difficulty in raising equity funds and their redirection offshore will ultimately result in decreasing increments to our national mineral inventory. Although current reserves and resources appear healthy, it is paramount that, if the industry is to be sustainable, new mineral discoveries should at a minimum compensate for the progressive depletion of current reserves as they are progressively mined.

Assuming for a moment that no new discoveries were to occur how long would it take for Australia to fully deplete its current inventory? Figure 19 shows that, based on current reserves and resources, about half of current major non-ferrous mines would be exhausted with 7 to 18 years. This is, of course, an unlikely scenario as, aside from new discoveries, resources will continue to be found in most of the existing mines thereby extending their life. However, as noted earlier in the case of Kambalda, it becomes progressively more difficult to replace the ore mined as the camp becomes more mature. It is a “given” that all mines/camps will eventually run out of ore. The key to the industry’s sustainability is the need to re-invigorate the portfolio by finding major new camps and this involves greenfield rather than brownfield exploration.

It is noted that the median age of the 41 major mines<sup>3</sup> listed in Figure 19 is 19 years, and that 8 of these mines are over 40 years old. It is also important to note that many of our current mines are exploiting deposits that were found decades ago.

The challenge for Australia is that while a number of mainly brownfield discoveries and rare greenfield ones will continue to be made, these will be progressively smaller and of lower grade/quality or requiring higher unit mining cost. There is in fact no room for complacency.

On the redeeming side, however, is the fact that brownfield projects close to existing infrastructure are easier to fund and generally involve shorter pre-production lead times, on average 6 years as compared to 8 years for greenfield discoveries (Figure 20). Even so, the challenge for industry is the fact that our existing mines have a median life expectancy of 7-18 years and that it takes on average, 7 years to convert a new discovery into an operating mine. Consequently, to be sustainable in the longer term, the mining industry needs to continuously build up a strong pipeline of projects at or close to the development stage. This, in turn, is only possible on the basis of an active and successful exploration sector feeding the pipeline.

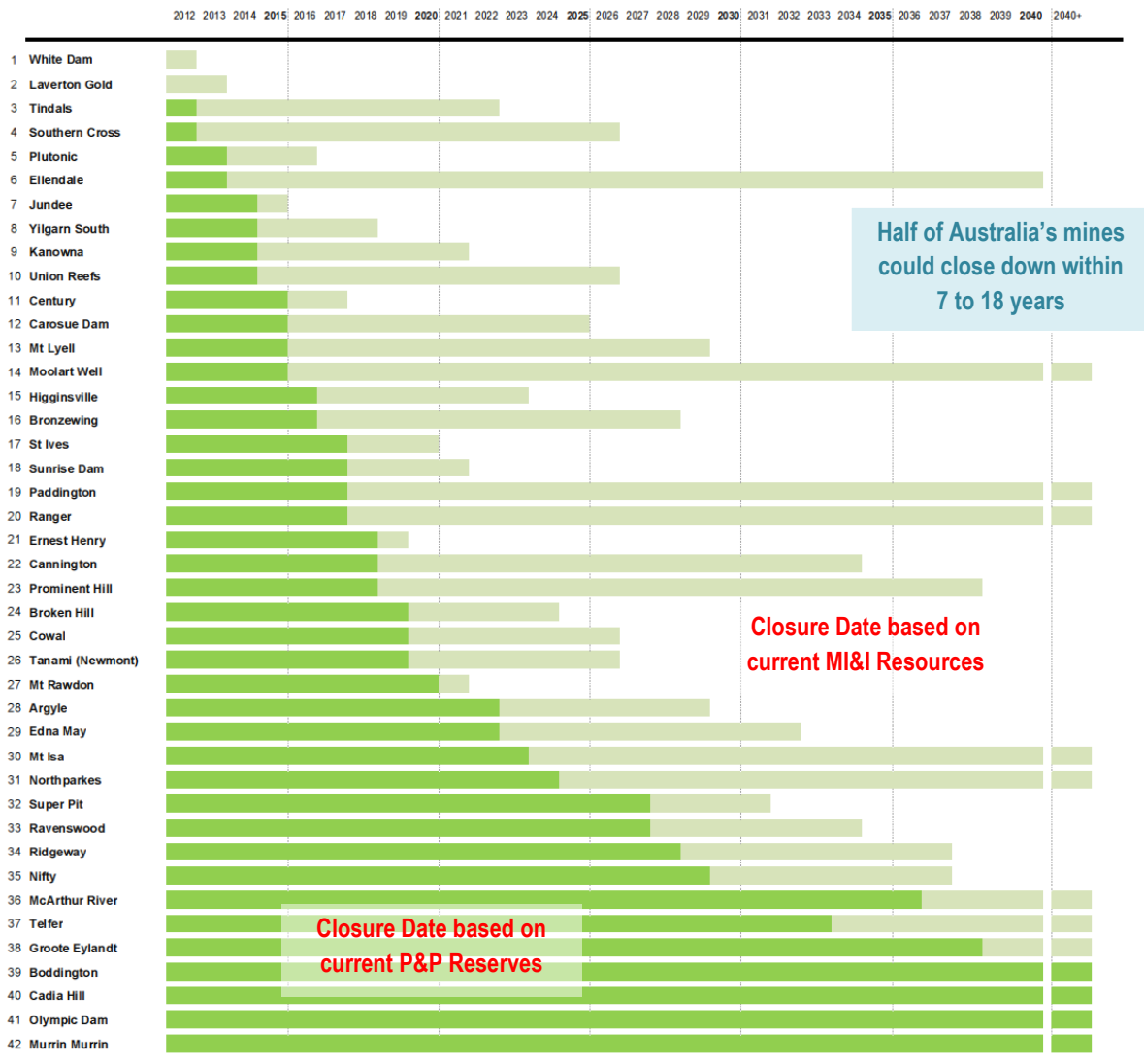
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<sup>3</sup> In terms of Australia’s total production, the 41 mines reported in Figure 19 accounted for 86% of gold, 88% of copper, 82% of zinc and 91% of lead production in 2011

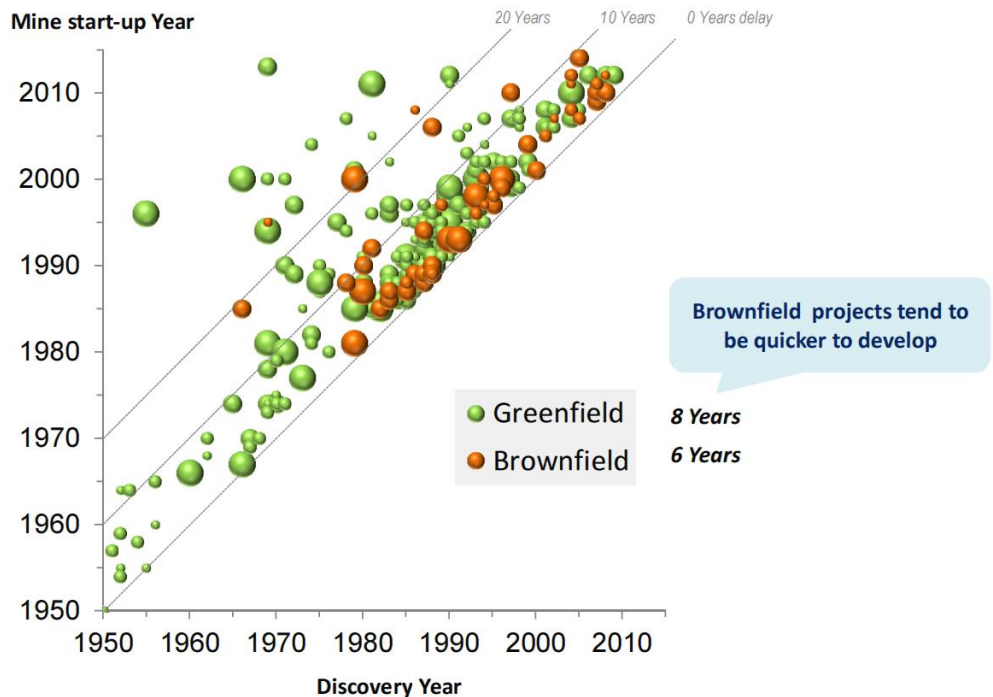
**Figure 19 – Time to exhaustion of Australian non-bulk commodity mines based on current reserves, resources and rate of exploitation**

Note: The notional mine life was calculated by dividing the current published P&P Reserves and MI&I Resources by the production rate reported for 2011

(Source: MinEx Consulting © August 2012)



**Figure 20 – Distribution of the pre-production lead time for Australian Greenfield and brownfield mineral discoveries (Source: MinEx Consulting © August 2012)**



### Perceptions versus reality: The Fraser Institute 2011 survey

Up to this point we have dealt with some factual measurements and trends of investment in and performance of the mineral exploration industry. It is now interesting to see how these appear to influence the perceptions of investors. One way to address the topic is to determine whether trends in perceptions of 94 respondent mining companies, as captured by the Fraser Institute Survey, are consistent with the factual picture we depicted so far. To do so we have analysed changes in the investment attractiveness of the various Australian states relative to alternative exploration destinations throughout the world over the period 2009 till 2011 based on a number of specific criteria as well as on a composite policy/mineral potential criterion.

Industry’s perceptions appear to be generally realistic and consistent with the factual factors discussed in this paper.

Figure 21 shows how Australia’s attractiveness based on the mining taxation criterion has deteriorated between 2009 and 2012 for all states except the Northern Territory, probably on account of its relative fiscal stability.

Figure 21 – Comparison of the results of the Fraser Institute 2009 and 2011 surveys relative to taxation regimes

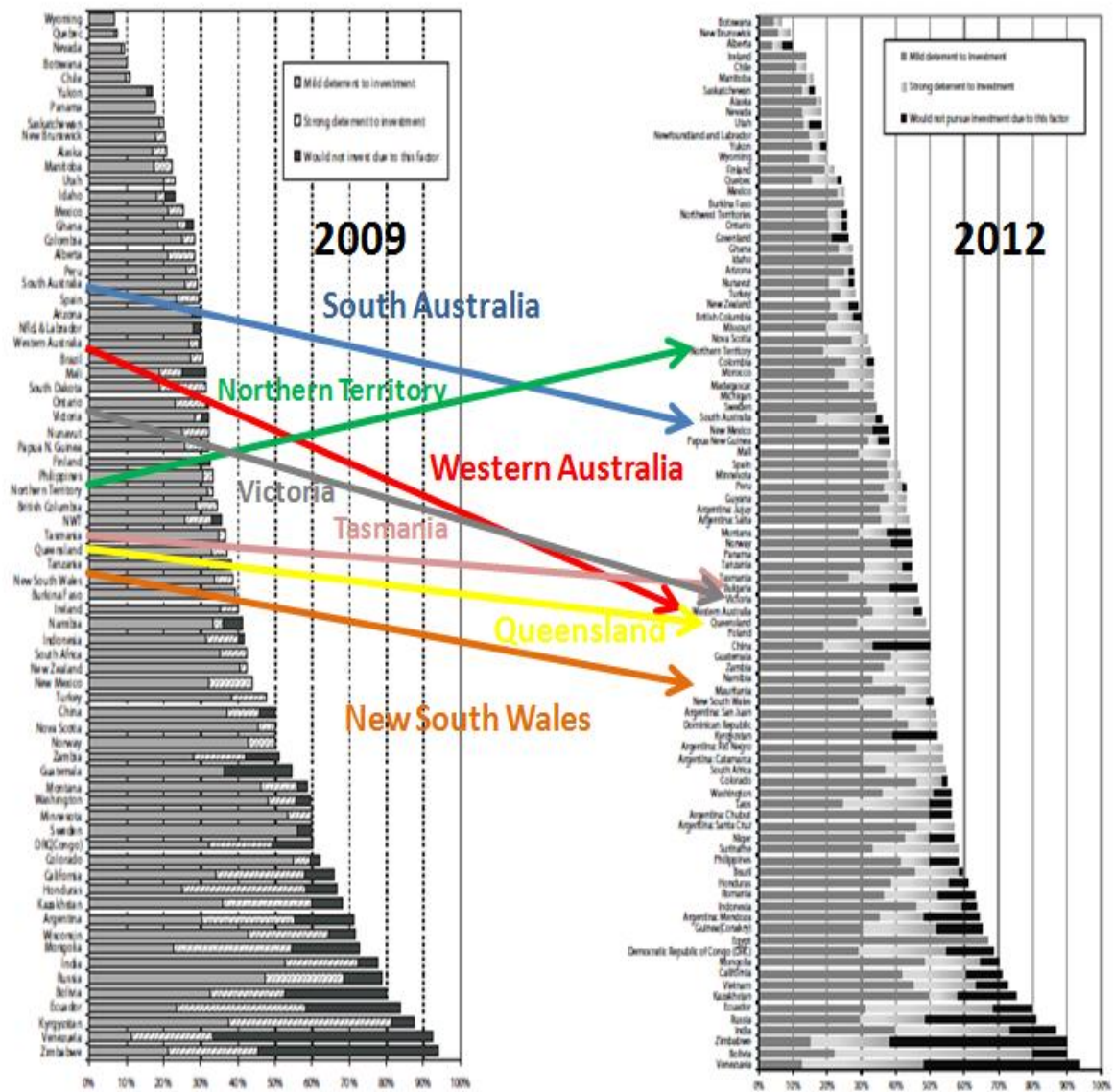
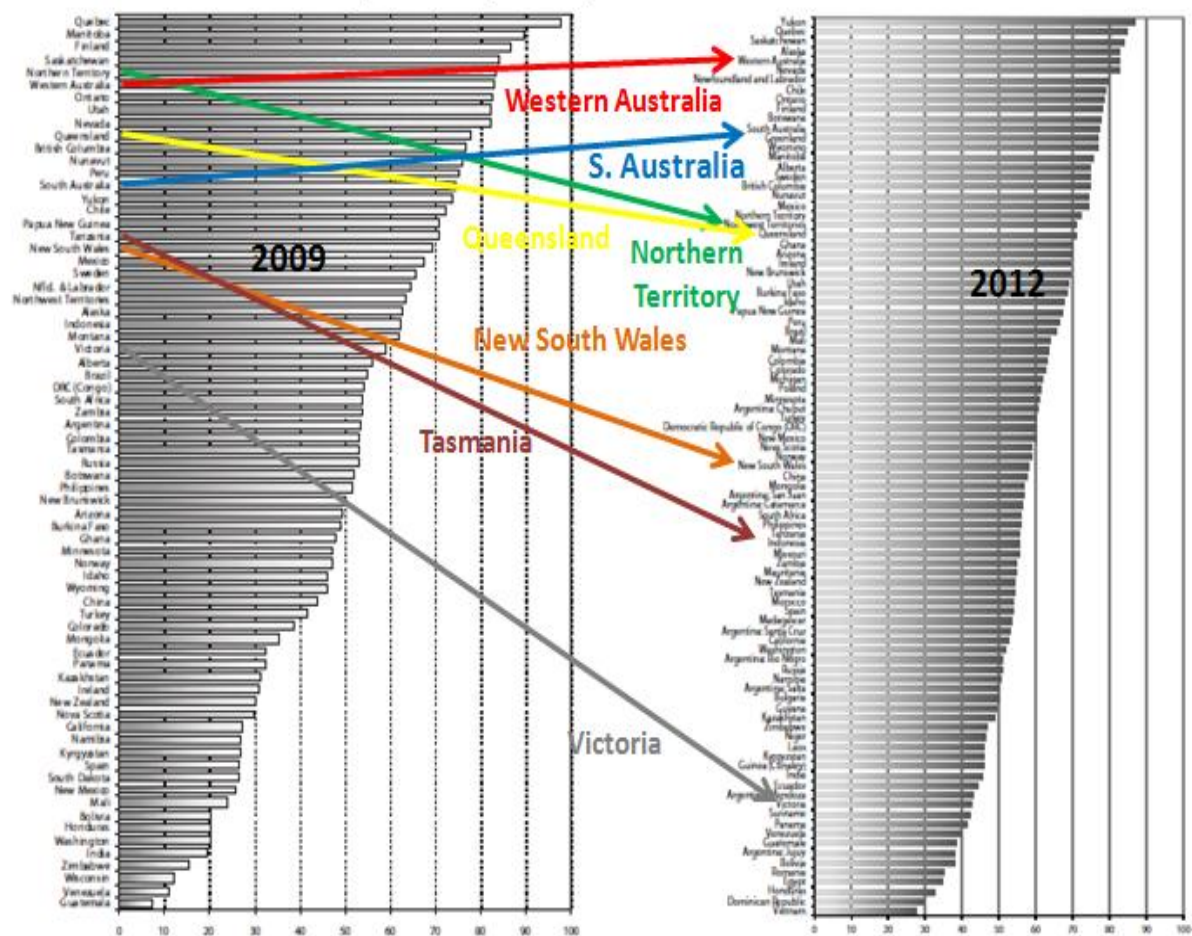


Figure 22 however indicates that over the same period Western Australia and South Australia managed to lift their desirability based on the composite policy/mineral potential criterion, probably on account of their significant government exploration incentives initiatives and some recent discoveries enhancing industry perceptions about their prospectivity.

Figure 22 – Comparison of the results of the Fraser Institute 2009 and 2011 surveys relative to the composite policy/mineral potential criterion



## Conclusions

World mineral exploration expenditure on non-ferrous metals has been recovering strongly from its low in 2009 and is back on the rising trend which commenced in 2002.

Australian exploration expenditure, while increasing in absolute terms, has continued to lose ground relative to other destinations in the world and now stands at a mere 12% of the total down from 21% in 1996.

Australian exploration expenditure and drilling fell during the March 2012 quarter in all states and for all commodities, particularly for iron ore and coal. Falls were greater in Queensland and Western Australia, which is probably attributable to the impending introduction of the MRRT and gradual softening of iron ore and coal prices. This trend appears to have continued on a seasonalised basis in the June 2012 quarter figures.

The 5-10 year outlook for these iron ore and coal is weak and consequently this will adversely impact on the level of activity for service providers and employment prospects in general.

There were also significant falls in the March 2012 quarter in the amount of drilling carried out particularly on “new deposits”. This continues a gradual trend of redirection of exploration and

drilling from greenfields to brownfields and bulk commodities, even though there is an indication of some improvement in the June 2012 quarter.

The number of small cap IPOs on the Australian stock exchange increased by 10% in 2011 to 92 listings (of which 78 were from junior mining companies), but the amount raised was down by 17% on the previous year.

The average level of funds raised by small caps IPOs was at its lowest level for five years at \$6.8 million.

On the basis of all these factors it is possible that the Australian exploration investment may be peaking and that the industry may now be entering a period of contraction.

Trends in decreasing efficiency and lower discovery rates continued. For example over the last ten years exploration investment in Australia increased fourfold in real terms but the total of the metres drilled only increased twofold indicating that exploration costs are escalating significantly in real terms.

This is also reflected in the decreasing number of discoveries per dollar over time for discoveries of all sizes, and particularly for giant discoveries which decreased because of the progressive maturing of some of our exploration terranes.

The gradual shift of funding from greenfield to brownfield exploration, while understandable in terms of short-term profitability, is worrying as in the long-run it will affect the metal contribution to the national resource inventory and with it the sustainability of the Australian mining industry.

It is estimated that, in the absence of new discoveries and ore body extensions, based on current reserves and resources, about half of Australia's non-bulk commodities mines would be exhausted between 7 and 18 years.

The Australian public at large and some of the politicians may not appreciate that the mineral exploration sector is experiencing mounting technical and financial pressures because they are masked by a perception that mining is in a phase of significant boom. This is, of course, true with regard to the frantic rate of development and construction of a long list of committed multi-billion dollars resources projects, but it is far from being the case for the mineral exploration industry. There is little room for complacency in this sector.

The question then still remains – “where will Australia's future mines come from?”

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