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SUSTAINABLE DEVELOPMENT, AND THE MINING SECTOR

- A BMR VIEW

BY

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INTRODUCTION

Australia's future well-being requires the development of our natural resources in a sustainable and environmentally responsible way. This means 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased' (Commonwealth Government, 1990).

The earth's crust is not only the source of our mineral resources and the greater part of our energy resources, it also controls the quality of the soils, and produces the fertilisers, on which our agricultural resources depend. The increase in our standard of living this century has, for the most part, depended on the development of these earth resources. If living standards are to be maintained and enhanced it will be necessary for the resources to be developed and managed in a proper manner.

The importance of the world's mineral and energy resources to our life styles cannot be underestimated. The demand for minerals and fossil fuels has increased appreciably over the last one hundred years. This has been caused by both an increased per capita demand as well as an increase in the global population.

For example in 1891 the per capita consumption of mineral and energy resources was estimated to have been about 2.4t per annum - for a population of 1.7 billion, whereas in 1987 it had risen to approximately 10t per annum - for a population of about 5.0 billion. In the resource hungry countries such as the US the level of consumption is about 17t per person per year (Skinner, 1989).

Because Australia is a major global supplier of mineral and energy resources, it is clear that management of our mineral and energy resources is vital to our future standard of living.

Strategic geoscience, leading to efficient management of our resource base, is therefore an essential element in a policy of sustainable development both on the global and on the national scale (see Rutland, 1989).

<u>Development</u> has been, and will continue to be, dependent on the exploitation of non-renewable natural resources of minerals and fossil fuels. The extraction and utilisation of minerals and fossil fuels from within the earth have changed the natural dynamics of the hydrosphere and atmosphere, resulting in substantial perturbation of the natural system and especially in pollution and change in the atmosphere.

<u>Sustainable</u> development depends on the recognition of these effects and their containment within acceptable limits.

Economic, social and political imperatives will continue to require the exploitation of natural resources. There seems little doubt that global demand for non-renewable mineral and fossil fuels resources will continue to grow, although there will be changes in the demand for individual commodities as a result of environmental concerns and technological advances leading to economies of use, or substitution of one commodity for another.

These demands will place increasing burdens on the stocks of key resources and will necessitate an expanded knowledge base on estimates of resource levels and assessments of their availability.

This short paper concentrates on two main issues (1) the maintenance of Australia's Stock of Economic Demonstrated Mineral Resources and (2) the national geoscientific programs that are necessary to maintain the EDRs.

MINERAL RESOURCES : THEIR SUPPLY AND DEMAND

As mentioned above the world demand for minerals and petroleum products has increased approximately 15 fold in the last hundred years. The demand for mining products is estimated to have risen from $3\text{-}4 \times 10^9$ tonnes in 1891 to 35×10^9 tonnes in 1987 (Skinner, 1989). Because of the per capita demand increase and the increase in the global population, it is likely that, at least for the foreseeable future, the demand will continue to increase.

However, in spite of the apparent inevitability of increased demands, and the legitimate long term concerns about the overall limits to growth imposed by the availability of resources (as well as by the environmental impact of resource usage) there is little evidence that the supply of economically extractable mineral deposits will be exhausted in the foreseeable future.

The evidence strongly suggests that new economically extractable deposits will continue to be discovered, provided that vigorous and innovative exploration programs are pursued based on a comprehensive up-to-date knowledge base.

Resources can be divided into several categories, depending on the degree of geological knowledge of the resource and the economic feasibility of extracting the resource. Changes in these can result in a resource being reclassified in a different category. Resource stocks are depleted by mining, and replenished by successful exploration. Hence, the overall resource picture is changing continually.

In the context of sustainable development it is useful to consider resource depletion in terms of the stock of Economic Demonstrated Resources (EDR) - that part of total resources which has been identified by exploration and drilling and which can be extracted economically under current conditions.

The stock of EDR is renewable, at least for the foreseeable future (Rutland, 1990). It can be renewed in two ways.

One way is by transfer from the pool of undiscovered resources. This requires the discovery and proving of new economic resources through active exploration programs based on geoscientific research. The discovery and processing of the resource at Olympic Dam is one of many examples.

EDR are also replaced by transfer from the huge pool of currently subeconomic resources. Technical advances can reduce extraction costs so that some currently subeconomic resources become economic. This was a factor in the recent gold mining boom.

If these two mechanisms of replenishment fail to replenish global EDR of a commodity at a rate sufficient to meet demand, the resultant potential scarcity of the commodity will cause its price to rise. Such a rise in price will result in some currently subeconomic resources becoming economic, the quantity depending on the amount needed to rebalance supply and demand. A substantial rise in price of a commodity is likely to result in increased exploration for that commodity and increased efforts to develop cheaper substitutes.

The pool of subeconomic resources is extremely large. Some resources are close to being economic now; the other extreme is the earth's crust and oceans. So in principle at least, the world is not likely to 'run out' of resources; the constraints probably will be economic, social and environmental costs.

In due course, as appropriate substitutes are found, the rates at which EDR of some commodities need to be replenished will be reduced. In the meantime maintenance of the stock of EDR can be seen as an important goal of sustainable development. The level of that stock related to demand is an important indicator of potential problems in sustaining supply.

Australia depends on mineral products for almost half its export income. To maintain our national growth and development we must continue to discover and develop, in an environmentally acceptable manner, mineral deposits that are economically viable in the highly competitive world market.

GEOSCIENTIFIC RESEARCH PROGRAMS

As the more easily found mineral resources are discovered and developed, new exploration targets become deeper and we need more sophisticated techniques and exploration strategies to find new resources.

Research is needed both to develop and refine exploration techniques and to develop the knowledge base to guide area selection and strategies for exploration, and to allow assessment of the long term environmental effects of these and other human activities.

Essentially it will be necessary to maintain two main programs of geoscientific research for sustainable development.

1. to establish the geological framework of the continent and thus assist in the understanding of the distribution and assessment of, exploration for, and development of, the nation's endowment of mineral and energy resources, and

2. to undertake research relating to the conservation of the environment. This includes research required for multiple land use assessments, assessment and mitigation of natural hazards, and for the assessment and mitigation of the impact of national and global problems caused by human activities.

The overall policy of an integrated approach to conservation and development requires that priority be given to both programs, a main objective being to co-ordinate and develop the national knowledge base within the overall global framework.

One requirement in enhancing the knowledge base is to develop the fullest understanding of existing ore deposits in terms of ore deposit models which relate the genesis of the deposits to their geological environments. This provides a framework for further exploration for such deposit types.

It has also been recognised however that new and commonly larger types of ore deposit have consistently been discovered, not as a result of exploration based on accepted target models, but as a result of pioneer prospecting in areas not regarded as favourable in terms of those models (e.g. Herriman, 1989).

This has been the situation in Australia and new deposit types continue to be discovered. Notable recent examples include the Kambalda (WA) type nickel, the Northern Territory (unconformity-related) uranium, the Olympic Dam copper, the Argyle (lamproite-related) diamond, the Boddington gold, and the Coronation Hill platinum-gold deposits. Moreover new mining and processing technologies have increased the range of economically exploitable deposits.

This emphasises that contemporary understanding of mineral deposit genesis and location is far from complete and suggests that strategic research should not be overly focused in relation to particular deposit types. Rather research should be directed at fuller basic geological mapping, documentation and understanding of the main mineral provinces which are believed to have considerable mineral potential (see Rutland, 1989).

For Australian mineral industries to be effective it is necessary that they have access to integrated geoscience data sets that cover the continent and its margins. It is also necessary that there are regular comprehensive assessments of the resource base to plan exploration strategies. This involves adequate land access because it is necessary to identify where the areas of greatest mineral potential are.

Sustainable development also requires that the highest grade and most readily treated ores be discovered, because the energy costs of processing ores is inversely proportional to their grade for any given type. This again requires that the maximum area be available for basic geoscientific research and potentially for subsequent exploration.

Access to land

Land access is a difficult problem at present in the mining industry. However, it might be useful to point out an important distinction between access to land for exploration by private companies in their search for minerals and petroleum and access for strategic research and mapping undertaken by government agencies. The provision of geoscientific maps and data bases by the government agencies is certainly an essential pre-requisite for effective and efficient exploration and companies have repeatedly argued for the need for this information to be made available. However, this activity is not exploration; the knowledge gained is an essential part of the understanding of the natural environment (including water resources, soils, and vegetation) and is indispensable for the evaluation of environmental impacts and for land management decisions.

Geoscientific knowledge is required for various purposes for all parts of the Australian continent. Ideally full geological (and biological) studies and resource assessments should be undertaken before areas are defined as national parks etc. For example, identification of special features of geological interest provides one of the criteria for World Heritage listing.

It is therefore inappropriate that any restrictions which may apply to exploration should apply to strategic geoscientific research. Indeed development of the geoscientific knowledge base will provide an improved basis for resolution of issues relating to access of land for exploration.

In the context of obtaining the necessary information for Sustainable Development we believe it would be appropriate for officers of BMR (as the Commonwealth's principal geoscience agency) and of State/Territory geological surveys to have relatively unimpeded access to all parts of Australia, subject only to normal courtesies of prior consultation and a guarantee of no environmental impact. Without proper land access the knowledge base for future decisions will be deficient.

CONCLUSIONS

For the foreseeable future the stock of Economic Demonstrated Resources (EDR) is renewable because the EDR can be replenished by the transfer of resources from the pool of currently subeconomic resources (although this may depend on economic and environmental costs) and also from the pool of undiscovered resource potential. The latter requires the discovery and proving of new economic deposits through active exploration programs based on geoscientific research and an appropriate knowledge base. For Australia to maintain its current lifestyle it is necessary to maintain a healthy and efficient mineral exploration industry.

The development of a comprehensive knowledge base on our mineral resources will require a concerted national effort, and the enhancement of geoscience programs to provide this information. Furthermore, the knowledge base cannot be properly developed without appropriate land access.

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