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How Does Exploration Add Value?

Slide 1: Talk Title Slide

One of the factors critical to the future success of any mining company is a growing inventory of high-quality mineral resources. Historically, exploration has been central to developing this inventory. However, in recent years the value proposition for exploration in large mining companies has been questioned.

Slide 2: Talk Overview

The purpose of this talk is to examine some of the very real challenges facing the exploration industry, and then examine the value proposition for exploration in a "Mega-Miner" such as BHP Billiton.

Slide 3: While exploration is always the life-blood of any resources company, we can't ignore the fact we are in a special time. In simple terms billions of people, who have never been part of the global economy, are making themselves heard. On the slide in front of you we are showing the consumption and share of global demand for Iron Ore, Copper, Nickel and Aluminium in China since 1995. This rapid rise in consumption has started to deplete the industry's resource base at a much higher rate than had been expected. This resource base needs to be replaced. Is this likely to be a short-term issue? We don't think so.

Slide 4: On the next slide we show the intensity of use for Copper as a function of per capita GDP. We are showing the progression of the US, Japan, Germany, Taiwan and South Korea. As the individuals in these economies increase their productivity and income, the amount of Copper they consume, on a per capita basis, increases until about $15,000 on a purchasing power party basis. At which point intensity flattens out. This is a pretty standard pattern.
[Click]

And here is China. As you can see it has some way to go. Multiply this by 1.4 billion people and you have significant demand growth and an ever increasing need to discover new resource. And we could draw a similar curve for other resources.

Slide 5: Base Metal Discovery Rates (1950-2004)

This slide presents a high-level overview of the global (at least Western World) base metal exploration industry over the last half a century. It tracks two important metrics over this time; total annual global expenditure and the number of significant deposits found each year. For the purposes of this exercise, a "significant" deposit has been defined as one containing greater than one hundred thousand tonnes of Cu-equivalent. Copper equivalence is defined on the basis of equivalence of in-situ value, using BHP Billiton long term price forecasts. These data exclude those satellite deposits discovered via brownfields exploration in known camps.

This slide shows that base-metal exploration expenditures have remained relatively high, although very volatile, for the last thirty-five years or so. Despite this, there is clear evidence that the discovery rate has been declining.

Slide 6: Unit Discovery Costs

What has this trend meant for unit discovery costs? This slide shows that discovery costs, in terms of cents per pound of Copper – equivalent, have on average doubled over the last thirty-five years. It is obvious that this trend has had a major influence on the development of a perception of a declining value proposition for exploration.

It is worth taking a moment to speculate on the probable driver for this trend. It most probably reflects the diminishing number of deposits in the world available to be relatively-easily discovered by surface-prospecting techniques. The implication is that most of the important discoveries of the future will be at depth, such as Olympic Dam, Resolution or the Hugo Dummett zone at Oyu Tolgoi. The challenge for us as an industry is to develop the technologies to make the discovery of such deposits more cost-effective.

Slide 7: Mining Industry Consolidation

The second part of the challenge for the exploration industry in arguing its value proposition relates to the very significant consolidation of the mining industry over the last fifteen years or so.

This slide illustrates this consolidation very clearly. I have chosen to use as a reference the share price list for major mining companies published by the London-based Mining Journal.

In June 1991, there were sixty-eight companies on this list. By April 2006, only twenty-four of these companies still existed. Of the forty-four which disappeared, thirty-seven (that is 84%) were taken over or merged into larger entities.

Why should industry consolidation have any impact on the perception of the exploration value proposition? The reason relates to the relative impact of a World-Class discovery on the value of an enterprise. For junior to medium-sized companies, a world-class discovery is the largest possible single event that can impact positively on their value. For these organizations, the value-proposition for exploration is obvious.

In contrast, for the very large mining companies , such as BHP Billiton, that have emerged over recent years the net present value added by an average world class deposit *at discovery,* which is about US$650 M, is of the order of about one percent of market capitalization. On most days, this is less than the daily fluctuation of the share-price.

So clearly, the value proposition for exploration in a major such as BHP Billiton has nothing to do with any immediate impact on the share-price. So what then is this value proposition?

Slide 8: Key aspects to the Exploration Value Proposition

The thesis of this paper is that, notwithstanding the above discussion, there is such a value proposition. Understanding this requires an understanding of four key aspects of exploration value creation.

These are:

- Resource availability risk
- The Long-term embedded option value of world class deposits
- The difference between top quartile and industry average performance
- The contribution of exploration to integrated business development and brownfields exploration

I will now discuss the significance of each of these in turn.

Firstly, I would like to consider the issue of **Resource Availability Risk**.

Slide 9: Highlight "Resource Availability Risk" on Key Aspects bullet point slide.

By this I mean that the risk that a company may find itself without the resources it needs to underpin its growth strategy. The alternative to a corporate exploration function is to rely on growing the resource base through the acquisition of high-value deposits. This can be either by buying them from the Juniors that find them, or through Merger and Acquisition activity. While partnering with Juniors or participating in M&A activities is part of the

answer, it cannot provide all the answer. This is because relying on this approach alone is a high-risk strategy that gives away control of your future.
In particular, a dependence on acquiring Junior discoveries implicitly limits the company's growth prospects to the geographical and commodity biases of the Junior market. At BHP Billiton we are increasingly finding that the imperative to grow our resource base is taking us into new geographies, not generally favored by the Junior market, which have complex challenges in areas such as safety and community relations. The next few slides are perhaps an illustration of some of these challenges.

Slides 10, 11, 12: Slides with visual illustration of the challenges of new geographies.

Slide 13: Illustrating upward trending Cu prices, as an example

The emergence of developing economies as significant consumers of raw materials provides important context for the issue of resource availability risk. This slide illustrates patterns in copper prices over the last century or so. It shows that there are in fact long periods where the overall trend in metal prices is actually upward. It is possible that we have now entered the beginning of one of these periods. If so, it implies a different world to the last thirty years, with upward trending metal prices putting an increasing value on high quality resources.
The corollary is that increasing amounts of capital will be available from the equity and debt markets to develop new discoveries and therefore Juniors need not be reliant on the Majors. In this environment, any discoveries that are actually offered to Majors are more likely to be subject to the same type auction that occurred following Diamond Field's discovery of Voisey's Bay.

Slide 14: Major Mining companies ranked by market cap.

This slide ranks all major, publicly-listed mining companies in order of their market capitalization. It is clear from this chart that the growth potential of M &A strategies is becoming limited for the Major Miners. Particularly once the parastatal and gold-only companies are excluded, there is now a depletion of the pool of target companies large enough to make a difference. Examples of such companies that have disappeared over recent years, or are in the process of disappearing, include; Falconbridge, WMC, Noranda and MIM.
In addition, as companies grow in significance in a particular market, anti-trust barriers may start to become a constraint, as was evidenced by the Alcoa-Reynolds transaction.

Slide 15: Highlight "Long-Term Embedded Option Value" on Key Aspects bullet point slide.

The next aspect that I would like to discuss is the **Long-term Embedded Option Value of World Class Deposits**. The market value of the mining industry today is of the order of US $800 Billion. As every deposit that contributes to this total was at some point discovered, it is obvious that mineral exploration at the macro-scale must add value! Why then do people sometimes question the value created by exploration? The explanation for this is that the vast majority of the value added by exploration is through the *long-term embedded option value* of world class deposits. That is, the ultimate value of these assets to the business is *much* larger than that recognized at the time of initial discovery. Important examples from our own business include Hamersley iron ore, Escondida copper, Olympic Dam copper and Darling Range bauxite. It is important to emphasize that it is *only* these world class deposits that have this embedded option value. In fact the presence of such option value is probably ultimately the most useful definition of a world class deposit!

This option value is ignored in conventional DCF (Discounted Cash Flow) valuations of deposits at discovery. There are two major reasons for this:

The first is that DCF analysis assigns little value after a time horizon that (depending on the cost of capital used) is usually shorter than the life of a world class deposit.

The second reason is that DCF valuation of a deposit at discovery does not take into account the value of additional ore found post the initial discovery. In the case of world class deposits this is commonly a very large amount. This additional ore is in fact often more profitable than the initial ore found because much of the required infrastructure capital is already amortized.

Slide 16: Ertsberg-Grasberg camp resource growth slide

The Ertzberg-Grasberg mining complex in West Papua is a good case-study of a world class deposit that continued to grow very significantly over time. In 1989, the year *after* the discovery of Grasberg, 4.2 Million tonnes of Cu metal were reported in reserves and the production rate was 158 000 tonnes of Cu per annum. By 2004, the reserve base had grown more than seven-fold to 30.2 Million tonnes of Cu, and production had peaked in 2002 at 980 000 tonnes of Cu per annum. Commonly this potential for reserve growth, and therefore production expansion, is not adequately recognized by the market. Ertsberg-Grasberg provides an interesting example of this.

Slides 17-24: Showing actual versus forecast production from Ertsberg-Grasberg over time.

These slides track the production forecasts for Ertsberg-Grasberg against actual production over a twenty-five year period. It is clear that, for about the first twenty years of this period, production forecasts were consistently underestimated, presumably because they did not anticipate additional ore discoveries in the future.

This example leads us into the final point to be made about option value and world class deposits. Few world class deposits are recognized as such immediately when they are first discovered. In some cases, it is the discovery of a much larger and/or higher grade body of mineralization within the mining complex that is the critical step. For example, it was not until the Grasberg discovery that the Ertzberg-Grasberg complex was clearly recognized as world class. In other cases, it is a technological discontinuity that is critical. A good example is the giant, but low-grade, Mt Keith nickel mine in Western Australia, which, although first discovered in 1969, was not developed until 1993 because of difficulties in processing that needed to be overcome. The recognition of these potential world class deposits is an important skill that a major mining company needs to develop. Although this will always involve a component of professional judgment and intuition, it is important to develop an approach that is as analytical as possible.

Slide 25: Highlight "Top Quartile versus Industry Average Performance" on Key Aspects bullet point slide.

Another important perspective on the exploration value proposition is the large difference in value created by top-quartile performance as opposed to the industry average performance. Industry average is diluted by many very poor performances.

In BHP Billiton we have a strong drive towards being a high-performance organization. One of the critical things we need to do to achieve high-performance is to develop robust measures of performance in all the spheres of our activities to hold ourselves accountable to. Exploration is no exception to this. We have set ourselves the goal of top-quartile exploration performance which means we have to define what that looks like in a quantifiable sense.

Slide 26: Summary of Parameters of Industry performance analysis

To achieve this, a recent BHP Billiton internal study analyzed the exploration performance of all Western world companies with significant exploration expenditures (defined as > US $100 M) over the period 1992 to 2004. This slide summarizes the key parameters of this analysis. Performance was evaluated in terms of cost per world class-equivalent discovery. The concept of world class-equivalence was required to incorporate the far more numerous

smaller discoveries into the analysis. This was necessary to provide a statistically meaningful dataset. Internal BHP Billiton jargon divides mineral deposits into Tier 1, 2 or 3. Tier 1 is synonymous with world-class and refers to deposits with > $250 Million NPV that are also profitable throughout the entire commodity-price cycle. Tier 2 deposits have NPVs in the range of $50 - $250 Million and/or are only profitable throughout part of the commodity-price cycle. Tier 3 deposits have NPVs <$50 Million and/or are only profitable at the peak of the commodity-price cycle. Based on the actual relative discovery-frequency over our study period of 1992-2004, one world class or Tier 1 deposit was considered equivalent to four Tier 2 deposits or twenty-two Tier 3 deposits.

Slide 27: Exploration Performance Summary Slide

This analysis – note that all numbers are in 2005 US dollars- found that the median cost per world class-equivalent discovery over this period was $918 Million. However, in comparison, the lower boundary of the top-quartile was $514 Million. The aggregate performance of all of the organizations that consolidated into BHP Billiton over this period was a credible $294 Million. In contrast, the World Class-Equivalent discovery cost at the bottom of the third quartile was a massive $5.084 Billion! These numbers reinforce the critical concept that it is not satisfactory to simply do exploration; you must do it very well!

Slide 28: Shareholder Return versus discovery performance

As this slide shows, when the exploration performances of the companies considered in this analysis are compared with measures of total shareholder return, a positive correlation is observed. This is interpreted as supporting evidence for the long-term contribution of exploration success to corporate value growth.

Slide 29: Highlight "Integrated Business Development and Brownfields Exploration" on Key Aspects bullet point slide.

At BHP Billiton, the Exploration Group is seen as a key part of Integrated Business Development, which also includes Technology and M & A activities. The corporate Exploration Group supports the Integrated Business Development activities of the Customer Sector Groups (CSGs; that is BHP Billiton terminology for our business units) in the areas of greenfields exploration, brownfields exploration and early-stage resource acquisition. The Exploration Group uses its experience and skills to manage the interface between the CSG's needs and the constraints of the exploration environment to deliver a realistic, customer-

focused exploration strategy. In particular, the skills for assessing the value of early-stage resources tend to naturally fit within, and be developed within, the Exploration Group.

Slide 30: Illustrates MINEX role in Brownfields/CSG-funded activities during FY06

The Exploration Group has an important role as the long-term custodian of the Company's resource base. This includes supervising CSG activities and resources to ensure that all value-adding brownfields opportunities are identified and pursued, providing key specialist input to support brownfields activities and, where appropriate, executing brownfield programs on behalf of the CSG.

This slide illustrates the current activities of the corporate exploration group in supporting the brownfields and advanced project exploration activities of the CSGs. These activities include $30 Million dollars of exploration activity directly managed by the corporate exploration group.

Slide 31: Illustrating relationship between stable greenfields and cyclic brownfields funding

This slide schematically illustrates the relationship between brownfields and greenfields exploration in a large mining company. Because brownfields activity tends to be fundamentally episodic, with peaks in spending driven either by immediate need or opportunity, the Exploration Group has an important role in providing a reservoir of relevant skills and experience to be available when demanded by brownfields campaigns. In particular, the Exploration Group can assist in ensuring a continuity of knowledge, both geoscientific and commercial, regarding the exploration environments around operating assets. An important implication of this model is the need for persistent stable funding of greenfields exploration at a critical-mass level. This is in contrast with the commodity price-cycle driven fluctuations in greenfields expenditure that have been common in many organizations in the past.

Slide 32: Conclusions slide

In conclusion, mineral exploration has a very important role to play in adding value to a large mining company such as BHP Billiton, particularly in an environment of increasing competition for quality resources.

This value is primarily added through the discovery of long-life world class deposits with significant long-term embedded option value. Therefore it is important that greenfields exploration programs be focused on the discovery of such deposits and that as analytical as

possible an approach is developed to facilitate the early recognition of such deposits, once they have been discovered.

To be successful in exploration, it is not sufficient to be average; excellence must be achieved! At BHP Billiton we are strongly focused on maintaining an exploration performance in the top quartile of industry performance.

Finally, at BHP Billiton, the Exploration Group is seen as an integral component of the broader process of Integrated Business Development and a key resource for the support of Customer Sector Group brownfields exploration activities. Exploration's contribution to broader value-addition must also be seen in this context.

Thank you for your attention.