Paper 33

The Impact of Government Pre-competitive Geophysical Data to the Exploration Community

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ABSTRACT

A key role of the Geological Surveys of New South Wales and Namibia is the promotion of geoscientific information to attract investment for mineral exploration and development. In 1994 both institutions embarked on similar initiatives focusing on the acquisition and distribution of modern high resolution airborne magnetic and radiometric data. These initiatives have proven successful in attracting increased exploration investment. Both countries are extending their programmes to include innovative 'state-of-the-art' geophysical technologies to enable future exploration challenges at depth.

INTRODUCTION

Despite many differences, including population, the economy and social development to name only a few, Namibia and New South Wales (NSW) both depend heavily on the mining and exploration industry. The two cover about the same area, and both governments have, over the past 10 to 15 years, invested some US$20 million each in the generation of pre-competitive high resolution airborne magnetic and radiometric data to assist and promote mineral exploration. To date, these data sets cover about 80% of each of the two regions and the availability of modern airborne geophysical data has sustained or increased exploration activities.

BACKGROUND

The mineral industry is the largest commodity export industry in NSW and in Namibia. It is a major contributor to the economy through business activity, investment, regional development and job creation. The total value of mineral production in 2005/6 is estimated at 3.5% of the GDP for NSW (NSW Minerals Industry Annual 2006) and 8.6% for Namibia (Chamber of Mines, Annual Review, 2006). It is anticipated that this will increase significantly as a result of the boom in commodity demand from China and South Asia and the worldwide resurgence in uranium. The Geological Surveys of NSW and Namibia play a major role in creating the geoscientific framework that assists the mineral exploration industry in discovering new ore deposits. The Geological Surveys actively participate in generating new exploration investment by providing new geoscientific information, which lowers the exploration risk, enhances employment opportunities in rural regions, and helps maintain the strong economic performance of this important primary industry. Industry-focused innovation and the application and production of value-added geophysical data by the Geological Surveys make a crucial contribution to exploration, and influence the exploration models used by industry. Most geophysical data contain subsurface information and can enable 3D visualisation.

CURRENT SITUATION

Both the governments of NSW and Namibia have spent approximately US$20 million each in acquiring high resolution magnetic and radiometric data over 80% of their region, together with more limited coverage of gravity, hyperspectral and electromagnetic data. This considerable investment was undertaken despite low expectations within the mineral investment sector at the time. The data generated by these programmes are now available and have laid the foundation for the current upturn in mineral exploration in NSW and Namibia.
To sustain the current levels of exploration there is a need to stimulate exploration with further government investments. Mineral exploration companies now consider that the next discoveries will lie from 100 to 200 metres below the surface and investigations at these depths require major advances in exploration by applying innovative 'state-of-the-art' geophysical technologies. Furthermore, the current 2D datasets delivered by NSW and Namibia are not sufficient for the mineral industry to

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fully interrogate the third dimension. To lower the risk and to increase the level of mineral exploration activity, government geoscientists must apply modern 3D technologies.

For instance, in 2002, the Geological Survey of NSW contracted the high technology 'FALCON™' airborne gravity system to acquire high resolution gravity data over the Broken Hill line-of-load. This was instrumental in significantly increasing the level of exploration activities in the Broken Hill region. Likewise in Namibia, application for mineral exploration licenses in general followed the progress of the government's airborne survey programme into covered and/or under-explored areas of the country.

NAMIBIA

The Namibia Perspective

Mining activities in Namibia date back to more than 100 years with the production of alluvial diamonds being the major contributor to the Mining industry. Non-diamond mining and exploration activities are mainly located in the two proterozoic fold belts of the Damara and Namaqua orogens, which host deposits of gold, base metals and semi-precious stones. The major exploration thrust in recent years has, however, been provided by the increased demand for uranium. The Langer Heinrich Mine entered production in late 2006 and several other projects are in the pre-feasibility or feasibility stages. The combined output of these new mines is expected to supercede the production of the well-known Rössing mine by the year 2010, and will make Namibia the third largest uranium producing country in the world.

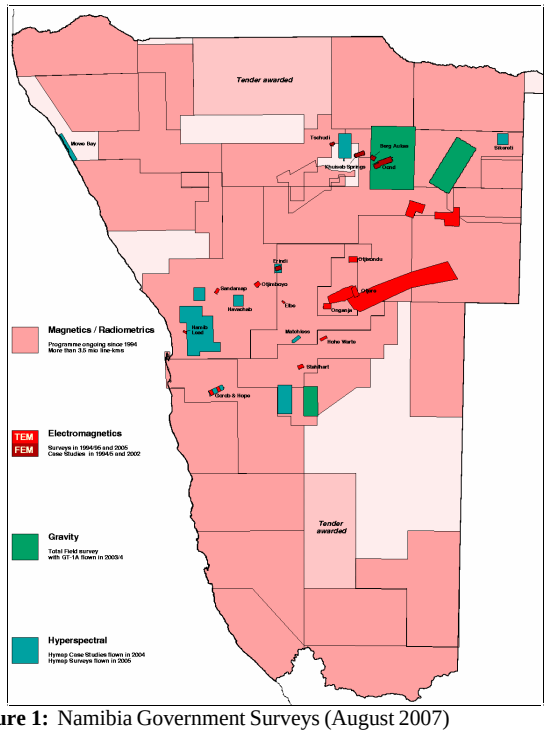

Figure 1: Namibia Government Surveys (August 2007)

Government Initiatives

In 1994 the Geological Survey embarked on the *High Resolution Airborne Geophysical Survey Programme* to assist and promote mineral exploration (Hutchins et al., 1997). This programme was encouraged by the success of similar surveys in Australia and was initially funded by the SYSMIN programme of the European Union. The main parameters adopted for the programme were 200 m line spacing with a nominal terrain clearance of 80 metres.

Following the completion of this first phase the Nambian Government included the programme in its national development plan from 1996. To date, the coverage of the country with magnetic and radiometric data is approaching 80%. Whilst the main thrust of the programme is with magnetic and radiometric surveys, other airborne geophysical techniques, such as electromagnetics, gravity and hyperspectral imaging have also been employed to solve specific exploration problems. Figure 1 shows the current extent (August 2007) of government surveys in Namibia.

Impact of Government Initiatives

Shortly after independence, exploration in Namibia was limited, despite regional geological and airborne geophysical data being available within the archives of the Geological Survey. At this time exploration licenses were largely confined to areas of outcrop with only a few companies venturing into areas covered by recent sediments (Figure 2a). This situation did not change much until 1995, when the first data from the *High Resolution Airborne Geophysical Survey Programme* became available.

Since then exploration in Namibia has increased annually, even in the years before the upturn in the commodity market in 2002. This can be attributed, at least in part, to the availability of modern airborne geophysical data, as exploration activity tracked the expanding coverage (Figure 2b).

Most of the licenses, prior to 2004, concentrated on the exploration for base metals, gold and platinum group metals. Therefore magnetic data were essential to provide information about the geological settings and to follow prospective horizons beneath sedimentary cover, while radiometrics was mainly used for surface mapping. More recently, the radiometric data has become extremely valuable to the exploration industry for locating elevated uranium levels. Namibia has recently attracted many investors by having almost the entire Central Damara Uranium province covered by high resolution airborne radiometric data.

Central Damara Uranium Province

In 2004, when the price for uranium started to recover from its long term low of below US$10 per pound, the Geological Survey promoted Namibia's uranium potential at the annual PDAC in Toronto. Newly acquired high resolution airborne radiometric data were presented to highlight areas of known uranium mineralization, causing exploration companies to flock

to Namibia's Central Damara Uranium province. First comers pegged ground over known primary, alaskite-hosted and secondary, gypcrete-hosted occurrences. These had been discovered and evaluated in the late 70s, but were uneconomic at that time. These projects have either already been developed into a mine (Langer Heinrich) or are in the stages of pre-feasibility or final feasibility (Trekkopie, Valencia).

After the initial rush, exploration had to spread to areas concealed by young cover sediments. Interpretation of high resolution magnetic data indicated the presence of potential uranium-bearing alaskite-domes in the western part of the Central Damara beneath cover (Figure 3). To further assist uranium exploration, the Geological Survey also acquired hyperspectral data over an area of about 15.000 km2 within the uranium Province. This data is proving useful in the delineation of near-surface gypcrete-deposits within paleo-channels.

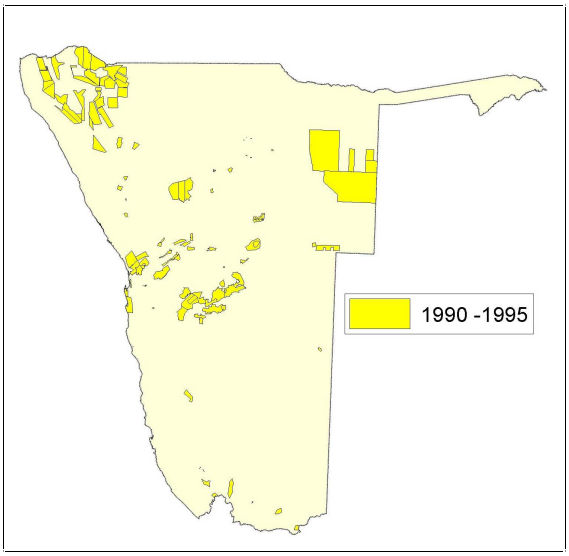

Figure 2a: Exploration Licenses from 1990 to 1995

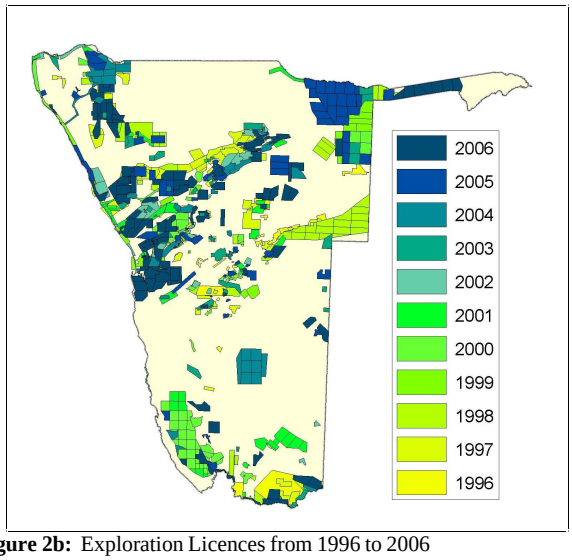

Figure 2b: Exploration Licences from 1996 to 2006

Special Surveys

The main programme aims at virtually complete coverage of Namibia with magnetic and radiometric surveys. IN addition, other airborne geophysical techniques have been employed by the Geological Survey to either test a certain method or to solve a specific exploration problem. These have included electromagnetic and gravity surveys and hyperspectral imaging.

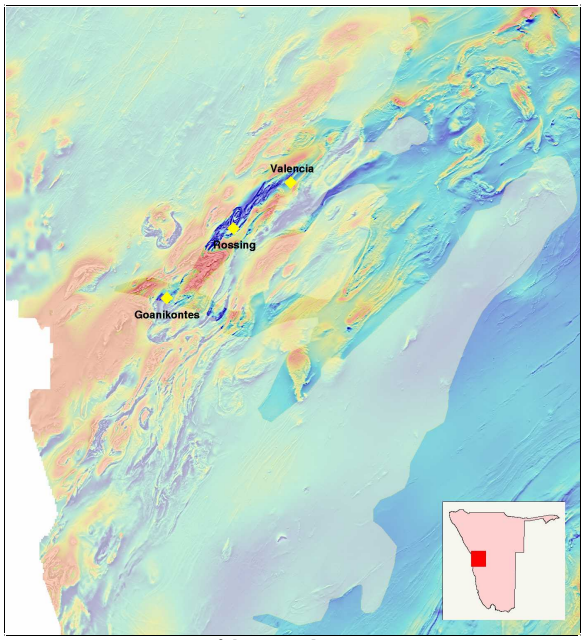

Figure 3: Magnetic map of the central Damara area

The first hyperspectral tests were flown in 2004. Since then, larger surveys have been conducted over important mineral provinces such as the Central Damara Uranium Province, the Haib copper deposit and the Tantalite valley in southern Namibia, and the Otavi Mountainland in the north of the country (Hausknecht et al., 2006). The latter was flown in 2006 to assist detailed mapping of this well-known mineral province and to solve environmental problems in and around the mining town of Tsumeb.

In 1994/95 an electromagnetic survey was included in the initial SYSMIN programme to delineate the extension of the copper rich Matchless Amphibolite Belt under young Kalahari sediments. This survey was followed by several case studies flown over known mineralisation using both, Frequency and Time Domain systems. In 2005 two 'TEMPEST™' surveys were flown in northeastern Namibia, an area concealed by young Kalahari sediments of variable thickness. The results indicated that these sediments can be penetrated by modern EM techniques and that the sediments are not too thick to discourage exploration.

In early 2004 the Geological Survey conducted two airborne gravity surveys using the new GT-1A gravimeter. The results were such that airborne gravity will be included in the next national development plan to improve the poor ground gravity coverage. This data will improve magnetic modeling of deeply covered ore bodies.

NEW SOUTH WALES

The NSW Perspective

The Lachlan Orogen is extremely important as almost all of the copper and gold production in NSW comes from this belt, predominantly from the Parkes–Orange region and the Cobar area. In 2005/6, the Cadia Valley Operations (Cadia Hill open cut mine/Ridgeway underground mine), produced 614,832 ounces of gold and 62 147 tonnes of copper, with a total value of around US$725 million. Its in-ground resource is valued at more than US$25 billion. Approximately 900 people are employed full-time or fixed term at the Cadia mining operations (NSW Minerals Industry Annual 2006).

Following the Government's investment in its core programmes and in exploration initiatives since 1994, NSW is now second only to the state of Western Australia in its level of gold production.

Government Initiatives

New South Wales began its six-year Discovery 2000 exploration initiative in 1994 (Robson and Lewis (1997)) with a US$30 million programme over six years. This was followed in 2001 by Exploration NSW that provided further funding of US$26 million over seven years.

New Frontiers began in 2006 with a US$7 million two-year extension to the highly successful Exploration NSW initiative targeted at promoting increased private sector exploration investment in the under-explored areas of NSW. The New Frontiers initiative is focused on the far north-west and south-west of the State in covered areas where poor quality data hindered interpretation and constrained exploration.

Impact of Government Initiatives

In 2005, a major high-resolution airborne geophysical survey and a deep crustal seismic survey were conducted over the far north-west of NSW under Exploration NSW. The new data, together with recently completed geological mapping, now provide a range of high quality data sets that indicate previously unrecognised potential for the discovery of economic deposits of copper, gold, and nickel.

Prior to these government projects, exploration activity in that area was subdued. Following the release of the major geophysical surveys and the recently completed geological mapping, the area (Figure 4b) has experienced an exploration boom. Figures 4a and 4c show the increase in exploration mineral titles from February 2005 to June 2007. Exploration commitments on these titles amount to over US$5million per year.

The Koonenberry Belt

In 1995, the Geological Survey of NSW began a mapping and geoscience programme in the Koonenberry Belt (western part of Thomson Orogen). The aims of the project included understanding the tectonic and metallogenic evolution of the belt, and using this knowledge to assist mineral exploration. The programme included geological mapping, geophysical surveys, whole rock geochemistry and zircon dating. These initiatives were funded by the Government's *Discovery 2000* and *Exploration NSW* initiatives.

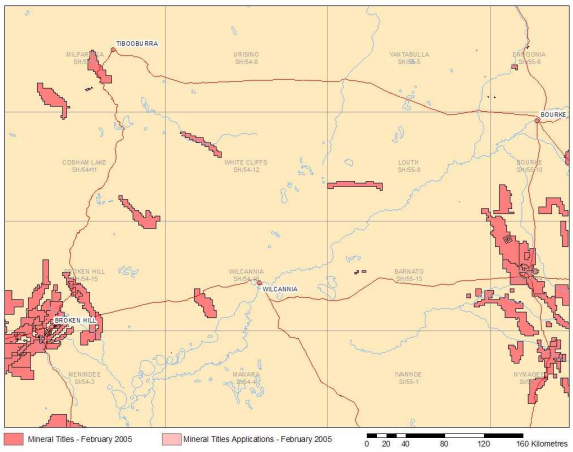

Figure 4a: Mineral titles in the Thomson Orogen area, 2005

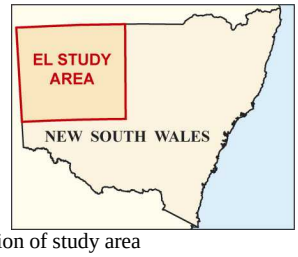

Figure 4b: Location of study area

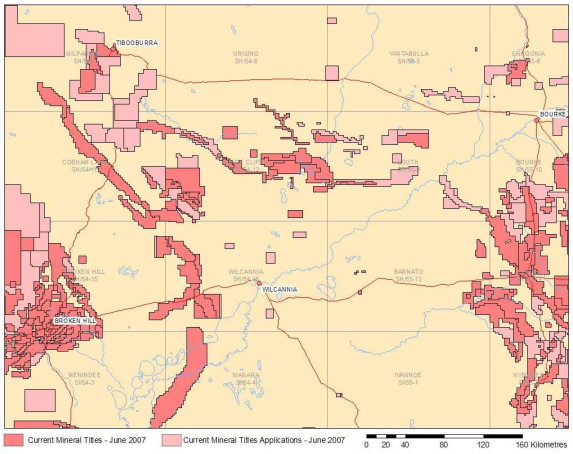

Figure 4c: Mineral titles in the Thomson Orogen area, 2007

The new generation of geological mapping, at 1:100,000 scale, commenced in 1995 immediately following a high resolution magnetic and radiometric survey carried out using Geological Survey of NSW Discovery 2000 programme funds. The NSW Department of Primary Industries markets a

'Koonenberry geoscience database' for sale on its website. The database includes latest geophysical imagery, 1:100,000 and 1:250,000 scale geological maps, comprehensive geoscience datasets, regional interpretations, Landsat images and geographical reference data. This information, and other packaged databases, are sold to only recover the costs of packaging and distribution. Following the release, there was a sustained increase in exploration licence uptake in the Koonenberry region. Modest levels of exploration coverage in 1995 have progressively increased to now cover almost all areas of outcrop and key adjacent covered areas. Low levels of exploration expenditure in 1995 have increased to more than US$1 million annually. Exploration in this region has led to the discovery of the first occurrence of cumulate nickel sulfides in ultramafic rocks in NSW and confirmed the area's potential as a significant copper province (ACIL Tasman, 2007).

FUTURE OUTLOOK

The success of the government initiatives of NSW and Namibia demonstrate the importance of pre-competitive geophysical and geological data for countries whose economy depends strongly on the mineral industry. High resolution geophysical data provide major incentives for exploration companies planning to extend their interest into previously under-explored areas. Both governments are willing to extend their current initiatives using 'state-of-the art' geo-technologies to assist and guide future exploration.

In Namibia the emphasis will move from the countrywide airborne magnetics and radiometrics towards the promotion of selective areas with high mineral potential using a variety of geophysical techniques. The areas will be selected following interpretation of existing geophysical data supported by geological mapping and stratigraphic drilling. Any additional airborne geophysics is likely to target specific areas and surveys will be designed to resolve specific exploration problems.

In NSW the focus will follow three themes – new energy, new frontiers and new dimensions. The studies will focus on the understanding and evaluation of frontier regions and update and re-assess geoscience information with the assistance of advanced 3D technologies.

CONCLUSION

Both the governments of New South Wales and Namibia recognized the importance of modern geophysical data in promoting mineral exploration in their respective countries. Both governments invested considerable financial resources in their initiatives, which started at a time when exploration was subdued due to low commodity prices. This foresight has already been rewarded, as the newly acquired data has attracted increased exploration investment, which is in turn leading towards new discoveries.

In Africa, Namibia has been the forerunner in providing modern high quality airborne geophysical data. The success of the Namibian programme in attracting mineral investment has prompted many African countries to embark on similar programmes, often financed by international agencies.

In NSW, the release of pre-competitive geophysical data has diversified the exploration effort into frontier regions and has led to new discoveries. The mining industry is very important as it helps diversify the economies of many regions, increases the resilience of regional NSW, and provides a demand for employment and services. Since the introduction of the first exploration initiative (*Discovery 2000*) programme in 1994, the discovery rate has increased by 27 percent as compared to the previous fifteen years.

It is clear from the above that the Geological Surveys of NSW and Namibia will continue to generate pre-competitive geophysical data and embark on new initiatives to assist and guide exploration.

REFERENCES

ACIL Tasman P.L., 2007. The role for NSW Government in pre-competitive geoscience information provision (Confidential). Prepared for the NSW Department of Primary Industries, 70p.

Hausknecht, P., Wackerle, R., Hutchins, D.G. and Jurza, P. 2006. Large Scale Hyperspectral Surveys for Exploration and Geo-Mapping in Namibia using Hymap. Presented at the 13th AustralAsian Remote Sensing Conference, Canberra, November 2006

Hutchins, D.G., Milner, S.C., Korkiakoski, E., 1997. Regional Airborne Geophysics and Geochemistry: A Namibian Perspective. Geophysics and Geochemistry at the Millenium: Proceedings of the Fourth Decennial International Conference of Mineral Exploration

Robson, D.F. and Lewis, P.C., 1997, Regional geophysics and geochemistry as an exploration initiative in New South Wales, Australia; p.793-803, Proceedings of Exploration 97: Fourth Decennial International Conference on Mineral Exploration, edited by A.G. Gubins, GEO F/X, 1068p.