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Mineral exploration expenditures

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13 Mineral exploration expenditures

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Exploration is the foundation of all mining. Exploration expenditure determines the rate of discovery of future mineral deposits and mines. There is a lack of exploration and more societal support of exploration is necessary. Exploration is a little known business and based on the discussion in this brief chapter it seems reasonable that there is a need for both more exploration and more exploration statistics.

13.1 Introduction

Exploration for minerals is the only remaining hunter gatherer activity that still plays any significant role in today's global economy. Even though the industry has made tremendous technical progress particularly over the last 50 years, with new exploration technologies and theoretical geological models, it is still impossible to predict with any certainty the outcome of a planned geological exploration campaign. There is still a considerable element of luck or in other words: the investment risk is still very high.

This uncertainty and high risks have made investments into new exploration projects vary quite considerably over time. It is clear that the main factor driving mineral exploration is metal prices or indirectly metal demand. The aim of this paper is to discuss this and other drivers in some detail and in later papers to apply the conclusions of this broader first paper to various geographical regions and to various time periods. The difficulties to predict exploration results also has important bearing on the presently growing discussion of "peak metal" production. A dangerous misconception that threatens logical and scientific decisions about the role of metals and minerals in the future economy of the world.

From a societal point of view the strong, short term variations up and down in exploration expenditure are increasing the uncertainties about future metal production levels in both the short and long term. The variations are further a waste of resources in that in periods of high demand for exploration services prices increase at a higher pace than in other parts of the economy. Only to fall dramatically, in some cases just a year later. Further many projects get started only to be closed down before the projects have come to an optimal stage and can be properly evaluated. There are considerable costs associated with starting and stopping projects, which result in a waste of funds and human resources when projects are operated in an on/off manner rather than extended until they are completed according to original plan. The industry, and society, would be better served by a steady flow of projects.

13.2 Continuous exploration expenditure

There are reasons why exploration expenditure should grow steadily over the years even if metal production is not increasing. If metal production grows, which it has done in recent years, there should also be an increase in exploration expenditure to deal with the increased speed of depletion of resources and/or reserves. There are also some doubts over the sucess rate of each exploration dollar spent and the question has been raised whether the success rate is actually going down. At least there are indications that this is happening. This might partly be explained by the fact that exploration is getting more difficult because of several factors but there could also be a decrease in exploration efficiency for other reasons such as difficulties to attract the best students to study geology and an increase in company bureaucracy.

The key reasons for a gradual increase in exploration expenditures (and at later stage metal prices) are:

1. New deposits are increasingly found in areas more distant from both metal markets and centers of exploration experience and availability of exploration services. Transport costs are increasing also at constant unit price of transport
2. New deposits are found in areas which are more inhospitable and exposed to more extreme weather conditions whether deserts with a lack of water and high temperatures or in Arctic areas with similar but reversed temperature problems. Areas at higher altitude and greater depths at sea are investigated.
3. These areas are more often related to higher political risks in addition to being further away from a cost point of view. Orebodies close to the surface have most often already been localised. In the future deposits will gradually be located at greater depths.
4. Ore bodies of high grade have already been been found and mostly depleted. At present the ore bodies that have not been found are in general of a lower grade and are hence generally more difficult to find. The chemical compostion of the ore is further increasingly complicated and this can make it more difficult to find the orebody and further in the following process steps it is more difficult and costly to extract the metal/mineral out of the ore.
5. Political changes and contradictions between centre and periphery where the exploration companies often represents the centre and the local communities the periphery which experience being exploited and not getting the benefits from a mineral deposit that they consider they are entitled to.

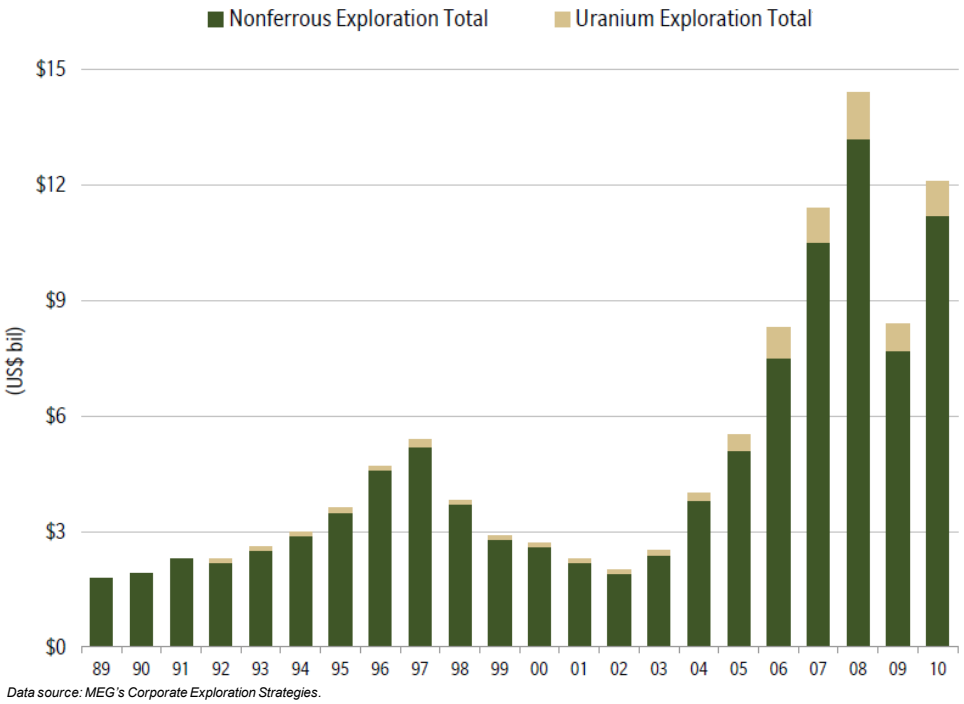

Figure 1: Estimated total worldwide nonferrous exploration budgets, 1989-2010 (Metals Economics Group 2010).

There has been a shift in recent years to the so called junior companies, i.e. companies which do not have a cash flow but are only set up with the goal to explore for and find new ore bodies. These companies are to be compared to the so called "high tech" companies in the bio-technology and IT sectors. They are small, flexible and have a highly trained staff with capacity to make quick and risky decisions that major companies often avoid. Further they can take greater political risks as they in some cases are not listed but depend on private capital which is sometimes willing to go to areas where a major established and listed company is not able to operate due to its CSR (corporate social responsibility) undertakings and ethical guidelines. These companies have a business idea to find a deposit, outline and sell it off to a major that has the financial, managerial and technical capabilities and human resource capacity to make an investment and take the deposit into production. The juniors are not delivering dividends annually based on their profits - they are always losing money and operating at a loss. They make money for their shareholders by an increasing, sometimes very steeply, share price at the prospect of finding something valuable, a bonanza deposit giving huge increases in share prices sometimes several hundred per cent in a limited period of time. This makes the juniors much more risk prone and the element of speculation in their programmes increases. It is possible that they would find more new ore deposits per dollar spent if they focused on areas with higher geological prospectivity but that would not result in the same type of bonanza deposits and less steep increase in share values.

A factor which is not structural in the same sense as the ones above but which will nevertheless influences the success of exploration in the next decade is the lack of trained geologists and other staff. Geologists further have to be willing to endure more extreme conditions as outlined above and this will further limit the availability of staff.

There are certainly also some factors working in the other direction that is making it less costly to find and prove new mineral deposits: e.g. if new technologies are invented and developed, which make it possible to find ore bodies at greater depths and with lower concentrations and more complex compositions and if new models for ore genesis are developed which reduces risks and makes the search more scientific.

With all these factors taken into consideration the optimal exploration expenditure over time should be increasing to cater for the increased rate of depletion and also growing due to the increasing difficulties of both geological, technical, financial and political/geo-political character. At the same time technical progress should work in the opposite direction and lower necessary exploration expenditure over time. It is not possible a priori to determine the effects of technical progress, which is not only difficult to measure but also varies over time and further its effects are often visible only long after they were first understood or introduced. There are however some indications that in the last decade the exploration efficiency has gone down i.e. the effects of technical progress have not counterbalanced the increased difficulties of finding new ore bodies.

Estimates by BHP Billiton indicate that during the 1950s for each exploration dollar spent there was a mine-site value of 507 dollar in reward. In the 1960s and 70s the average was 310 dollars and then declining further to 74 dollars in the 1980s but increasing again to 126 in the 1990s[1]. It is difficult to find later figures but there are strong indications that exploration costs continue to increase (as discussed in detail above) and hence even if the discovery rate is not going down the mine site value per dollar spent on exploration continues its downward trend. Particularly in the present period of high metal prices creating an overheated market situation with a lack of geologists and drilling crews, there are indications that there is also inflation in the cost of exploration.

The answer to these problems is increased R&D efforts as both the expenditure by governments and companies have gone down in recent decades as the industry has been forced to concentrate on survival during the very poor years in the end of the 1900s. Since then the attractiveness of the exploration and mining industry has been low and only few students have chosen these fields of study making the available pool of researchers decrease as well.

There is, however some hope in the fact that Chinese exploration expenditure is increasing very strongly when there is a more cyclical behaviour in the rest of the world. During the 2000s, Chinese exploration expenditure has grown and China is by the end of the decade the largest exploration country of all.[2] It is difficult to compare the exploration costs in China with other countries but it seems as if just by the straight dollar-by-dollar comparison (not taking into account that a dollar spent in China probably gets more exploration work done than in the US or Canada for example) results in more Chinese expenditure than in any other country. The Chinese expenditure is not included in the most common figures published over "global" exploration. Total exploration by Chinese companies for all minerals in China reached 26 billion RMB (approximately 4 billion US $) in 2010. The expenditure rose also in 2009 and 2010 when the western world exploration efforts plummeted. To make a more exact comparison possible the exploration for coal and iron ore should be deducted and the Chinese figure is reduced to 14 billion RMB which is a little more than 2 billion US $.

[1] BHP Billiton R. Schodde, Mineral Exploration Round-up Vancouver, January 2007.

[2] Sources: Molar, China and MEG Canada.

During the past decade there has been a shift in exploration away from the mining companies themselves over to the so called junior companies. These are specifically focusing exploration and do not have any cash flow of their own but are only intended to make profits for their shareholders through the potential find of a new deposit and then their share price will shoot up. They are never expected to pay any dividends and are hence more speculative than other companies. They exhibit some similarities with bio-technology companies in that they are small and have highly experienced and well educated staff. They can take higher risks than normal mining companies and hence venture into countries and regions with higher political risks. But these companies are very vulnerable to the increased volatility of metal prices and for example during the 2008/09 financial crisis the exploration expenditure dropped dramatically due to the almost complete stop in funding for these companies. The same thing will happen during the present financial crunch and this is damaging to the exploration industry which is much more long term in its activities. And further with increasing metal price volatility the amplitude of ups and downs in exploration will most likely increase. The results of a decline in exploration in 2012 and possibly 2013 will be fewer new deposits being located in the mid term and hence less new capacity in the long term and continued high metal prices. In some countries most importantly Canada but also to some extent Australia the funding of risky exploration ventures is supported through generous tax deduction schemes the so called flow through share system. In this system the losses in the company you have invested can be deducted against your personal income and as a junior exploration company per definition always makes a loss the effects are dramatic and the risk is reduced to almost zero for the investor.