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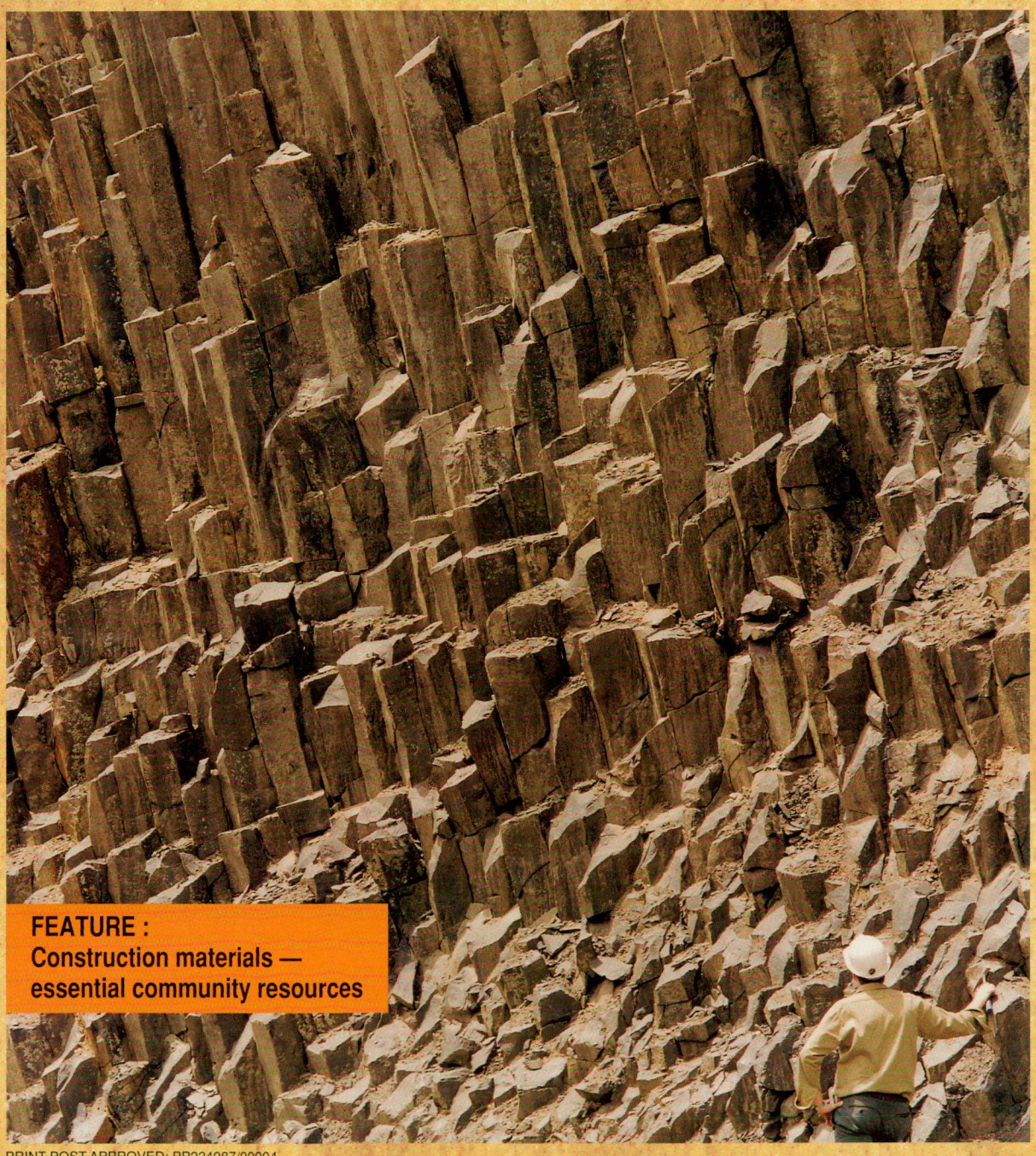

FEATURE :
Construction materials — essential community resources

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DEPARTMENT OF MINERAL RESOURCES

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No. 58

EDITOR:
Frances De Biasi

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PHOTOGRAPHY:
Photography by David Barnes, unless acknowledged otherwise

GRAPHIC DESIGN:
Val Grant
Terry Stewart

PUBLISHING ASSISTANT:
Pauline D'Souza

COVER PHOTO:
Columnar jointed basalt at Hymix Industries Pty Ltd's Kulnura quarry, north-west of Gosford.

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MINERAL RESOURCES

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FEATURE — Construction materials

CONSTRUCTION MATERIALS — ESSENTIAL COMMUNITY RESOURCES

Land use planning for future construction resources requires both well informed government agencies and a community which understands their importance.

Construction materials are very much community resources because modern communities use such large quantities of sand, gravel, crushed rock and structural clay for buildings and road construction. New South Wales uses about 50 Mt of construction materials every year, with a value of about $500 million.

Because construction materials have a relatively low unit value and are used in large quantities, and because the cost of transport from quarry to consumer is a major component of the price, resources must be reasonably close to the market where they are needed. Minimising transport distance also reduces the environmental impact of the transport of large quantities of construction materials along public roads.

To ensure that the community's future building and construction needs are met, it is essential that known and potential construction material resources are made known to planners. Good land use planning requires that these essential community resources are available for possible future use.

Deposits of construction materials are not uncommon, but they are not always available or suitable for exploitation. Availability may be especially restricted in the vicinity of major urban areas where competition between land uses is particularly intense and where demand for construction materials is high.

Urban and other development, such as recreational and sporting facilities, intensive agriculture, and rural residential estates, exert extreme pressure on existing and known potential construction material sources close to urban areas. Conservation areas such as National Parks, where mineral exploration and mining are prohibited, further limit the availability of resources. Residential development can encroach on existing quarries and prevent exploitation of, and access to, undeveloped resources.

Because of this, it is essential that land use decisions are made with the benefit of informed advice on the nature, disposition and importance of known construction materials resources and on the potential for further discoveries.

When major changes are proposed to existing land use, various government agencies are consulted about the potential impact on, for example, mineral resources, agriculture, heritage values or water resources. The Department of Mineral Resources plays a recognised and accepted role in assessing the State's construction materials resources and providing advice on their management and extraction.

The Department assesses such proposals to land use changes to ensure that known or potential mineral resources, particularly extractive resources, continue to be made available to the community.

In New South Wales, a range of planning measures is used to identify existing and potential construction material resources and to protect them from incompatible development. Measures include regional and local environmental plans. One of the most important of these is Sydney Regional Environmental Plan (REP) No 9, which is designed to protect construction material resources near the Sydney metropolitan area from incompatible competing land uses to minimise the cost of construction materials needed by the community.

A more recent measure is the requirement for local councils to consult with the Department of Mineral Resources when preparing Local Environmental Plans that may prevent or restrict mining and quarrying. This ensures that extractive and other mineral resources are considered at an early stage in land use planning.

The community needs to understand the importance and role of construction materials in the development and maintenance of modern society. Local and district planners need to recognise the importance of taking account of known construction material resources when making land use planning decisions and developing future resource and land management strategies.

An informative booklet, *Construction Materials — Building Our Community's Future,* is available gratis from the Information Counter of the Head Office of the Department at St Leonards on (02) 9901 8269, fax (02) 9901 8247.

LAND USE PLANNING AND EXTRACTIVE RESOURCES MANAGEMENT

An understanding of the nature and significance of extractive resources can enable governmental agencies to collaborate to protect them for future use.

The Department of Mineral Resources is one of the State Government's natural resource agencies whose advice may be sought when a proposed land use development or zoning change is being considered. It is asked for advice about the possible impact of a development or zoning change on known or potential mineral resources. The proposal may be a development application, local environmental plan, or development control plan. Such proposals are usually the responsibility of a local government agency or council. The Department's advice is also frequently sought on proposals by other State Government agencies. Examples are regional environmental plans or strategies prepared by the Department of Urban Affairs and Planning, conservation proposals (National Parks and Wildlife Service), or Crown Land Assessments (Department of Land and Water Conservation).

The Department of Mineral Resources' advice is also frequently sought about development applications which may or may not be minerals or extractive resources related. Such requests normally come from proponents or the local government agency which has to determine the application. If they are minerals related, proposals may be for a new development or for modification or extension of an existing mine or quarry. A large proportion of the minerals related proposals concern extractive resources (also called construction materials).

The existing planning framework requires local government agencies to consult with the Department of Mineral Resources before making some types of planning decision. Such requirements are included in:

- The Environmental Planning and Assessment Act (1979);
- Sydney Regional Environmental Plan No 9 — Extractive Industry (SREP 9), which was specifically written to protect regionally significant extractive resources;
- Illawarra Regional Environmental Plan No 1, which also identifies regionally significant extractive resources; and
- Direction G28 — Coal, Other Minerals, Petroleum and Extractive Resources issued in 1994 under Section 117 of the Environmental Planning and Assessment Act. This applies to specific areas identified by the Department of Mineral Resources in advice provided to local councils (Section 117 notifications to councils are explained on p 12 of this issue).

In most cases, the land use decision is ultimately the responsibility of the relevant local council. The great majority of the land use matters referred to the Department originate from the eastern part of the State, where most land use planning activity and development are concentrated. About 75% of the routine matters referred originate from within the Central Coast Planning Region (the Sydney—Newcastle—Wollongong region), and about 15% from the North Coast Region, which includes the coastal areas between Taree and Tweed Heads area. Many of the matters relate directly to, or require consideration of, extractive resources.

Land uses shown here, which include a national park, agriculture, extractive resources and expanding residential development, require co-operative planning to meet present and future community needs

The Department provides information and advice on the known and potential mineral resources which may be within or near areas affected by proposed developments or zoning changes (figure 1). In the case of proposals for mining or extraction, advice is given on mineral resource assessment and management aspects. In contributing to land use planning decisions, the Department's objective is to ensure that the eventual decision is an informed one. It aims to ensure that any

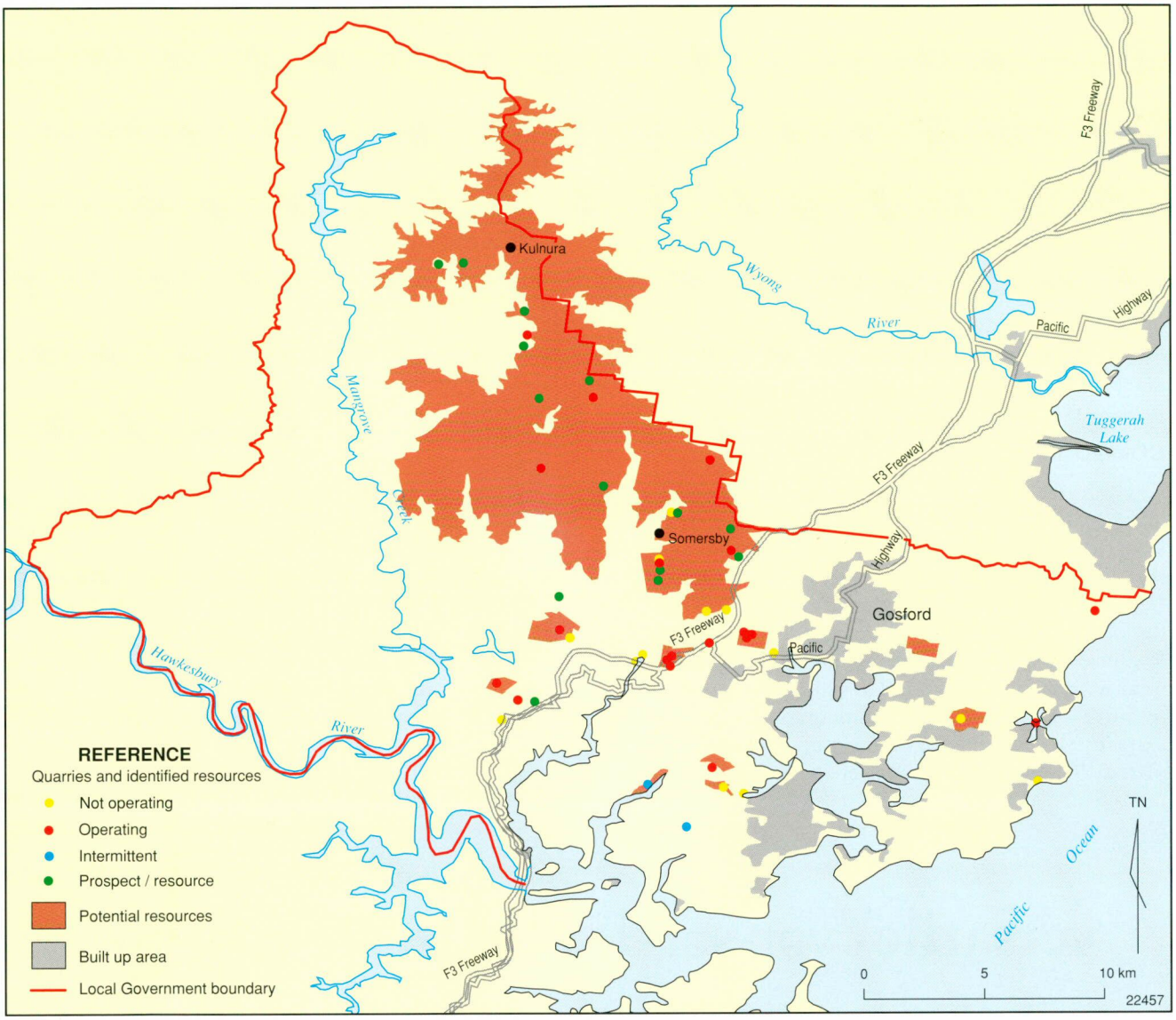


Figure 1. Department of Mineral Resources information on quarries and identified extractive resources within Gosford City Council boundaries

land use planning decision takes account of known and potential mineral resources which may be affected, particularly where the development or rezoning may prevent mineral exploration or resource development.

Extractive resources need a somewhat different approach from that taken with other mineral resources in land use planning and resource management.

Despite their importance to any modern community, extractive resources are comparatively low unit cost commodities. This, and the fact that they are used in large volumes, means that transport costs are a major factor in determining extraction sites and market prices. Sources must normally be within a certain maximum distance of markets, usually no more than 150 km from major urban centres. Extraction sites are thus often located in, or on the fringes of, population centres, which can lead to conflict with other land uses such as urban and rural residential development, usually through encroachment of these uses around existing quarries. SREP 9 was specifically designed to help overcome some of these problems.

Community perceptions of the nature and importance of mineral resources are another significant factor in many land use conflicts, particularly those involving extractive resources. Like other mineral resources, extractive resources cannot be 'moved'. Alternative sites are often not easily identified in many regions, and even if they do occur, their availability is uncertain at best. The community will usually not bear the cost of using more remote sources because of the effect of transport costs on price, as well as the environmental impact of additional transport.

Management of extractive resources is best approached on a regional or district basis, depending on the size and extent of the region involved. For example, in the North Coast Region, the market area is essentially restricted to the coastal plain which extends from around Taree to the Queensland border, and, because of its extent, the region is best regarded as a number of district markets (and see p 10, this issue).

Prerequisites for sound extractive resource management include a detailed inventory of existing sites and available and potential resources, and detailed statistics on past and

present production and consumption in a region. Combined with population statistics, these data can be used to estimate foreseeable future demand, and the capacity of known available resources to meet that demand. Current and future supply problems can be identified. The data can also be used to assess the relative importance of particular resources which may be affected by, or become the subject of, specific land use or development proposals.

Regionally important resources should be identified and planning action taken to ensure that they remain accessible where possible. Planning objectives should ensure that the community has sufficient resources to meet likely future demand at reasonable cost, and with acceptable environmental impact. Access to land for resource assessment and possible future development should be maintained wherever possible.

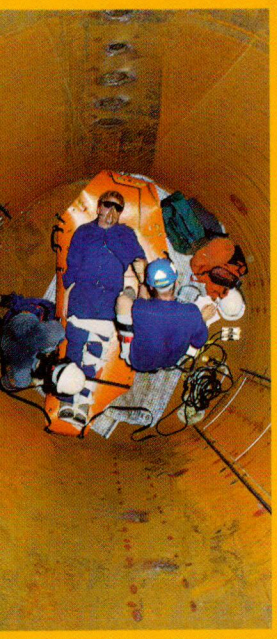
COMMUNITY PARTICIPATION

Community participation in decisions affecting management of extractive resources is essential. The Department's dealings with local government agencies are a very important means of achieving this. The Department is becoming involved in local land use planning through its contact with local councils wherever possible. Regional organisations of local councils have proved to be an extremely useful forum in which to address mineral resource issues in a land use planning context, particularly extractive resource management issues. Recent initiatives of two North Coast regional council organisations on management of extractive resources are examples of what can be achieved (see article on p of this issue). Catchment management committees have also proved to be a useful forum for catchments containing important extractive and other mineral resources.

Protection of potential extractive and other mineral resources is one of the most difficult resource management problems. Difficulties arise because potential extractive resources may cover larger areas, and their size and quality, and therefore importance, may be uncertain. In addition, when planning for future supply, it is necessary to retain as many sourcing options as possible. The result of this is that the total potential resources which need to be protected may be much larger than the resources which will actually be needed by the community. Further, there may be no current industry interest in specific potential resources, and this may be perceived to reduce the importance of specific resource sites.

Current major extractive resource management issues include: shortages of construction sand in the Sydney Region; various resource management issues in the North Coast Region; the conflict between resource extraction and other land uses in the Stockton Bight–Port Stephens area (see p 14, this issue); and increasing rural residential development. The latter is of particular concern because of the large areas of land to which access for resource assessment and possible development may be hindered or prevented.

For further information on these issues, contact Steve Lishmund, Manager, Land Use and Resource Assessment, on (02) 9901 8344, fax (02) 9901 8256.



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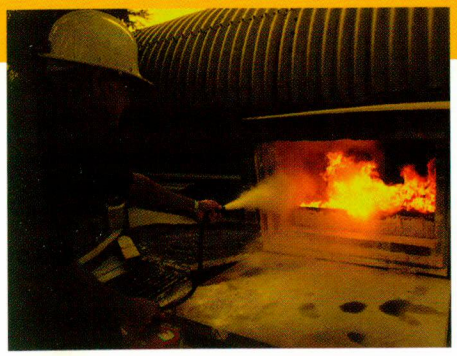

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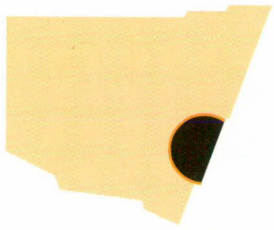
THE CONSTRUCTION SAND CRISIS IN THE SYDNEY REGION



One of the most difficult and pressing problems in managing construction material resources in New South Wales is the supply of construction sand to the Sydney market.

The Sydney region uses about 6 Mt of construction sand annually, valued at about $100 million. Until 1979 the region was self sufficient, with only minor amounts of sand being brought into marginal parts of the region from adjoining areas. However, since 1980 increasing amounts of sand have been obtained from outside the region, and currently constitute about 15% of supplies. This has mainly been caused by depletion of existing sources and lack of alternative resources within the region. It has resulted in considerable additional costs to the community through increased transport costs and increased truck movements with their associated environmental impacts.

Construction sand is used in making concrete and mortar, and for filling and other general construction purposes. The dominant application is in concrete, where it is used as the fine aggregate. It usually consists of quartz sand and, in concrete, sand with different grain sizes and grain shapes is needed to reduce cement demand. Coarse grained sand with angular grain shapes is normally obtained from fluvial deposits such as those along the Hawkesbury River, and fine grained, rounded sand from marine deposits such as coastal dunes or offshore deposits.

The present serious shortfall in supply of sand to the Sydney market is likely to become critical within the next 10 years as further major sources in the region, such as the Kurnell deposits, are depleted or become exhausted. The situation has been exacerbated by the decision in 1994 to refuse the proposal by Metromix to mine sand in deposits offshore from Sydney. If this proposal had been successful, offshore sources would have provided a replacement for supplies of fine sand from the Kurnell deposits.

Unless major new resources become available, the Sydney region will be obtaining up to 50% of its supplies from other regions within 10 years. This is a serious concern, since the increased costs of transport from more distant sources will result in increased building and construction costs, possibly by as much as 10%.

Studies by the Department of Mineral Resources have established that there are only a few major deposits within the region which could be considered as alternative sources of supply. These are: the Richmond Lowlands deposit (230 Mt, undeveloped at present), the Maroota deposits near Wisemans Ferry (currently in production, 80 Mt remaining), the Wrights and Wellums Creeks deposits near Wisemans Ferry (40 Mt, undeveloped), and the Somersby Plateau deposits (currently in production, very large but unquantified resources remaining). The location of these and other resources in the region are shown on figure 2. All of these deposits are affected by difficult, unresolved environmental and other issues, and only the Richmond Lowlands deposit could be regarded as having both major resources and convenient location.

A sand deposit at Maroota near Wisemans Ferry, north-west of Sydney, with previously mined areas returned to agricultural use

The Department of Mineral Resources has also identified very large resources of sand within deeply weathered (friable) sandstone deposits in adjacent regions in the Southern Highlands and on the Newnes Plateau (figure 2). Significant quantities of sand are already being supplied to the Sydney region from these deposits, and it seems likely that they will become the main sources of construction sand for the region in the longer term, whether major additional sources are made available within the region itself or not. Increased reliance on these deposits will increase the cost of construction sand within the region, primarily as a consequence of increased transport and processing costs. Significant environmental costs will also be incurred if road transport to Sydney increases.

There is a clear need for a coordinated strategy within State and local

Figure 2. Identified deposits of fine aggregate (sand) in the Sydney Region

government agencies to deal with this challenge, if the predicted shortages in supply and associated increased costs to the community are to be avoided or minimised. Such a strategy should:

- Enable optimal use of current sources of supply within the region. Sydney Regional Environmental Plan No 9 – Extractive Industry (SREP 9) partly addresses this issue.
- Enable the review of the unresolved environmental and other issues relevant to the availability of the major undeveloped or partly developed resources within the region. SREP 9 does not provide a means of resolving these issues.
- Ensure that the region has access to an adequate range of sand types from a number of major sources to meet requirements, and to ensure continued competition and price restraint.
- Ensure that appropriate planning and other action is taken to preserve the identified major resources both within and outside the Sydney region for future large scale extraction.

The growing shortfall in the supply of construction sand in the Sydney region led to the establishment in 1994 of a joint industry–government task force to consider the issue and recommend a strategy to resolve the problem.

The task force identified marine aggregate, the Richmond Lowlands, Newnes Plateau and the Southern Highlands deposits as the major options for large scale future production. The task force report has been completed, but has not yet been released.

The Departments of Mineral Resources and Regional and State Development are undertaking a study into opportunities for increased use of substitutes for construction sand and concrete, as recommended in the task force report.

For further information contact Steve Lishmund, Manager, Land Use and Resource Assessment, on (02) 9901 8344, Iain Paterson, Senior Geologist, on (02) 9901 8368, or Geoff Oakes, Senior Geologist, on (02) 9901 8366, fax (02) 9901 8256.

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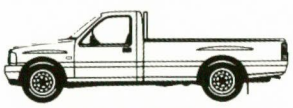
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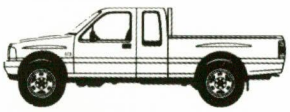
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EXTRACTIVE INDUSTRY MANAGEMENT ON THE NORTH COAST

A proposed strategy for the management of extractive resources in the North Coast Region of New South Wales could provide an example of collaborative problem solving and resource management for other regions.

INTRODUCTION

An important discussion paper on the management of extractive resources in the North Coast Region of the State, *Extractive Industries and Minerals on the North Coast*, has recently been released by the local government agencies in the region in collaboration with the Department of Urban Affairs and Planning.

The North Coast is part of the North East Planning Region of the State, and takes in 19 local government areas between the Great Dividing Range and the eastern coastline, and from the Great Lakes Shire in the south (which starts north of Newcastle) to the Tweed Shire on the Queensland border, a distance of over 500 km (figure 3).

The region has the largest population in the State after the Central Coast Region (which includes Sydney, Newcastle and Wollongong). Not surprisingly, it has the largest regional demand for extractive resources after Sydney and a high level of land use pressures. It consumes approximately 5 Mt of construction materials each year, which is about one fifth of the consumption in the Sydney region.

Conflicts between resource extraction and other land uses have been common in the past, and local shortages of some types of extraction materials have occurred. Many extraction operations have experienced problems with the encroachment of other incompatible land uses, and there have also been difficulties with transport of quarry products. Identification and exploitation of suitable new resources have been hindered by relatively dense settlement patterns as well as other constraints.

Industry and a number of local councils first raised these problems in the early 1990s as they were experiencing shortages of some construction materials. This led the two northern regional organisations of councils, the Mid North Coast Regional Organisation of Councils (MIDROC) and the Northern Rivers Regional Organisation of Councils (NOROC), to hold a forum on the issue in 1992.

At a second forum, attended by local and State government agencies and industry and community representatives, a standing committee was established under the auspices of MIDROC and NOROC to address the future management of extractive resources in the region. The committee was established in 1996. It comprises local and State government agencies, industry, and community representatives.

As one of its first major tasks, the committee has examined ways to protect existing extraction sites, and to ensure that the quarrying and transport of extracted materials meet acceptable environmental standards. The results of the study are presented in the discussion paper, which has been

Figure 3. The North Coast Region and regionally significant operating quarries

circulated within the region and to relevant State government agencies and extractive industry bodies for comment. The paper's recommendations constitute a strategy for the management of existing resources. A significant element of the strategy is the recognition and protection of regionally significant sites to ensure that exploitation of these resources is not unduly hindered or prevented by adjacent development or zoning changes.

This is the first time that local councils throughout an entire region have recognised the need for a regional strategy on extractive resources management, and the approach may serve as a model for other areas. The standing committee will also consider the more complex problem of protection of potential extractive resources, a problem shared with other regions where land use pressures and demand for resources are both high.

Copies of the discussion paper can be obtained from the Department of Urban Affairs and Planning in Grafton on (02) 6642 0622.

An aggregate quarry near Ballina, close to rural residential properties and agricultural development

For further information contact Steve Lishmund, Manager, Land Use and Resource Assessment, Department of Mineral Resources, Sydney, on (02) 9901 8344, fax (02) 9901 8256, or Jim Stroud, Senior Geologist, Armidale Office, on (02) 6770 2112, fax (02) 6770 2121.

A NEW WAY OF PROTECTING MINERAL RESOURCES

Information provided to local councils by the Department helps to ensure that mineral resources are considered in land use planning decisions.

In most cases land that has been mined can be rehabilitated for other purposes or even restored to its former state. On the other hand, there are many land uses which can eliminate mineral resource potential. Besides conservation uses and infrastructure such as roads and railways, water supply and power generation, one of the major causes of elimination of mineral resource potential is residential development. Rural residential development is a particular problem because it can occupy large areas.

Residential development prevents access to land for mineral exploration and mining, and can therefore prevent the development of known and potential mineral resources. When considering changes to the zoning of land to allow residential or other development, local councils consult various State government agencies, such as the Department of Mineral Resources, which may have resource information which could affect zoning decisions. In the past, where there have been few or no mineral resource developments within a council area, the council may not have been aware of the need to consult. This often led to situations where land containing regionally significant mineral resources was developed in such a way that possible future availability of the resources was lost.

THE IMPORTANCE OF A SECTION 117 DIRECTION

In December 1994, the then Minister for Planning issued a Section 117(2) Direction No G 28 — Coal, Other

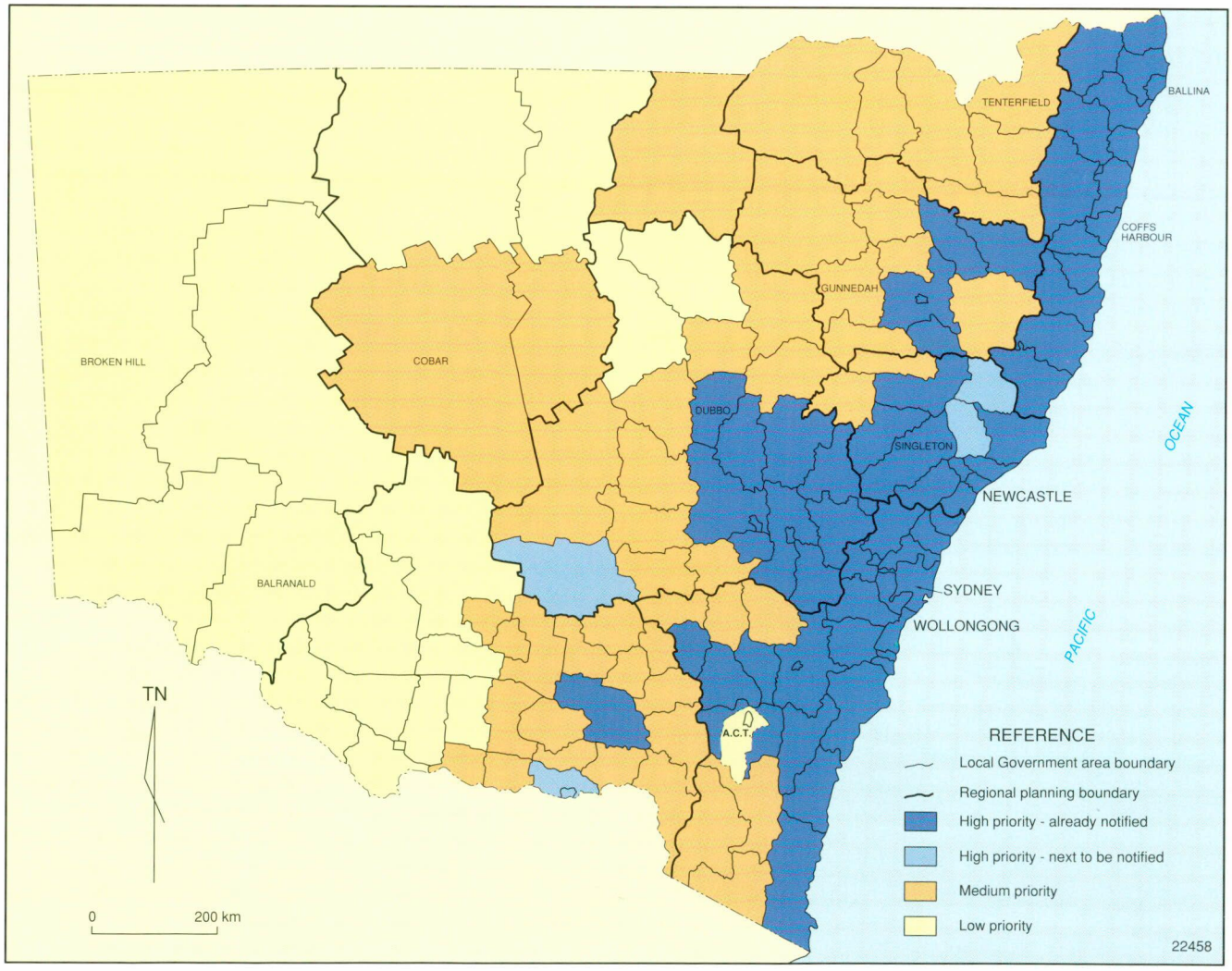


Figure 4. Local government boundaries, showing the progress of the Department's notifications to councils of sites with known or potential mineral resources (other than coal or petroleum) as at November 1997

Minerals, Petroleum and Extractive Resources under the Environmental Planning and Assessment Act (1979) to all local government bodies. This requires local councils to consult with the Department of Mineral Resources when preparing Local Environmental Plans that may prohibit or restrict mining and extraction in certain areas. The Department is obliged to provide advice as to whether it has an objection, and why, within forty days. If the Department does object but the council still wishes to proceed, the matter must be referred to the Department of Urban Affairs and Planning, which will decide whether the plan can proceed to public exhibition.

The Direction ensures that councils give proper consideration to mineral resources within their local government areas and that development does not compromise the future extraction of these resources.

The Section 117 Direction emphasises the responsibility of the Department to provide information to councils on the locations of known and potential mineral resources.

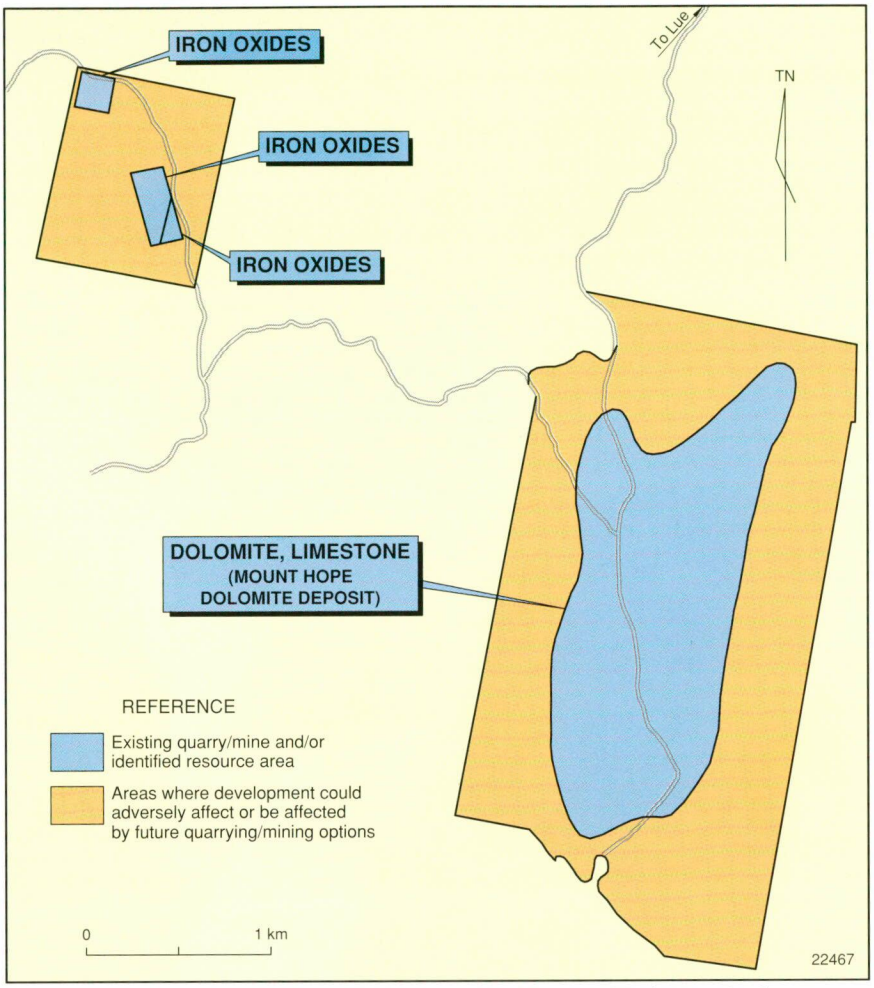


Figure 5. An example of an identified site, 11 km west of Rylstone, in the Rylstone Local Government Area, showing identified mining sites and areas

INFORMATION TO LOCAL COUNCILS

The Land Use and Resource Assessment group of the Geological Survey of New South Wales (within the Department of Mineral Resources) is systematically advising local councils on the mineral and extractive resources within their individual local government areas.

The project began in late 1995. The areas of greatest land use pressures, ie the coastal areas and some inland centres, were assigned highest priority (figure 4). Lower priority was initially assigned to areas west of the Dividing Range where there has traditionally been less pressure on land use. However, the trend to more rural residential development in the State's central west has increased the pressure on some areas on the tablelands and western slopes.

The information given to each council consists of a list of all regionally significant extractive and mining operations within its area, as well as identified mineral resources and areas held under mining titles. These data are collated from the Department's databases, existing publications and company reports.

The identified sites are presented on a series of maps, usually at 1:25 000 scale. The maps show existing mining sites and zones around the identified sites within which other forms of development may adversely affect, or be adversely affected by, a mining operation (figure 5). In addition, the maps show areas where certain types of development could hinder or prevent exploitation of known or potential mineral resources.

Most of the high priority councils have already been notified. Advice has also been sent to other councils at their request.

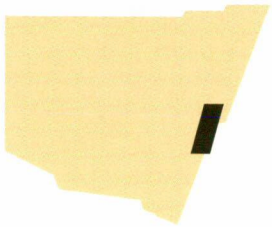
The project is ongoing and information sent to councils will be continually updated as new developments occur and existing mining operations cease. Eventually the Department hopes to be in a position to advise all councils on all known important mineral resources within each local government area. As a further development, the Department is digitising the data so that they can be provided to councils in electronic form in the future.

CONCLUSION

The project is providing local councils with up-to-date information about the locations of mineral resources to help ensure that mineral resource issues are considered in local land use planning decisions. It also enables the Department to participate in these decisions at a local level, as well as providing an opportunity to increase community awareness of the importance of mineral resources.

For further information contact Steve Lishmund, Manager, Land Use and Resource Assessment, on (02) 9901 8344, or Jyrki Pienmunne, Geologist, on (02) 9901 8369, fax (02) 9901 8256.

PORT STEPHENS SAND RESOURCES



The Stockton Bight to Port Stephens area is a major source of construction and industrial sand for the Newcastle and Sydney regions, supplying all the colourless glass sand, and much of the coloured glass sand used by the State's glass manufacturing industry. It has also been an important source of heavy minerals, principally rutile and zircon for many years.

INTRODUCTION

The Stockton Bight–Port Stephens area is situated near Newcastle, about 160 km north of Sydney. The area between Stockton, Anna Bay, Nelson Bay Road and the coastline is called Stockton Bight and the area from Salt Ash to Lemon Tree Passage is known as the Tilligerry Peninsula (figures 6 and 7).

The area contains extensive deposits of sand suitable for use in glass manufacturing, foundries, construction applications such as concrete manufacture and other uses such as filtration sand and ceramics (figure 7). The area also contains important deposits of heavy minerals, principally rutile and zircon. Quarries at Lemon Tree Passage and Salamander Bay supply much of the hardrock aggregate needs of the local building and construction industries.

The Newcastle and Sydney regions use most of the industrial and construction sand obtained from Stockton Bight–Port Stephens, although small amounts of foundry sand are exported to Southeast Asia.

Industrial and construction sand output have significantly increased in recent years. Almost 1.1 Mt was produced in 1996/97. During the same period, about 50 000 t of heavy mineral concentrates, mostly rutile and zircon, were produced. This constituted much of New South Wales output of heavy minerals.

Constraints to mining in the Stockton Bight–Port Stephens area include increasing urban development, extensive water catchment protection areas, archaeologically sensitive sites, military weapons testing zones and conservation zones. There is also a proposal to incorporate much of Stockton Bight into the proposed Stockton Bight National Park.

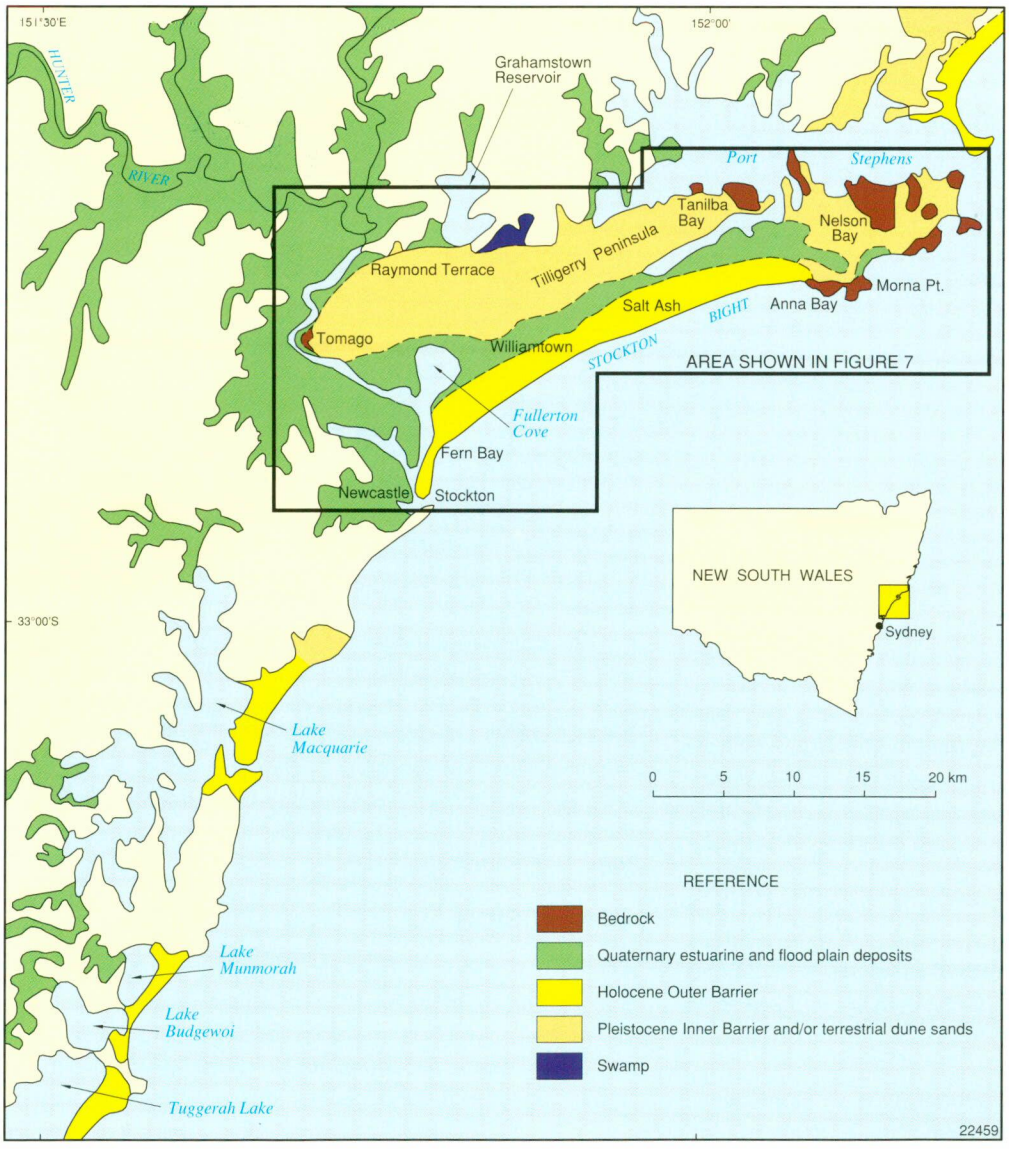


Figure 6. Location and simplified geology of the Stockton Bight – Port Stephens area

GEOLOGY

Deposits of Late Quaternary age cover an area of over 100 sq km. These sediments range in thickness from less than 30 m in the north-west to over 150 m in the south-east.

The Stockton Bight–Port Stephens area has a dual barrier sand system, the Holocene age Outer Barrier, and the Pleistocene age Inner Barrier, developed parallel to the present shoreline of the Pacific Ocean. A narrow corridor of sediments of Holocene age separate the Inner Barrier from the Outer Barrier (figure 6). The sand in the northern part of the Outer Barrier is suitable for foundry use and in the southern part for construction purposes. Sand in the central part of the Outer Barrier is mainly used to make coloured glass products. The Inner Barrier contains sand used to produce colourless glass products. Heavy mineral deposits occur throughout the Inner Barrier and the Outer Barrier.

The Inner Barrier formed about 140 000 to 120 000 years ago. Intensive wind erosion and sub-aerial weathering subsequently produced topographically subdued, symmetrical dunes with well developed soil profiles. The formation of the Outer Barrier, which began about 6 500 years ago, featured widespread deposition of estuarine mud, principally near Fullerton Cove, and the formation/development of prominent active and vegetated dunes along the coastal margin.

Figure 7. Construction and industrial sand resources of the Stockton Bight–Port Stephens area

Active dunes burying older dunes in Stockton Bight, looking south towards Newcastle

GEOLOGICAL FEATURES AFFECTING RESOURCE DEVELOPMENT

The most important geological features which affect the nature and distribution of the sand resources are:

- A decrease in sand grainsize from the Outer Barrier dunes in the south-west to the north-east. Construction sand deposits are therefore more common towards Williamtown, and foundry sand deposits are more common towards Anna Bay. Dune sand from Salt Ash, near the central part of the Outer Barrier, is used for coloured glass manufacture.

- Prolonged weathering of Inner Barrier dunes, most notably in the Tilligerry Peninsula. This has depleted the upper parts of the dunes of much of their calcium carbonate and iron oxide, resulting in thick sand deposits within the Northern Dune and the Southern Dune of exceptionally high chemical purity. These sands are extracted for glass manufacture and other specialised industrial uses, such as filtration sand and ceramic applications.

- The widespread development of generally high grade, relatively large deposits of heavy minerals, which have largely been mined out. The deposits typically contained high proportions of rutile and zircon and occured as shallow strandline and aeolian deposits of Pleistocene and Holocene age. Marine sequences beneath the coastal margin of the Outer Barrier at depths of more than 20 m also have demonstrated potential for heavy mineral deposits.

DISTRIBUTION AND EXTRACTION

Construction Sand

Construction sand from Stockton Bight–Port Stephens is mainly used in concrete manufacture, and also as fill. Grain shape, composition and grading of sand for concrete manufacture are of prime importance. The Williamtown area has large deposits of sand that are mostly in the size range of 0.3 to 0.6 mm and are often low in materials such as calcium carbonate or clay.

The area has secured resources of about 20 Mt of construction sand, sufficient to last up to 30 years at current and expected production rates. During 1996/97, about 800 000 t of construction sand were produced. Most of this was obtained from deposits in the Outer Barrier near Williamtown. Some of this sand is used in the Sydney Region. Production has increased during the last few years, in part owing to the substantial increase in sand production by Boral Resources (Country) Pty Ltd from deposits towards Fullerton Cove.

There are relatively few prospects for significant deposits of construction sand in the Inner Barrier. Several dunes near Salamander Bay that were mined for heavy minerals may contain fill quality sand. Residential developments and associated infrastructure, however, cover much of this area.

Glass Sand

Sand for glass manufacture requires >99% silica and <0.2% iron oxide, and sand grains of consistent shape and size. Sand suitable for glass manufacture in the region contains greater than 99.5% silica. Processed sand from the Northern Dune has about 99.9% silica, less than 0.05% iron oxide and titanium dioxide, and about 2 ppm chromic oxide. Sand from the Southern Dune, which is of marginally finer grainsize, has traditionally been favoured for colourless glass manufacture. However, sand extraction in the Southern Dune has finished. Processed sand from Salt Ash has about 99.2% silica, less than 0.05% titanium dioxide, roughly 0.1% iron oxide, and about 2 ppm chromic oxide. This sand is used in the production of coloured glass products

During 1996/97, almost 200 000 t of sand, mainly for glass manufacture were produced. Secured coloured glass sand deposits at Salt Ash are about 2.2 Mt. Known resources of colourless glass sand in the Northern Dune are about 4.7 Mt, about 2 Mt of which have been approved for extraction. At current and expected production rates, secured resources of coloured glass sand are expected to be extracted in under 10 years and secured deposits of colourless glass within about 20 years.

Apart from the major dune systems of the Tilligerry Peninsula, there do not appear to be any other resources of coloured glass sand of comparable significance in the region.

Industrial Sand

During 1996/97, about 90 000 t of foundry sand were produced in the Stockton Bight–Port Stephens area.

Active dunes at Anna Bay contain about 20 Mt of industrial (foundry) sand, its fine grained nature rendering it unsuitable for use in concrete manufacture. Raw sand from Anna Bay is about 97% silica, of consistent grain size, mostly less than 0.3 mm, and contains up to 1% calcium carbonate. Specialised foundry applications in south-east Asia use up to 40 000 t of sand from Anna Bay annually. It should be noted that the State's foundries often prefer sand of coarser grain size to that obtained from Anna Bay. It appears that much of the sand from Anna Bay is used in other industrial applications or as fill by the domestic market.

Current and expected production rates indicate that identified industrial sand deposits at Anna Bay are sufficient to last well over 20 years. Sand suitable for industrial uses also occurs at Williamtown.

Heavy Mineral Resources

Heavy minerals, principally rutile and zircon, occur widely as strandline and aeolian dune deposits of Holocene and Pleistocene age. About 50 000 t per annum of heavy mineral concentrates have been produced recently by RZM Pty Ltd from deposits at Tomago and Big Swan Bay. BHP Titanium Minerals Pty Ltd, formerly Mineral Deposits Ltd, has recently begun mining deposits near Fullerton Cove. Known heavy mineral resources are likely to be exhausted during the next few years at current and expected production rates.

The Inner Barrier contained an extensive network of upper and lower strandlines in the Tomago Sandbeds developed parallel to the north-easterly trend of the barrier which have largely been mined out. They extended over 25 km from Tomago, along the eastern side of Moffats Swamp Nature Reserve, to Tanilba Bay. The heavy mineral grades of the Outer Barrier typically range from 0.3 to 0.5%, with grades occasionally exceeding 1%. It has been possible to mine these deposits, despite their relatively low grades, because of their large size.

Heavy mineral deposits of commercial interest may occur beneath the Outer Barrier at depths greater than 20 m. The inner shelf of Stockton Bight has potential for heavy mineral deposits but has been insufficiently explored to evaluate these resources. It appears that the various sequences, including old strand systems, are substantially eroded but preserved in part. Exploration near Swansea revealed the presence of relatively large, low and moderate grade (1 to 2%) heavy mineral deposits dominated by rutile and zircon in the upper several metres of the strand systems. It is possible that heavy mineral deposits of similar character may exist off the coastline of Stockton Bight.

CONCLUSIONS

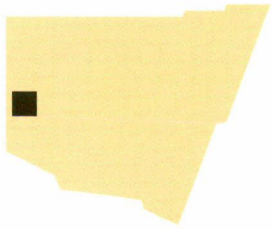
The Stockton Bight–Port Stephens area has large deposits of sand suitable for use in construction, glass making and foundry applications and should remain an important source of these materials for the Newcastle and Sydney regions for many years. Its known heavy minerals deposits of current economic interest are likely to be exhausted within the next 3 to 5 years.

The reconciliation of the demand for the mineral and extractive resources of the area with the constraints affecting their development is a major challenge for industry, government and the local community.

A fuller discussion on the geology and resources of the Stockton Bight–Port Stephens area has been published in *Quarterly Notes* No **104**, which is available from the Information Counter at the Head Office of the Department on (02) 9901 8269, fax (02) 9901 8247.

For further technical information contact John Whitehouse, Geologist, Geological Survey of New South Wales, on (02) 9901 8513, fax (02) 9901 8256.

INVESTIGATIONS OF AEROMAGNETIC ANOMALIES AT BROKEN HILL*



Studies of anomalies shown in aeromagnetic data in the Broken Hill area have aimed to identify geological factors which produce concentrations of magnetite. These concentrations have been an important aid in understanding stratigraphy and structure.

INTRODUCTION

High quality aeromagnetic data is an important component of modern exploration and geological mapping programs. It can be acquired rapidly, but the significance of the resultant magnetic patterns can take much longer to understand.

Detailed aeromagnetic surveys have been a major component of the Broken Hill Exploration Initiative over the last two years. The Australian Geological Survey Organisation (AGSO) has flown the Proterozoic Willyama Supergroup of the Broken Hill Block and nearby area at 100 m line spacing and 60 m ground clearance, producing the most detailed and precise regional aeromagnetic coverage in Australia. The resulting images show a mixture of complex and simple anomalies.

Although some of the magnetic anomalies may relate directly to orebodies containing magnetite or pyrrhotite and 'holes' in magnetic patterns may be related to alteration patterns around orebodies, most of the anomalies can be related to rocks containing little if any mineralisation of economic interest. The magnetic anomalies can be used to better understand regional geology, particularly under regolith cover. From this understanding, the design of exploration programs can be improved.

STRUCTURAL TERMS

The notations S1, F1, D1, S2, F2, D2, and so on, are used in structural geology to denote events which deformed the rocks, and features produced in those events. D1, D2 and D3 are deformation events, numbered in the order in which they occurred. S1, S2 and S3 are schistosities formed during those events, and F1, F2 and F3 are folds formed in those events.

In the Broken Hill Block, some prominent magnetic anomalies are generated by magnetite disseminated in metasediments. The Department of Mineral Resources has been investigating some of these to identify geological factors which produce concentrations of magnetite. Ground magnetic traverses were carried out over three areas containing magnetically anomalous metasediments and two were studied in detail by geological mapping, structural analysis, magnetic susceptibility mapping, thin section petrography and geochemical analysis.

The results from the 'Monuments' grid are discussed here. The Monuments grid was chosen for its relatively good outcrop and relative scarcity of retrograde shear zones and pegmatite intrusions.

ROCK TYPES IN THE BROKEN HILL REGION	'STYLE' OF MAGNETIC ANOMALIES
Magnetite disseminated in metasediments	Long, tabular magnetic anomalies
Magnetite disseminated in partially melted metasediments (ie composite gneisses and migmatites)	Complex magnetic patterns
Magnetite in a number of albite-quartz rich rock types	Complex magnetic patterns along the south-eastern margin of the Broken Hill Block
'Potosi-type' garnet-biotite rich quartzofeldspathic gneisses	Magnetic anomalies, not always coincident
Quartz-magnetite rocks	A small number of high intensity anomalies
Garnet-magnetite-quartz-apatite banded iron formation	Small-area intense anomalies
Basic gneisses (amphibolite and hornblende granulite)	Weakly to strongly magnetic
Some younger basic and ultrabasic intrusions	Very marked magnetic anomalies
Magnetite in basic gneisses	Commonly produce magnetic anomalies

*Article written by Barney Stevens, Principal Research Scientist, New South Wales Department of Mineral Resources, Broken Hill Office.

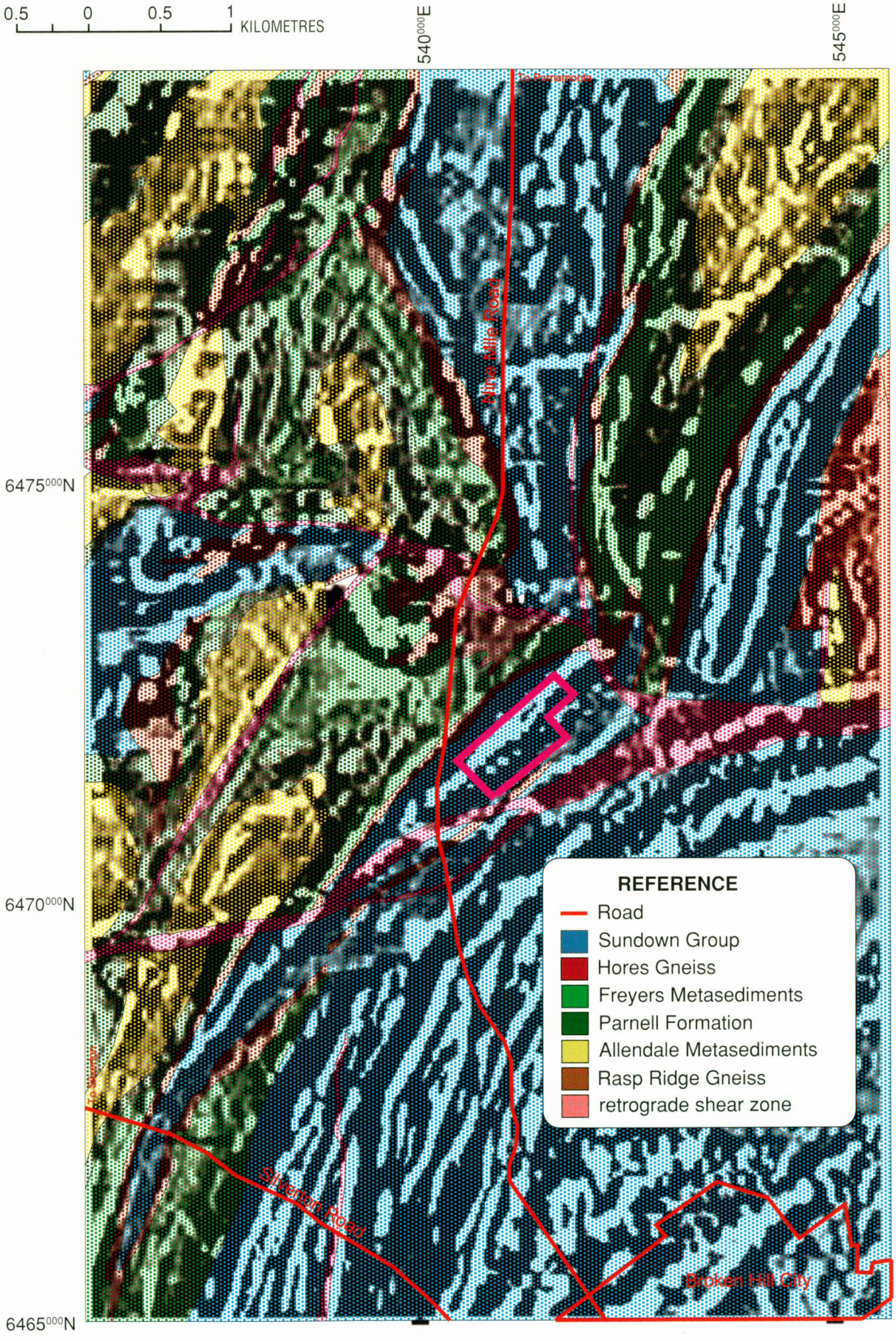


Figure 8. 'Monuments' survey grid area (outlined in magenta) north of Broken Hill. Second vertical derivative magnetic image with interpreted stratigraphic units

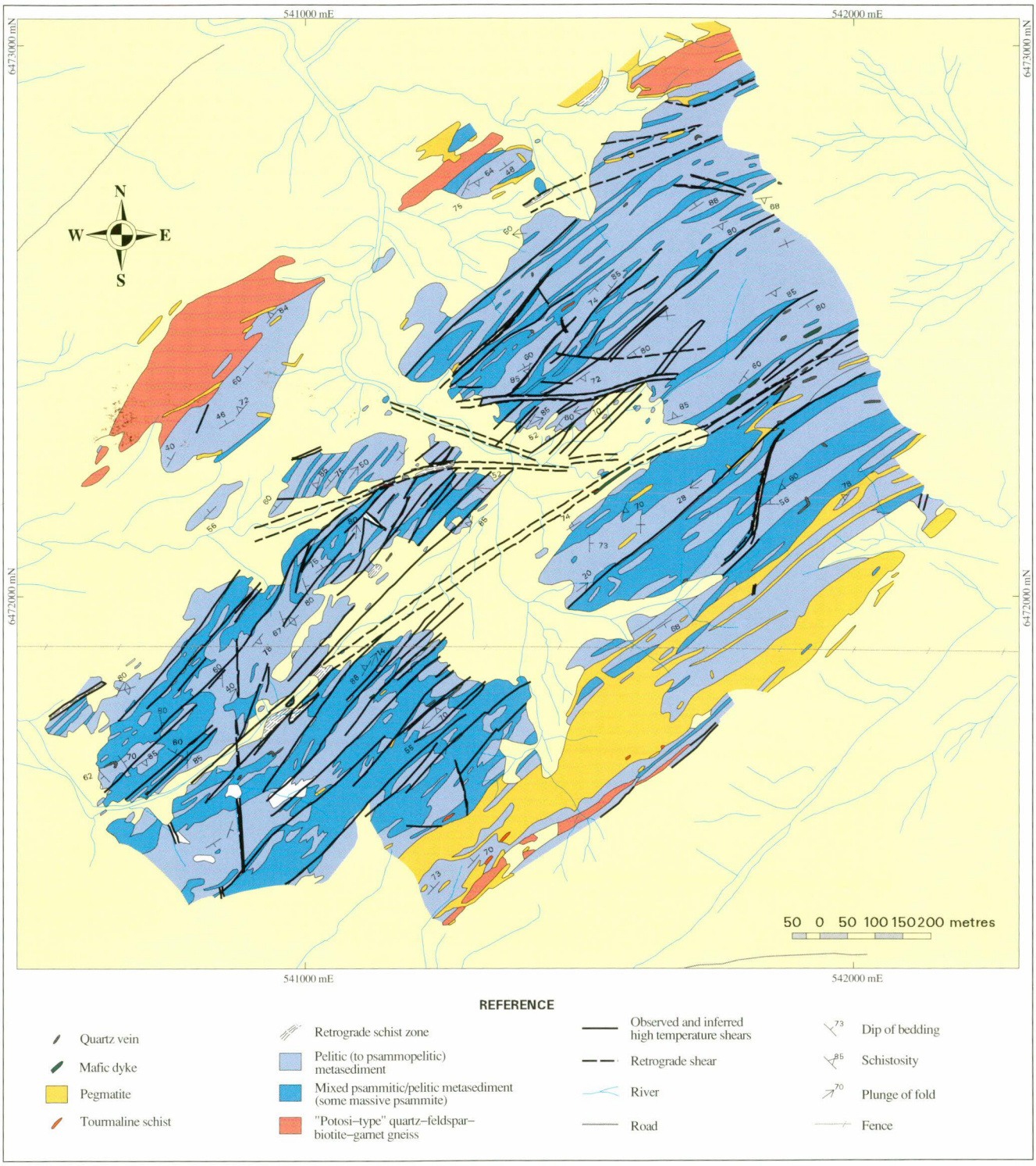


Figure 9. Geological map of the 'Monuments' grid, showing some of the high temperature shear zones which have shredded the metasediments, and which largely control the distribution of lithologies

ANOMALIES IN METASEDIMENTS AT THE MONUMENTS GRID

In areas like the Monuments grid, the interaction of folded lithological boundaries with numerous high and low grade shears may destroy continuity in the metasediments (figure 9). In such areas even the detailed aeromagnetic surveys still represent a defocused image, compared with ground magnetics, with line spacing as low as 10 m needed to adequately delineate magnetic features. Aeromagnetics may identify additional cross-cutting shears; and a combination of ground magnetics and detailed geological mapping is also useful in identification of high and low temperature shears parallel to strike. In the Monuments grid area, the Sub Audio Magnetics (SAM) resistivity technique highlighted cross-cutting retrograde shears, and a suspected major shear nearly parallel to strike.

The anomalies in the Monuments grid area are hosted by metasediments of the Sundown Group, which are enclosed on two sides by Hores Gneiss (Broken Hill Group) (figure 8). In this area the Sundown Group is predominantly upward younging and the regional structure is interpreted as an F2 syncline, heavily disrupted by high temperature shears oriented parallel to the north-easterly trending S2 schistosity. Within this regional syncline local indications of downward younging of bedding indicates that smaller F1 folds may be present. A small number of folds, unrelated to the strong S2 schistosity, are classed as F3. Retrograde shear zones, distinguished by abundant fine-grained white mica, cut across the earlier structures at low to high angles.

Total magnetic intensity (TMI) aeromagnetic images over the Monuments area show one substantial anomaly about 3 km long, and some minor anomalies. A second vertical derivative image (figure 8) shows the main anomaly separating into two branches. Ground magnetic surveys were undertaken to gain a more detailed view of the main anomaly and to see whether magnetite is concentrated in any specific type or facies of metasediment. Three surveys were undertaken: a pilot study with 100 m line spacing in the northern part and 50 m line spacing in the southern part, a detailed survey over the central part of the grid, with 10 m line spacing, and a southern extension, also with 10 m line spacing. The detailed survey over the central section was

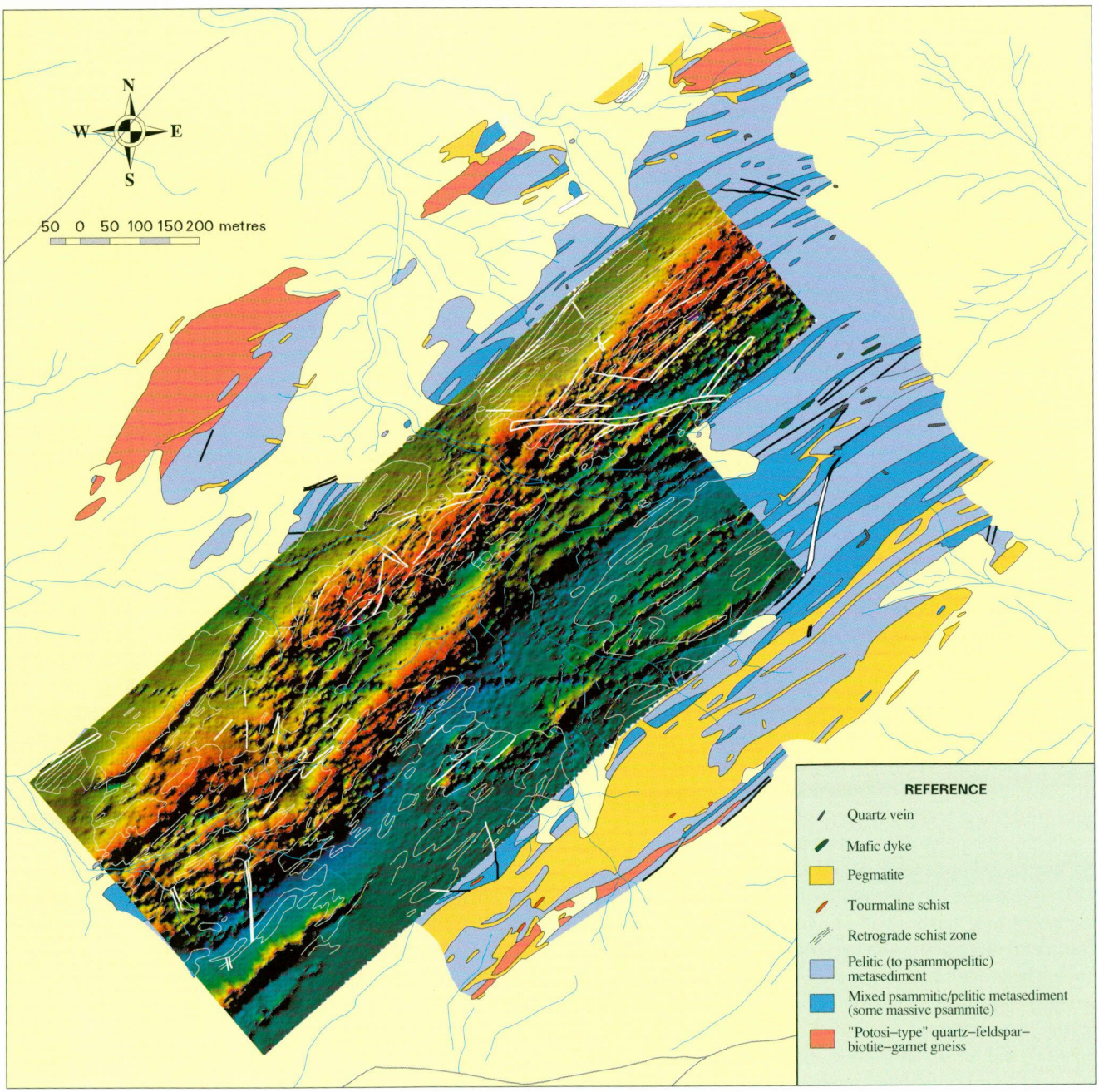


Figure 10. Pseudocolour image of ground magnetic survey (10 m line spacing) superimposed on the geological map of the 'Monuments' grid. The anomalies are parallel to the general strike of the mapped lithological units, which in turn is largely controlled by the high temperature shears. At this scale, and in outcrop, the magnetic data are conformable with the mapped geology

carried out by the Geophysical Research Institute, using the SAM system and incorporating a resistivity component.

The ground magnetic surveys separate the 400 to 500 m wide aeromagnetic anomaly into a series of discontinuous anomalies, each about 25 to 75 m across. The 100 m line spacing survey allowed separation of the main anomaly into a series of smaller anomalies, but left questions concerning continuity of individual segments and definition of retrograde shear zones. The 50 m line spacing gave better, but still unsatisfactory, definition. Ten metre line spacing produced good definition of anomalies and very good delineation of some cross-cutting shear zones (figure 10).

Geologically, the metasediments of the area are broken up into a collection of shapes which approximate elongate prisms (figure 9). The prisms comprise pelite-rich metasediments and psammite-rich or mixed psammite/pelite-rich metasediments. The long sides of the prisms comprise north-east trending high-temperature shears or near-parallel lithological boundaries of psammite-rich units and pelite-rich units. The short sides of the prisms mainly consist of lithological boundaries, either straight or folded. Few of the prisms are more than 50 m across, and they range in length from a few tens of metres to possibly hundreds of metres. The prisms are the result of close-spaced, high temperature shears slicing through and displacing the folded metasediments.

It is considered that individual anomalies of about 25 to 75 m width and 200 to 1000 m length, delineated by ground magnetic survey, are made up of a series of such prisms. In the magnetically anomalous areas, bedding in the metasediment prisms is commonly oriented obliquely to the long sides of the prisms, and to the overall trend of the magnetic anomalies. This is because the magnetically anomalous metasediments are located close to the dissected core of the regional F2 syncline.

MAGNETIC METASEDIMENTS AS A STRATIGRAPHIC MARKER WITHIN SUNDOWN GROUP

On outcrop scale, magnetite concentrations in the Sundown Group metasediments of the Monuments area are bedding-parallel, and folded by F2 folds. There is a good case to investigate the use of magnetic metasediments as a stratigraphic marker within the Sundown Group.

Within the metasediments of the Monuments grid, it has not been possible so far to delineate a structural form surface. This is because no distinctive marker horizon has been identified, nor have all the high temperature shears been confidently identified, and the amount of offset on the shears has not been determined. For these reasons it is difficult to say whether the main magnetic anomalies are confined to a particular stratigraphic interval. Geological mapping at 1:5 000, and locally at 1:2 500, shows that the magnetically anomalous zones include mappable units of pelite, several metres to tens of metres across, and mappable units of psammite with or without minor pelite, of similar size. Overall, this mixed psammitic/pelitic package appears to be situated stratigraphically above a much more pelitic package which forms the lower part of the Sundown Group.

A similar situation exists further east, in the Sundown area, to the east, where a magnetically anomalous psammitic/pelitic part of the Sundown Group overlies a magnetically subdued pelitic sequence. Other areas of the Sundown Group which contain magnetically anomalous metasediments some distance above the base include the Rupee Antiform (Mt Gipps 1:25 000 map sheet), the area west of Bijerkerno, the Parnell Synform (Lakes Creek 1:25 000 map sheet), and Yanco Glen, the type area of the Sundown Group. At Yanco Glen, the magnetic metasediments occur at the top of the Sundown Group. They are also mixed psammitic/pelitic, but the underlying Sundown Group metasediments include both pelitic and psammitic units.

On the basis of regional geology there is a good case to investigate the use of magnetic metasediments as a stratigraphic marker within the Sundown Group. But is the magnetite really stratigraphically controlled, or is it controlled by shear zones, some of which coincidentally fall within the Sundown Group?

To answer this question, detailed magnetic susceptibility mapping was carried out on a number of outcrops, each measuring only a few square metres. The mapping was carried out by drawing a chalk grid on the outcrops, drawing the geology to scale and measuring magnetic susceptibility at 10 cm intervals. In each outcrop it was found that the main control on magnetite concentration is bedding, and that cross-cutting schistosity has little influence. The results of this work will be published later.

CONCLUSIONS

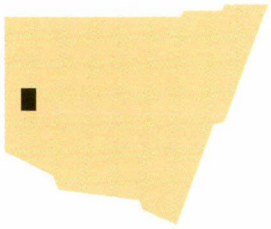
To make full use of aeromagnetic data, it is necessary to understand the geological controls on the magnetic materials, primarily magnetite. In the Monuments area the observation that bedding trends in some outcrops are oblique to the trend of the aeromagnetic anomaly led to early erroneous interpretations that magnetite was epigenetic and emplaced in shear zones.

Detailed geological mapping and ground magnetics showed that magnetite concentrations are parallel to bedding, and that the folded magnetic beds are sliced up and strung out along the north-easterly trend of the high temperature shears, producing the observed aeromagnetic anomaly. Magnetite concentrations in Sundown Group metasediments may assist with stratigraphic subdivision of the group on a regional scale, and delineate folds and shear zones affecting these rocks.

For further information, contact Barney Stevens, Principal Research Scientist, Broken Hill Office, on (08) 8080 0629, fax (08) 8087 8005.

DISCOVERY 2000

CORONA 1:25 000 CROWNS THE BROKEN HILL MAPPING PROJECT



Completion of the geological mapping of the prospective Corona 1:25 000 map area marks the final stage in the Broken Hill mapping project, begun over 20 years ago.

The Department has recently completed the 1:12 000 scale geological mapping and mineral deposit data collection for the Corona 1:25 000 map. The map area is located at the northern end of the Euriowie Block, approximately 100 km north of Broken Hill (figure 11). The mapping and metallogenic data collection for the Broken Hill and Euriowie Blocks was begun in the mid 1970s and the Corona mapping marks its completion. This major mapping program will be the subject of a future article in *Minfo*

Compilation of the Corona data is in progress and will result in the publication of the Corona 1:25 000 geological map, the Euriowie Block 1:50 000 metallogenic map and the Euriowie Block metallogenic synthesis notes.

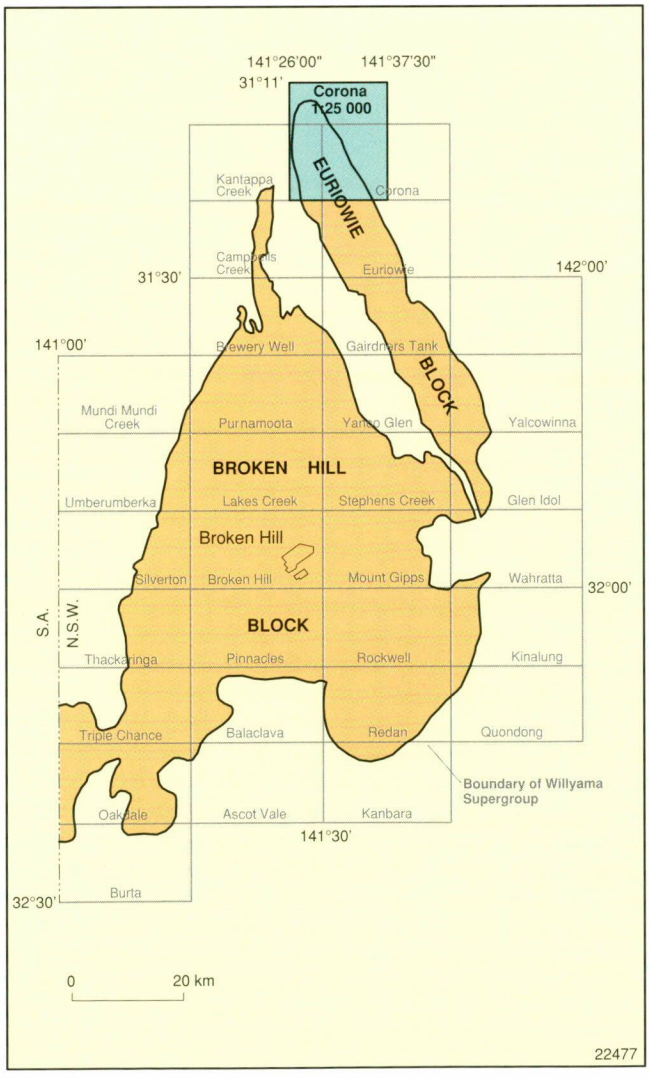


Figure 11. Location of the Corona 1:25 000 map sheet area

MINERAL DEPOSITS

Mineral deposits in the map area include tin bearing pegmatites, copper +/- gold bearing quartz veins, amethyst veins and the Corona Ironstone.

An east dipping thrust fault of probable Delamerian age extends for several kilometres along the western edge of the Euriowie Block. Slivers of Adelaidean dolomite +/- diamictite have been faulted into this structure. In places the fault contains well developed hydrothermal breccias, indicating that the structure has been a pathway for fluids, possibly with the potential for gold mineralisation. Another siliceous fault breccia strikes north-easterly through the eastern part of the Block and is probably also of Delamerian age.

Tin bearing pegmatites cluster in the south-eastern part of the area, forming the northern end of the Euriowie Tin Field, and mainly occur within Paragon Group rocks. They are several metres wide to several hundred metres long but contain only sporadic occurrences of cassiterite. The pegmatites were worked from the late 19th to early 20th centuries, producing minor amounts of tin with lesser amounts of amblygonite (a lithium mineral) and beryl. The pegmatites are probably related to the granitoid intrusions in the area and were emplaced either before or during the early stages of the prograde metamorphism and tectonism.

Copper +/- gold bearing quartz veins cluster at the northern end of the Euriowie Block and occupy narrow north-east to NNE-trending retrograde schist zones. The veins are generally several centimetres wide and are almost completely oxidised, containing mainly disseminated to stringy secondary iron oxide and malachite. Primary sulphide minerals were probably mainly chalcopyrite and pyrite. The veins were worked from the late 19th to early 20th centuries and total production is estimated to have been several tens of tonnes of ore.

Amethyst veins are a common target for fossickers, clustering in the north within both the Adelaidean McDougalls Well Conglomerate and the Willyama Supergroup along the margin of the Euriowie Block. Like the copper +/- gold veins, amethyst veins also occupy NNE-trending retrograde schist zones and minor pyrite has been identified in some of them. It is speculated that they may be genetically related to the copper +/- gold veins. Both types of vein probably formed during the Delamerian Orogeny.

The Corona Ironstone is a sporadically developed goethite-rich regolith-related ironstone occurring mainly on the Adelaidean Corona Dolomite, on the western side of the Euriowie Block. It was of interest to prospectors in the late

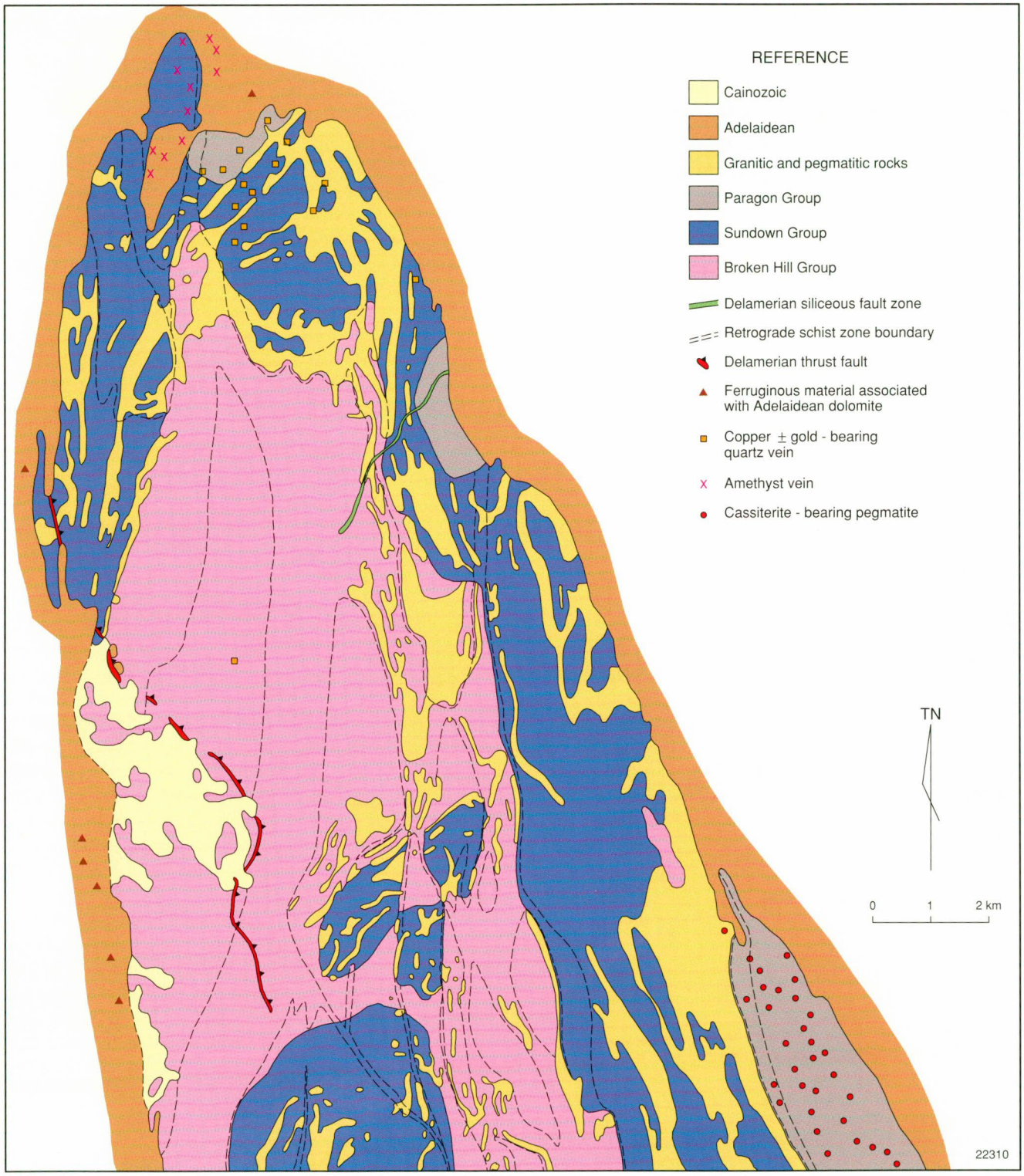


Figure 12. Simplified geology of the Corona map area

19th century and also to mineral explorers from the 1970s to 1980s. While minor amounts of copper, zinc and uranium have been obtained, it is not considered to be of economic significance.

GEOLOGY

The Euriowie Block is a Palaeoproterozoic inlier east of the Broken Hill Block, comprising regionally metamorphosed rocks of the Willyama Supergroup (figure 12). Rocks of the Broken Hill Group, Sundown Group and Paragon Group are present within the map area.

The Broken Hill Group comprises mainly composite gneiss and migmatite with numerous basic gneiss pods, minor quartzo-feldspathic gneiss (including the well known 'Potosi' type gneiss), various types of calc-silicate rock, including calc-silicate ellipsoids, and rare banded iron formation.

The Sundown Group comprises mainly metasediments with minor calc-silicate ellipsoids while the Paragon Group comprises mainly graphitic metasediments, albitic psammites and a laminated calc-silicate horizon (the King Gunnia Calc-Silicate Member). The stratigraphic sequence has been intruded by pegmatites and granitoids, the latter comprising 'Granite' gneiss, leucocratic quartzo-feldspathic gneiss and leucocratic granite.

Adelaidean rocks comprising chiefly dolomite, diamictite and mudstone unconformably overlie the Willyama Supergroup and outcrop to the west, north and east of the Euriowie Block on the Corona map area. The unconformable contact is sheared over most of its extent.

Prograde metamorphic assemblages in metasediments range from andalusite-bearing rocks in the Paragon Group to sillimanite-bearing rocks in the Sundown and Broken Hill Groups. The Broken Hill Group metasedimentary rocks contain significant amounts of partial melt and the basic gneisses have all been metamorphosed to amphibolite facies. Prograde metamorphism was associated with D_1 deformation, producing the S_1 foliation which is parallel to bedding in metasediments, and D_2 deformation, producing upright north-plunging F_2 folds and the axial planar S_2 foliation (see page 18 for explanation of S_1, D_1, F_1, etc). Numerous retrograde schist zones, mainly northerly trending, occur in the map area but pervasive retrogression is widespread. Retrogression occurred after prograde metamorphism and there have probably been several periods of shearing. The last major shearing event occurred during the Delamerian Orogeny in the Cambrian.

The Corona map will be published in 1998.

For further information on the Corona 1:25 000 geological map and the Euriowie Block metallogenic study contact Gary Burton, Geologist, Orange Office, on (02) 6360 8225, fax (02) 6360 8344.

DISCOVERY 2000 HIGHLY COMMENDED IN 1997 PREMIER'S PUBLIC SECTOR AWARDS

The Department's Discovery 2000 Exploration Initiative has received a Highly Commended Award for its contribution to the State's economy in the 1997 inaugural Premier's Public Sector Awards.

The Premier inaugurated the awards to recognise publicly New South Wales public sector achievements and their contribution to the community. The awards recognise significant contributions to the quality of the State's economy, environment, service delivery, employment equity and social justice.

The Discovery 2000 Program was nominated in the category for 'Achievements that make a significant contribution to the economy'. The key criteria for this category were:

- demonstrated sustained financial contribution to New South Wales;
- the use of creative/innovative strategies and systems;
- establishment of new markets for New South Wales.

The basis of the Department's Discovery 2000 nomination was the successful development of state-of-the-art information and technology systems to boost mineral and petroleum exploration in New South Wales. The systems are providing an enhanced geological and information framework to increase growth in the State's mining sector, and therefore in the State's economy.

The Discovery 2000 program, by its use of modern state of the art technology to provide geoscience data and a first class information network/delivery system, is accelerating the development of the resources industry in the State. In its first three years, mineral exploration activity has increased 38%, with exploration extending into a number of new areas. More recently the search for oil and gas has been marked by a dramatic upswing. Fifteen titles have been taken over the area covered by the exploration initiative.

The economic benefits of the Discovery 2000 program are evident in this exploration phase and are a particular boost to regional centres in the State, in areas such as Broken Hill, Bourke and Albury. Longer term benefits are expected when the new targets generated are defined as mineable resources. These benefits will include increased employment through mining and minerals processing, and greater royalty returns to the State.

The Deputy Premier, the Hon Andrew Refshauge, presented the awards during a ceremony held at the Powerhouse Museum on 3 December 1997. John Cramsie, Director of the Geological Survey of New South Wales, Peter Lewis, Program Manager (Discovery 2000 – Minerals), and Ron Lucas, Assistant Director (Information), accepted the award on behalf of the Department. All staff on the project were later presented with certificates of achievement signed by the Premier in recognition of their individual and team efforts.

The success of Discovery 2000 has involved many people in the Department as well as the active participation of others in industry. The Department, and in particular the Discovery 2000 team, would like to send its sincere thanks to colleagues in the resources industry who have responded so positively to the initiative.

For further information, and for data available from Discovery 2000, contact Peter Lewis, Program Manager (Discovery 2000 – Minerals), on (02) 9901 8372, fax (02) 9901 8753, or Brad Mullard, Chief Geologist – Coal and Petroleum, on (02) 9901 8505, fax (02) 9901 8520.

DEPARTMENT STAFF SPEAK AT MAJOR CANADIAN CONVENTION

Peter Lewis, Program Manager for Discovery 2000 (Minerals) and David Robson, Chief Geophysicist, recently attended the Exploration '97 Conference in Toronto, Canada, to present papers.

Peter Lewis was asked to speak on data management and geographic information system (GIS) practices within Australian government surveys. His talk was presented at a plenary session on the first day of the conference attended by over 800 delegates.

David Robson was invited to speak at a session on regional geophysical surveys. His topic was centred on the major geophysical surveys that the Department has carried out for both Discovery 2000 and the National Geoscience Mapping Accord (NGMA).

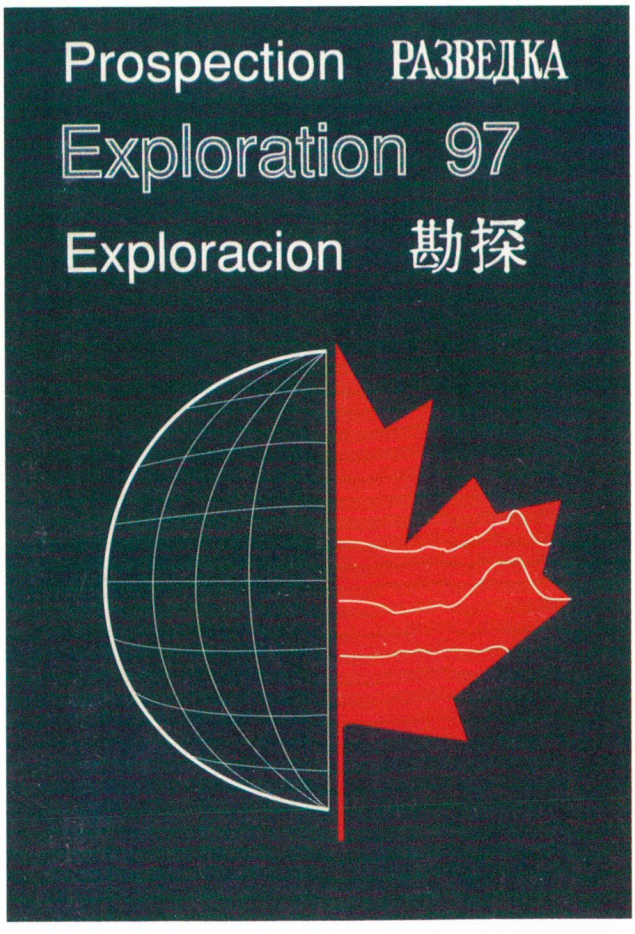
Exploration '97 is a major convention held every ten years to review changes in exploration related technology, research and concepts. It concentrates on three streams — geophysics, geochemistry and information–GIS management. All speakers are invited to participate by the relevant session convenor. They are chosen either to highlight 'state of the art' technology and application as used in a project, or to speak on trends within the industry at a national level.

The conference was attended by over 1100 delegates. Most were from North America, with a significant number from Europe and Australasia. Delegates also came from such countries as Indonesia, the Philippines, Iran, South Africa, Botswana and Vietnam.

Both Departmental speakers reviewed the products and services displayed by numerous company and government exhibitors. From the talks and exhibits they were able to appraise new technology being applied to geophysics, data processing, data modelling, GIS and information technology. Discussions were held with a wide range of geoscientists and included the demonstration of a helicopter-borne system for measuring gravity (HeliGrav).

The presentations were a good opportunity to convey the message that New South Wales is an attractive low risk exploration target area. The choice of two speakers from the Geological Survey was significant. It brought the Department to the attention of a new market as an organisation with good credentials, and reinforced the Department's reputation with the exploration industry for providing high quality data and technical support.

For further information contact David Robson, Chief Geophysicist, on (02) 9901 8342, fax (02) 9901 8256, or Peter Lewis, Program Manager (Discovery 2000 – Minerals), on (02) 9901 8372, fax (02) 9901 8753.



OUTLOOK FOR GOLD IN NEW SOUTH WALES

Despite the marked fall in the gold prices recently, New South Wales gold production is set to increase due to new and existing projects and low operating costs.

INTRODUCTION

The New South Wales gold industry is forecast to enter a period of sustained production growth over the next five years. Growth will be underpinned by new and expanded gold projects, despite the current low gold price. Projected future production growth will be based on discoveries in prospective areas of the State, particularly the Lachlan Fold Belt, highlighted by geological information resulting from the Discovery 2000 exploration initiative.

Projects anticipated to contribute to New South Wales gold production over the next five years are Cadia Hill and Ridgeway, while projects such as Cowal (formerly called Lake Cowal) and Timbarra could also contribute, subject to environmental approval of their development applications. However, a potential threat to the outlook of significantly increased New South Wales gold production, in the short term, is the current depressed level of gold prices.

GOLD PRICE

The price of gold has fallen almost 24% over the past two years, from a high of A$554.78 per ounce in February 1996 to a low of A$423.65 per ounce in July 1997. To a significant extent, gold lost its appeal over this period as an investment medium, due to the higher returns available in equity markets and the low level of interest rates on funds to finance such investments. Even central banks around the world, the largest holders of gold, have questioned the longer term merits of holding it. Central banks hold over 28 000 t of gold, representing over 12 years annual world gold production. The prospect of the systematic rundown in these stocks has depressed the gold price indirectly as other market participants have sold, speculating that the gold price would fall in the future. This has combined recently with the decrease in demand for fabricated gold due to the Asian currency crisis, pushing the price of gold to a 12 year low, below US$285 (A$425) per ounce in early December 1997. However, the October–December 1997 drop in the Australian dollar has cushioned the impact on the gold price in domestic currency terms.

Despite this, the most immediate impact of the decline in the gold price has been a reduction in the attractiveness of shares in gold companies. In the period since February 1996, when the price of gold was at its highest for two years, the value of gold shares has fallen almost 60% compared to the 12.5% gain in value made by the 'all shares' traded on the Australian Stock Exchange. This is of fundamental concern to gold producing and exploration companies who derive capital from share issues. This constraint on the sector to raise new share capital could be expected to impact on the capacity of small explorers to maintain exploration programs vital to the continued discovery of new projects beyond those already known.

However, the price of gold may stabilise over the next year. A slowdown in the rate of world gold mine supply growth as a result of the present price level should add to future positive price pressure and at least offer greater scope for the market to absorb any future supplies arising from central bank sales. The current uncertainty regarding future share market performance and general economic outlook, particularly in the Asian region, should increase investment demand and hence provide a basis for an improved gold price outlook, barring continued large scale central bank sales in the immediate future.

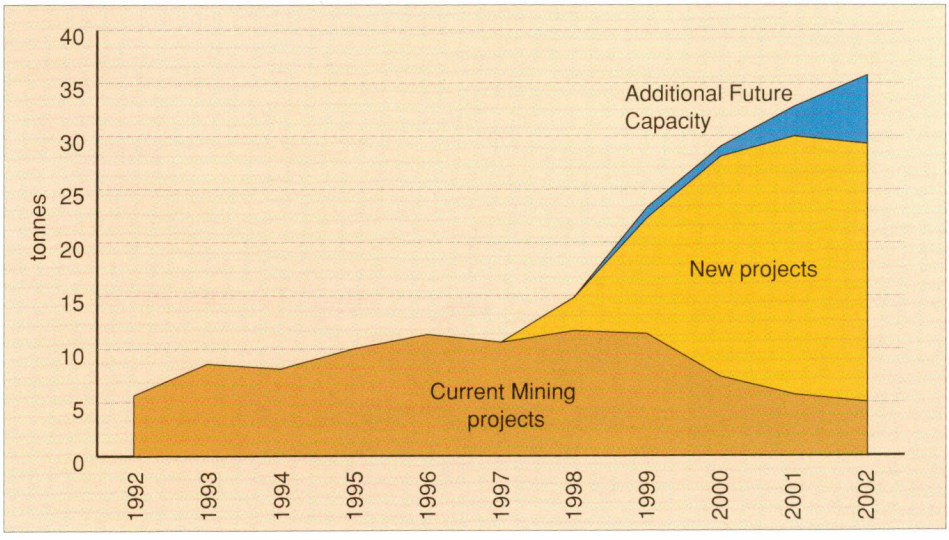


Figure 13. Actual and projected gold production in New South Wales between 1992 and 2002

PRESENT PRODUCTION

Even in the short term, if low gold prices persist, the New South Wales gold sector is relatively secure, given its level of hedging and generally

low operating costs. While the spot price in the June quarter 1997 averaged just under A$465 per ounce, the weighted average operating cost in New South Wales at the same time was A$255 per ounce, while total average cost was estimated to be around A$325 per ounce. This implies a gross operating margin of A$140 per ounce for the June quarter, even greater when the received price is taken into account. Margins in the industry remain healthy, albeit significantly reduced.

Gold producing mines operating in New South Wales include Browns Creek, Northparkes, Hillgrove, The Peak and Peak Hill. McKinnons is in the final stages of its operational mine life. The largest of these mines is The Peak which produced 37 000 ounces in the June quarter, up almost 6% on the previous quarter. The Peak mine is also a significant producer of silver, lead, zinc and copper. Northparkes also produces copper and Hillgrove antimony. The prospects of these gold mines in New South Wales are not only a function of the future gold price but also of future prices for base metals.

FUTURE PRODUCTION

With operating margins anticipated to remain reasonably attractive over the next five years, New South Wales gold production is forecast to reach almost 36 t by 2002, up 215% from the 11.36 t produced in 1996. The bulk of this production growth is anticipated to come from the new projects shown in yellow in figure 13. These new projects are forecast to contribute over 24 t of gold production by 2002.

The largest of these projects is Cadia, being developed by Newcrest Mining Ltd, 21 km south of the central west town of Orange. The Cadia Hill mine is planned to commence production in 1998 with a forecast peak annual production of about 300 000 ounces and 23 000 t of copper per year from its opencut operation. The deposit contains 202 Mt of ore with an average grade of 0.73 g/t gold and 0.17% copper. The company estimates that unit mining cash operating costs per annum, after copper credits, will average about A$300 per ounce of gold produced.

Near the Cadia opencut project, the underground Cadia Ridgeway deposit is the subject of a detailed feasibility study by Newcrest, including construction of an $11 million exploration decline. The feasibility study should be completed in late 1998, with production possibly starting in 2001.

At this early stage, Newcrest estimates that the Cadia Ridgeway underground mine could produce more than 200 000 ounces of gold and 20 000 t of copper per annum.

Another sizeable project that could enter production, subject to environmental approval, is the Cowal project, 40 km north-east of West Wyalong, also in central west New South Wales. Contained reserves are about 2.5 million ounces of gold, while annual production could reach aproximately 225 000 ounces. Subject to environmental approval and a suitable gold price, North Ltd plans to develop an opencut mine. The capital development cost is forecast to be about $220 million.

North's first development application was rejected on environmental grounds and a second application is being prepared to meet strict environmental standards. If development consent were granted, it would be at least 1999 before construction of the mine commenced, with first gold being produced at earliest in 2000.

The other current significant project likely to contribute to future New South Wales gold production is Timbarra, a small to medium opencut deposit near Tenterfield in the State's north, which is being developed by Ross Mining NL. It contains reserves of about 325 000 ounces of gold. Annual production is scheduled at around 50 000 ounces per year over its predicted five year mine life.

CONCLUSION

New South Wales is well placed to increase significantly its share of national production from just under 4% in 1996 to more than 11% by 2002. Beyond this date, further increases in production are anticipated to come from new discoveries resulting from exploration in prospective areas of the state and ongoing exploration successes resulting from the Discovery 2000 initiative, which is fostering continued increases in exploration expenditure in the State.

For further information contact Simon Middleton, Principal Mineral Economist, Industry Development, on (02) 9901 8825, fax (02) 9901 8493.

CENTRAL WEST INFRASTRUCTURE MINERALS STUDY

The Commonwealth and State Governments and the mining industry have combined to fund a central west New South Wales infrastructure study.

The Commonwealth Government is encouraging a coordinated regional approach to the development of new mines, mineral processing and related infrastructure through its Regional Minerals Program.

Two such projects have been completed already, in Western Australia and Queensland, in conjunction with the respective state governments and the mining industry. The Federal Government subsequently approached New South Wales to nominate an area for a similar study to be undertaken. The New South Wales Government proposed an area in the central west of the State, and this was selected for the study (figure 14).

One of the prerequisites of the Commonwealth initiated studies is the requirement for equal funding contributions from the Commonwealth and State governments and the mining industry. Funding has already been committed from mining companies to add to that contributed by the New South Wales Department of State and Regional Development and the Commonwealth Department of Primary Industry and Energy.

The central west of New South Wales contains operating mines and projects at advanced stages of planning. In addition, it is highly prospective for gold and base metals and is attracting high levels of exploration. Exploration activity has been stimulated in the last two years by the Discovery 2000 program, a State government initiative. The program has substantially expanded the regional geophysical database and extended the known prospective areas in this part of the State.

Early in 1997, the Department of Mineral Resources surveyed a number of companies with mines or advanced projects in the Cobar, Girilambone and Parkes districts of the central west to identify actual or potential impediments to future development. At the same time, in the area from Wellington to Cowra, the Department was coordinating a study of potential mine developments and their infrastructure.

The information obtained from the company survey and from the Wellington–Cowra study indicated that there were actual or potential impediments to future mine developments in the region.

A management committee, made up of representatives from the participating organisations, has been set up. The committee chairman is Lindsay Mac Alister, a former chairman of the New South Wales Minerals Council, who has had a long career in the mining industry. The project secretariat is provided by the Department of Mineral Resources.

Companies involved to date in the study are Girilambone Copper Company Pty Ltd, North Ltd, Newcrest Mining Limited, Pasminco Australia Ltd, Alkane Exploration NL, Rio Tinto Ltd and Hargraves Resources NL.

Issues such as water, infrastructure, government charges, government processes and land access will be covered by the study. Water availability will be a significant issue.

The study will be carried out by Dames & Moore Pty Ltd who were selected by the management committee in December 1997. The study is expected to take about four months.

The findings will be used by government and industry to plan for and prioritise future mining related infrastructure needs of the central west.

For further information contact Denis Casey, Senior Project Officer, on (02) 9901 8511, fax (02) 9901 8493.

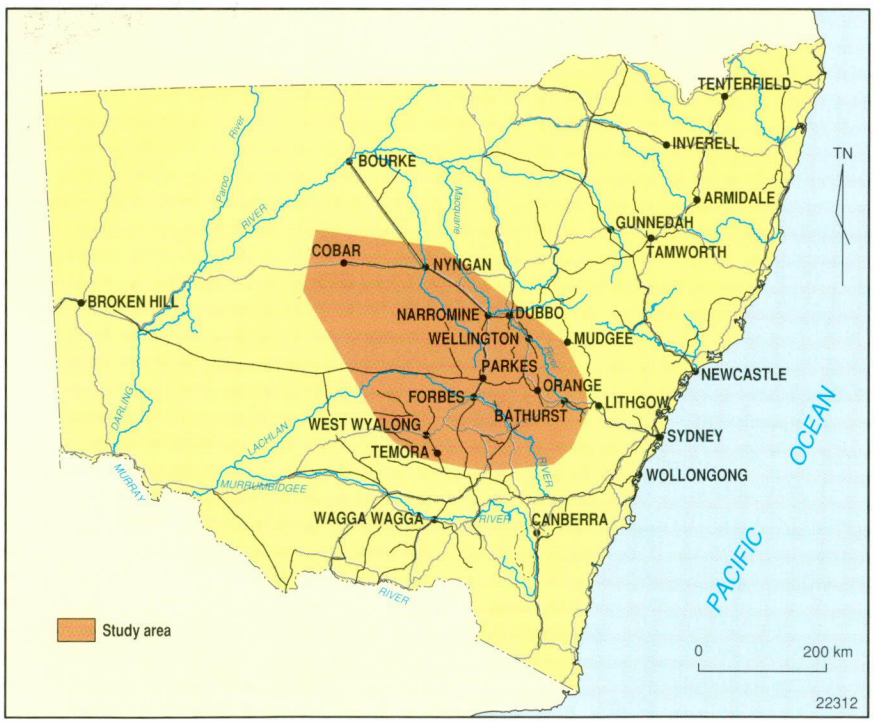


Figure 14. Location of the central west infrastructure study to be carried out under the Regional Minerals Program

The Drilling News

Births Deaths and Marriages

Lord Bros, of Orange are pleased to announce the arrival of Mark 111 UDR 1500. Mark 111 joins Mark V UDR 1000 and the twin UDR 650 brothers who have performed with great strength and reliability in many applications. All are in fine health. Mark 111 joins a huge swag of quality drilling equipment at Lord Bros sites, which gives a complete service to exploration companies, mining companies and others in the central and western areas of New South Wales. Visits to see Mark 111, who will reside at Cadia for the time being, can be arranged by phoning Roger or Phil Lord on (063) 62 0714

Now Lord Bros, renowned in the exploration industry as being 'The Best in the Hole World', can drill deeper, faster and more accurately than ever with their new UDR 1500 Mark 111.

The new UDR 1500 Mark 111 has features others only dream about:

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And it's safe...

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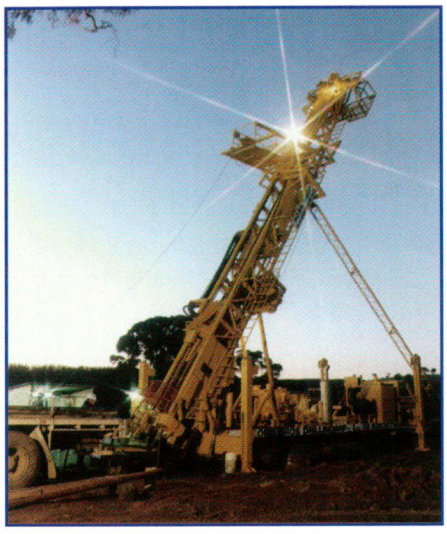

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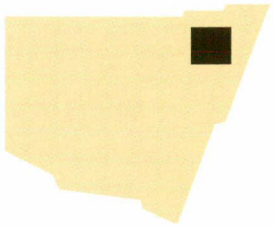
NEW PUBLICATIONS ON INVERELL



The Inverell area is highly mineralised with numerous occurrences of tin, gold, sapphire and other metals as well as other gemstones and industrial minerals.

Inverell 1:250 000 Metallogenic Map; Metallogenic Study and Mine Data Sheets, by R.E. Brown and W.J. Stroud.

Inverell 1:250 000 Metallogenic Map, by W.J. Stroud and R.E. Brown.

The Inverell 1:250 000 Metallogenic Map and accompanying notes provide a comprehensive mineral deposits database for the region, a modern recompilation of the geological data and a regional metallogenic framework for use in mineral exploration, landuse planning and mineral resource management.

The Inverell 1:250 000 map sheet area covers parts of the New England Fold Belt (Central Block and Tamworth Belt), the far north-east of the Gunnedah Basin, and the eastern parts of the Surat Basin. Extensive Tertiary volcanics and sediments and Quaternary sediments occur throughout the area, which has 975 recorded mineral deposits (figure 15).

The map area has been host to some of the largest tin, sapphire, and diamond deposits in the State and continues to have high potential for these commodities. Sapphire mining continues at the Strathdarr deposit in the upper reaches of Kings Plains Creek (refer *Minfo* **37**, pp 10–14). As well, extensive alluvial and hard rock tin has been mined from the Elsmore–Tingha–Gilgai and the Gulf areas. Nearly 250 000 carats of diamonds were won from the Copeton and Bingara deep leads, and these areas are still the focus of extensive exploration. Over 175 000 t of sulphides (mainly Pb, Ag and Zn) were mined from the Conrad mine and other lodes associated with the western margin of the Gilgai Granite. Over 18 000 t of sulphide ore were mined from the Webbs Consols mine associated with the Webbs Consols Leucogranite. Possibly over 200 000 t of sulphide ore may be present at the Tangoa prospect south-east of the Webbs Consols mine.

Coal has been extracted commercially from the Ashford Coal measures. The Gunnedah Basin and its northern equivalents in the Bowen Basin and the overlying Surat Basin have coal and hydrocarbon potential.

Most of the remaining mineral deposits are small and include both hard rock and alluvial deposits. Commodities mined or prospected for include:

- Non-metals: coal, diamond, limestone, magnesite, magnetite and sapphire.
- Metals: antimony, base metals, chromium, gold, manganese oxide, molybdenum, nickel, tin and tungsten.

MAPPING HIGHLIGHTS

Highlights of the Inverell metallogenic mapping are:

- the identification and delineation of numerous previously undocumented base metal occurrences associated with the Gilgai Granite.
- the detailed mapping of the widespread lode cassiterite deposits.
- recognition of the Whitlow gold group, a cluster of metahydrothermal gold deposits (refer *Minfo* **55**, pp 40–41) apparently associated with the upper surface of a regional-scale thrust.
- recognition and delineation of mineralisation associated with the Dumboy–Gragin Granite.
- delineation of the extensive alluvial and metahydrothermal lode gold deposits comprising the Bingara gold group.

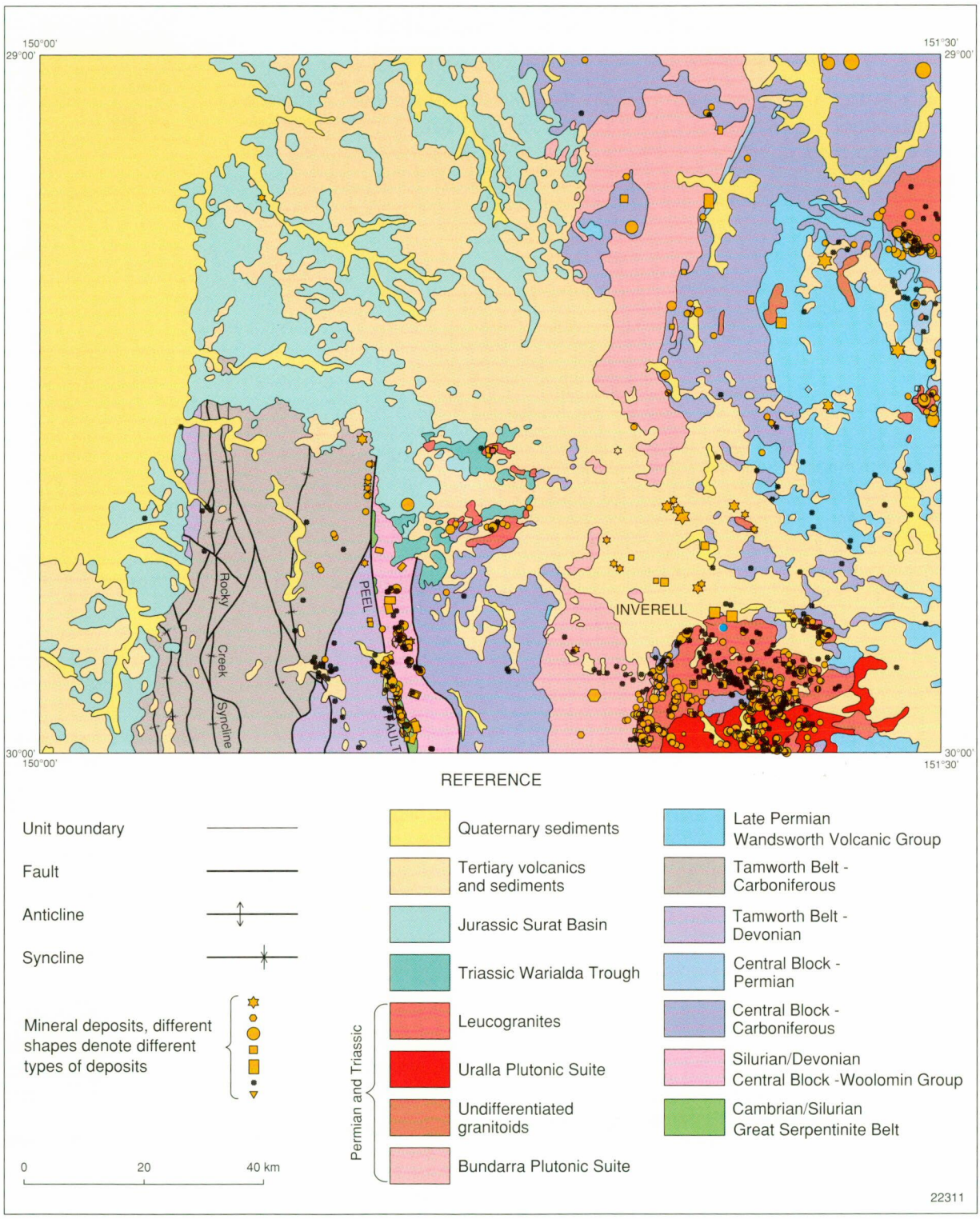


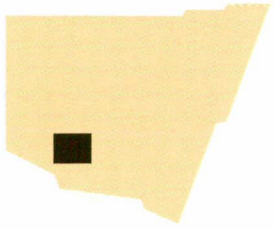
Figure 15. Simplified Inverell 1:250 000 scale metallogenic map showing main mineral occurrences

- recognition of the high exploration potential for major alluvial cassiterite, sapphire, gold and diamond deposits, lode base metal deposits and small, although rich, gold, cassiterite and wolframite lodes.

The Inverell 1:250 000 Metallogenic Map will be published early in 1998. The *Inverell 1:250 000 Metallogenic Study and Mineral Deposit Data Sheets* are now available for $30.00 from the Information Counter, Head Office, St Leonards, on (02) 9901 8269, fax (02) 9901 8247.

For further information on the map or the study and mineral deposit data sheets contact Jim Stroud, Senior Geologist, or Bob Brown, Geologist, at the Armidale Office, on (02) 6770 2112, fax (02) 6770 2121.

MURRAY BASIN MAPPING PROGRESS



The semi-arid Booligal map sheet area in the Riverine Plain has a shallow basement prospective for volcanogenic related mineralisation in the east and a central unexplored possible structural basin of Devonian sediments – the Booligal Trough.

INTRODUCTION

The Murray Basin Mapping Project has been outlined in earlier issues of *Minfo* (issues **13** p 51, **20** p 70, and **31** p 14). The published results to date were outlined in *Minfo* **52**, pp 56-59, where recent heavy mineral sand discoveries were discussed. The explanatory notes and map for the Booligal 1:250 000 map sheet area have now been published. The Booligal map sheet area and its relationship to the Murray Basin mapping program is shown in *Minfo* **52**, p 57. The completion of the Ana Branch, Pooncarie and Booligal mapping leaves the Balranald, Hay and Deniliquin 1:250 000 map areas to be mapped. Within the Balranald sheet area there are major exploration targets for heavy mineral sands.

GEOLOGY

The Booligal 1:250 000 map sheet area lies immediately west of Hillston in New South Wales. It is a flat, semi-arid region, dominated by interacting Quaternary morphostratigraphic units (figure 16). The study area is almost entirely covered with unconsolidated and consolidated sediments of the Murray Basin, and the basement consists for the greatest part of Lachlan Fold Belt rocks. This area lies within the eastern part of the Murray Basin and consists of fluvial and possibly marginal marine Tertiary sedimentary units deposited in an intracratonic setting. Sedimentary thicknesses vary from 20 m to 200 m overlying basement highs and from 200 m to 410 m within basement troughs. The basement comprises pre-Tertiary sequences, especially Lachlan Fold Belt rocks and intrusions.

Basement rocks crop out in three areas: the Warranary Range; Trida; and Caninganima Hill. The Warranary Range forms a topographic basin, U-shaped in plan, with the axial plane oriented north-west–south-east. The range rises to an elevation of 309 m at Warranary Trigonometrical Station. The main outer escarpment, consisting of litharenite, sublitharenite and (bimodal) quartz arenite of the Early (to Middle) Devonian Gundaroo sandstone and Marooba Formation (Cobar Supergroup), rises very steeply in a stepped morphology for approximately 100 m. A small resistant unit at the top forms cliffs up to 30 m high. Unconformably overlying the Marooba Formation (in effect lining the topographic basin) are the matrix-supported quartz conglomerates and sublitharenites of the Early to Middle Devonian Meadows Tank Formation of the Mulga Downs Group. Small, previously unmapped, low-lying outcrops at Trida are mapped as Winduck Group (Gundaroo Sandstone). The remaining exposed outcrop at Caninganima Hill consists of polymictic pebble conglomerate and litharenite, and is tentatively assigned to the Cocoparra Group (Mailman Gap Conglomerate Member).

Because there is very limited outcrop of pre-Tertiary rocks in the Booligal region, extensive use was made of geophysical data (magnetic, gravity and seismic) to complement the limited drill hole data. This allowed interpretation of the inferred Lachlan Fold Belt rocks of the basement. Basement depth varies to about 300 m or 350 m, but over much of the Booligal area is no more than 200 m. Several suites of volcanic and sedimentary rocks have been interpreted in the basement, as well as granite intrusions. The Hillston Volcanic Complex and the Booligal Trough provide examples of the first two terrains being interpreted using geophysical aids (figure 16).

Overlying the basement rocks are several fluvial to lacustrine units of Tertiary age. These are the Olney Formation of the Renmark Group (which can be subdivided into three intervals) and the Calivil Formation. A minor unit, the Pooncarie Ironstone, may also be present, but has not been mapped in the Booligal area. There are two aquifer-bearing depositional sequences within this Tertiary succession. The older consists of the concealed basal fluvio-lacustrine Middle Eocene to Late Miocene Olney Formation of the Renmark Group. A Late Tertiary depositional hiatus underlies the second (overlying) sequence, which consists of subsurface sands and sandstones of the Pliocene to Early Pleistocene fluvial Calivil Formation. Included within this second sequence is the Shepparton Formation, in addition to Early to mid-Quaternary fluvial deposits.

The formerly interacting Quaternary morphostratigraphic units of fluvial, aeolian, and lacustrine depositional systems are now largely inactive. The areally dominant fluvial systems are mapped as either Coonambidgal Formation or Shepparton Formation. A system of nomenclatural qualifiers further subdivides these two groupings according to geomorphological and surface characteristics. The southwesterly flowing, perennial, suspended-load Lachlan River displays a sinuosity which increases downstream until it reaches its usual terminus in the Great Cumbung Swamp. Willandra Creek is intermittent until Morrisons Lake near Mossgiel and then changes to an ephemeral stream. All other watercourses are ephemeral, generally effluent, and display a sinuosity formed when the streams were more competent than under the fluvial regimes of today.

Aeolian systems show four geomorphological forms: sandplains; openly spaced linear to openly spaced connected-crescent dunefields (Woorinen Formation); closely spaced linear to sub-parabolic dunefields; and parabolic (mallee-

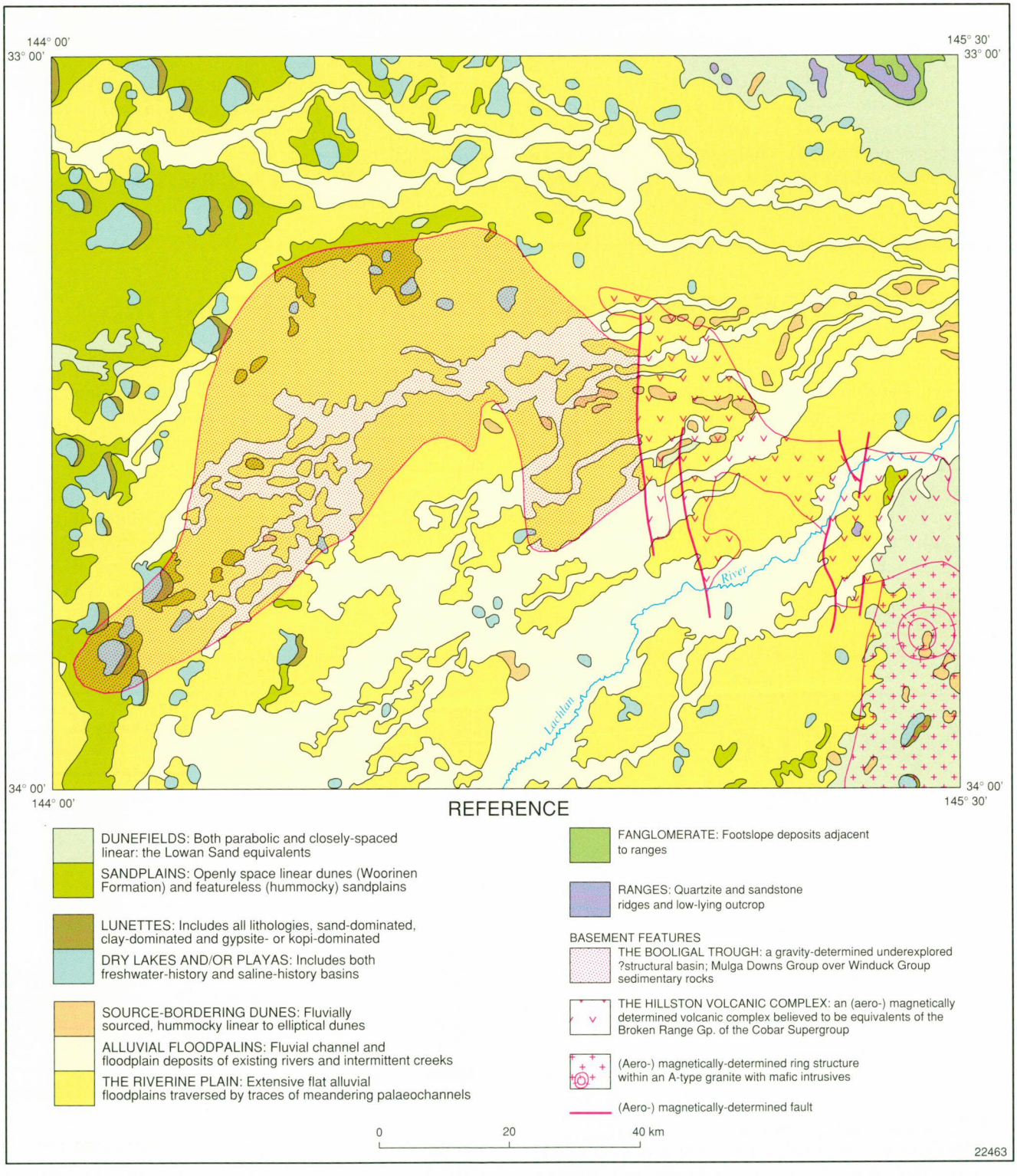


Figure 16. Simplified geology of the Booligal 1:250 000 map area with superimposed interpreted basement

type) dunefields. Lacustro-aeolian quartzose and clay lunettes have formed on the eastern shoreline of dry lakes and are morphologically simple or compound. Source-bordering dunes are the fluvial equivalents of lunettes. The dry lakes show morphological and sedimentological features indicating late stage saline histories. Dry lakes without lunettes are palaeo-overflow lakes similar to Popiltah–Mindona Lakes on the Great Ana Branch of the Darling River or the Menindee Lakes on the Darling River.

The major geomorphological unit covering the Booligal 1:250 000 map area is the extensive and flat Lachlan alluvial fan, which in turn is a major component of the Riverine Plain of south-western New South Wales. Aeolian landforms in the western and eastern extremities are also primarily extensive flat sandplains, with minor stabilised dunefields. Hills and footslopes form about 2% of the Booligal study area.

RESOURCES

Currently there is no exploitation of significant mineral resources apart from some minor production of construction materials in the area covered by the Booligal 1:250 000 map sheet. There is some potential for titanium minerals (heavy mineral sands) in the Murray Basin sequence although the host unit for heavy minerals further west (Parilla Sand) has not been identified in the area. Because of their regional setting, basement rocks may have potential for metallic resource deposits. The potential for fuel resources is limited, restricted to deep basins similar in style to Coorabin in Oaklands. Apart from minor construction materials production, there is no other known exploitation of significant mineral resources. Groundwater is a scarce resource in the Booligal region.

For further information contact Roger Cameron, Geologist, on (02) 9901 8370, fax (02) 99018256.

REGISTER OF MINERAL DEVELOPMENT OPPORTUNITIES

The Department of Mineral Resources maintains a **Register of Mineral Development Opportunities** to assist minerals investors and project developers in New South Wales.

The register was updated in December 1997. It gives details of exploration, mining and minerals processing projects in New South Wales in which companies are seeking investment and/or joint venture participation. Copies of the register are distributed in Australia and internationally and are available free of charge on application.

There are currently 12 listed ventures, covering diverse exploration, mining and value-added minerals processing projects.

Mining/exploration projects include gold, copper, antimony and other metals, vermiculite, bentonite, olivine (dunite) coalbed methane and petroleum.

Value-added minerals processing projects include fused silica and dimension stone.

Companies and project proponents who would like to register specific minerals based opportunites, or those interested in obtaining data and contact details on investment opportunities should contact Dave Barnard, Development Officer, on (02) 9901 8463, fax (02) 9901 8493.

A MAJOR NEW STRATOTECTONIC MAP OF NEW SOUTH WALES

A major new 1:1 000 000 scale *Stratotectonic Map of New South Wales* by Dr Erwin Scheibner is now available. The map is one of a set of products on the geology of New South Wales being prepared by Dr Scheibner.

Although Dr Scheibner has retired from the Department as a Principal Research Scientist, he has continued to develop a two-volume set, *Geology of New South Wales*, with accompanying State maps.

WHAT IS A STRATOTECTONIC MAP?

To quote Erwin Scheibner, 'a stratotectonic map shows the predeformation properties and tectonic settings of rock complexes ... and gives an illustration of the tectonic history of a region, of the processes of crustal evolution in time, and the origin of the architecture of the earth's crust in time'.

INFORMATION ON THE MAP

The new stratotectonic map shows a stratotectonic interpretation of outcropping rocks in the State's fold belts and of basement rocks beneath sedimentary basins and younger cover rocks (figure 17). The basins are represented by their limits, with the exception of the Sydney–Bowen Basin.

The colours on the map indicate the tectonic stages and thus represent age intervals. Within the stages, the depth of deposition, the facies, and the types of volcanics and intrusives are indicated. Standard structural symbols indicate structural information. The style of the lines indicates the type of boundary, with a hierarchial set for those concealed beneath basins.

The reference for the map is in the form of Time/Space Plots (a list of lithostratigraphic units in each tectonic stage will be included in the explanatory notes (see below)). On these plots the vertical axis is a representation of the ages of the tectonic stages. The horizontal axis shows all the structural blocks in New South Wales, including higher category structural units: structural zones, fold belts and basins, as well as cover rocks. Mapped rock complexes and those based on subsurface borehole information are shown. As well, an interpretation of the deeper basement is attempted.

The map was produced by the Cartography Section of the Geological Survey of New South Wales using ArcInfo software. The digital methods used for map preparation, combined with traditional high-quality printing, have resulted in large time and cost savings without the loss of cartographic quality.

PRINTING AWARDS

Mercury–Walch Pty Ltd were awarded two gold certificates for the printed map at the Printing Industry Craft Awards (PICA) in Tasmania in November 1997.

The awards were given for the best map printed in Tasmania during the previous 15 months, and the second, the Craft Award, for a map which included a full sheet showing all trim marks, registration set up and colour control strips.

RELATED PRODUCTS

The explanatory text for the Stratotectonic Map, 'Geology of New South Wales — Synthesis: Volume 2 Geological Evolution' (*Geological Survey of New South Wales, Memoir* **Geology 13**(2)), is well advanced and will be published in 1998. An unpublished GS report (GS1997/389), comprising a preliminary version of chapters 11-18 of the volume, has recently been issued to enable the information, and especially the new ideas, contained in this part of the volume to be made available as early as possible.

The *Structural Framework Map of New South Wales, scale 1:1 500 000*, was published in 1996, together with an explanatory text: 'Geology of New South Wales — Synthesis: Volume 1 Structural Framework' (*Geological Survey of New South Wales, Memoir* **Geology 13**(1)).

For further technical information contact Dave Suppel, Principal Geologist, on (02) 9901 8345, fax (02) 9901 8256.

To obtain the map or Volume 1 of the 'Geology of New South Wales', contact the Information Counter at St Leonards on (02) 9901 8269, fax (02) 9901 8247.

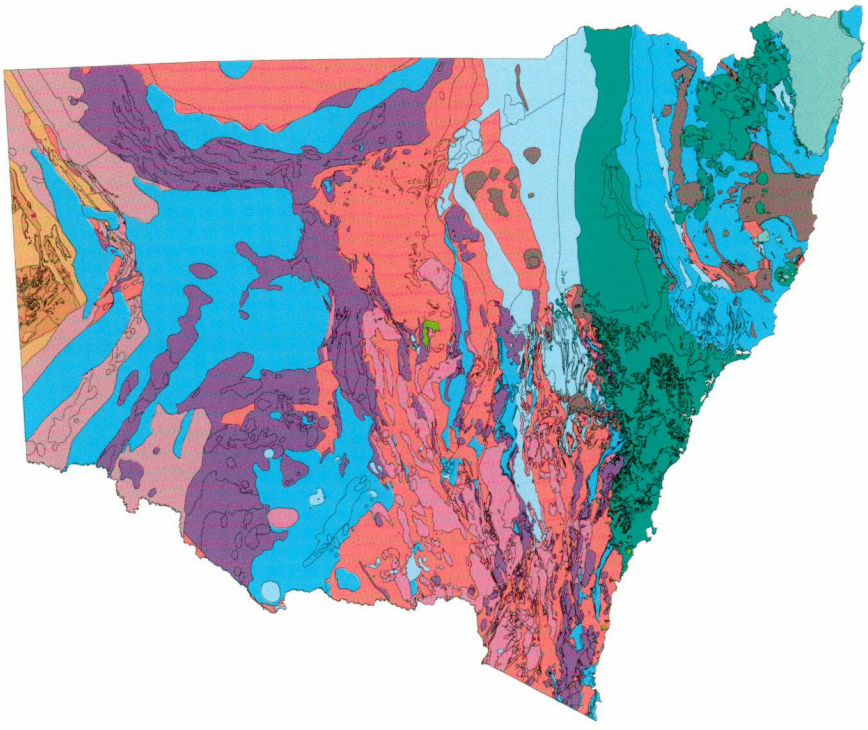


Figure 17. The new stratotectonic map of New South Wales, published at 1:1 000 000 scale

IMPORTANT NEW SOUTH WALES MINERAL PROJECTS

Name	Commodities	Location	Resource
GOLD			
Cadia Project (Cadia Hill, Cadia East)	Gold, copper	21 km SSW of Orange	Cadia Hill: 202 Mt at 0.73 g/t Au, 0.17% Cu (1995 Cadia East: 150 Mt at 0.44 g/t Au, 0.43% Cu (1996
Cobar Central Project (New Cobar, New Occidental)	Gold, copper	3 km SE of Cobar	Under review
Cowal Project (Lake Cowal, Endeavour 42)	Gold	40 km NE of West Wyalong	49.6 Mt at 1.53 g/t Au (1995)
Lewis Ponds prospect	Gold, lead, zinc, silver (copper)	13 km E of Orange	Main Zone: 2.7 Mt at 3.6 g/t Au, 0.21% Cu, 2.56% Pb, 4.17% Zn, 123 g/t Ag. Tom's Zone: 1.0 Mt at 1.95 g/t Au, 0.30% Cu, 5.36% Pb, 7.9% Zn, 214 g/t Ag (1995).
Ridgeway prospect (Cadia Mines Project)	Gold, copper	20 km SW of Orange (3 km NW of Cadia Hill)	Main Zone: 28 Mt at 3.3 g/t Au, 0.95% Cu Halo Zone: 26 Mt at 0.67 g/t Au, 0.50% Cu (1997)
Timbarra Project (Poverty Point, Big Hill, RMT)	Gold	30 km SE of Tenterfield	9.9 Mt at 0.89 g/t Au (1995) plus 2.85 Mt at 0.73 g/t Au (RMT deposit - 1996)
SILVER & BASE METALS			
Bowdens prospect (Bowdens Gift)	Silver (lead, zinc)	25 km ESE of Mudgee	18.8 Mt at 99 g/t Ag, 0.32% Pb, 0.37% Zn (1995)
Lake Innes prospect (Hurlls Hill, Pacific Hwy)	Nickel, cobalt, (chromium, scandium)	7 km SW of Port Macquarie	Hurlls Hill + Pacific Hwy combined: Lower Zone: 9.3 Mt at 0.81% Ni, 0.11% Co, 35.7 ppm Sc Upper Zone: 3.1 Mt at 0.26% Ni, 0.02% Co, 57.2 ppm Sc (1997)
Tritton prospect (Bonnie Dundee project area)	Copper (gold, silver)	22 km SW of Girilambone	9.75 Mt at 3.01% Cu, 0.21 g/t Au, 11 g/t Ag (1996)
INDUSTRIAL MINERALS			
Bendemeer Project	Granite (dimension stone)	50 km N of Tamworth	1.0 million cubic metres
Oberon Project	Feldspar, mica, (silica)	6 km E of Oberon	3.3 Mt at 57% feldspar, 11% mica (1996) (very large additional resources available)
Twelve Mile Project (Birthday Gift)	Rutile, zircon, ilmenite (leucoxene)	210 km SE of Broken Hill (Murray Basin)	61 Mt at 3.6% HM containing 19% rutile, 11% zircon, 49% ilmenite, 8% leucoxene (1997)

The Department lists on these pages details of important exploration and mining projects that may proceed to development within the next three years. All information is based on non-confidential company reports and published data.

The information is updated as developments arise. New projects will be added to the list, and others deleted. For information contact John Chapman, on (02) 9901 8347, fax (02) 9901 8256 or Garth Holmes on (02) 9901 8480, fax (02) 9901 8468.

Resource Status	Proposed Mine Type	Operator	Project Status
Reserve - mineable (Proved + Probable) (Inferred resource at Cadia East)	Opencut	Newcrest Mining Ltd	Site construction is well advanced and plant comissioning remains on schedule for August 1998. Exploration drilling is continuing at Cadia East.
	Opencut & underground	Peak Gold Mines P/L	Mining studies in progress. Resource drilling continuing and revised resource estimates expected to be announced at the end of 1997.
Resource - in situ (Measured + Indicated + Inferred)	Opencut	North Ltd	New EIS studies underway with a view to lodging a new development application early in 1998.
Resource - in situ (Indicated + Inferred)	Underground	Tri Origin Australia NL	Exploration is continuing. Recent drilling has confirmed down dip extensions to Tom's Zone mineralisation.
Resource - in situ (Inferred)	Underground	Newcrest Mining Ltd	$24 million feasibility study approved by the Board. Exploration decline for underground drilling and bulk sampling commenced. Production could start by the year 2001.
Reserve - mineable (Proved + Probable)	Opencut (heap leach)	Ross Mining NL	Mining lease granted in April 1996. Additional application lodged to expand project to include the RMT resource. Start up planned for early 1998.
Resource - in situ (Indicated + Inferred)	Opencut and possible u/ground	Silver Standard Resources Inc	Metallurgical work is continuing. Further drilling to test for resource extensions is underway.
Resource - in situ (Measured + Indicated)	Opencut	Jervois Mining NL	Metallurgical studies underway. Exploration is continuing.
Resource - in situ (Measured + Indicated + Inferred)	Underground	Nord Resources (Pacific) P/L (JV with Straits Resources Ltd)	Mining lease applications lodged May 1997. EIS and prefeasibility studies in progress.
Resource - in situ (Measured)	Opencut	Southpac Ld	Development consent granted December 1996. Production planned to commence late 1997.
Resource - in situ (Measured)	Opencut	Minerals Corporation Ltd	EIS and feasibility studies in progress.
Resource - in situ (Indicated + Inferred)	Opencut	RZM Pty Ltd (JV with Aberfoyle Ltd)	Mining lease applications lodged. EIS and feasibility studies in progress. Earliest time frame for mining is 2-3 years.

EXPLORATION LICENCES

EXPLORATION LICENCES IN FORCE OCTOBER 1997

No	Mining Div'n*	Holder	Expiry date+	Min grp#
1466	CO	Norgold Ltd	15.10.99	1
1563	OR	Gold Mines of Aust (NSW) Pty Ltd	19.02.99	1
1590	OR	Goldfields Exploration Pty Ltd North Gold (WA) Ltd	12.03.97	1
1994	WA	Gold Mines of Aust (NSW) Pty Ltd	27.02.97	1
1999	OR	Triako Resources Ltd	03.03.2002	1
2033	OR	Climax Aust Pty Ltd	06.07.98	1
2037	OR	Silver Orchid Pty Ltd	19.01.94	1
2059	WA	Gold Mines of Aust (NSW) Pty Ltd	22.08.99	1
2071	BH	Aberfoyle Resources Ltd	30.08.99	1
2151	OR	Gold Mines of Australia Ltd	16.01.98	1
2208	GO	Denehurst Ltd	02.04.98	1
2290	OR	Newcrest Mining Ltd Golden Cross Resources NL	13.11.97	1
2291	OR	Golden Hills Mining NL	13.11.98	1
2376	DU	Commercial Minerals Ltd	21.02.98	5
2378	OR	Climax Aust Pty Ltd	25.02.98	1
2392	GO	Young Mining Co Pty Ltd	18.04.99	2
2513	BH	Pasminco Australia Ltd	06.11.97	1
2521	OR	Helix Resources NL	09.12.97	1
2528	GO	Denehurst Ltd	15.12.97	1
2619	IN	Ross Mining NL	16.01.94	1
2629	OR	Tiwana Pty Ltd	29.06.98	1
2652	OR	Lachlan Resources NL	07.09.98	1
2658	OR	Penklis, Michael; Penklis, Peter; Sirol, Graziano (Gary); Sirol, Danica	14.09.98	1
2662	IN	Norminco Ltd	15.09.96	1
2669	BH	Pasminco Australia Ltd	24.09.2000	1
2680	CO	Pasminco Australia Ltd	06.10.98	1
2683	NE	Rutile & Zircon Mines (Newcastle) Ltd	02.10.97	1
2727	OR	Mount Conqueror Minerals NL	25.11.98	1
2743	BH	Pasminco Australia Ltd	06.11.98	1
2767	DU	Alkane Exploration NL	03.02.99	1
2774	AR	J M Stephen Pty Ltd	18.02.98	2
2864	BH	Aberfoyle Resources Ltd	27.05.99	1
2865	OR	North Gold (WA) Ltd	01.06.98	1
2921	BH	Pasminco Australia Ltd	12.10.97	1
2934	GO	Telminex NL	22.10.98	1
2976	OR	Young Mining Co Pty Ltd	18.04.99	2
2984	OR	Climax Aust Pty Ltd	10.01.98	1
3085	NE	Rutile & Zircon Mines (Newcastle) Ltd	02.10.95	1
3104	BH	Aberfoyle Resources Ltd	23.06.98	1
3127	IN	Cluff Minerals (Australia) Pty Ltd	07.07.97	6
3138	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	25.07.99	1
3149	OR	Newcrest Mining Ltd Cyprus Gold Australia Corp	02.01.98	1
3203	BH	Aberfoyle Resources Ltd	09.10.96	1
3217	WO	Metromix Pty Ltd	14.11.94	4
3218	WO	Metromix Pty Ltd	14.11.94	4
3219	SY	Metromix Pty Ltd	14.11.97	4
3220	NE	Metromix Pty Ltd	14.11.94	4
3221	SY	Archdall Investments Pty Ltd Unisearch Ltd	14.11.97	4
3232	CO	Burdekin Resources NL	07.12.99	1
3243	DU	Barnu Pty Ltd	20.12.97	1
3252	DU	Silver Standard Aust Pty Ltd	12.01.98	1
3275	DU	North Mining Ltd	05.04.99	1
3276	OR	North Mining Ltd	05.04.99	1
3277	OR	North Mining Ltd	05.04.99	1
3278	OR	North Mining Ltd	05.04.98	1
3297	CO	Pasminco Australia Ltd	12.04.99	1
3299	CO	Pasminco Australia Ltd	12.04.99	1
3311	OR	Silver Standard Aust Pty Ltd	12.01.98	1
3320	OR	Southpac Ltd	09.08.98	4
3325	AR	Cluff Minerals (Australia) Pty Ltd	22.08.97	6
3326	AR	New England Antimony Mines NL	22.08.98	1
3352	DU	Southpac Ltd	20.09.98	4
3364	DU	Climax Australia Pty Ltd	25.09.99	1
3425	OR	Hargraves Resources NL	25.02.99	1
3465	CO	Pasminco Australia Ltd	21.03.99	1
3500	BH	Aberfoyle Resources Ltd	19.04.98	1
3522	AR	Alphadale Pty Ltd	15.05.99	1
3523	AR	Alphadale Pty Ltd	15.05.98	1
3575	CO	Redfire Resources NL	04.07.98	7
3576	CO	Redfire Resources NL	04.07.98	7
3619	OR	North Gold (WA) Ltd	30.07.99	1
3620	OR	North Mining Ltd	30.07.98	1
3632	CO	Peak Gold Mines Pty Ltd	19.08.99	1
3666	OR	Helix Resources NL	09.12.97	2
3671	DU	GSM Exploration Pty Ltd	07.11.97	1
3685	DU	Climax Aust Pty Ltd	18.11.98	1
3700	OR	Dominion Mining Ltd	22.11.97	1
3706	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	04.12.98	1
3707	CO	Nord Australex Nominees Pty Ltd Straits Resources Pty Ltd	04.12.98	1
3708	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	04.12.98	1
3709	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	04.12.98	1
3710	CM	Delta Gold Exploration Pty Ltd	04.12.98	1
3711	OR	Fitzgerald, Guy Malcolm	04.12.94	6
3712	CO	Central West Gold NL Mount Conqueror Minerals NL	06.12.98	1
3714	DU	Central West Gold NL Mount Conqueror Minerals NL	11.12.97	1
3720	GO	Young Mining Co Pty Ltd	18.104.99	2
3722	GO	Mumbil Mines NL	20.12.98	1
3728	OR	Newcrest Mining Ltd Cyprus Gold Australia Corp	02.01.98	1
3729	BH	Aberfoyle Resources Ltd	02.01.98	1
3747	OR	Renison Ltd	04.02.98	1
3756	OR	Goldrim Mining Aust Ltd	12.02.98	1
3765	DU	Hodgkinson, Stephen Henry Charles	13.02.99	1
3767	OR	Climax Australia Pty Ltd	06.07.98	1
3772	WA	Mt Adrah Resources Pty Ltd Arimco Mining Pty Ltd	20.02.99	1
3773	WA	Mt Adrah Resources Pty Ltd Arimco Mining Pty Ltd	20.02.99	1
3775	WA	Mt Adrah Resources Pty Ltd Arimco Mining Pty Ltd	20.02.99	1
3784	AR	Kelson, Herbert Charles	04.03.98	1
3785	LM	Tooloom Gold Pty Ltd	11.03.98	1
3788	IN	Ross Mining NL	11.03.99	1
3794	CH	RZM Pty Ltd	01.04.98	1
3798	CM	GDR Mines Development Pty Ltd	03.04.98	1
3831	BH	Aberfoyle Resources Ltd	18.04.99	1
3832	BH	Aberfoyle Resources Ltd	18.04.99	1
3840	CH	Andrews, Raymond Noel Ronald	08.05.98	1

No	Mining Div'n*	Holder	Expiry date+	Min grp#
3848	IN	Presala Pty Ltd	14.05.99	6
3854	CO	Metallurgical Refining & Development Pty Ltd, Celebration Mining Co	20.05.99	1
3856	OR	Newcrest Mining Ltd	20.05.98	1
3858	OR	Metallic Resources Pty Ltd	20.05.95	1
3898	CO	Pasminco Australia Ltd	16.06.99	1
3900	DU	Rio Tinto Exploration Pty Ltd	16.06.97	1
3910	OR	Franke, Franciscus Nielsen, Bent Heinrich	24.06.93	1
3915	CO	Delta Gold Exploration Pty Ltd	24.06.99	1
3929	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	26.06.97	1
3930	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	26.06.97	1
3931	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	26.06.97	1
3932	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	26.06.97	1
3933	OR	North Mining Ltd	26.06.99	1
3936	IN	P J McSharry & Associates Pty Ltd	02.07.99	6
3938	OR	Rio Tinto Exploration Pty Ltd	02.07.98	1
3939	BH	Thomson, Kenneth Stuart	08.07.99	1
3950	NE	Dronvisa Pty Ltd	07.07.93	5
3969	IN	Manuel, James Frederick Manuel, Jill	15.07.97	6
3972	WA	Manton, Desmond Raymond	18.07.97	1
3996	WA	Adelong Consolidated Gold Mines NL	31.07.99	1
4001	AR	Geoservices Pty Ltd	31.07.97	1
4003	DU	Geoservices Pty Ltd	07.08.98	1
4011	CO	Everingham, Bruce David	11.08.97	1
4022	DU	Rio Tinto Exploration Pty Ltd	13.08.98	1
4023	DU	Rio Tinto Exploration Pty Ltd	13.08.98	1
4024	DU	Rio Tinto Exploration Pty Ltd	13.08.98	1
4027	AR	Aitken, Donald Aitken, Kevin Eric Clarke, Dominic Reginald Clarke, Marshall John	18.08.93	1
4038	CO	Central West Gold NL	26.08.98	1
4039	AR	New England Antimony Mines NL	26.08.98	1
4041	IN	Rynne, David Colin Rynne, Joan Doris	27.08.99	6
4051	CO	Delta Gold Exploration Pty Ltd	11.09.97	1
4052	CO	Delta Gold Exploration Pty Ltd	11.09.97	1
4059	AR	Newbury, Gavin John	15.09.97	1
4065	SY	Boral Montoro Pty Ltd	19.09.97	5
4067	CO	Central West Gold NL Mount Conqueror Minerals NL	29.09.97	1
4070	WA	Dowmill Pty Ltd	29.09.99	1
4074	OR	North Mining Ltd	01.10.97	1
4075	OR	North Mining Ltd	01.10.97	1
4076	GO	Dowmill Pty Ltd	02.10.98	1
4078	OR	Golden Cross Operations Pty Ltd	13.10.98	1
4082	OR	Rio Tinto Exploration Pty Ltd	15.10.98	1
4083	OR	Rio Tinto Exploration Pty Ltd	15.10.98	1
4099	OR	Burridge, Phillip	31.03.99	1
4119	OR	Golden Cross Operations Pty Ltd	12.11.98	1
4125	DU	Rio Tinto Exploration Pty Ltd	20.11.98	1
4126	DU	Rio Tinto Exploration Pty Ltd	20.11.98	1
4127	OR	Rio Tinto Exploration Pty Ltd	20.11.98	1
4128	OR	Rio Tinto Exploration Pty Ltd	20.11.98	1
4130	DU	Metallic Resources Pty Ltd	25.11.98	1
4131	OR	Metallic Resources Pty Ltd	25.11.99	1
4136	OR	Timms, Peter David	27.11.97	1
4137	OR	Tri Origin Australia NL	27.11.97	1
4142	WA	Gundagai Gold Pty Ltd	02.12.95	1
4145	CO	Delta Gold Exploration Pty Ltd	05.12.97	1
4146	CO	Delta Gold Exploration Pty Ltd	05.12.97	1
4155	OR	Rio Tinto Exploration Pty Ltd	15.12.97	1
4158	OR	Timms, Peter David	15.12.97	1
4159	CO	Desertstone NL	17.12.98	7
4160	IN	Ross Mining NL	16.01.96	1
4174	GO	Homestake Australia Ltd	16.01.94	1
4175	IN	Ross Mining NL	11.03.99	1
4179	AR	Alphadale Pty Ltd	19.01.99	1
4180	AR	Alphadale Pty Ltd	19.01.98	1
4181	AR	Alphadale Pty Ltd	19.01.98	1
4184	DU	Barnu Pty Ltd	22.01.98	1
4191	OR	Renison Ltd	04.02.98	1
4192	OR	Newnes Kaolin Pty Ltd	06.02.98	5
4199	DU	Rio Tinto Exploration Pty Ltd	16.02.98	1
4200	GO	Homestake Australia Ltd	16.02.98	1
4214	AR	Alphadale Pty Ltd	01.03.98	1
4215	OR	Anderson, Robert George	04.03.98	1
4223	OR	Renison Ltd	10.03.98	1
4224	OR	Renison Ltd	10.03.98	1
4225	DU	Rio Tinto Exploration Pty Ltd	10.03.98	1
4227	GO	Pioneer Building Products Pty Ltd	11.03.98	5
4232	CO	Ausmindex NL	16.03.99	1
4234	DU	Rio Tinto Exploration Pty Ltd	31.03.98	1
4238	BH	Aberfoyle Resources Ltd	27.05.99	1
4240	GO	Michelago Resources NL Denehurst Ltd	06.04.98	1
4247	WA	Ausmindex NL	23.04.98	1
4257	CO	Dominion Gold Operations Pty Ltd Peak Gold Mines Pty Ltd	04.05.98	1
4258	CO	Dominion Gold Operations Pty Ltd Peak Gold Mines Pty Ltd	04.05.98	1
4267	AL	Arumpo Bentonite Pty Ltd	11.05.96	5
4268	AL	Arumpo Bentonite Pty Ltd	11.05.96	5
4269	OR	Hargraves Resources NL	12.05.98	1
4271	DU	Rio Tinto Exploration Pty Ltd	16.02.98	1
4272	DU	Nepean Quarries Pty Ltd	21.05.98	1
4276	OR	Renison Ltd	10.06.98	1
4278	IN	Jesasu Pty Ltd	22.06.97	6
4282	OR	Compass Resources NL	28.06.98	1
4283	WA	Gold Mines of Aust (NSW) Pty Ltd	29.06.98	1
4284	WA	Gold Mines of Aust (NSW) Pty Ltd	29.06.98	1
4285	WA	Gold Mines of Aust (NSW) Pty Ltd	29.06.98	1
4297	AR	Southpac Ltd	23.07.98	2
4298	BH	Aberfoyle Resources Ltd	02.08.98	1
4403	OR	Fraser, Robert John	01.09.98	1
4404	OR	Pritchett, Ian Philip	01.09.98	1
4405	OR	Roberts, Russell	01.09.98	1
4412	WA	Gold Mines of Aust (NSW) Pty Ltd	01.09.98	1
4422	CO	Nord Australex Nominees Pty Ltd Straits Mining Pty Ltd	10.09.98	1
4425	DU	Ajax Joinery Pty Ltd	17.09.99	1
4426	DU	Ajax Joinery Pty Ltd	17.09.99	1
4429	OR	Gold Mines of Aust (NSW) Pty Ltd	07.10.98	1
4432	OR	Tri Origin Australia NL	27.11.97	1
4439	CO	Cobar Mines Pty Ltd	19.10.98	1
4442	NE	Chambigne Resources Pty Ltd	14.05.99	1
4446	CO	Delta Gold Exploration Pty Ltd	27.10.98	1
4453	CO	Delta Gold Exploration Pty Ltd	17.11.96	1
4454	OR	Platsearch NL	18.11.98	2
4457	CO	Dominion Gold Operations Pty Ltd Peak Gold Mines Pty Ltd	23.11.98	1
4458	CO	Ausmindex NL	16.03.99	1
4459	IN	Central West Gold NL Mount Conqueror Minerals NL	03.12.97	1
4462	OR	Adanak Explorations Pty Ltd	13.12.98	1
4469	AR	Southpac Ltd	29.12.96	4
4473	OR	Sitegoal Pty Ltd	11.01.98	2
4474	AR	Dennis, Noel Norman	12.01.98	1
4476	DU	Rio Tinto Exploration Pty Ltd	18.01.98	1
4478	AR	Geoservices Pty Ltd	24.01.98	1
4483	BH	Diamond Ventures Exploration P/L	02.02.99	6

No	Mining Div'n*	Holder	Expiry date+	Min grp#
4484	BH	Diamond Ventures Exploration P/L	02.02.99	6
4485	BH	Diamond Ventures Exploration P/L	02.02.99	6
4486	BH	Diamond Ventures Exploration P/L	02.02.99	6
4487	DU	Evans, Sydney Benton	02.02.98	1
4495	BH	Diamond Ventures Exploration P/L	15.04.98	6
4497	AR	Cluff Minerals (Aust.) Pty Ltd	22.08.97	6
4502	OR	Newcrest Operations Ltd	20.05.99	1
4503	OR	Newcrest Operations Ltd	20.05.99	1
4504	CM	Eddaglide Pty Ltd	25.05.95	1
4508	OR	North Gold (WA) Ltd	25.05.99	1
4510	OR	North Gold (WA) Ltd	25.05.99	1
4512	OR	Dowmill Pty Ltd	01.06.99	1
		Nosebi Mining & Management P/L		
		Newcrest Mining Ltd		
4513	SY	Platsearch NL	02.06.98	1
4514	OR	Central West Gold NL	06.06.98	1
		Mount Conqueror Minerals NL		
4515	OR	Newcrest Operations Ltd	06.06.97	1
4520	BH	Aberfoyle Resources Ltd	03.07.96	1
4521	BH	Aberfoyle Resources Ltd	15.06.99	1
4523	CO	Peak Gold Mines Pty Ltd	17.06.99	1
4525	OR	Rio Tinto Exploration Pty Ltd	22.06.97	1
4527	OR	Rio Tinto Exploration Pty Ltd	22.06.97	1
4530	OR	North Mining Ltd	24.06.98	1
4535	BH	Rio Tinto Exploration Pty Ltd	30.06.99	1
4536	BH	Rio Tinto Exploration Pty Ltd	30.06.99	1
4543	OR	Australian Feldspar Pty Ltd	13.07.97	2
4544	OR	Australian Feldspar Pty Ltd	13.07.97	2
4545	OR	Australian Feldspar Pty Ltd	13.07.97	2
4546	OR	Australian Feldspar Pty Ltd	13.07.97	2
4547	OR	Australian Feldspar Pty Ltd	13.07.97	2
4548	OR	Australian Feldspar Pty Ltd	13.07.97	2
4549	OR	Australian Feldspar Pty Ltd	13.07.97	2
4550	OR	Australian Feldspar Pty Ltd	13.07.97	2
4553	AR	Alphadale Pty Ltd	13.07.97	1
4555	AR	Alphadale Pty Ltd	13.07.97	1
4556	OR	Alkane Exploration NL	13.07.99	1
		Kiwi Aust Resources Pty Ltd		
4561	OR	Adanak Explorations Pty Ltd	13.12.98	1
4562	CO	CIM Resources Ltd	27.07.99	7
4563	IN	Cluff Minerals (Australia) Pty Ltd	07.07.97	1, 6
4564	OR	Rio Tinto Exploration Pty Ltd	28.07.97	1
4566	OR	Climax Mining Ltd	03.08.97	1
4567	CO	Delta Gold Exploration Pty Ltd	04.08.97	1
4572	OR	Compass Resources NL	12.08.97	1
4573	OR	Tricol Investments Pty Ltd	16.08.98	1, 2
4580	SI	Alphadale Pty Ltd	02.09.97	1
4584	OR	Allstate Explorations NL	07.09.99	1
		Michelago Resources NL		
		Sipa Exploration NL		
4591	SY	Nosebi Mining & Management P/L	14.09.98	1
		Dowmill Pty Ltd		
4595	OR	Michelago Resources NL	23.09.99	1
4600	OR	Michelago Resources NL	06.10.98	1
		Denehurst Ltd		
4602	OR	Compass Resources NL	10.10.97	1
4605	SY	Denehurst Ltd	13.10.98	1
4606	SY	Denehurst Ltd	13.10.98	1
4611	SI	PGH Ltd	26.10.95	5
4613	SY	Michelago Resources NL	28.10.98	1
		Denehurst Ltd		
4614	IN	Auralia Resources Pty Ltd	28.10.97	1
4615	OR	Lac Minerals (Australia) NL	07.11.97	1
4616	OR	Newcrest Mining Ltd	07.11.95	1
4618	CO	Delta Gold Exploration Pty Ltd	16.11.98	1
4619	AR	Warren Jay Holdings Pty Ltd	09.10.98	1
4620	OR	Newcrest Operations Ltd	18.11.95	1
		Jervois Mining NL		
4621	BH	Aberfoyle Resources Ltd	02.01.99	1
4622	AR	Goldrap Pty Ltd	29.11.98	1

No	Mining Div'n*	Holder	Expiry date+	Min grp#
4624	OR	Muller, Peter James	02.12.98	1, 5
4629	AR	Michelago Resources NL	08.12.98	1
4632	BH	Acacia Resources Ltd	20.12.97	1
		Triako Resources Ltd		
		Broken Hill Metals NL		
4634	CH	Goldrap Pty Ltd	23.12.97	1
4636	AR	Mogul Mining NL	04.01.98	1
4642	AR	English, Peter Warren	10.03.98	4
4656	BH	Savage Resources Ltd	20.04.98	1
		Platsearch NL		
4657	BH	Savage Resources Ltd	20.04.98	1
		Platsearch NL		
4659	BH	Platsearch NL	26.04.98	1
4664	OR	Compass Resources NL	05.06.98	1
4669	OR	Imperial Mining NL	13.06.98	1
4672	CH	Tara City Mining Pty Ltd	29.06.96	1
4673	CH	Tara City Mining Pty Ltd	29.06.96	1
4694	WA	Imperial Mining (Aust) NL	19.09.98	1
4695	CO	Sitegoal Pty Ltd	20.09.98	1
4702	AR	Warren Jay Holdings Pty Ltd	09.10.98	1
4707	BH	Plutonic Operations Ltd	18.10.98	1
4708	IN	Auralia Resources NL	27.10.98	1
4712	IN	Auralia Resources Pty Ltd	27.10.98	1
4713	IN	Deveri Pty Ltd	27.10.98	6
		Pan Gem Resources (Aust) Pty Ltd		
4714	AR	Alsop, Peter John	02.11.98	1
		Hume, John Alfred		
4715	SY	Barnu Pty Ltd	08.11.98	2
4722	CO	Desertstone NL	21.11.98	7
4743	CO	Golden Cross Operations Pty Ltd	17.04.98	1
4744	BH	Pasminco Australia Ltd	07.12.98	1
4752	OR	Metallic Resources Pty Ltd	11.12.98	1
4756	CO	Platsearch NL	14.12.98	1
4757	IN	P.J. McSharry & Associates Pty Ltd	15.12.98	6
4761	IN	Great Northern Mining Corp NL	28.12.98	6
4763	OR	Hughes, Warwick Samuel	02.01.99	1
		Yaffe, Leonard		
		Yaffe, Norman Ronald		
4766	OR	Mount Conqueror Minerals NL	08.01.99	1
4768	BH	Diamond Ventures Exploration P/L	17.01.99	6
4769	BH	Diamond Ventures Exploration P/L	17.01.99	6
4770	CO	Cobar Mines Pty Ltd	17.01.99	1
4771	CO	Ausmindex NL	19.01.99	1
4772	CO	Delta Gold Exploration Pty Ltd	19.01.97	1
4773	CO	Delta Gold Exploration Pty Ltd	19.01.97	1
4786	AR	Alphadale Pty Ltd	09.02.99	1
4788	LR	Westman, Charles L	12.02.97	7
		Slack-Smith, Neil		
		Slack-Smith, Cheryl Marea		
4792	BH	Normandy Exploration Ltd	19.02.98	1
4796	OR	Gold Mines of Australia (NSW) P/L	27.02.99	1
4799	OR	Rio Tinto Exploration Pty Ltd	28.02.97	1
4801	CH	GIO Australia Holdings Ltd	05.03.98	1, 6
4808	OR	Minerals Corporation Ltd	13.03.99	1
4811	WA	Gateway Mining Ltd	19.03.99	1
4818	OR	Telminex NL	27.03.99	1
4819	OR	Telminex NL	27.03.99	1
4822	IN	Rio Tinto Exploration Pty Ltd	19.04.97	6
4823	WA	Gundagai Gold Pty Ltd	19.04.97	1
4824	WA	Vulcan Mines Pty Ltd	19.04.97	1
4826	OR	Bray, Gregory Lawrence	25.04.99	1
		Watson, Eric Samuel		
		Ling Shi, Jian		
4827	OR	Newcrest Mining Ltd	25.04.99	1
4828	CO	Nord Australex Nominees Pty Ltd	27.04.97	1
		Straits Mining Pty Ltd		
4829	BH	Pasminco Australia Ltd	27.04.99	1
4830	CO	Peak Gold Mines Pty Ltd	27.04.99	1

No	Mining Div'n*	Holder	Expiry date+	Min grp#
4831	AR	Andrews, Raymond Noel Ronald	30.04.97	6
		Terp, Joseph Roy		
4832	IN	Great Northern Mining Corp NL	04.05.97	6
4833	CO	Cobar Mines Pty Ltd	07.05.99	1
4835	SI	Chambigne Resources Pty Ltd	14.05.99	1
		Sirocco Resources NL		
4836	OR	Goldfields Exploration Pty Ltd	14.05.99	1
4839	CO	Renison Ltd	16.05.97	1
4844	OR	Delta Gold Exploration Pty Ltd	21.05.97	1
		Tri Origin Australia NL		
4846	BH	Timms, Peter David	29.05.99	1
4848	SI	Hewett, Robert Patrick	18.08.98	1
4856	OR	ACI Operations Pty Ltd	19.06.99	2
4861	CO	Carstein, David Roy	04.07.99	1
4862	CO	Opal Mining & Exploration NL	11.07.99	7
4863	AR	David Mitchell (NSW) Pty Ltd	16.07.97	2
4871	BH	CRA Exploration Pty Ltd	01.08.99	1
4873	OR	Goldfields Exploration Pty Ltd	01.08.99	1
4874	OR	Goldfields Exploration Pty Ltd	01.08.99	1
4880	AR	Alphadale Pty Ltd	06.08.97	1
4881	OR	Timms, Peter David	07.08.99	1
4887	CO	Pasminco Australia Ltd	17.08.99	1
4888	CO	Pasminco Australia Ltd	23.08.99	1
4889	AR	Probe Resources NL	24.08.97	1
4892	CO	Delta Gold Exploration Pty Ltd	24.08.99	1
4894	CO	Rio Tinto Exploration Pty Ltd	27.08.97	1
4895	CH	Chadcole Pty Ltd	30.08.97	5
4896	OR	Vulcan Mines Pty Ltd	30.08.99	1
4897	BH	Endeavour Minerals Pty Ltd	30.08.98	1
4898	CO	Burdekin Resources NL	30.08.97	1
4899	CO	Burdekin Resources NL	30.08.97	1
4900	IN	Tooloom Gold Pty Ltd	06.09.97	1
4904	OR	Rootes, Edwin George	28.09.99	1
		Howard, Gordon		
4905	BH	Golden Cross Operations Pty Ltd	10.10.99	1
4908	OR	Arimco Mining Pty Ltd	12.10.99	1
4909	OR	O'Leary Investments Pty Ltd	22.10.97	1
4910	OR	Duncans Enterprises Pty Ltd	22.10.98	1
4916	BH	Platsearch NL	22.11.97	1
4919	CO	Delta Gold Exploration Pty Ltd	11.12.97	1
4920	OR	Empire Gold Mines NL	14.12.97	1
4921	SY	Alma Mining Co Pty Ltd	19.12.98	1
4922	WA	Arimco Mining Pty Ltd	28.12.97	1
		Mt Adrah Resources Pty Ltd		
4924	OR	Monier PGH Holdings Ltd	07.01.98	5
4927	BH	Industrial Wreckers Pty Ltd	30.01.98	7
4928	OR	Golden Cross Operations Pty Ltd	31.01.98	1
4930	BH	Minerals Mining & Metallurgy Ltd	01.02.98	1
4931	BH	Minerals Mining & Metallurgy Ltd	01.02.98	1
4933	OR	Rio Tinto Exploration Pty Ltd	06.02.98	1
4935	OR	Gold Mines of Aust (NSW) Pty Ltd	15.02.98	1
4936	OR	Newcrest Mining Ltd	15.02.98	1
4940	AR	Warren Jay Holdings Pty Ltd	19.02.98	1
4941	CO	Newcrest Mining Ltd	21.02.98	1
4942	IN	Desertstone NL	22.02.98	1
4943	CO	Rio Tinto Exploration Pty Ltd	26.02.98	1
4946	OR	Sipa Exploration NL	27.02.98	1
4947	OR	Sipa Exploration NL	27.02.98	1
4949	CO	Pasminco Australia Ltd	07.07.99	1
4951	CO	Cobar Mines Pty Ltd	03.03.98	1
4952	CO	Cobar Mines Pty Ltd	04.07.97	1
4954	OR	Golden Hills Mining NL	07.03.98	1
4955	OR	Golden Hills Mining NL	07.03.98	1
4956	OR	Mount Conqueror Minerals NL	07.03.98	2, 6
		Central West Gold NL		
		Compound Securities and Management Ltd		
4957	OR	Mount Conqueror Minerals NL	07.03.98	2, 6
		Central West Gold NL		
		Compound Securities and Management Ltd		
4960	WA	Gold Mines of Aust (NSW) Pty Ltd	18.04.98	1
4961	CO	Nord Australex Nominees Pty Ltd	17.03.98	1
		Straits Mining Pty Ltd		
4962	CO	Nord Australex Nominees Pty Ltd	17.03.98	1
		Straits Mining Pty Ltd		
4963	BH	Platsearch NL	04.07.97	1
4964	CH	Jervois Mining NL	24.03.98	1
4965	CO	Delta Gold Exploration Pty Ltd	18.09.98	1
4966	CO	Delta Gold Exploration Pty Ltd	18.09.96	1
4967	CO	Delta Gold Exploration Pty Ltd	06.10.98	1
4970	BH	Rio Tinto Exploration Pty Ltd	29.11.98	1
4971	OR	Telminex NL	31.03.98	1
4972	OR	Michelago Resources NL	26.09.99	1
4973	BH	Golden Cross Operations Pty Ltd	17.04.99	1
4974	CO	Golden Cross Operations Pty Ltd	17.04.99	1
4975	OR	Golden Cross Operations Pty Ltd	13.04.99	1
4976	OR	Golden Cross Operations Pty Ltd	13.04.97	1
4977	CO	Redfire Resources NL	18.09.98	7
4978	OR	Delta Gold Exploration Pty Ltd	17.11.96	1
		Tri Origin Australia NL		
4979	WA	Sitegoal Pty Ltd	04.07.98	1
4985	WA	Adelong Consolidated Gold Mines NL	19.12.98	1
4987	OR	Compass Resources NL	05.06.99	1
4988	BH	BHP Minerals Pty Ltd	28.04.98	1
4990	CO	Burdekin Resources NL	28.04.98	1
4991	OR	Delta Gold Exploration Pty Ltd	27.11.98	1
		Tri Origin Australia NL		
4992	BH	Rio Tinto Exploration Pty Ltd	30.04.98	1
4993	BH	Diamond Ventures Exploration P/L	30.04.98	6
4994	OR	Rio Tinto Exploration Pty Ltd	30.04.98	1
4995	OR	Binvale Pty Ltd	29.04.98	4
4996	OR	Burdekin Resources NL	29.04.98	1
4998	OR	Ausmindex NL	29.08.99	1
4999	IN	Accord Capital Investors Pty Ltd	06.05.98	1, 6
5000	OR	Folsom, Edward Bare	06.05.98	1
5002	CO	Silver Standard Aust Pty Ltd	08.05.98	1
5003	CO	Pasminco Australia Ltd	08.05.98	1
5004	CO	Pasminco Australia Ltd	08.05.98	1
5005	OR	Silver Standard Aust Pty Ltd	12.05.98	1
5006	CO	Peak Gold Mines Pty Ltd	12.05.98	1
5008	OR	Newcrest Mining Ltd	13.05.98	1
5009	OR	Newcrest Mining Ltd	13.05.98	1
5010	CO	Straits Mining Pty Ltd	15.05.98	1
5011	SY	Zephyr Minerals NL	16.05.98	1
5012	OR	Goldfields Exploration Pty Ltd	15.05.98	1
5013	IN	New England Tin NL	16.05.98	1
5014	OR	Conquest Mining Ltd	19.05.98	1
5015	OR	Conquest Mining Ltd	19.05.98	1
5016	OR	Conquest Mining Ltd	19.05.98	1
5017	OR	Conquest Mining Ltd	19.05.98	1
5018	CO	Conquest Mining Ltd	19.05.98	1
5020	OR	Rio Tinto Exploration Pty Ltd	29.11.98	1
5021	OR	Rio Tinto Exploration Pty Ltd	11.12.98	1
5022	OR	Croesus Mining NL	27.05.98	1
5023	CO	Oxiana Resources NL	28.05.98	6
5024	AR	Alphadale Pty Ltd	27.11.98	1
5025	OR	Rio Tinto Exploration Pty Ltd	28.05.98	1
5026	OR	Rio Tinto Exploration Pty Ltd	28.05.98	1
5027	OR	Rio Tinto Exploration Pty Ltd	28.05.98	1
5028	OR	Rio Tinto Exploration Pty Ltd	28.05.98	1
5029	OR	Minerals Corporation Ltd	28.05.98	1
5030	OR	Delta Gold Exploration Pty Ltd	30.05.98	1
		Tri Origin Australia NL		
5032	IN	New England Tin NL	05.06.98	1
5034	CO	Croesus Mining NL	06.06.98	1

No	Mining Div'n*	Holder	Expiry date+	Min grp#
5035	CO	Croesus Mining NL	06.06.98	1
5036	CO	Croesus Mining NL	06.06.98	1
5038	BH	BHP Minerals Pty Ltd	16.06.98	1
5039	CO	Savage Resources Ltd	18.06.98	1
5040	OR	Rootes, Edwin George	19.06.98	1
5041	IN	James, Frank Reginald	17.10.97	6
5042	CO	Silver Standard Aust Pty Ltd	20.06.98	1
5046	CO	Zintoba Pty Ltd	25.06.98	1
5047	OR	Woodham, Stephen William	27.06.98	1
5049	SY	Chemical & Extractive Metallurgical Engineering PT	01.07.98	1
5051	OR	Straits Exploration (Aust) Pty Ltd	08.07.98	1
5052	SY	Michelago Resources NL	08.07.98	1
5053	CO	Straits Exploration (Aust) Pty Ltd	08.07.98	1
5054	CO	Straits Exploration (Aust) Pty Ltd	08.07.98	1
5056	IN	Desertstone NL	09.07.98	6
5057	IN	Desertstone NL	09.07.98	6
5058	IN	Desertstone NL	09.07.98	6
5059	IN	Desertstone NL	09.07.98	6
5060	IN	Desertstone NL	09.07.98	6
5061	OR	Golden Hills Mining NL	09.07.98	1
5062	OR	Michelago Resources NL	09.07.98	1
5063	WA	Rootes, Edwin George Howard, Gordon	15.07.98	1
5064	CO	Croesus Mining NL	16.07.98	1
5066	WA	Bolnisi Gold Ltd	22.07.98	1
5067	WA	Wallarah Minerals Pty Ltd	23.07.98	1, 2
5068	AR	Alphadale Pty Ltd	23.07.98	1
5069	SY	Southpac Ltd	25.07.98	4
5070	BH	RZM Pty Ltd	29.07.98	1
5073	SI	Sheldon, Mark Andrew Sonnberg, James	01.08.98	2
5075	WA	Michelago Resources NL	07.08.98	1
5076	CO	Compass Resources NL	07.08.98	1
5077	OR	Newcrest Mining Ltd	07.08.98	1
5078	OR	Newcrest Mining Ltd	07.08.98	1
5079	CO	Burdekin Resources NL	08.08.98	1
5081	OR	Director General, Dept Mineral Resources	07.08.98	5
5082	CO	Santa Fe Mining Aust Pty Ltd	19.08.98	1
5084	OR	Sipa Exploration NL	19.08.98	1
5085	WO	Great Northern Mining Corp NL	20.08.98	1, 6
5090	WO	Gold Mines of Australia (NSW) P/L	21.08.98	1
5092	OR	Resolute Samantha Ltd	26.08.98	1
5093	OR	Croesus Mining NL	26.08.98	1
5094	WO	Gold Mines of Australia (NSW) P/L	27.08.98	1
5095	OR	Croesus Mining NL	28.08.98	1
5096	CO	Sitegoal Pty Ltd	28.08.98	1
5097	CO	Sitegoal Pty Ltd	28.08.98	1
5098	OR	Newcrest Mining Ltd	01.09.98	1
5101	OR	Compass Resources NL	01.09.98	1
5102	SY	Dowmill Pty Ltd Nosebi Mining & Management Pty Ltd	04.09.98	1
5103	OR	Bepike Pty Ltd	04.09.98	6
5105	CO	Delta Gold Exploration Pty Ltd	08.09.98	1
5107	SY	Nosebi Mining & Management P/L Dowmill Pty Ltd	09.09.98	1
5111	CO	Rio Tinto Exploration Pty Ltd	10.09.98	1, 6
5112	AR	Alergold Pty Ltd	22.05.97	1
5114	SI	Monier PGH Holdings Ltd	17.09.98	5
5115	CO	Ausmindex NL	19.09.98	1
5117	OR	Golden Hills Mining NL	19.09.98	1
5120	WO	Michelago Resources NL	24.09.98	1
5121	WO	Michelago Resources NL	24.09.98	1
5122	IN	New England Tin NL	26.09.98	1
5125	OR	Timms, Peter David	01.10.98	1
5126	OR	P.M.W. Goldmining Co Pty Ltd	01.10.98	1
5127	OR	Newcrest Mining Ltd	02.10.98	1
5128	OR	LFB Resources NL	02.10.98	1
5129	OR	North Gold (WA) Ltd	02.10.98	1
5130	CO	Golden Cross Operations Pty Ltd	08.10.98	1
5131	CO	Nosebi Mining & Management P/L Dowmill Pty Ltd	10.10.98	1
5133	WA	Carbon Minerals NL	13.10.98	1
5134	BH	BHP Minerals Pty Ltd	13.10.98	1
5135	OR	Duncans Enterprises Pty Ltd	14.10.98	1
5136	OR	Savage Australian Exploration P/L	14.10.98	1
5137	OR	Savage Australian Exploration P/L	14.10.98	1
5139	WA	Savage Australian Exploration P/L	15.10.98	1
5140	WA	Savage Australian Exploration P/L	15.10.98	1
5141	SY	Michelago Resources NL	30.10.98	1
5142	SY	Michelago Resources NL	30.10.98	1
5143	OR	Tio Tinto Exploration Pty Ltd	30.10.98	1
5144	OR	Michelago Resources NL Sipa Exploration NL	30.10.98	1
5145	OR	Ausmindex NL	30.10.98	1
5146	IN	Golden Reef Enterprises Pty Ltd	31.10.98	1
5148	SI	Alphadale Pty Ltd	11.11.98	1
5149	OR	Rootes, Edwin George	13.11.98	1
5150	OR	Rootes, Edwin George	13.11.98	1
5151	OR	Plato Mining Pty Ltd	13.11.98	1
5152	OR	Golden Reef Enterprises Pty Ltd	13.11.97	1
5153	OR	Rootes, Edwin George	13.11.98	1
5154	OR	North Mining Ltd	13.11.98	1
5155	OR	North Mining Ltd	13.11.98	1
5156	CO	Golden Cross Operations Pty Ltd	17.11.98	1
5157	IN	New England Tin NL	18.11.98	1
5158	LR	Opal Ventures NL	20.11.98	7
5160	CO	Websters Find Gold Pty Ltd	24.11.98	1
5161	OR	Croesus Mining NL	25.11.98	1
5162	WA	Golden Cross Operations Pty Ltd	27.11.98	1
5163	CO	Burdekin Resources NL	28.11.98	1
5164	OR	Golden Hills Mining NL	01.12.98	1
5165	OR	Golden Hills Mining NL	01.12.98	1
5166	OR	Australian Dolomite Co Pty Ltd	03.12.98	2
5168	CO	Polymetals Pty Ltd	08.12.98	1
5169	OR	Websters Find Gold Pty Ltd	09.12.98	1
5170	WA	Sipa Exploration NL	16.07.98	1
5172	SY	Platsearch NL	15.06.98	6
5173	SY	Austminex NL	19.12.98	1
5174	OR	LFB Resources NL	22.12.98	1
5175	OR	LFB Resources NL	22.12.98	1
5177	OR	Resolute Ltd	22.12.98	1
5178	OR	Newcrest Mining Ltd	01.01.99	1
5179	SY	Chemical & Extractive Metallurgical Engineering Pty Ltd	21.08.98	1
5180	SY	Alkane Exploration NL	22.04.98	1
5181	WA	Gold Mines of Aust (NSW) Pty Ltd	15.08.98	1
5182	WA	Austminex NL	09.01.99	1
5184	CH	Gordon, Dudley	21.09.98	1
5185	CH	J ervois Mining NL	14.01.99	1
5186	OR	Tresmonay Pty Ltd	13.01.99	1
5187	OR	Tresmonay Pty Ltd	13.01.99	1
5188	OR	Goldfields Exploration Pty Ltd	16.01.99	1
5189	OR	Goldfields Exploration Pty Ltd	16.01.99	1
5190	IN	Ross Mining NL	21.01.99	1
5191	OR	North Gold (WA) Ltd	22.01.99	1
5193	CO	Pasminco Australia Ltd	22.01.99	1
5194	CO	Fairey, Alfred Walter Heighton Fairey, Michael John Vasic, Dobrasav	22.01.99	1
5195	BH	Mount Isa Mines Ltd	23.01.99	1

No	Mining Div'n*	Holder	Expiry date+	Min grp#
5196	SY	Platsearch NL	08.09.98	1
5197	WA	Golden Cross Operations Pty Ltd	02.02.99	1
5198	WA	Golden Cross Operations Pty Ltd	02.02.99	1
5199	OR	Tresmonay Pty Ltd	02.02.99	1
5200	SY	Denehurst Ltd	25.06.98	1
5201	OR	GDR Mines Development Pty Ltd	05.02.98	1
5204	OR	Straits Gold Pty Ltd	03.02.99	1
5205	OR	Straits Gold Pty Ltd	03.02.99	1
5206	OR	Gold Mines of Aust (NSW) Pty Ltd	04.02.99	1
5207	OR	Michelago Resources NL	27.06.98	1
5208	OR	Michelago Resources NL	04.02.99	1
5209	OR	Golden Cross Operations Pty Ltd	04.02.99	1
5210	OR	Golden Cross Operations Pty Ltd	04.02.99	1
5211	OR	Golden Cross Resources NL	04.02.99	1
		Imperial Mining NL		
5212	SI	Commercial Minerals Ltd	13.03.98	5
5213	OR	Monier PGH Holdings Ltd	09.02.99	5
5214	OR	Kings Minerals NL	09.02.99	1
5215	CO	Golden Cross Operations Pty Ltd	10.02.99	1
5216	SY	Dowmill Pty Ltd	13.06.98	1
		Nosebi Mining & Management Pty Ltd		
5217	BH	Golden Cross Operations Pty Ltd	10.02.98	1
5218	BH	Golden Cross Operations Pty Ltd	10.02.98	1
5219	CO	Tresmonay Pty Ltd	10.02.99	1
5220	CO	Tresmonay Pty Ltd	10.02.99	1
5221	OR	Mount Conqueror Minerals NL	10.02.99	1
		Central West Gold NL		
5223	IN	Desertstone NL	11.02.99	6
5224	SY	Denehurst Ltd	12.10.98	1
5226	OR	Rio Tinto Exploration Pty Ltd	29.11.97	1
5227	OR	Goldfields Exploration Pty Ltd	14.05.98	1
5228	OR	Mount Conqueror Minerals NL	12.06.98	1
		Central West Gold NL		
5229	WA	Michelago Resources NL	17.02.99	1
5230	SY	Chemical & Extractive Metallurgical Engineering Pty Ltd	21.08.98	1
5231	CH	Gordon, Dudley	21.09.98	1
5232	OR	Golden Cross Operations	17.02.99	1
5233	OR	Michelago Resources NL	13.10.98	1
5234	OR	Hargraves Resources NL	14.03.98	1,2,6
5235	OR	Hargraves Resources NL	14.03.98	1,2
5236	OR	Hargraves Resources NL	01.02.98	1,2
5237	OR	Hargraves Resources NL	14.03.98	1,2
5238	OR	Golden Cross Resources NL	19.02.99	1
		Imperial Mining NL		
5239	OR	Ausmindex NL	28.09.98	1
5240	OR	North Mining Ltd	23.11.98	1
5241	OR	Michelago Resources NL	14.08.98	1
		Allstate Explorations NL		
		Sipa Exploration NL		
5242	OR	Michelago Resources NL	02.05.98	1
5244	AR	Goldrap Pty Ltd	05.12.98	1
5245	OR	Goldfields Exploration Pty Ltd	19.08.98	1
5246	WA	Gold Mines of Aust (NSW) Pty Ltd	22.09.98	1
5247	CO	Savage Australian Exploration Pty Ltd	02.03.99	1
5248	CO	Savage Australian Exploration Pty Ltd	03.03.99	1
5249	OR	LFB Resources NL	04.03.99	1
5250	WA	Gold Mines of Aust (NSW) Pty Ltd	22.09.98	1
5251	IN	New England Tin NL	10.03.99	1
5252	IN	Ross Mining NL	11.03.99	1
5253	CO	Sitegoal Pty Ltd	13.03.99	1
5255	SY	Platsearch NL	09.07.98	1
5256	WA	Gold Mines of Aust (NSW) Pty Ltd	16.03.99	1
5257	SY	Newcrest Operations Ltd	17.03.99	1
5258	OR	Jervois Mining NL	23.03.98	1
		Newcrest Operations Ltd		
5259	BH	Newcrest Operations Ltd	19.03.99	1
5260	AR	Centfield Mining Pty Ltd	20.03.99	1
5261	CO	Kings Minerals NL	20.03.99	1
5262	CO	Kings Minerals NL	20.03.99	1
5263	OR	Michelago Resources NL	23.03.98	1
		Sipa Exploration NL		
5264	OR	Goldfields Exploration P/L	19.10.98	1
5265	BH	Morton, Peter James	31.03.99	2
		Morton,Suzanne Esther		
5266	CO	Rio Tinto Exploration Pty Ltd	01.04.99	1,6
5267	CH	Kitson, Leonard	07.04.99	1
5268	SY	Risinger, John	07.04.99	1
5269	BH	Pasminco Australia Ltd	07.04.99	1
5270	BH	Pasminco Australia Ltd	07.04.99	1
5271	BH	Pasminco Australia Ltd	07.04.99	1
5272	OR	Phillips, Millie	19.09.98	1
5273	SI	Alphadale Pty Ltd	02.09.98	1
5274	AR	Alphadale Pty Ltd	08.04.99	1
5275	SI	Platsearch NL	15.06.98	6
5276	SY	Chemical & Extractive Metallurgical Engineering Pty Ltd	01.07.98	1
5278	OR	Endeavour Minerals Pty Ltd	14.04.99	1
5279	OR	Michelago Resources NL	14.04.99	1
5280	OR	Goldfields Exploration Pty Ltd	28.04.98	1
5281	OR	Davies, William Thomas	15.04.99	1
5282	CO	Sipa Exploration NL	15.04.99	1
5283	OR	Gibran Holdings Pty Ltd	16.04.99	1
5284	OR	Silver Standard Australia Pty Ltd	01.02.98	1
5286	SI	Jenkins, Bret Roy	18.05.98	1
		Cook, Peter Lawrence		
		Fraser, David Robert		
5287	OR	Michelago Resources NL	19.06.98	1
		Denehurst Ltd		
5288	OR	Michelago Resources NL	13.05.98	1
		Denehurst Ltd		
5289	OR	Michelago Resources NL	24.04.99	1
		Sipa Exploration NL		
		Allstate Explorations NL		
5290	OR	Golden Hills Mining NL	01.05.99	1
		Straits Gold Pty Ltd		
5293	SY	Risinger, John	05.05.99	1
		MacDonald, Stanley		
5294	OR	Delta Gold Exploration Pty Ltd	06.05.99	1
		Tri Origin Australia NL		
5295	CO	Polymetals Pty Ltd	06.05.99	1
5296	CO	Delta Gold Exploration Pty Ltd	11.05.99	1
5298	BH	Rio Tinto Exploration Pty Ltd	14.05.99	1
5299	OR	Austminex NL	18.05.99	1
5300	CO	Delta Gold Exploration Pty Ltd	19.05.99	1
5301	WA	Michelago Resources NL	07.05.98	1
5302	OR	Golden Cross Resources NL	22.05.99	1
		Imperial Mining NL		
5303	OR	LFB Resources NL	25.05.99	1
5304	WA	Climax Mining Ltd	26.05.99	1
5305	IN	McIntosh, Roderick Skinner	29.05.99	1, 6
5306	SY	Savage, Leslie Herbert	27.05.99	5, 9
		Savage, Robert James		
5307	CH	Kitson, Leonard	03.06.99	1
5308	CH	Allegiance Mining NL	19.10.98	1
5312	AR	New Ind Resources Pty Ltd	17.06.99	2
		Fidunu Pty Ltd		
5313	BH	Pasminco Australia Ltd	17.06.99	1
5314	SY	Rio Tinto Exploration Pty Ltd	18.06.99	1
5315	CH	Jervois Mining NL	24.06.99	1

No	Mining Div'n*	Holder	Expiry date+	Min grp#
5316	OR	Parkes Mining NL	26.06.99	1
5317	WA	Michelago Resources NL	02.07.99	1
5318	OR	Millennium Minerals (Operations) P/L	07.07.99	1
5319	OR	Austminex NL	07.07.99	1
5320	OR	Agustin, Raymond Glenn	07.07.99	1
5321	WA	Michelago Resources NL	13.07.99	1
5322	OR	LFB Resources NL	14.07.99	1
5323	OR	North Mining Ltd	17.07.99	1
5324	CO	Cooper, Michael Douglas Cooper, Richard John	20.07.99	7
5325	BH	Howley, Lance Edward	21.07.99	2
5326	OR	Sipa Exploration NL Michelago Resources NL	29.07.99	1
5327	OR	Golden Cross Operations Pty Ltd	29.07.99	1
5328	SI	Monier PGH Holdings Ltd	04.08.99	5
5329	CO	Delta Gold Exploration Pty Ltd	04.08.99	1
5330	BH	Platsearch NL	07.08.99	1
5331	CO	Pasminco Australia Ltd	10.08.99	1
5332	SY	Mt Bannaby Resources Pty Ltd	10.08.99	1
5333	SY	Baker, Christopher Colin Parkes, Paul	10.08.99	1
5334	OR	Delta Gold Exploration Pty Ltd Tri Origin Australia NL	28.02.99	1
5335	OR	Delta Gold Exploration Pty Ltd	27.06.99	1
5336	SI	NSW Gold NL	28.08.98	6
5338	OR	Goldfields Exploration Pty Ltd	14.08.99	1
5339	AR	Wildesign Pty Ltd	29.01.98	1
5340		Search Prospectors (NSW) Pty Ltd	19.08.99	1
5341	OR	Madsen Opals Pty Ltd	21.08.99	1
5342	BH	Plutonic Operations Ltd	25.08.99	1
5343	CO	Mount Conqueror Minerals NL Central West Gold NL	25.08.99	1
5344	BH	Larmon Pty Ltd	27.08.99	2
5345	WA	Adelong Consolidated Gold Mines NL	04.09.99	1
5346	BH	Triex Minerals Ltd	04.09.99	1

EXPLORATION (PROSPECTING) LICENCES IN FORCE NOVEMBER 1997

EPL No	Mining Div'n*	Holder	Expiry date+	Min grp#
892	OR	Ajax Joinery Pty Ltd Goldrim Mining Aust Ltd	30.11.98	1
1016	GO	Denehurst Ltd	02.04.98	1
1017	GO	Denehurst Ltd	02.04.98	1
1018	GO	Denehurst Ltd	02.04.98	1
1024	OR	Newcrest Operations Ltd	20.05.98	1
1049	OR	Tri Origin Australia NL	28.09.98	1
1050	IN	Kemlo, Kenneth Garry	22.10.97	1
1070	BH	Faber, Martin Thomas	16.08.99	1
1071	LR	Central Pacific Minerals NL Southern Pacific Petroleum NL	23.08.97	7
1082	IN	Capricornia Prospecting Pty Ltd	28.02.98	1
1084	IN	Capricornia Prospecting Pty Ltd	11.03.99	1
1085	IN	Capricornia Prospecting Pty Ltd	11.03.99	1
1086	IN	Capricornia Prospecting Pty Ltd	11.03.99	1
1094	NE	Hewett, Robert Patrick	18.08.98	1,2,6
1099	IN	Ross Mining NL	11.03.99	1
1100	IN	Ross Mining NL	11.03.99	1
1101	IN	Ross Mining NL	11.03.99	1
1103	NE	Hewett, Robert Patrick	30.01.98	1,2,6
1112	DU	Mineral Commodities NL	12.04.98	1
1113	DU	Mineral Commodities NL	12.04.98	1
1117	SY	Boral Montoro Pty Ltd	21.05.98	5
1135	IN	McKissock, John Andrew Dwyer, Peter Henry	03.10.94	1
2364	BH	Pasminco Australia Ltd	07.03.99	1
2379	BH	Pasminco Australia Ltd	07.03.99	1
3365	BH	Pasminco Australia Ltd	07.03.99	1
3661	BH	Pasminco Australia Ltd	07.03.99	1

EXPLORATION LICENCES GRANTED OCTOBER — NOVEMBER 1997

No	Mining Div'n*	Holder	Area$	Expiry date+	Min grp#
5348	SY	Golden Kingdom Minerals Pty Ltd	42.0 U	15.09.99	1
5349	BH	Morton, Peter James	1.0 U	18.09.99	2
5350	WA	Michelago Resources NL	42.0 U	22.09.99	1
5351	OR	Resolute Ltd	233.0 U	22.09.99	1
5352	IN	Coscrove, Judith Patricia	2.0 U	28.09.99	6
5353	SI	Mackay, Murray	1.0 U	28.09.98	1
5354	WA	Gateway Mining NL	84.0 U	30.09.99	1
5356	CO	Wall, Richard Gillen	57.0 U	06.10.00	1
5357	OR	Cosier Air Services Pty Ltd	4.0 U	07.10.99	1
5358	CH	Walker, Ellis Richard	1.0 U	08.10.99	2
5359	BH	RZM Pty Ltd	1109.0 U	08.10.99	1
		Aberfoyle Resources Ltd			
5360	BH	Arumpo Bentonite Pty Ltd	20.0 U	09.10.99	5
5361	BH	Corundum Pty Ltd	33.0 U	09.10.99	5
5362	BH	RZM Pty Ltd	1617.0 U	09.10.99	1
		Aberfoyle Resources Ltd			
5363	SY	Clerminston Pty Ltd	98.0 U	14.10.99	1,6
5364	OR	Estuary Resources NL	26.0 U	30.06.98	1
5365	OR	Estuary Resources NL	61.0 U	07.08.98	1
5366	OR	Homestake Gold of Aust Ltd	115.0 U	19.10.99	1
5367	CO	Mort, Jonothan Laidley	2.0 U	20.10.99	2
5368	BH	Peregrine Mineral Sands NL	678.0 U	20.10.99	1
5369	OR	Millennium Minerals (Operations) P/L	5.0 U	29.10.99	1
5371	OR	North Mining Ltd	119.0 U	25.06.99	1
5372	BH	Alphadale Pty Ltd	79.0 U	03.11.99	1
5373	BH	Morton, Peter James	1.0 U	03.11.99	2
5374	OR	Bella Montagna Pty Ltd	47.0 U	03.11.99	1
5375	OR	Tri Origin Australia NL	6.0 U	05.11.99	1
		Delta Gold Exploration Pty Ltd			
5376	CO	Savage Australian Exploration Pty Ltd	92.0 U	06.11.99	1
5377	SY	The Austral Brick Company Pty Ltd	29.0 U	09.11.99	5
5378	OR	Plato Mining Pty Ltd	100 .0 U	09.11.99	1
5379	OR	Plato Mining Pty Ltd	95.0 U	09.11.99	1
5380	OR	Plato Mining Pty Ltd	78.0 U	09.11.99	1
5381	OR	Plato Mining Pty Ltd	54.0 U	09.11.99	1
5382	OR	Casanza Pty Ltd	7.0 U	09.11.98	4
5383	OR	Cabonne Contractors Pty Ltd	6.0 U	12.11.99	2
5384	OR	Alphadale Pty Ltd	68.0 U	12.11.99	6
5385	IN	Ross Mining NL	127.0 U	12.11.99	1
5386	CO	Polymetals Pty Ltd	1.0 U	16.11.99	1
5387	OR	Plato Mining Pty Ltd	166.0 U	20.11.99	1
5388	OR	Plato Mining Pty Ltd	199.0 U	20.11.99	1
5389	CH	Malachite Resources NL	80.0 U	24.11.99	1
5390	OR	Golden Cross Operations Pty Ltd	11.0 U	23.11.99	1
5391	AR	Malachite Resources NL	80.0 U	24.11.99	1
5392	AR	Malchite Resources NL	48.0 U	24.11.99	1

REFERENCE

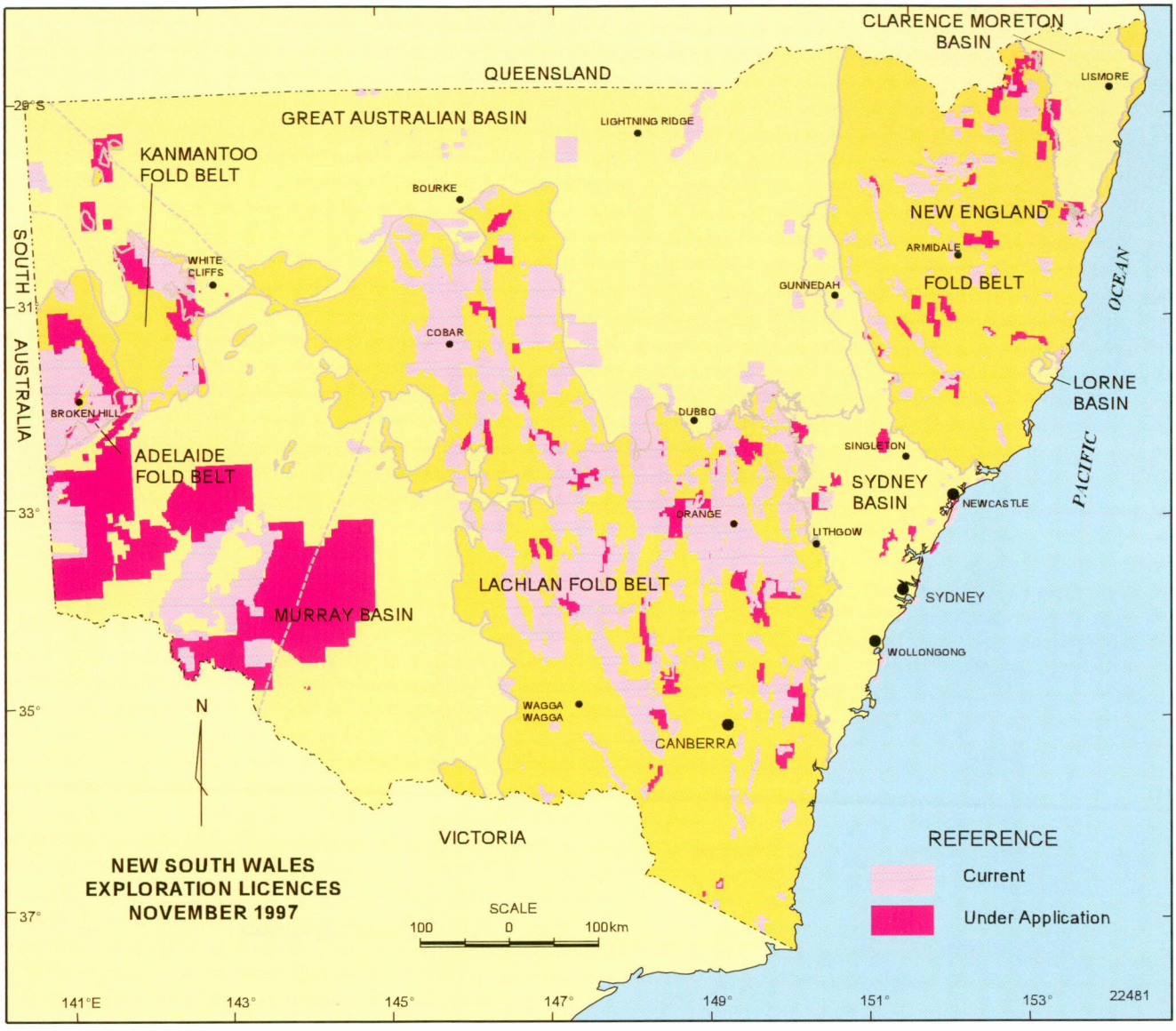
* AL Albury
AR Armidale
BH Broken Hill
CH Coffs Harbour
CM Cooma
CO Cobar
DU Dubbo
GO Goulburn
IN Inverell
LM Lismore
LR Lightning Ridge
NE Newcastle
OR Orange
SI Singleton
SY Sydney
WA Wagga Wagga
WO Wollongong

\# Group 1 - Elemental minerals (metallics)
Group 2 - Non-metallics
Group 3 - Semi-precious stones
Group 4 - Hard rock minerals
Group 5 - Clay minerals
Group 6 - Diamond, sapphire
Group 7 - Opal
Group 9 - Coal, oil shale

$ U = Graticular system units

\+ ELs with passed expiry dates may either be subject to renewal applications or continue by virtue of "flow on" applications

EXPLORATION LICENCES IN FORCE NOVEMBER 1997



SUMMARIES OF TERMINATED EXPLORATION LICENCES

EXPLORATION LICENCES CANCELLED/EXPIRED JULY – SEPTEMBER 1997

Reports on these ELs are no longer confidential; note that reports on EPLs are generally not included.

EL 3940 **K. Thomson**

Location: 5 km W of Tibooburra

Objective: Gold

Prospecting was carried out by metal detector and bulk sampling over an area which included the old Easter Monday dry-blower workings. An estimated 5 t of material, when treated, yielded an average of 1 g/t gold.

EL 3998 **Rio Tinto Exploration Pty Ltd**

Location: Canowindra

Objectives: Copper and gold

This licence was acquired to explore Ordovician volcanics for porphyry copper–gold deposits. Quartz vein gold occurrences were found to show no promise of size potential. Soil and rock chip sampling detected no other sites of interest.

EL 4505 **Rio Tinto Exploration Pty Ltd**

Location: 2 km W of Breadalbane

Objectives: Copper and gold

Aircore, RAB and percussion drilling of aeromagnetic anomalies did not intersect any significant mineralisation. The best result was 214 ppm Cu, 820 ppm Pb, and 670 ppm Zn. Modelling of one of these anomalies concluded that the likely depth of the target is greater than 700 m, too deep to warrant further investigation.

EL 4537 **L.H. Savage**

Location: 2 km S of Leadville

Objective: Magnetite

Magnetite pods occur in a hornfelsed sequence of felsic volcanics and sediments over a strike length of 200 m. Drilling confirmed

that the magnetite pods overlie mixed sulphide–magnetite (values to 8.5% Zn and 1.5% Pb). Magnetite-rich zones are narrow (0.8 m or less) and do not have commercial potential.

EL 4538 **Giuseppe Lombardo**

Location: 30 km N of Lithgow

Objective: Diamonds

This licence covered old deep lead and alluvial gold and diamond workings at Airly Mountain. Little effective exploration was conducted and activities were subject of a Wardens Court inquiry. The licence was terminated on the recommendation of the Warden.

EL 4552 **Alphadale Pty Ltd**

Location: 50 km NE of Narrabri

Objective: Diamonds

Seventy-six reconnaissance drainage samples for geochemical analysis were collected and limited rock and petrological studies carried out. Four small drainage samples for diamond indicator minerals were also collected, with positive indicators being recovered at three sites.

ELs 4557, 5074 **Michelago Resources NL**

Location: 45 km SE of Bourke

Objectives: Tin and other base metals

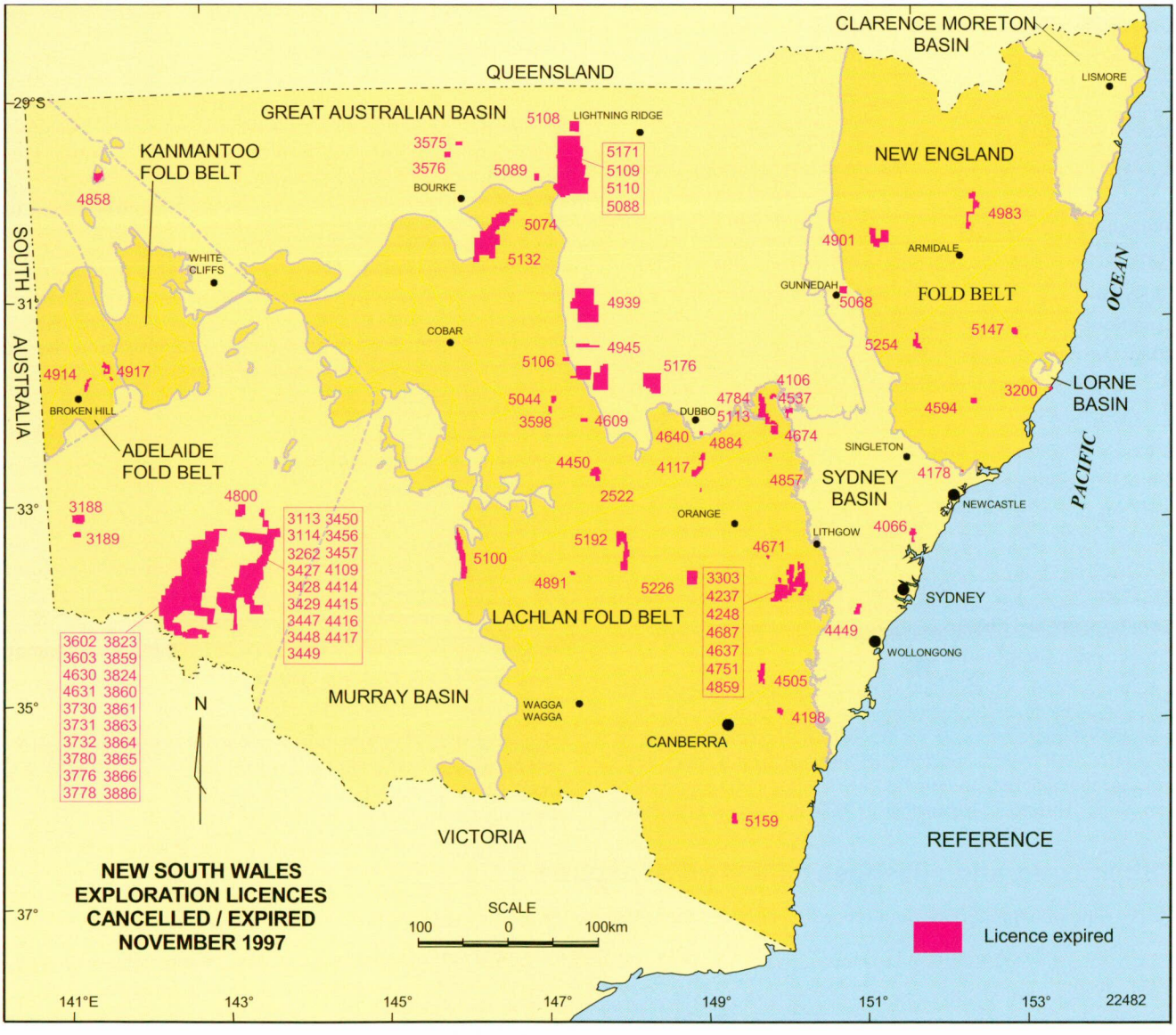
These licences covered the Doradilla–Midway–3KEL line of skarn deposits. Exploration carried out included reassessment of the mineralisation including analyses of core from the large body of previous drilling, geochemistry and airphoto and airborne geophysics interpretations. Orientation geochemistry suggested regoleach and biogeochemical methods would be more successful than conventional soil sampling in detecting buried mineralisation.

EL 4560 **Ross Mining NL**

Location: 20 km S of Tabulam

Objective: Gold

This licence covered old workings on quartz reefs, including the Lombardy–Band of Hope, Garibaldi and Mount Arthur lines. Sampling gave only spotty high gold results and significant alteration is absent. Potential for bulk tonnage mineralisation was discounted.



EL 4603 **Denehurst Ltd**

Location: 6 km W of Braidwood

Objective: Base metals

Known prospects and magnetic anomalies were explored by rock chip and stream sediment geochemistry without encouraging results.

EL 4604 **Denehurst Ltd**

Location: 6 km N of Captains Flat

Objectives: Base metals

The licence covered extension of the Foxlow gossans. Rock chip sampling yielded no significant results.

EL 4816 **Alergold Pty Ltd**

Location: 15 km SE of Bingara

Objectives: Gold

Only reconnaissance work was undertaken. The licence changed hands during its term and exploration focus shifted from hard rock to alluvial gold. The licence expired due to a late renewal application and another application has been lodged over the area.

EL 4868 **RZM Pty Ltd**

Location: Wilcannia

Objectives: Heavy minerals

Regional geological studies and drilling indicate lithologies are dominated by fluvial sequences with possible interfingering of marginal marine sediments of the Murray Basin. Significant deposits of heavy mineral are unlikely to occur here.

EL 4885 **Sedimentary Holdings Limited**

Location: 5 km W of Gulgong

Objectives: Diamonds

A literature review was the only work done on this licence.

EL 4901 **Universal Services Group Pty Ltd**

Location: 11 km SE of Barraba

Objective: Diamonds

No work was done on this licence.

EL 4929 **Jaunsz Piotr Wieclaw**

Location: 12 km N of Milparinka

Objective: Gold

This one unit licence covered a line of reef diggings extending north from the Pioneer shaft. Sampling failed to return any values above 1 g/t Au.

EL 4939 **Mount Isa Mines Limited**

Location: 46 km NNE of Nyngan

Objectives: Copper and gold

Interpretation of aeromagnetics indicated that high responses believed to be due to Ordovician volcanics are sourced too deep beneath sedimentary cover for evaluation. A separate elongate magnetic high over suspected Girilambone Group rocks has a circular low magnetic feature at one end, indicating a possible intrusion. This zone was further defined by a ground magnetic survey. The elongate zone and the circular feature warrant drill testing but were low on the company's priorities.

EL 4945 **Mount Isa Mines Limited**

Location: 19 km SSE of Nyngan

Objectives: Copper and gold

Interpretation of aeromagnetics detailed the multiphase nature of an interpreted intrusive complex beneath sedimentary cover. Several circular features (possibly intrusions) and linear structural features were identified. Ground magnetic data defined a prominent orthogonal structure recognised in the aerogmagnetic data. This structure and three other kilometre sized circular features warrant drill testing but were low on the company's priorities.

EL 4982 **North Mining Limited**

Location: 45 km E of West Wyalong

Objectives: Copper and gold

Magnetic anomalies trending beneath extensive tertiary cover were tested by aircore drilling. Holes intersected dioritic intrusions and trachyte lava within siltstone. Weakly anomalous gold, copper, zinc and silver results were considered not significant.

EL 5100 **Compass Resources NL**

Location: 59 km SW of Lake Cargelligo

Objectives: Gold and base metals

A literature survey and assessment of Discovery 2000 aeromagnetic and radiometric data were followed by inspection and limited sampling of aeromagnetic anomalies and gold occurrences. The prospects inspected consisted of quartz veins in sandstones with little potential.

EL 5110 **Rio Tinto Exploration Pty Ltd**

Location: 20 km SE of Brewarrina

Objective: Diamonds

This licence was acquired to investigate a number of Discovery 2000 aeromagnetic anomalies. However, no work was carried out because drilling on similar anomalies in an adjoining licence encountered intrusions which were not considered prospective in conventional diamond models.

EL 5113 **PlatSearch NL**

Location: 11 km NNW of Ulan

Objective: Diamonds

Interpretation of palaeodrainage to diamond bearing alluvials suggested a source in the Gulgong–Ulan area. A previously discovered diatreme at Box Hill was considered a possible source, but was not tested after bulk sampling of diatremes in an adjoining licence was negative.

EL 5225 **Denehurst Limited**

Location: 15 km E of Bungendore

Objectives: Gold and base metals

Extensive rock chip and stream sediment sampling identified several areas of base metal anomalism. Some of the geochemical anomalies remain unexplained. Broad areas of low values were not drill tested.

Other exploration licences cancelled or expired

At the time of compilation, final reports had not been received for the following licences:

ELs 2075, 3200, 3279, 3303, 3310, 3315, 3543, 3909, 3947, 3978, 4249, 4419, 4447, 4571, 4578, 4594, 4684, 4685, 4890, 4893, 4980, 4981, 5044.

Reports to remain confidential due to 'flow-on' application:

ELs 4797, 4860, 4926.

EXPLORATION LICENCES TERMINATED BEFORE JULY 1997

EPL 1237 **Baybridge Pty Ltd**

Location: Forbes

Objective: Gold

This licence covered the old Brittannia Mine that is now incorporated into the 'Lachlan Vintage Village' tourist park. Some minor geochemical sampling by Geopeko Exploration Ltd was the only exploration conducted.

EL 3088 **D.A. Lloyd, A.T. Lloyd, K.J. Foster & J.J. Clift**

Location: 8 km NE of Uralla

Objective: Gold

The Sydney Flat deep lead at Rocky River gold field was investigated by spoil sampling and 12 holes drilled through basalt cover of up to 25 m thickness. Gold of fine grain size is present and the drilling confirmed continuation of the unworked lead to the north-east. Grade estimations vary up to 4 g/t gold, but overall were not encouraging.

EL 3928 **Nord Australex Nominees Pty Ltd & Straits Mining Pty Ltd**

Location: 60 km NW of Girilambone

Objectives: Gold and base metals

Girilambone Group rocks in the licence area are extensively soil-covered. Shallow bedrock sampling to 3 m average depth did not identify any gold or base metal anomalies. Earlier recorded anomalous values were traced to contamination from an insecticide compound used on power poles.

ELs 4649, 4700 **Queensland Consolidated Coal NL**

Location: Hillgrove

Objectives: Gold and antimony

Exploration was for shear and fracture-hosted systems. Targets generated from remote sensing and geology were tested by soil geochemistry. Best results are from the Limerick Creek prospect, along strike from the Clarks Gully deposit, and included values to 3150 ppm Sb, 8500 ppm As and 1.25 ppm Au.

EL 4716 **Jacfin Pty Ltd**

Location: 17 km W of Parramatta

Objective: Construction aggregate

The Horsley Park diatreme was mapped and the volcanic breccia diamond drilled to 45 m depth at 9 sites. Testing of core showed the rock does not meet specifications required for pavement, concrete or sealing aggregate applications.

EL 4748 **Rio Tinto Exploration Pty Ltd**

Location: 25 km E of Canowindra

Objectives: Copper and gold

This licence was acquired to explore Ordovician volcanics of the Molong Anticlinorium for porphyry copper–gold deposits. Mapping at 1:25 000 scale and minor soil and rock chip geochemistry did not give any encouraging results.

EL 4767 **Epoch Mining NL**

Location: 7 km S of Mount Hope

Objectives: Gold, silver and base metals

The Anomaly 3 oxidised deposit has an estimated 56 000–63 000 t at 3.1 g/t Au and about 50 g/t Ag. Reassessment of previous drilling identified a subsidiary narrow zone of mineralisation (plus 1% Cu) that is possibly a feeder zone for the deposit or is perhaps related to the along-strike mineralisation of the nearby Comet/Hodges line of lode.

EL 4802 & 4804 **Universal Services Group Pty Ltd**

Location: 20 km S of Bingara

Objective: Primary diamond deposits

No work was carried out on these licences.

EL 4820 **Gateway Mining NL**

Location: E of Parkes

Objectives: Gold and base metals

No exploration was carried out apart from general reconnaissance.

EL 4983 **Rio Tinto Exploration Pty Ltd**

Location: Guyra

Objective: Diamonds

This licence was acquired to test aeromagnetic anomalies and air photo features in a narrow strip of terrain between Llongothlin and Guyra. Work carried out included ground checking of seven anomalies and the collection of three gravel samples for indicator mineral analysis. One of the targets south of Guyra was considered encouraging but was not followed up with further work.

GOVERNMENT ACTION ON NEWCASTLE PORT

Through the second half of 1997, considerable delays were experienced by ships waiting to load coal from the Newcastle coal export terminals (figure 19). The demurrage bill for coal exporters is running at $120 million a year, at a time when industry profitability has also been affected by low coal prices.

Although the port coal loaders are owned and operated by the coal industry, the New South Wales Government is concerned that the delays at Newcastle will damage the State's credibility as a reliable exporter. The Minister for Mineral Resources, Mr Bob Martin, convened a high level forum in early November 1997 to discuss issues related to coal export for the Hunter Valley. It was chaired jointly by the Minister and Dr Col Gellatly, the Director-General of the Premier's Department. Chief executives of coal companies, coal buyers, investors, local politicians and key government and industry personnel associated with the coal export chain attended the conference.

The forum generated considerable discussion on short and long term measures for dealing with the present and expected growth of coal exports through Newcastle. At the request of the Minister, the coal shippers have prepared a plan of action directed at overcoming short term problems and have submitted it to him.

The new coal ship loader at Kooragang Island near Newcastle. In the background the first loader can be seen loading coal for export to Korea

The Director–General of the Department of Mineral Resources, Alan Coutts, and the Director of Resource Planning and Development, Tony Galligan, are going to Japan in early February 1998 to reassure Japanese coal buyers that action is taking place to alleviate the problems.

Mr Martin indicated that the government might have to consider limiting new mine developments through mining lease conditions if project proponents cannot demonstrate the availability of port capacity to deal with the increase in exports from the project.

For further information contact Denis Casey, Senior Project Officer, Industry Development, on (02) 9901 8511, fax (02) 9901 8493.

JOB LOSSES IN NEW SOUTH WALES COAL MINES

Continuing low prices for export coal have forced a number of coal mines to cut workforces in the past six months. In the Southern Coalfield, BHP Ltd announced in September 1997 that it planned to cut up to 800 jobs from its coal mines in the Illawarra region. To November 1997, 160 voluntary redundancies had been accepted at 4 of the mines. BHP also confirmed that 200 jobs would be shed from Cordeaux Colliery in 1998. At Oakdale Colliery in the Illawarra district, 80 miners were retrenched in September 1997.

In the Western Coalfield, Cyprus laid off 70 workers at Baal Bone in June 1997 and 160 miners from Clarence (50% of the workforce) in October 1997.

Rio Tinto Ltd has targeted a reduction of 220 at its Mount Thorley Mine in the Upper Hunter, and Shell Australia will shed 174 jobs at its Drayton opencut mine by early 1998. Teralba colliery, in the Lower Hunter Valley, retrenched 127 workers in late June 1997 and Ellalong Colliery, near Cessnock, shed 97 jobs in September.

The current negotiations between coal producers and leading Japanese coal buyers in which benchmark prices are set for the next Japanese fiscal year will be crucial to the viability of a number of New South Wales mines at their present production levels.

At 30 June 1997, total employment in New South Wales coal mines stood at 14 351.

For further information, contact Denis Casey, Senior Project Officer, Industry Development, on (02) 9901 8511, or fax (02) 9901 8493.

ERRATUM

In the abstract of the article on the Bengalla coal mine on p 22, *Minfo* Issue **57**, it was erroneously stated that the project would be the biggest opencut coal mine in New South Wales. While a significant coal mining project in the Upper Hunter Valley, Bengalla will not be the biggest.

COAL PROJECTS SUBMIT DEVELOPMENT APPLICATIONS

Kayuga and Mount Pleasant, neighbouring coal projects in the Upper Hunter Valley (figure 18), are following similar timetables for their development. Both have submitted development applications and accompanying Environmental Impact Statements (EIS) to Muswellbrook Council and both have requested Commissions of Inquiry. The inquiries are expected to be scheduled for early 1998 but the timing is at the discretion of the Office of Commissioners of Inquiry.

The Kayuga opencut proposal is planned to produce 1.5 Mt of saleable coal per year. Mount Pleasant will also be an opencut mine, producing about 8 Mt of coal for the export market.

An EIS for the Ravensworth West project, also in the Hunter Valley, has been displayed and a development application made to Singleton Council. The project is an extension of the mining operations at Ravensworth South and Narama, and will add substantially to the life of the mine.

A development application was lodged in early December 1997 for an extension to the Cooranbong underground mine near Lake Macquarie (figure 19).

For further information contact Denis Casey, Senior Project Officer, Industry Development, on (02) 9901 8511, fax (02) 9901 8493.

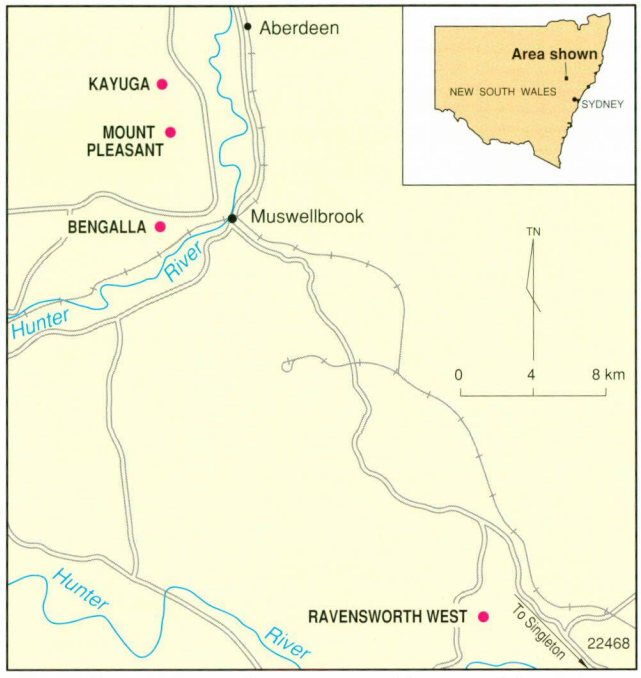


Figure 18. Location of the proposed Kayuga, Mount Pleasant and Ravensworth West coal projects

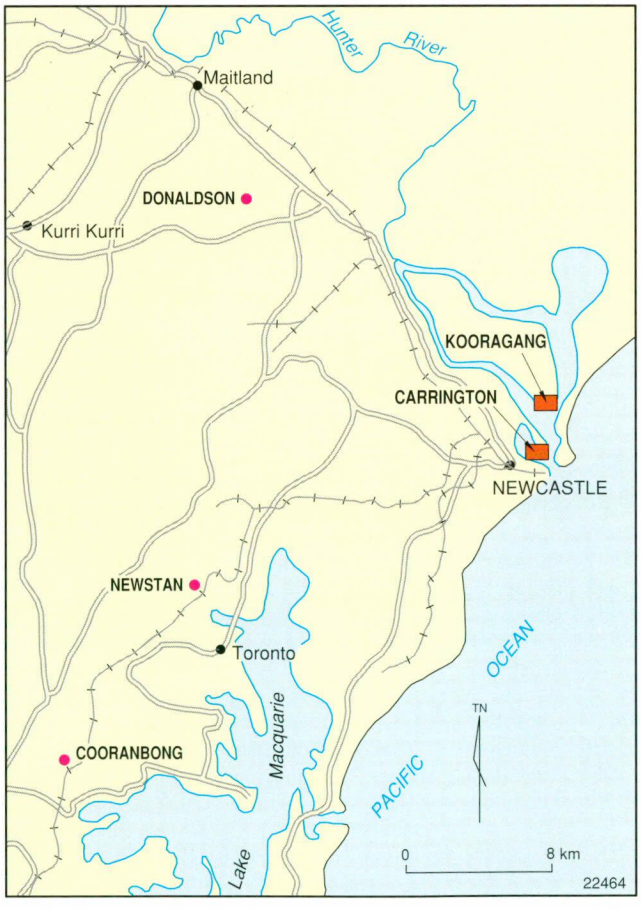


Figure 19. Location of Newstan and Cooranbong coal mining projects, and Kooragang and Carrington coal terminals at the Port of Newcastle

NEWSTAN PLANNING FOCUS

Newstan Colliery is an underground mine owned and operated by Powercoal Pty Ltd. The mine, on the western side of Lake Macquarie on New South Wales central coast, has been in operation for over 100 years. About 3 Mt per year of coal is extracted by a longwall operation. Extensive reserves are available within the Young Wallsend and West Borehole seams to the south of the current operations. The proposed development will allow mining to continue for at least a further 21 years.

Powercoal held a Planning Focus meeting on site in October 1997 to present its proposal to the relevant agencies. About 25 representatives from 13 agencies attended. Mining within the extension area is proposed initially to involve continuation of longwall mining in a southerly direction from Newstan Colliery. Existing surface facilities at Newstan will continue to be used. The proposed extension will require the establishment of additional reject capacity at the existing facilities; upgrading of the rail loading facilities; future construction of a ventilation shaft; and personnel and materials access at Awaba Colliery surface facilities to facilitate mining within the southern part of the extension area.

The Environmental Impact Statement in preparation will pay particular attention to the issue of subsidence. Lake Macquarie borders the extension area on the south-east, while the settlement of Rathmines is located on the foreshore of the lake. Other surface structures in the extension area will have to be protected against subsidence damage.

For further information contact David Agnew, Regional Manager – Northern, Titles, on (02) 6572 4200, fax (02) 6572 1201.

COAL AUTHORISATIONS/EXPLORATION LICENCES NOVEMBER 1997*

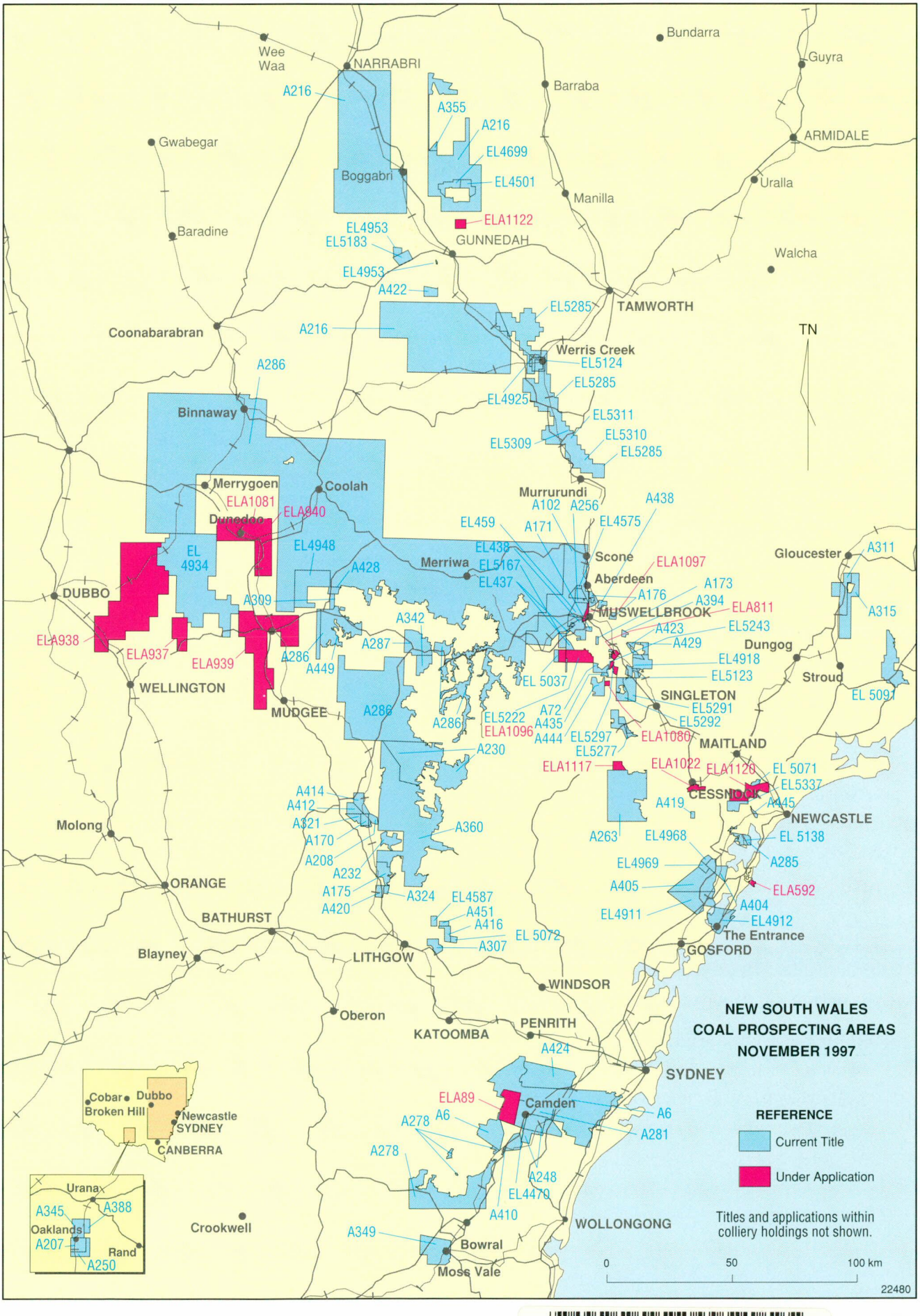
No	Holder	Nearest town
A6	Dept Mineral Resources	Campbelltown
A72	Novacoal Australia P/L Mitsubishi Development P/L	Jerrys Plains
A81	Navidale P/L Toyota Tsusho Mining (Australia) P/L DIA Coal Mining P/L	Camberwell
A102	Dept Mineral Resources	Muswellbrook
A168	Dept Mineral Resources	Muswellbrook
A170	Genders Mining P/L	Capertee
A171	Bayswater Colliery Co P/L	Muswellbrook
A173	Drayton Coal P/L	Muswellbrook
A175	Coalex P/L	Ben Bullen
A176	Muswellbrook Coal Co Ltd	Muswellbrook
A208	Genders Mining P/L	Capertee
A216	Dept Mineral Resources	Gunnedah
A230	Dept Mineral Resources	Rylstone
A232	Novacoal Australia P/L	Capertee
A248	BHP Steel (AIS) P/L	Menangle
A250	Mitsubishi Development P/L Queensland Coal P/L	Oaklands
A256	The Bellambi Coal Co Ltd Marubeni Thermal Coal P/L Showa Coal (NSW) P/L	Aberdeen
A263	Dept Mineral Resources	Wollombi
A278	Dept Mineral Resources	Mittagong
A281	Dept Mineral Resources	Camden
A285	Dept Mineral Resources	Toronto
A286	Dept Mineral Resources	Gulgong
A287	Austen & Butta Ltd	Bylong
A307	Hartley Valley Coal Co P/L	Lithgow
A309	Ulan Coal Mines Ltd	Ulan
A311	CIM Resources Ltd CIM Strathford P/L	Gloucester
A315	CIM Resources Ltd CIM Strathford P/L	Gloucester
A321	Genders Mining P/L	Capertee
A324	Lithgow Coal Co Ltd	Ben Bullen
A342	Austen & Butta Ltd	Bylong
A349	Austen & Butta Ltd	Sutton Forest
A355	Idemitsu Boggabri Coal P/L	Boggabri
A360	Dept Mineral Resources	Rylstone
A388	Queensland Coal P/L Mitsubishi Development P/L	Oaklands
A394	Liddell Tenements P/L	Muswellbrook
A404	Powercoal P/L	Morisset
A405	Coal Operations Australia Ltd	Cooranbong
A410	Tahmoor Coal P/L	Picton
A412	Genders Mining P/L	Ilford
A414	Charbon Coal P/L Yukong Aust P/L	Kandos
A419	Newcastle Wallsend Coal Co P/L	Cessnock
A420	Lithgow Coal Co Ltd	Ben Bullen
A422	Preston Coal Co P/L	Gunnedah
A423	Hunter Valley Coal Corporation	Ravensworth
A424	Dept Mineral Resources	Campbelltown
A428	Ulan Coal Mines Ltd	Gulgong
A429	Hunter Valley Coal Corp. P/L	Singleton
A435	Coal & Allied Operations P/L	Singleton
A437	Bayswater Colliery Co P/L	Muswellbrook
A438	Bengalla Mining Company P/L	Muswellbrook
A444	The Construction Forestry Mining & Energy Union	Singleton
A445	Newcastle Wallsend Coal Co	Boolaroo
A449	Dept Mineral Resources	Ulan
A450	Saxonvale Coal P/L	Bulga
A451	Coalex P/L	Lithgow
A459	Coal & Allied Operations P/L	Aberdeen

EL No	Holder	Nearest town
4470	BHP Steel (AIS) P/L	Camden
4501	Namoi Valley Coal P/L	Gunnedah
4574	The Bellambi Coal Co Ltd Marubeni Thermal Coal P/L Showa Coal (NSW) P/L	Muswellbrook
4575	The Bellambi Coal Co Ltd Marubeni Thermal Coal P/L Showa Coal (NSW) P/L	Muswellbrook
4587	Clutha Springvale Ltd Samsung Development (Aust) P/L	Lithgow
4699	Namoi Valley Coal P/L	Boggabri
4911	Coal Operations Australia Ltd	Wyee
4912	Coal Operations Australia Ltd	Wyee
4918	Dept Mineral Resources	Ravensworth
4925	Alphadale P/L	Quirindi
4934	Rio Tinto Exploration P/L	Gulgong
4948	Dept Mineral Resources	Ulan
4953	Namoi Mining P/L	Gunnedah
4968	Powercoal P/L	Wyee
4969	Powercoal P/L	Wyee
5037	Dept Mineral Resources	Denman
5071	Donaldson Projects P/L	Thornton
5072	Coalex Pty Ltd	Lithgow
5091	Hunter Valley Mining Corp P/L	Buladelah
5124	Alphadale P/L	Quirindi
5138	Powercoal P/L	Awaba
5167	Bayswater Colliery P/L	Muswellbrook
5183	Namoi Mining P/L	Gunnedah
5222	Dept Mineral Resources	Jerrys Plains
5243	Novacoal Aust Pty Ltd Mitsubishi Development P/L	Ravensworth
5277	Saxonvale Coal P/L	Warkworth
5285	Rio Tinto Exploration P/L	Quirindi
5291	Esso Australia Resources Ltd	Warkworth
5292	Esso Australia Resources Ltd	Warkworth
5297	Peabody Resources Ltd	Ravensworth
5309	Alphadale P/L	Willow Tree
5310	Alphadale P/L	Quirindi
5311	Alphadale P/L	Quirindi
5337	Newcastle Coal Co P/L	Seahampton
5347	Coal Operations Australia Ltd Catherine Hill Resources P/L	Wyee
5370	Namoi Mining P/L	Gunnedah

EXPLORATION LICENCE APPLICATIONS

No	Mining Divn	Applicant
89	Sydney	Clutha Coal P/L (Camden)
811	Singleton	Cumnock No 1 Colliery P/L (Ravensworth)
937	Orange	CRA Exploration P/L (Wellington)
939	Orange	CRA Exploration P/L (Gulgong)
940	Orange	CRA Exploration P/L (Gulgong)
1000	Singleton	Coal & Allied Operations P/L (Warkworth)
1022	Singleton	Oceanic Coal Aust. Ltd (Cessnock) Excel Mining P/L
1034	Singleton	Coal & Allied Operations P/L (Warkworth)
1080	Singleton	Coal & Allied Operations P/L (Warkworth)
1081	Singleton	Ulan Coal Mines Ltd (Ulan)
1096	Singleton	The Shell Co of Aust Ltd & others (Denman)
1097	Singleton	Bayswater Colliery Co P/L (Muswellbrook)
1117	Singleton	Saxonvale Coal P/L (Singleton) Nippon Steel Australia P/L
1120	Singleton	Excel Mining P/L (West Wallsend)
1122	Armidale	Alphadale P/L (Gunnedah)

*Authorisations and Exploration Licences over colliery holdings are not listed.


Wee Waa
NARRABRI
Bundarra
Guyra
Barraba
ARMIDALE
Gwabegar
Boggabri
Manilla
Uralla
Baradine
GUNNEDAH
Walcha
TAMWORTH
Coonabarabran
TN
Werris Creek
Binnaway
Merrygoen
Coolah
Murrurundi
Dunedoo
Scone
Merriwa
Aberdeen
Gloucester
DUBBO
MUSWELLBROOK
Dungog
Stroud
WELLINGTON
MUDGEE
SINGLETON
MAITLAND
CESSNOCK
NEWCASTLE
Molong
ORANGE
BATHURST
Blayney
LITHGOW
The Entrance
GOSFORD
WINDSOR
Oberon
KATOOMBA
PENRITH
SYDNEY
Camden
Cobar
Broken Hill
Dubbo
Newcastle
SYDNEY
CANBERRA
Urana
Oaklands
Rand
Crookwell
WOLLONGONG
Bowral
Moss Vale
A216
A355
EL4699
EL4501
ELA1122
EL4953
EL5183
A422
EL5285
A286
EL4925
EL5311
EL5310
EL5309
ELA1081
ELA940
EL 4934
EL4948
A428
EL438
EL5167
EL437
A102
A256
A438
EL459
A171
EL4575
ELA1097
A173
A176
A394
ELA811
A309
A342
A423
EL5243
A429
ELA938
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EL4968
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EL4911
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A170
A208
A232
A175
A420
A324
A360
EL4587
A451
A416
A307
EL 5072
A424
ELA89
A6
A278
A281
A248
EL4479
A410
A349
NEW SOUTH WALES
COAL PROSPECTING AREAS
NOVEMBER 1997
REFERENCE
Current Title
Under Application
Titles and applications within colliery holdings not shown.
0
50
100 km
22480

COAL MINING PROPOSALS NOVEMBER 1997

Company	Location	Coal type	Mine type	Development stage
Austral Coal Ltd	Tahmoor Mine infill areas ('prohibited' in LEP)	Coking	Underground	A*
Centennial Coal Co Ltd	Airly Mountain, 42 km north-west of Lithgow	Thermal	Underground	D
Coal & Allied Operations Pty Ltd	Carrington, 18 km west of Singleton	Thermal	Opencut	A*
Coal & Allied Operations Pty Ltd	Mount Pleasant, 6 km north-west of Muswellbrook	CWM/thermal coking	Opencut	B*
Cumnock No 1 Colliery Pty Ltd	Cumnock Mine, southern extension, 20 km north-west of Singleton	Coking/thermal	Opencut	D*
Dartbrook Joint Venture	Kayuga, south of Dartbrook Mine	Thermal	Opencut	B*
Donaldson Projects Pty Ltd	Donaldson, 5 km south-east of Maitland	Thermal/coking	Opencut	A
Duralie Coal Pty Ltd	Duralie, 20 km south of Gloucester	Coking	Opencut	C*
Idemitsu Boggabri Coal Pty Ltd	Boggabri, 17 km north-east of Boggabri	Thermal	Opencut & underground	D
Lemington Coal Mines Ltd	Lemington Mine southern extension, 10 km west of Singleton	Coking/thermal	Opencut	A
Liddell Coal Operations Pty Ltd	Glendell, 18 km north-west of Singleton	Thermal	Opencut	D
Lithgow Coal Co Ltd	Feldmast, 20 km north of Lithgow	Thermal	Opencut & underground	B
Maitland Main Collieries	Glennies Creek, 12 km north-west of Singleton	Coking	Underground	D
Nardell Coal Corp Pty Ltd	Nardell, 18 km north-west of Singleton	Coking/thermal	Underground	D
Oceanic Coal Aust Ltd	Mitchells Flat, 10 km east of Singleton	Thermal/coking	Underground	D
Oceanic Coal Aust Ltd	Lachlan, near Wakefield	Thermal/coking	Underground	D
Peabody Resources Ltd	Ravensworth West extension	Thermal	Opencut	B*
Peabody Resources Ltd	Ravensworth East	Thermal	Opencut	A*
Powercoal Pty Ltd	Cooranbong extension	Thermal/coking	Underground	A
Powercoal Pty Ltd	Newstan Mine extension, 30 km south-west of Newcastle	Thermal/coking	Underground	A*
Queensland Coal Pty Ltd (CRA)	Maules Creek, 20 km north-east of Boggabri	Thermal	Opencut	D
Rio Tinto	Howick Mine extension	Coking/thermal	Opencut	C
Tender Area	Mount Arthur North, 5 km south-west of Muswellbrook	Thermal	Opencut	A
Ulan Coal Mines Ltd	Ulan expansion	Thermal	Underground	A
Wallerawang Collieries Ltd (Coalex)	Baal Bone Mine addition	Thermal	Opencut	F*

* Development stage has advanced since publication of the previous schedule (June 1997)

DARTBROOK JOINT VENTURE PARTNERS

The Bellambi Coal Co P/L (75%)

Marubeni Thermal Coal P/L (15%)

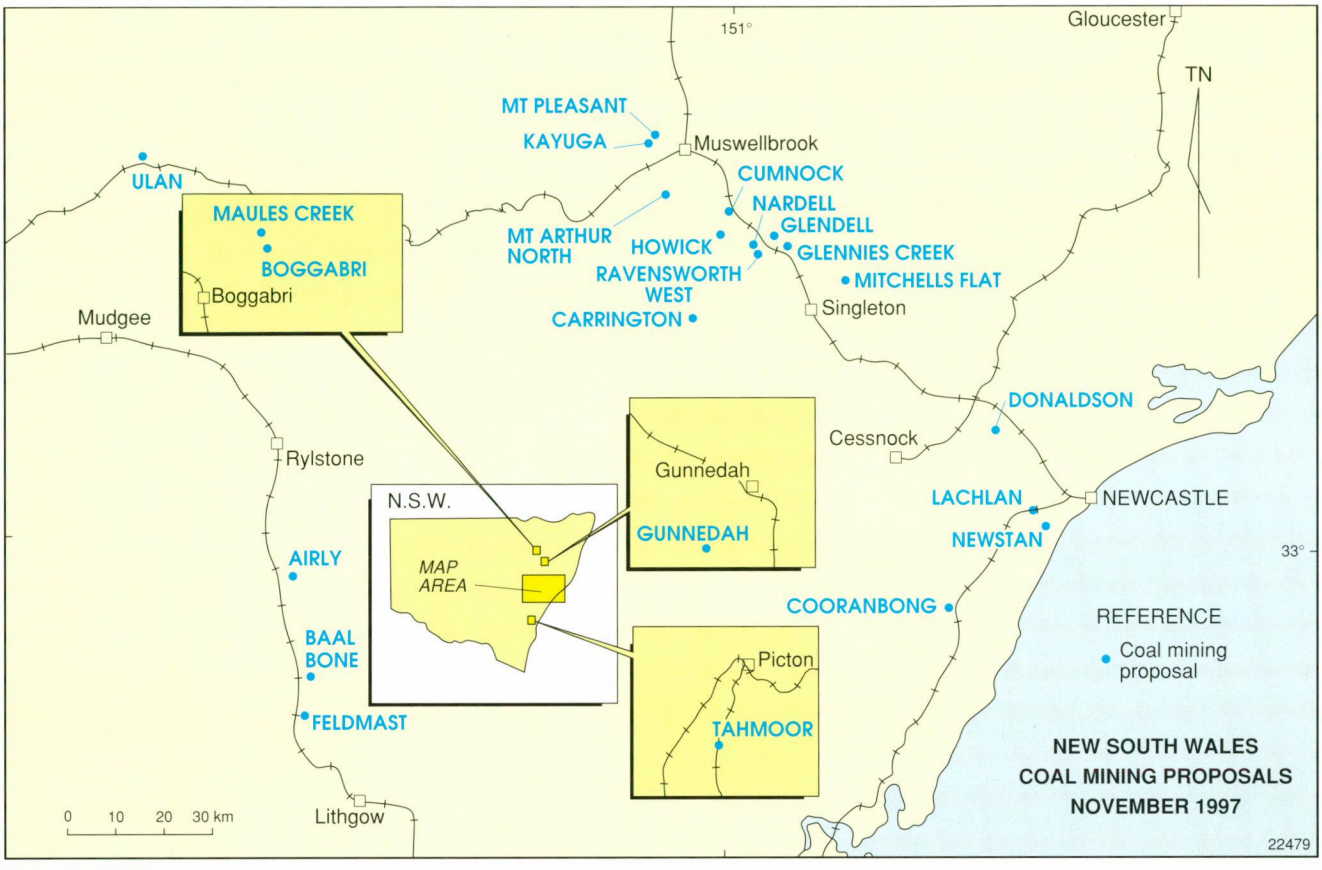
Ssang Yong Resources P/L (7%)

Showa Coal (NSW) P/L (3%)

NOTES:

Stages defined:

- A Environmental and preliminary feasibility studies.
- B Development application lodged, environmental impact statement complete.
- C Development consent determined.
- D Coal lease granted.
- E All government approvals obtained.
- F Construction/development in progress.



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Please specify what your Company/Organisation does (eg Exploration or Mining Company, Colliery or Quarry Operator, Government, Mining Consultant, Educational, Supplier, FInancial Investment, Individual, etc)

.....

PETROLEUM TITLES — NOVEMBER 1997

PETROLEUM EXPLORATION LICENCES

No	Holder	Area (No of blocks)+	Expiry date#
PEL 238	Petroleum Securities P/L, Great Southland Petroleum P/L	132	31.08.1999
PEL 267	Amoco Australia Development Co, Sydney Oil Co (NSW) P/L, Government Insurance Office of NSW	107	19.01.1999
PEL 283	Bannerblock P/L, Golvom P/L, Capital Energy NL	70	09.04.1999
PEL 285	Pacific Power	24	15.04.1999
PEL 286	Australian Coalbed Methane P/L	24	10.02.1999
PEL 1	Australian Coalbed Methane P/L	127	10.02.1999
PEL 2	Amoco Australia Development Co, AGL Gas Company (NSW) Ltd Pacific Power	120	28.03.1999
PEL 4	Amoco Australia Development Co, Pacific Power	113	10.11.1999
PEL 5	Pacific Power	40	10.11.1999
PEL 6	Eastern Energy Australia P/L	82	08.12.1996
PEL 8	Maple Oil & Exploration NL	135	13.12.1999
PEL 9	Oil Co Australia Ltd, Claremont Petroleum NL, St Barbara Mines Ltd, Pacific Power	19	19.12.1995
PEL10	Australian Coalbed Methane P/L	6	10.02.1999
PEL12	Australian Coalbed Methane P/L	39	26.09.2001
PEL13	Oil Co Australia Ltd, Pacific Power, Claremont Petroleum NL, St Barbara Mines Ltd	41	26.11.2001
PEL14	Knight Industries P/L, Petroleum Development P/L	140	09.03.2001
PEL16	Carlita Holdings P/L	11	12.11.1999
PEL17	Capital Energy NL	91	30.01.2003
PEL18	Capital Energy NL	93	30.01.2003

+ Total area, ie area available plus exclusions where relevant. In New South Wales, 1 block equals approximately 5 minutes of latitude by 5 minutes of longitude and is approximately 75 km^2.

Title continues where valid renewal application has been lodged.

PETROLEUM EXPLORATION LICENCE APPLICATIONS

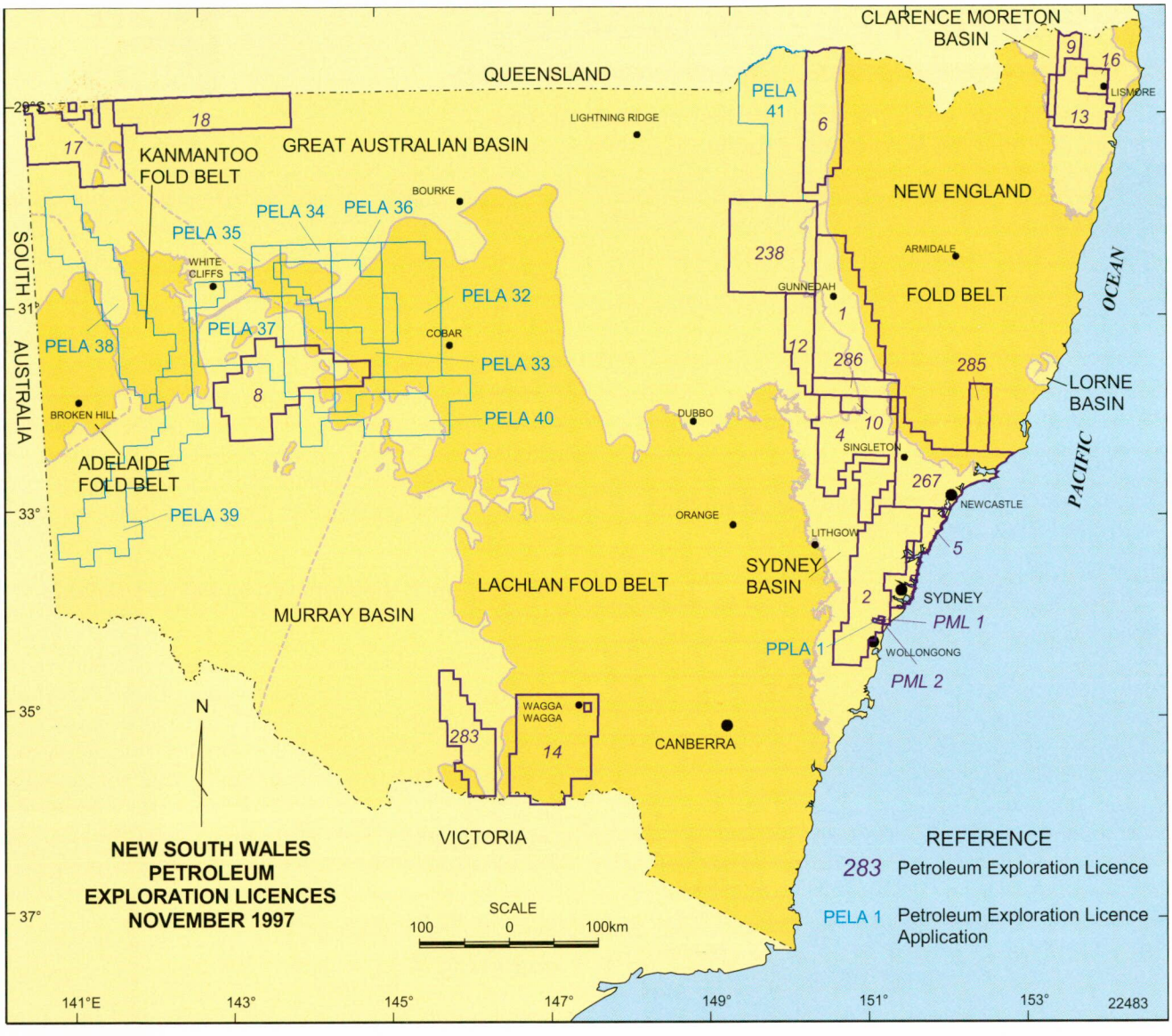
No	Applicant	Area (No of blocks)	Application date
PELA 32	First Sourcenergy Group Inc	136	28.04.1997
PELA 33	First Sourcenergy Group Inc	132	28.04.1997
PELA 34	First Sourcenergy Group Inc	132	28.04.1997
PELA 35	First Sourcenergy Group Inc	140	28.04.1997
PELA 36	Capital Energy N/L	101	26.05.1997
PELA 37	Capital Energy N/L	136	26.05.1997
PELA 38	Otto Oil P/L	140	21.07.1997
PELA 39	Go Resources (Aust) P/L	140	29.07.1997
PELA 40	Go Resources (Aust) P/L	140	29.07.1997
PELA 41	Strike Oil NL	122	23.09.1997

PETROLEUM MINING LEASES

No	Holder	Area (km^2)	Expiry date
PML 1	BHP Steel (AIS) P/L	28.5	12.05.2001
PML 2	BHP Steel (AIS) P/L	40.5	12.05.2001

PETROLEUM PRODUCTION LEASE APPLICATION

No	Applicant	Area (m^2)	Application date
PPLA 1	BHP Steel (AIS) P/L	8895	31.03.1995



MINE SAFETY REVIEW UPDATE

Emphasis has turned to the progress that the Task Groups have made under the Mine Safety Review.

The Minister for Mineral Resources, the Hon Bob Martin, announced after the Mine Safety Review Steering Committee meeting in October 1997, that excellent progress was being made with the implementation of the Mine Safety Review recommendations (refer *Minfo* **57**, pp 66-67).

The Review's Implementation Group is overseeing the work of four Task Groups, the New South Wales Minerals Council, and individual mine sites. Progress to the end of November 1997 is set out below.

Task Group 1: Introduction and Use of Remote Controlled Equipment Underground

The Task Group assessed all available information and prepared a report which was tabled at the Implementation Group Meeting in October 1997. The report stated that although a standard for the use of remote controlled mining equipment already exists (AS/NZS 4240), the standard is not well known within the industry and does not satisfy all requirements of Mine Safety Review Recommendation 15.

The Implementation Group accepted the option recommended by the Task Group that technical and procedural guidelines be produced to supplement the available guidance material. Draft guidelines and consultation with stakeholders were completed in late December 1997. Finalised guidelines were completed by 22 December. They will be promoted throughout the industry during January and February 1998.

Task Group 2: Performance Measures and Information Sharing

Task Group 2 reviewed the New South Wales Minerals Council guidelines on minesite occupational health and safety performance measurement and prepared a draft discussion paper on measures for industry occupational health and safety performance. A discussion paper and the options paper were circulated to stakeholders and comment was required by late December. Final recommendations were to be submitted to the Implementation Group by late January 1998 and an implementation plan will be completed in February. A final report on implementation will be prepared for the Implementation Group meeting in early April 1998.

Task Group 3: Risk Assessment, a Two-Tiered Regulatory Approach, Mine Safety Management Plans, and Contractor Issues

The Task Group has discussed the draft guidelines on contractor OH&S prepared by the New South Wales Minerals Council and has identified one outstanding issue, the role of a registration scheme for contractors. A report on discussions was presented to the Implementation Group in early December 1997 for consideration.

The Task Group reviewed and assessed Mine Safety Management Plan (MSMP) models and will prepare a work book to assist minesites by February 1998. The group reviewed the draft discussion paper on a new regulatory framework prepared for the New South Wales Minerals Council and presented an options paper to the Implementation Group at the early December 1997 meeting. The Task Group will consult stakeholders during January and February 1998 and will present a final report on the recommended principles for a new regulatory system to the Implementation Group in early April 1998.

Task Group 4: Inspectorate and Moura Related Issues

Task Group 4 completed a major progress report on its activities for the Implementation Group. The report details the progress made on all 20 of the Recommendations. It describes the changes to be made to the Mine Safety and Environment Division, including a new structure, resource requirements, and changes to work priorities and patterns. The report sets out work programs covering the stages of implementation for each recommendation until the new Divisional structure is implemented. The target date for restructuring is 1 July 1998.

MINESITES

Individual minesites are responsible for the implementation of 14 of the recommendations. The Implementation Group sent a questionnaire to all sites employing more than 4 people to assess the level of implementation and to assess what, if any, assistance sites might require. The responses have been assessed and the Implementation Group is considering further action to assist implementation.

NEW SOUTH WALES MINERALS COUNCIL

The council has completed its tasks except for the ongoing promotion of the *Guidelines for Contractor Occupational Health & Safety* and the detailed study of the safety impact of production bonuses. A survey on production bonuses and safety incentive schemes was circulated to minesites and responses were assessed in early December 1997. A report was submitted to the Implementation Group at its 22 December 1997 meeting. The Implementation Group is deciding on what, if any, actions are required to address any negative effects of these schemes.

For further information contact Nicole Webb or Michael Hill, Mine Safety Review Secretariat, on (02) 9901 8689, fax (02) 9901 8468.

PROPOSED RETRAINING FOR MINE MANAGERS

In a lively discussion between a panel of those involved in the setting up of proposed requirements for the maintenance of competencies by mine managers and over 60 industry participants, overall approach and detail of the proposed competencies were debated, challenged and clarified.

The open forum took place during an industry workshop in October 1997 at the Australian Maritime Museum at Darling Harbour in Sydney. The workshop was arranged by the Department of Mineral Resources for industry to comment on the proposed competency standards.

Before the open forum, participants heard from other industries' approaches to certification and maintenance of competencies, and were also given a mining industry perspective.

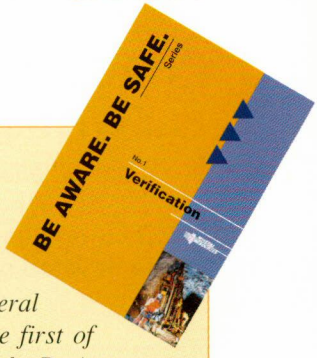
Professor Dennis Else, Chairman of the Mine Safety Review Implementation Group, facilitated the forum. He said that the workshop had questioned the whole process. He asked the workshop if there were a better way — would the system add the best value to the end point, or was there an alternative process? The meeting was not to be considered an end point in the consultation process, as members of the panel wanted further information and opinions from industry.

For further information on the proposed maintenance of mine manager competencies contact Keith Chilman, Regional Inspector of Mines, on (02) 9901 8456, fax (02) 9901 8468.

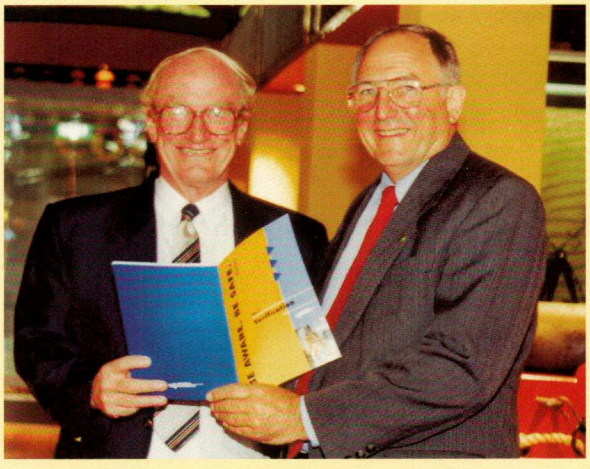
Below: The panel members responsible for setting up the proposed retraining of mine managers. From left, Greg Goodsir, the Above Ground Mine Managers Board; Professor Dennis Else, Chairman of the Mine Safety Review Implementation Group; Tony Ingram, Institute of Quarrying; Graham Terrey, Director, Mine Safety and Environment, Department of Mineral Resources; Noel Parish, NSW Mining Industry Advisory Body; Bob Gibbons, Coal Mine Managers Qualification Board; and Ross Garling, the Australasian Institute of Mining and Metallurgy

(photos by Studio Commercial Photography Pty Ltd)

BE AWARE. BE SAFE.



After closing the industry workshop, the Hon Bob Martin, Minister for Mineral Resources, launched Verification, the first of the safety booklets to be published in the Be Aware. Be Safe. series. The series has been devised to help understand and implement the General Rule, 1994. Verification has been produced to assist mine managers, supervisors and operators to meet the monitoring and review requirements of the General Rule. Verification is a way for mining operations to test the effectiveness of their own safety and health management systems.
For further information on Verification, contact Bruce Kremmer, Senior Inspector of Mines, Armidale Office, on (02) 6770 2101, fax (02) 6770 2121.
The booklet costs $29.95. To obtain a copy, contact the Information Counter at the Head Office of the Department at St Leonards on (02) 9901 8269, fax (02) 9901 8247.



Above: The Minister for Mineral Resources, Mr Bob Martin, and Bruce Kremmer, Senior Inspector of Mines, at the launch of the Be Aware. Be Safe. Series

CHALLENGES FOR ELECTRICAL ENGINEERS

Electrical engineers in the mining industry need to be aware of new regulations and to develop new understandings and competencies in the coming year.

'Issues for 1998' was the theme of the 1997 Electrical Engineering Safety Seminar held at Penrith in early November 1997. While Australian electrical engineers have built a reputation for safety that is the envy of the world, 1998 and beyond will see a new era which will challenge them in many ways.

John Waudby, Senior Inspector of Electrical Engineering, who officially opened the seminar, outlined some of the changes that electrical engineers in the New South Wales mining industry could expect. The most pivotal is the move away from a central role by government to leadership from electrical engineers in the private sector. Other major changes are:

- The influence that the Gretley tragedy will have on the new regulations expected to come into force in 1998;
- The introduction of higher energy electrical distribution in underground coal mines, at voltages of 22 000 and 33 000 volts, to cater for larger machinery. More microprocessor controls, and greater machine complexity;
- True remote control, where operators are located well away from the working face;
- National consistency in competency requirements and safety legislation;
- Traditional boundaries will be broken down by:
    - * greater teamwork and changed management
    - * a more sophisticated workforce
    - * more temporary and casual workers.

The overall challenges for engineers will be to improve electrical safety in coal mines and to spread the current achievements and future improvements into the metalliferous sector and into the general mine workforce.

The themes that John Waudby raised were addressed during the seminar by Departmental, industry and educational presenters. Some of these are briefly set out below.

THE NEW REGULATIONS

Stan Maginnis, Inspector of Electrical Engineering, outlined the new draft regulations for the industry. He emphasised that changes to existing regulations will have far reaching effects on the way the mining industry operates. The regulations pursuant to the Coal Mines Regulation Act 1982 No. 67 have been reviewed and sent to parliament for drafting for legislation. Following legal assessment of the regulations by a parliamentary committee, they will be signed off by the Chief Inspector of Coal Mines, then gazetted and given a date for becoming effective.

The Department wants industry to be involved in making changes at minesites now, so that they are ready for the implementation of the new regulations in 1998.

A CASE STUDY OF DEVELOPMENT AND IMPLEMENTATION OF PROCEDURES

Drayton Coal Pty Ltd has recently developed its own Mine Managers Scheme for Isolation Procedures, and in doing so has provided a good example of leadership by industry for on-site safety.

The company believes that the wider umbrella of duty of care under the New South Wales Occupational Health and Safety Act prevails over even 'compliant' schemes that are acceptable under the Coal Mine Regulation Act. It considers that risk identification and management are at the forefront of changes in the mining industry.

The way the company approached the development and implementation of new isolation procedures may be useful for other companies.

CASE STUDY OVERVIEW

Company engineers have found alternative ways to control what have been traditional risks in the workplace, in this instance isolation procedures. The process that the company developed and used, and how it implemented the procedures were important lessons from the project for those involved.

Drayton engineers realised the need for changes to existing isolation procedures following a review which showed that the scheme did not take care of risks, was very legislative, hard for operators to understand and in some parts, ambiguous in meaning.

When the engineers understood what was needed, they formed a working group. Key roles in the working group were those of facilitator, challenger and detail checking. A key element in the process was wide consultation with the mine's workforce over the twelve month duration of the project.

Boundaries were decided which set the criteria for direction checking. Boundaries included practicality, a balance built into the scheme between risk and the level of prescription, and implementation of training. Implementation of training was a key area in which the previous scheme had not succeeded.

The 60 issues identified in the review as needing resolution were addressed and checked throughout the project.

The group consulted widely with external consultants, other mines in the Shell group in Queensland and New South Wales, the Department of Mineral Resources Inspectorate and other industries.

The scheme was implemented through competency based training. The basic assumptions in doing this were:

- Do not assume any level of competency
- Use workplace assessment
- Use scenarios
- Ensure quality, consistency and integrity
- Change in all training – probe, ask
- Deal quickly with 'fit for purpose' matters.

Key learnings on hazard identification and risk assessment were:

- Do not ignore issues
- Use the Inspectorate
- Use competency based training
- The scheme is only as good as review and ongoing training.

COMPETENCIES FOR HAZARDOUS AREAS

The important subject of some key electrical engineering competencies is being addressed through two projects in progress in Queensland and New South Wales. Bob Kennedy, a member of the New South Wales Coal Mining Qualifications Board and convenor of the Electrical Engineering Panel, spoke on the aims of the projects.

The first of these projects is to improve the accessibility and availability of electrical skills training, assessment and accreditation in the Australian black coal industry.

The Queensland Board of Examiners and the New South Wales Coal Mines Qualifications Board have been working together to formulate common subjects which would be accessible in both states and recognised by both boards as satisfying the educational prerequisites for statutory electrical certificates. On acceptance, common subjects will become part of an electrical diploma course which would give the professional accreditation of mine electrical engineer to AQF level 6.

In the second project, a standards committee has overseen the development of 14 competencies for hazardous areas which will become part of the National Competency Standards. The resource material for the hazardous areas competencies will be assembled into 14 training packages and it is planned to submit them to the two state qualifications boards, to the National Mining Industry Training Advisory Board and to the state mining ITABs for review and accreditation.

The learning material should stimulate both a rise in the number of qualified mine engineers as well as mine electricians with an increased depth of knowledge in electrical safety. One of the major benefits of the learning material will be its use to enhance the training and competence of face workers in the recognition and consequences of damage or other conditions of danger.

RISK CONTROL?

Corrie Pitzer, Principal, SAFEmap, challenged the seminar with a thought provoking talk on the risk of disasters. He asked if the mining industry has the ability to prevent disasters effectively, or if is it faced with increasing risk as a result of the increasing complexities of mining technology, management systems and practices.

It is possible that perceived improvements in risk control may be an illusion, and that the likelihood of mining catastrophes may be exponentially increasing.

Risk Definition

Pitzer contends that the right solutions are being applied to the wrong problems. He says that the focus is technological and procedural, whereas the real problem is one of production cultures 'ripe for error and failure'.

Risk is not something physical that can be precisely measured and managed. Risk management has created the illusion that risk can be quantified on the basis of probability, exposure to risk, and from the likely consequences of accidents occurring.

Risk is, rather, a social construction. Everyone has a unique set of assumptions and experiences that shape their interpretations of objects and events. People find what they expect to find.

The social organisation of mistakes

There are two main reasons why operators, supervisors and/or managers should not automatically be blamed for disasters. Firstly, the complexity of even the most trivial events renders any operator or manager instantly incompetent to deal with the situation. Secondly, operators and managers are often forced to carry on a daily basis as if nothing is wrong, even though they are continually faced with evidence that something is wrong — a process in which abnormalities are 'normalised'.

Disasters happen because mistakes are made, but it is not a simple case of human error. Mistakes are 'socially' organised and systematically produced. Their source can be found in routines and the taken-for-granted aspects of organisational life.

Three processes lead to disasters: an organisation's production of culture, its culture of production and its structural secrecy.

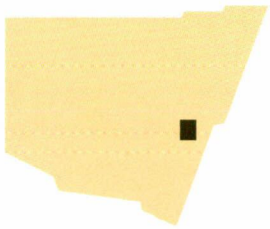
Organisations suffering disasters generally suffer from failures of foresight; Disasters have often had long incubation periods during which warning signals have been ignored, rationalised, or accepted as normal.

Organisations need mechanisms to counteract these organisational influences. Ensuring that the culture of an organisation does not produce the social readiness for a disaster requires bold and comprehensive actions from management. It has to allow the organisation to be subjected to severe 'shocks and criticism' to continually break the growth of complacency.

Tony Ryan, District Inspector of Coal Mines, spoke on the developing use of remote control mining equipment, and Stephen Burke of Moore Products Co., spoke on the safety advantages of programmable logic controllers.

For further information, contact John Waudby, Senior Inspector of Electrical Engineering, Cardiff Office, on (02) 4954 7899, fax (02) 4954 8019.

REHABILITATION OF THE ABANDONED GLEN AYR MINE SITE



The Environment Unit of the Department is trialling a passive anoxic limestone drain system in the rehabilitation of the abandoned Glen Ayr coal mine.

HISTORY

Glen Ayr is an old underground mine in the Greta Coal Measures at Testers Hollow near Maitland. It was abandoned in the 1940s because of extensive flooding and collapse of the workings. Acidic saline minewater began seeping from the underground mine entry in the early 1990s. An additional concern was the possible effect of the minewater on Testers Hollow, a semi-permanent wetland immediately downstream of the minesite, which is a sanctuary for local and migratory birdlife.

In 1993, the Environmental Geochemistry Laboratory of the Department began monitoring the quality of minewater draining from the site. Monitoring confirmed acid minewater with moderate salinity was draining into Testers Hollow.

REHABILITATION METHODS

Following an assessment of the various treatment technologies available, the Department undertook a remedial action plan with funding provided by the Derelict Mined Lands Rehabilitation Program.

The anoxic limestone drain under construction at Glen Ayr. When sealed from the atmosphere, the limestone will neutralise the acidic water seeping from the old mine

The aim of the plan was to improve the quality of water leaving the site by reducing acidity and iron content, and to rehabilitate all areas of disturbance.

The Environment Unit of the Department is now trialling a passive minewater treatment system designed to improve the quality of minewater leaving the minesite. The treatment system includes an anoxic limestone drain and constructed wetland (figure 20).

An anoxic limestone drain is a sealed trench (usually below ground) which contains interlocked rubble of pure limestone (figure 21).

The water entering the limestone drain must be deficient in oxygen. This is achieved by the decomposition of organic matter, in this case chicken manure, which has been placed in the inlet dam. Available oxygen is consumed by the decomposing matter before water can pass through the drain. Within the drain, limestone reacts to neutralise the acidic water. The high concentrations of iron, also in the water, remain in solution in the absence of oxygen, and run through to the wetland where the iron oxidises and precipitates. The drain does not remove salinity, so salt tolerant vegetation must be chosen for rehabilitation.

The passive anoxic limestone drain system should last 30 years at design projections. After this time, the drain will need to be replenished with new limestone.

There has been limited investigation of the science and practicality of anoxic limestone drains in Australia, and this project is one of the first in New South Wales.

REMEDIAL ACTION PLAN

The remedial action plan has involved three key stages of improvement. They are:

Stage 1 (1995)

A spillway and large secondary dam were constructed to accommodate overflows from the mine entry. Herringbone cross banks, which were joined to a central spine drain, and revegetation with tolerant grasses and trees, stabilised the site from further scalding and degradation. Perimeter fencing was provided to restrict human, vehicular and animal access.

Stage 2 (1996)

Earthworks were completed on the dam embankment to maintain water storage at the old mine entrance and provide a trickle pipe at full storage level.

A permanent artificial wetland was constructed below the seepage which would simulate the conditions and function of a natural wetland system. Species tolerant of the acidic and saline conditions were planted. The wetland enables evapotranspiration and the oxidisation and precipitation of

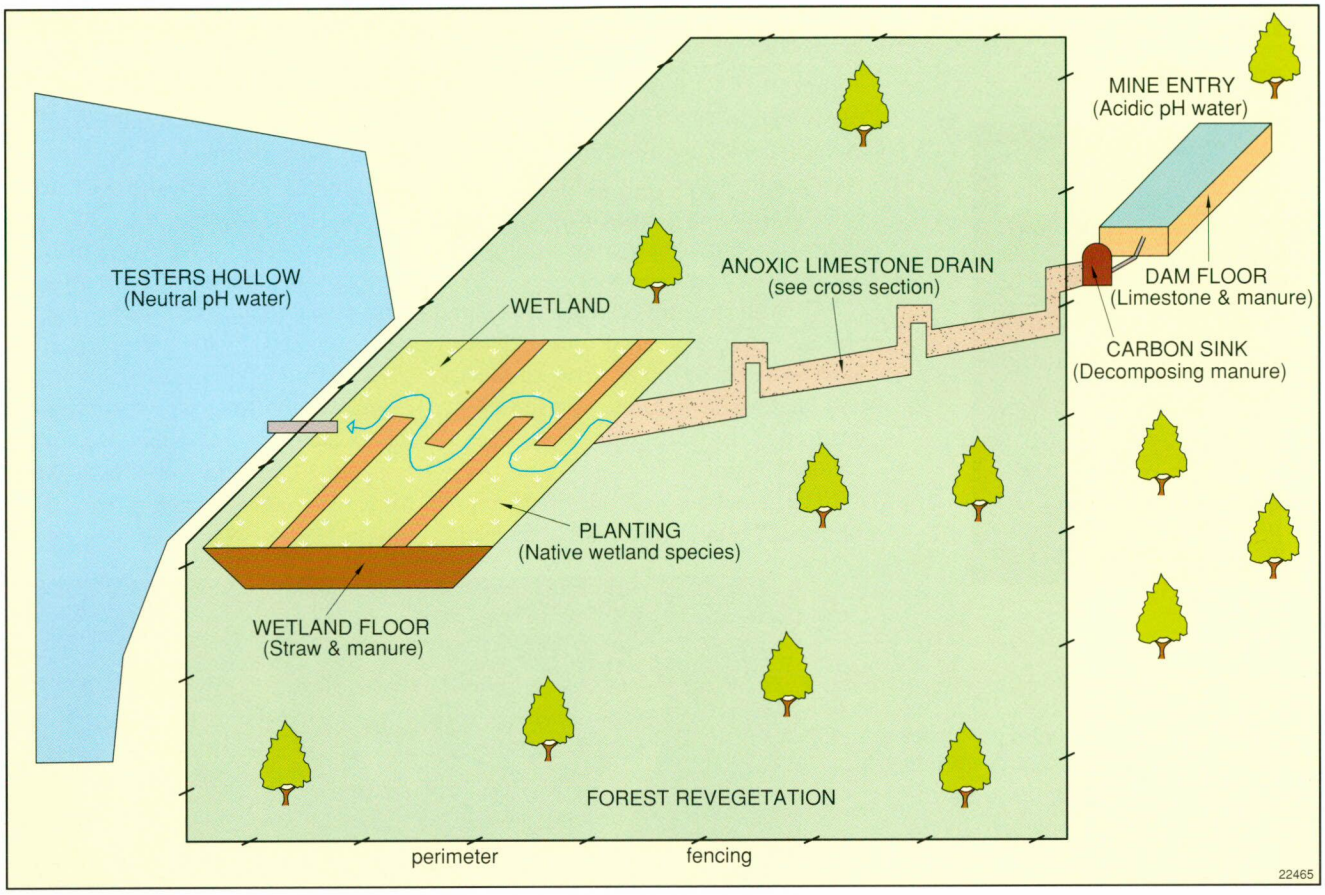


Figure 20. Plan of the rehabilitation at the Glen Ayr minesite between 1995 and 1997

metals contained in the water stream from the anoxic limestone drain. It also provides numerous ecological benefits to wildlife.

Stage 3 (1996–97)

Construction of the anoxic limestone drain between the flooded mine entry and wetland. The drain was installed a metre below the ground surface and was connected to the wetland via a trickle pipe. As the seepage flows through the drain and constructed wetland, the acid is neutralised and the iron removed, but salinity remains.

Following construction of the drain, the total disturbed area was ripped and regrassed.

The Catchment Advisory Unit of the Department of Land and Water Conservation was employed by the Department of Mineral Resources to carry out remediation earthworks. All work was designed and funded through the Derelict Mined Lands Rehabilitation Program.

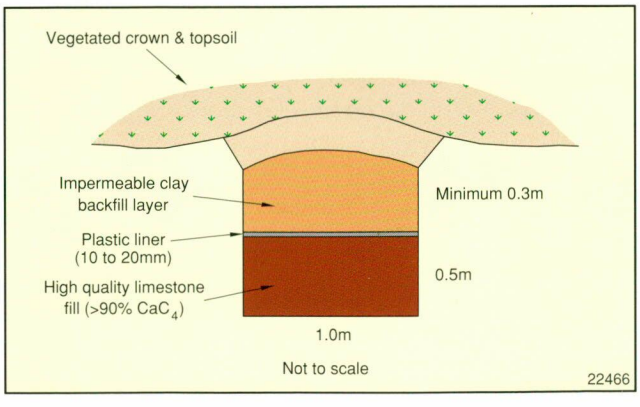


Figure 21. Cross section of the limestone drain

COMMUNITY CONSULTATION AND MONITORING

The community has been consulted throughout the monitoring, investigation and implementation of the Remedial Action Plan to ensure objectives are compatible and that local residents are informed.

Community consultation has been facilitated through the Wallis Creek Catchment Management Committee.

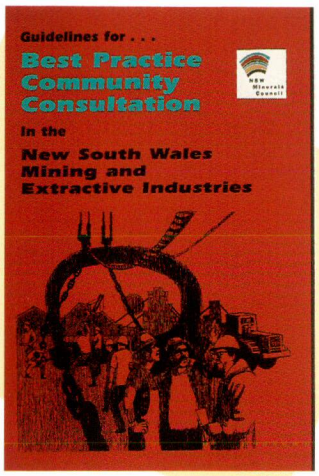
The Department is proposing to plant over 100 native tree seedlings in early autumn 1998 to increase revegetation and evapotranspiration in the area.

The monitoring of the project has continued since its inception and results of water quality consistently show an improvement of pH from 2.5 (acidic) at the flooded mine entry to 7.5 (neutral) at the wetland's outlet. By using piezometers, monitoring has also shown negligible dissolved oxygen levels within the limestone drain.

The water monitoring and community consultation programs will both continue in the future to ensure the contingency and success of the rehabilitation project for the Glen Ayr site.

For further information contact Greg Summerhayes, Principal Environmental Officer, or Carl Bagnall, Environmental Officer, at the Department's Singleton Office, on (02) 6572 1899; fax (02) 6572 1201.

BEST PRACTICE IN COMMUNITY CONSULTATION



New guidelines to help develop effective working relationships between the New South Wales mining and extractive industries and the community have been released by the New South Wales Minerals Council.

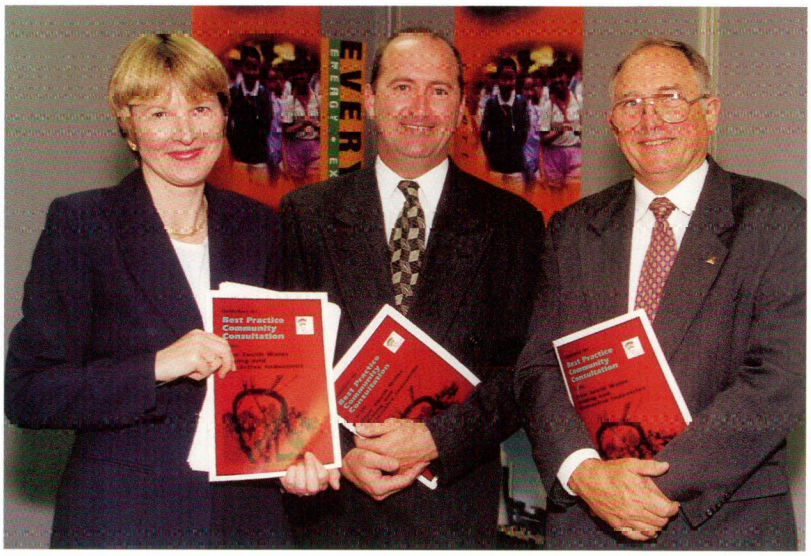
Guidelines for Best Practice Community Consultation in the New South Wales Mining and Extractive Industries recognise that community consultation is an ongoing process from the time that a project is conceived, as well as during commissioning, operation and decommissioning.

The guidelines were launched by the Minister for Urban Affairs and Planning, the Hon Craig Knowles in October 1997. At the launch, the Minister noted that community consultation and participation are at the core of the environmental and planning system in New South Wales. The guidelines aim to ensure that when issues arise as part of project development and operation they are addressed and resolved.

The Minister believes that companies should actively find community members who are interested in a project, and undertake genuine consultation using early, honest and clear communication.

The guidelines were prepared for the Minerals Council with assistance from State government agencies and members of communities where mining is taking place. They define best practice for community consultation within a theoretical framework of risk communication. Their practical emphasis includes when to use different forms of consultation and how to prepare for, and proceed with, consultation.

The guidelines are available free of charge. For further information, or to obtain a copy, contact Jane Robertson, Executive Director, New South Wales Minerals Council, on (02) 9267 6488, fax (02) 9264 1121.



(Photo courtesy New South Wales Minerals Council)

The Chief Executive Officer of the New South Wales Minerals Council, Ms Jane Robertson, left, with the Minister for Urban Affairs and Planning, Mr Craig Knowles and right, the Minister for Mineral Resources, Mr Bob Martin, at the Guidelines launch

ORANGE WARMS TO MINERALS INDUSTRY MESSAGE

The New South Wales minerals industry has received an encouraging response to an exhibition held in Orange, the centre of the current central western exploration boom.

Attendance at the industry's stand at the Orange Field Days, held from November 11-13 last year, was the highest it has been in the four years the industry has been exhibiting, with reaction from the community being overwhelmingly positive.

The Orange Field Days are the largest agricultural show held in the central west and one of the biggest in the state.

The minerals industry stand was a joint project of the Department of Mineral Resources, the New South Wales Minerals Council and mining companies operating in the region, including Newcrest Mining Ltd and North Ltd.

The stand, the most ambitious to date, featured a simulation of an underground mine (the 'Very, Very, Very Small Mine'), computer games, information on the history of gold mining, demonstrations of environmental monitoring, company displays and free mineral samples, including opal potch from Lightning Ridge.

Overall attendance at the industry stand was estimated at 5000.

The industry stand at next year's show, which will have longer opening hours and will run from Thursday to Saturday rather than mid-week, should be even bigger and better.

For further information contact Bruce Harris, Public Relations Officer, Department of Mineral Resources, on (02) 9901 8221, fax (02) 9901 8246.

TEACHERS LEAVE NO STONE UNTURNED

Hundreds of teachers and their students will benefit from the Department's Londonderry Core Library open days held in August 1997.

Teachers were invited to select from thousands of excess maps and publications produced by the Department. They were particularly keen to obtain specially prepared rock and mineral specimen sets and to choose different mineral and fossils from over 150 pallets of specimens.

The teachers arrived from all over the State and literally filled their cars and trailers to the limit. They commented that this was the most useful collection of resource materials ever provided for the teaching of geoscience in high schools.

The event was sponsored by the Geological Society of Australia and by the Department of Mineral Resources' Information and Customer Services Branch.

For further information contact John Leeks, Manager, Information and Customer Services, on (02) 9901 8298, fax (02) 9901 8246.

(photos by IC&S staff)

Above and left: Teachers were delighted to be able to freely take teaching resource materials. Above, Brian Johns from the University of Wollongong stocks up on maps and publications. The teachers at left are inspecting rock specimens for use in the classroom

NEW MINERAL INDUSTRY ANNUAL PUBLICATION

The Department is preparing a new annual review, the *NSW Mineral Industry Annual 1998*, scheduled for publication in July 1998.

The new publication will replace both the *Mineral Industry Review* and *Mining Industry Directory* while retaining some of their features. It will also be the vehicle for publishing annual New South Wales mineral statistics. The annual will be a complementary volume to the comprehensive *NSW Coal Industry Profile*.

The annual will be a popular reference for people and companies involved in the New South Wales minerals industry, and will further promote mineral development investment in the State. The annual will include:

- A New South Wales mineral industry overview chapter, including summary data on industry trends and outlook, production, mineral exports, new mines and projects, exploration, environmental management and minerals processing,
- An energy minerals chapter, including summary data on coal and petroleum,
- Information on metallic minerals and metals, including summary data on major commodities, new developments and outlook,
- Industrial minerals, including summary data on major commodities, new developments and outlook,
- Dossiers on significant mines (metallic and industrial minerals) and an index,
- Minerals statistics for 1996–97,
- Extractive industries overview and index,
- Suppliers index,
- Reference information, including government and industry organisations, major exploration companies and general index.

For further information on the content of the annual contact Garth Holmes, Principal Adviser, Minerals on (02) 9901 8480, fax (02) 9901 8493.

For further information on advertising and publication contact Peter Walker, Manager, Publishing and Marketing, on (02) 9901 8230, fax (02) 9901 8246.

NEW DRILL CORE AVAILABLE FOR INSPECTION

The drill core listed below was received by the Department of Mineral Resources Core Library at Londonderry during the period May to November 1997.

Prospect (Area)	Tenement	Company	Details	
Arrawa-CNW3	EL3297	CRA Exploration Pty Ltd	Diamond core	1 hole
Bobadah/Walkers Hill	EL0774	CRA Exploration Pty Ltd	Diamond core	1 hole
*Burri CNW1	EL3465	CRA Exploration Pty Ltd Pasminco Australia Ltd	Diamond core	2 holes
Carpina Ridge	EL3242	CRA Exploration Pty Ltd	Diamond core	1hole
Doradilla	PL161, 163, 201, 202, 245, 246	Aberfoyle Australia Pty Ltd	Diamond core	4 holes
*Edendale	PEL6	Maple Oil NL	Cuttings and one piece of core (from 568.5 m – 568.7 m)	
Elecom Eraring	A254	Pacific Power	Diamond core (Box Nos 23, 24, 32, 33, 38, 39, 40, 45, 46, & 49 missing)	1 hole
Elsinore	EL1144	CRA Exploration Pty Ltd	Diamond core (The first 16 core boxes are missing from DD79EC1)	3 holes
Gannans Tank	EL2825	CRA Exploration Pty Ltd	Diamond core	1 hole
Happy Jacks	EL2065	CRA Exploration Pty Ltd Blue Circle Southern Cement Ltd	Diamond core	2 holes
Hilltop	EL1078	CRA Exploration Pty Ltd	Diamond core	1 hole
Ironbark	EL2065	CRA Exploration Pty Ltd	Diamond core	1 hole
Kershaw	EL2065	CRA Exploration Pty Ltd	Diamond core	1 hole
Kershaw	EL2065	CRA Exploration Pty Ltd	Diamond core	2 holes
Knightvale	EL0963	CRA Exploration Pty Ltd	Diamond core	1 hole
Laurie's Backyard		Dept of Mineral Resources	Diamond core	1 hole
*LittleBillagoe	EL3844	CRA Exploration Pty Ltd	Diamond core	1 hole
Mt Dijou/Wilga Downs	EL1138	CRA Exploration Pty Ltd	Diamond core	1 hole
Mt Drysdale	EL2367	Preussag Australia Pty Ltd	Diamond core	2 holes
*Nymagee	ML53, ML90	CRA Exploration Pty Ltd	Diamond core	1 hole
OsterleyDowns	EL0776	CRA Exploration Pty Ltd	Diamond core	1 hole
Red Tank	EL1796	CRA Exploration Pty Ltd	Diamond core	1 hole
Restdown	ML5995, ML5996	Cobar Mines Pty Ltd	Diamond core	1 hole
Rosevale	EL2147	CRA Exploration Pty Ltd	Diamond core	1 hole
South Durnings	EL1078	CRA Exploration Pty Ltd	Diamond core	1 hole
Tara Mine	EL0817	CRA Exploration Pty Ltd	Diamond core	2 holes
Tindarey	EL2951	CRA Exploration Pty Ltd	Diamond core	2 holes
Wagga Tank	EL2031	Cyprus Minerals Australia Homestake Australia Ltd	Diamond core	1 hole
Wagga Tank	EL2031	Homestake Australia Ltd Amoco Minerals Australia Co Ltd	Diamond core	4 holes
Wagga Tank	EL2031	Homestake Australia Ltd	Diamond core	1 hole

*Confidential

For further information and to arrange inspection contact Steve Hall, A/Core Library Manager, on (02) 4724 4997. Where core is marked as confidential, permission of the company must be obtained before inspection can be arranged.

MINDEV 97 EXHIBITION

The Department participated at an exhibition held in conjunction with the recent major international conference on mine project development, 'MINDEV 97'. The conference and exhibition were held at Sydney's Hilton Hotel, from 24–26 November 1997. They were hosted by the Australasian Institute of Mining and Metallurgy . The conference attracted an audience of about 200 delegates who showed considerable interest in the Department's stand at the adjoining exhibition. The stand featured displays of the Department's activities in enhancing mine safety and environmental management in the State's mineral industry, as well as promoting investment interest in the Lithgow Minerals Processing Park and the Mount Arthur North coal tender area.

For further information, contact Garth Holmes, Principal Adviser, Minerals, on (02) 9901 8480, fax (02) 9901 8493.

INVESTMIN UPDATE

InvestMin, the regular newsletter providing timely information about minerals investment developments and opportunities in New South Wales, is proving to be very popular with industry readers. It communicates such news quickly to key analysts, stockbrokers, investment advisers and specific companies within Australia and internationally, thereby increasing awareness and promoting minerals investment interest in New South Wales.

To date, two issues of *InvestMin* have been issued and these have generated over 60 requests for further information on featured items.

For further information (or to receive *InvestMin*), contact Garth Holmes, Principal Adviser, Minerals, on (02) 9901 8480, fax (02) 9901 8493.

PUBLICATIONS RELEASED OCTOBER – MID DECEMBER 1997

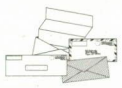
GEOLOGICAL MAPS

Reprint of Geological Map of New South Wales 1:3 000 000 (1967 edition)	$2.00

MINFO No 57 (subscription gratis) per single purchase $5.00

GENERAL

Department of Mineral Resources Annual Report 1996/97	Gratis
Safety in Mines — The Role of Geology. Proceedings of a Symposium held at Newcastle, New South Wales, 24-25 November 1997, edited by Rod Doyle, Julie Moloney, John Rogis & Mark Sheldon.	$40.00



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