



**Australian Government**  

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**Geoscience Australia**

APPLYING GEOSCIENCE TO AUSTRALIA'S  
MOST IMPORTANT CHALLENGES

**Submission by Geoscience Australia**

to the

**Parliament of Victoria**

**Economic Development & Infrastructure Committee**

**Inquiry into**

**Greenfields mineral exploration and project development in Victoria**

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## Introduction

The Economic Development & Infrastructure Committee of the Parliament of Victoria invited Geoscience Australia (GA) to make a submission to the inquiry into greenfields mineral exploration and project development in Victoria. GA's submission addresses four areas of the inquiry's terms of reference (ToR), these include:

- (a) Victoria's mineral endowment (often referred to as 'prospectivity') across a portfolio of commodities (including energy earth resources and extractives products);
- (f) different approaches and programs applied in other Australian and international jurisdictions to foster increased investment in greenfields exploration for, and development of, minerals and energy earth resources;
- (g) the different roles of government (this may include, but is not limited to, targeted industry engagement, facilitation and generation of geological survey information); and
- (i) consideration of the costs and benefits of greenfields mineral exploration (economic, social and environmental), and whether there are opportunities to improve the management of potential conflict between exploration and land uses.

The submission provides an overview of GA, the role of government, a discussion on greenfields mineral exploration and the benefit of pre-competitive geoscience information with reference to GeoScience Victoria initiatives.

## Geoscience Australia

GA is Australia's national geoscience research and geospatial information agency. It undertakes geoscientific research and develops, maintains and disseminates a wide range of geoscientific and geospatial information.

GA provides geoscientific information and knowledge to enable the government and the community to make informed decisions on the economic, social and environmental management and exploitation of the nation's natural resources, including mineral and energy resources. Other responsibilities of the agency include providing expert geoscience support to natural resources and climate change policies, providing key services to assist preparation and response to natural disasters, and the definition of Australia's land and marine jurisdictions.

GA is focused on key issues such as the global attractiveness of Australia for mineral and energy exploration and improved resource management and environmental protection. GA provides pre-competitive geoscience information for mineral and energy exploration with a focus on frontier (greenfield) areas, both onshore and offshore. This is achieved through integrated programs of data gathering, interpretation and assessment, frequently in collaboration with state and territory geoscience agencies. These programs assist in reducing geological uncertainty, enhancing the opportunities for resource discovery and are aimed at attracting exploration investment for a sustainable resources sector.

## Greenfields mineral exploration

There are two kinds of mineral exploration activities, 'greenfields' and 'brownfields'. These terms are widely used, generally understood but loosely defined. In general terms, greenfields refers to work undertaken in remote locations (frontier areas) that are unexplored or incompletely explored.<sup>1</sup> Brownfields exploration is associated with known areas of mineralisation, either proving up a known deposit or near existing mines.

The Association of Mining and Exploration Companies (AMEC) has noted a decline in greenfields exploration as well as exploration success rates in Australia over the years, as it is becoming harder to find at or near-surface mineral deposits. AMEC also noted that greenfields exploration is increasingly being undertaken by junior explorers who do not have the resources to conduct broad

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<sup>1</sup> The Parliament of the Commonwealth of Australia, 2003, Exploring; Australia's Future – impediments to increasing investment in minerals and petroleum in Australia. House of Representatives Standing Committee on Industry and Resources, Canberra.

regional surveys and largely relied on government pre-competitive geoscience and mapping to assist with early stage targeting and project generation.

The Australian Bureau of Statistics (ABS) mineral and petroleum exploration expenditure data for 2010 indicates that private mineral (excluding petroleum) exploration expenditure in Australia was \$2.47 billion, of which \$1.53 billion was associated with exploration to delineated or prove up an existing deposit (brownfields) and only \$0.94 billion was associated with new deposits exploration on previously unknown mineralisation (greenfields).<sup>2</sup> Brownfields exploration dominates mineral exploration expenditure as explorers attempted to capture benefits of high metal prices.

There are large parts of Australia that remain relatively unexplored or under-explored. For government, a high priority for achieving future domestic energy security and servicing the export markets is through encouraging exploration in frontier (greenfields) areas.<sup>3</sup>

### ***Victoria's mineral prospectivity***

ToR (a) – Victoria's mineral endowment across a portfolio of commodities

The mineral industry forms a significant part of Victoria's economy. According to Victoria's Department of Primary Industries 2009-2010 Statistical Review, Victorian mineral production is dominated by brown coal, gold and mineral sands. In 2009-10, brown coal production, predominantly from the Latrobe Valley for electricity generation, was reported at 68.7 million tonnes. In 2009-10, gold production was 241,965 ounces (valued at \$300.1 million) and mineral sands (zircon, rutile and ilmenite) production was 235,889 tonnes (valued at \$190.9 million).

Victoria is a world-renowned gold province. Gold production from Victoria's thirteen goldfields accounts for two per cent of all the gold that has been mined throughout the world. GeoScience Victoria suggests that there may be 73 million ounces of gold still to be discovered under the cover of younger sediments in northern Victoria.

Victoria's mineral sand resources are estimated at 8 million tonnes of rutile and 6 million tonnes of zircon. Most activity is focused on the Murray Basin in the state's west, which is estimated to have more than 260 million tonnes of mineral sand resources. In addition, the Gippsland and Otway basins are emerging as mineral sands provinces, with new discoveries in recent years near Bairnsdale, eastern Victoria.

Base metal (copper, lead, zinc, molybdenum and nickel) occurrences are known throughout the state. Prospectivity under cover in the state's northwest is considered to be high based on geological similarities with mineralised areas in New South Wales.

Victoria's 430 billion tonnes of brown coal represent a significant proportion of the world's brown coal endowment. About 80 per cent of Victoria's brown coal is located in the Gippsland Basin (southeast Victoria) and approximately half of this has been identified as 'potentially economic'. However, the high water content and reactivity of Gippsland Basin brown coal has precluded it from coal export and its future development depends on advances in new drying, gasification and liquefaction technologies. There may be potential for coal seam gas and possibly underground coal gasification in Victoria.

### **Role of government**

ToR (g) – the different roles of government

Mineral exploration and development differ from most other economic activities in three important respects: the location is constrained by geology, the long timeframe and the high risk. Pre-competitive geoscience assists in mitigating these exploration challenges and attracting exploration investment by allowing industry to identify areas of favourable mineral potential. Pre-competitive geoscience increases exploration efficiency by making it unnecessary for companies to duplicate

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<sup>2</sup> ABS, 2011, Mineral and Petroleum Exploration December Quarter 2010, ABS report 8412.0, Canberra.

<sup>3</sup> Commonwealth of Australia, Department of Finance and Deregulation, 2011, Strategic Review of Geoscience Australia.

common information or spend money on non-prospective ground and assists with risk-based decision-making. By reducing exploration costs and risk, pre-competitive geoscience not only improves returns on private investment but also increases revenues accruing to governments as royalties and taxes.<sup>4</sup>

The Policy Transition Group (PTG) established in July 2010 by the Australian Government considered the best way to promote future exploration and ensure a stream of new resources projects for future generations. The current resources boom and high commodity prices have contributed to a focus on brownfields exploration. For sustainable resources development in the longer term, the PTG stated that maintaining greenfields exploration will be important. The PTG noted it is widely viewed that private industry would not conduct broad regional surveys on its own and that GA, in collaboration with states and territories geological surveys, captures operational efficiencies and economies of scale in undertaking regional onshore pre-competitive surveys and providing pre-competitive geoscience information.<sup>5</sup>

In 2009, a Productivity Commission Review finding stated that GA, and State and Northern Territory counterparts play a valuable role in attracting private sector exploration investment in frontier areas by providing pre-competitive data.<sup>6</sup>

## **Pre-competitive geoscience to increase investment in mineral exploration**

ToR (f) – different approaches and programs applied in other Australian and international jurisdictions to foster increased investment in greenfields exploration for, and development of, minerals and energy resources

ToR (i) – consideration of the costs and benefits of greenfields mineral exploration and whether there are opportunities to improve the management of potential conflict between exploration and land uses

Development of mineral resources can be an important driver of economic growth.<sup>7</sup> Investment in mineral exploration is required in order to discover and develop mineral and energy resources, and to maintain and expand the resources sector.

A number of factors play an important role in influencing mineral exploration expenditure. The most important factor underlying global funds available for mineral exploration is the price of mineral commodities. Higher prices tend to encourage mineral exploration. The geological prospectivity of a region plays a critical role in determining mineral exploration expenditure at the regional level. The higher the perceived chances of discovering mineral deposits, which can be economically developed, the more exploration expenditure is likely. Governments have the ability to influence the perception of prospectivity through the collection and provision of pre-competitive geoscience information.

### ***The benefits of pre-competitive geoscience***

The recent Department of Finance and Deregulation Strategic Review of Geoscience Australia<sup>8</sup> (Review) assessed the geoscience products and services developed and maintained by GA and determined that there is a significant public good in geoscience information. The Review assessed the requirement for and extent of Commonwealth intervention in geoscientific research activity, and specifically the benefits in providing pre-competitive information.

The Review paid particular attention to GA's role in producing pre-competitive geoscience due to the significance of this information as a major (and expensive) product of GA. Over the years, GA's

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4 Duke, 2010, Government geoscience to support mineral exploration: public policy rationale and impact. Report for Prospectors and Developers Association of Canada.

5 Commonwealth of Australia, Policy Transition Group, 2010, Report to the Australian Government - Minerals and Petroleum Exploration, Canberra.

6 Productivity Commission, 2009, Review of Regulatory Burden on the Upstream Petroleum (Oil and Gas) Sector.

7 ABARE, 2007, Mineral exploration in APEC economies, a framework for investment, ABARE Report 07.22.

8 Commonwealth of Australia, Department of Finance and Deregulation, 2011, Strategic Review of Geoscience Australia.

programs for investment in new pre-competitive data have been aimed at capturing long-term investment by explorers in Australia. In addition, there are other important applications of pre-competitive geoscience such as in groundwater assessments, informing salinity management and identification of potential Carbon Capture and Storage sites.

For many years, debate on the business case for pre-competitive geoscience have centred on its public good attributes, spill over benefits and its role in reducing exploration risks. The Review commissioned an independent consultant, ACIL Tasman, to report on the economic value of pre-competitive geoscience.

ACIL Tasman noted that the public good nature of pre-competitive geoscience is one of a number of market failures identified by a parliamentary inquiry which supported the economic case for government investment.<sup>9</sup> Other factors identified include the positive externalities generated by the information, the reduction of risk in exploration and the harmonisation of data at regional and national scales, which would not occur if left to the private sector. ACIL Tasman found that failure by governments to invest in pre-competitive geoscience means private interests are not likely to invest in exploration to the optimum level, hence result in economic loss over the longer term.

ACIL Tasman considered that pre-competitive geoscience plays a significant role in reducing risk for the resources industry, by assisting companies make informed decision on exploration projects. ACIL Tasman also noted that pre-competitive data supported the governments in maximising the future value of resources that it owned on behalf of society.

ACIL Tasman investigated the level of investment by other countries and found that a number of countries with significant petroleum and minerals industries have established geological surveys with budgets that are comparable to or exceed the collective expenditures by GA and the state and territory geological surveys. There was a correlation between exploration activity and the availability of good geoscience data. ACIL Tasman report stated that where pre-competitive geoscience data was sold, it appeared more likely that the exploration industry would focus on known prospective areas (brownfield) at the expense of under-explored or frontier areas.

The Prospectors and Developers Association of Canada commissioned a report in 2010 on the impacts of government geoscience on mineral exploration. The report identified the immediate outcomes of public geoscience programs as increased levels of exploration, lower exploration costs and reduced risk. Economic benefits are often difficult to quantify in dollar terms for a range of reasons, which included ‘assumptions about the duration of exploration, the probability of discovery, and the share of results attributable to government geoscience are highly uncertain, making credible estimation of the net present value of benefits exceedingly difficult’. However, in examining a range of case studies, the report concludes that every \$1 spent by the Canadian Government will result in \$5 of private sector exploration investment.<sup>10</sup>

### ***GeoScience Victoria initiatives***

GeoScience Victoria has undertaken several initiatives since the early 1990s, which have provided geoscientific data packages to explorers for project generation and better exploration targeting in greenfield areas.

The Victorian Initiative for Minerals and Petroleum (VIMP) was a \$30.5 million investment over about 10 years. VIMP provided Victoria with the most complete coverage of airborne geophysical survey data, ground gravity data and GIS geological data of any state in Australia. The initiative was successful in promoting and attracting investment in mineral and petroleum exploration in Victoria. GeoScience Victoria states that the initiative attracted hundreds of millions of dollars in

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<sup>9</sup> House of Representatives Standing Committee on Industry and Resources, 2003, *Exploring: Australia's Future – impediments to increasing investment in minerals and petroleum exploration in Australia*, Canberra.

<sup>10</sup> Duke, 2010, *Government geoscience to support mineral exploration: public policy rationale and impact*. Report for Prospectors and Developers Association of Canada.

private sector exploration expenditure, and it was instrumental in the discovery of new gas fields in the Otway Basin, mineral sands in northwest Victoria and new gold prospects throughout the state.

Complimentary initiatives to the VIMP were the Gold Undercover and Rediscover Victoria. The Gold Undercover initiative was a \$9 million initiative over 4 years (ending in 2009) that delivered new geoscience to assist exploration for gold resources concealed by sediments. The Rediscover Victoria initiative invested \$5 million over 4 years (ending June 2011), to assisted exploration companies through grants for drilling in greenfield areas and the development of a state-wide three dimensional (3D) geological model as a geoscience tool to assist explorers target explorations projects.

Notwithstanding GeoScience Victoria achievements, it is an opportune time to invest in developing the next generation of pre-competitive geoscience in order to sustain the mineral exploration sector in Victoria. This next generation of 21<sup>st</sup> century understanding of the geology requires developing a 3D plus time (4D) geological model of the state. The time component to a 3D model provides insight, and improved knowledge of specific ore development processes and a timeframe in which a deposit may have formed. The data acquired over the past initiatives can be integrated and transformed into a new comprehensive 4D model, which will provide essential information to assist explorers identify potential new prospective (greenfield) areas at depth.

There is no reason these deeper exploration areas (greater than 200 metres to 1000 metres) are any less prospective than the shallow rock sequence that hosted the surface ore deposits, which historically have been mined. The next generation of pre-competitive geoscience will provide essential information for explorers to target areas where prospective rock sequences extend beneath covering sediments. For example, the prospective gold hosting rock sequences that extend beneath sediments in northern Victoria, these younger sediments cover the potential mineral wealth from exploration.

The challenge of ‘seeing through the materials that cover the ore deposits’ was a topic of the Australian Academy of Science’s High Flyers Think Tank series in 2010. The convention of leading researchers and respected resource industry ‘thinkers’ acknowledged that the mineral exploration sector will need the next generation of subsurface geoscience information and tools to discover new economically valuable ore deposits.<sup>11</sup>

## **Concluding comments**

Pre-competitive geoscience is a public good which is non-rivalrous and non-excludable to some extent. It plays a significant role in reducing risk for the resources industry, assisting companies make informed decisions on exploration projects as well as supporting governments in maximising the future value of resources that it owned on behalf of society. Governments may also use pre-competitive geoscience for other applications, such as natural resources management, groundwater assessment and Carbon Capture and Storage studies.

Greenfields exploration is a high cost, high risk activity with a low probability of a commercial discovery. The provision of pre-competitive geoscience assists companies make informed decisions on selecting leases in greenfield areas and reducing the cost and risk of exploration.

A 2003 ABARE<sup>12</sup> report on public geological surveys in Australia, found that basic geoscientific information is a public intermediate good that reduces private mineral exploration costs and risks and increases industry economic rent. The report notes that in 1999-2000, the exploration budgets of public geological surveys in Australia were around \$75 million, compared with mineral and petroleum royalty payments of about \$2.4 billion.

The ABARE report states that public geological surveys provide direct economic benefits to the resources industry and governments, as well as to other users of the information. The geological

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<sup>11</sup> Theo Murphy High Flyers Think Tank, 2010, Searching the deep earth: the future of Australian resource discovery and utilisation proceedings, Canberra.

<sup>12</sup> ABARE, 2003, Public Geological Surveys in Australia. Report 03.15, Canberra.

surveys were seen as being an important source of Australia's competitive advantage in the resources sector in a highly competitive global market for resources exploration funds.

Victoria was the first state to have the most comprehensive coverage of airborne geophysics, ground gravity and GIS geological data available for explorers. GeoScience Victoria is well placed to be the leader in a new paradigm of 21<sup>st</sup> century pre-competitive geoscience. A new generation of geoscience tools will assist explorers to identify prospective areas (greenfields) at depth. Exploration success will require the ability to 'see' beneath the cover to discover new economically viable ore deposits. This 21<sup>st</sup> century pre-competitive geoscience will provide a competitive advantage for Victoria in attracting mineral exploration investment to greenfield areas.

Growth in Australia's resources sector depends critically on investment in exploration. The strength of the mineral resource sector is important to Australia's, the state's and the local community's economies. The longer term sustainable contribution of the resources sector to the state's economic performance will require new deposits in greenfield areas to be discovered and developed.