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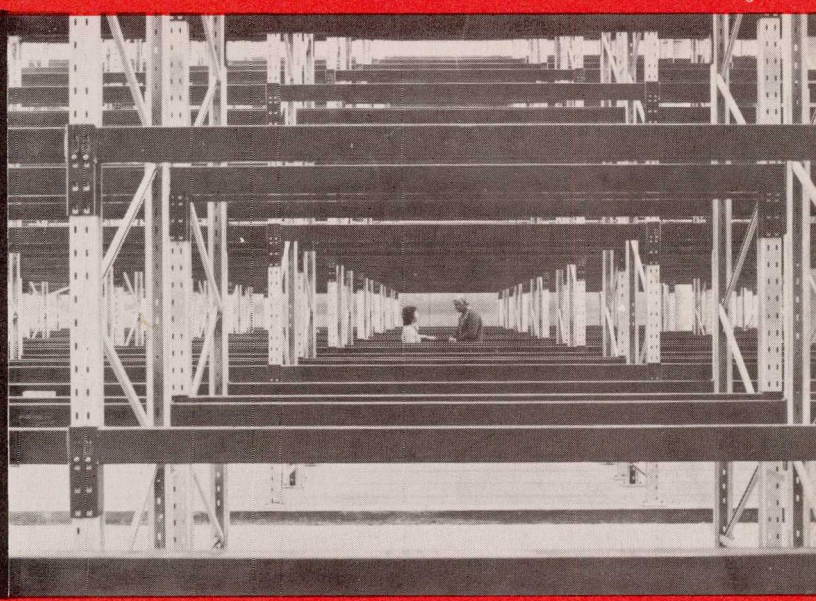
New South Wales Mining and Exploration Quarterly

No. 4 JANUARY–MARCH 1984



DEPARTMENT OF MINERAL RESOURCES

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New South Wales Mining and Exploration Quarterly No. 4

Contents

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MINERALS

NEW DEVELOPMENTS IN DOWNHOLE ELECTRICAL LOGGING

In 1982, the Department of Mineral Resources began a research project to develop an effective geophysical logging tool for mineral exploration. The project is jointly sponsored with the Australian Mineral Industries Research Association Ltd (AMIRA). The New South Wales Department was the first state or federally funded mineral resources department to receive support from AMIRA, which acts as a co-ordinating body for sponsorship funding by major exploration companies in Australia.

The product will be a **continuously** recording, computer controlled, downhole resistivity and induced polarization system. This represents a significant leap in technology from systems which can only make measurements at discrete "stations" in the hole.

The sponsor companies for this project are:

* The Broken Hill Proprietary Co. Ltd
* Carpentaria Exploration Co. Pty Ltd
* CRA Exploration Ltd
* CSR Ltd
* Esso Australia Ltd
* Renison Goldfields Consolidated Ltd
* Western Mining Corporation Ltd

ELECTRICAL BOREHOLE LOGGING

The Principle

A mineral borehole is likely to intersect a very complex, partly metamorphosed and folded geological sequence, with both host rocks and mineralization occurring as distinctly three-dimensional units which may persist away from the borehole from between a few centimetres to hundreds of metres. It is therefore advisable in mineral boreholes that small electrode spacing "physical property" array measurements be made in conjunction with larger spacing "exploration" array measurements. These latter measurements are aimed at determining the persistence of units away from the borehole as well as detecting mineralization adjacent to, but not intersected by the hole.

Electrical logging therefore, effectively extends the exploration diameter of a borehole, at relatively minor additional expense (i.e. approximately 10% of initial drilling costs).

Present Position in Australia

The measurement of induced polarization (IP) and resistivity in mineral boreholes in Australia is conducted infrequently and is

normally obtained using standard surface geophysical instrumentation and a makeshift cable arrangement. This type of system only allows for measurements to be made at discrete stations in the drill hole. A continuous log cannot be obtained and therefore adequate definition of rapidly changing electrical rock properties is not possible.

At present no electrical logging system available in Australia can provide continuous "physical property" array measurements and "exploration" array measurements. Such systems are only beginning to be developed in the United States, and will probably take some years to become available to Australian industry.

THE NEW LOGGING SYSTEM

The research has involved the design and development of specialized computer controlled instrumentation which allows the geophysical logging measurements to be automated.

Primary requirements of the system are:

* continuous recording of measurements downhole (i.e. reading every 5 cm)
* stable transmitting of current at either AC or DC frequencies over a range from 1 μA to 0.5 A.
* accurate recording of resultant voltages (to microvolt levels).

To ensure that stable electric current is transmitted into the ground and that accurate digital full waveform recording of the resultant voltage is possible, totally new circuit concepts have been developed.

The system has a facility to plot the geophysical parameters as a "parameters versus depth" graph for direct comparison with any geological log available. Other important aspects of the project are the development of field techniques, and of computer programs to control measurement procedures and plotting and interpretation of the data.

FIELD RESULTS

A prototype computer-automated logging system was first tested in May 1983 and successful measurements of continuous logs were obtained in mineral and engineering holes.

Figure 1 gives an example of the continuous logging measurements that are now being made and shows the usefulness of this type of information in assessment of the geological log from a mineral drill hole.

The figure illustrates a graphic geological log of a borehole that intersects the main massive sulphide lens at Mount Bulga, near Orange, New South Wales. The format of the geophysical logs

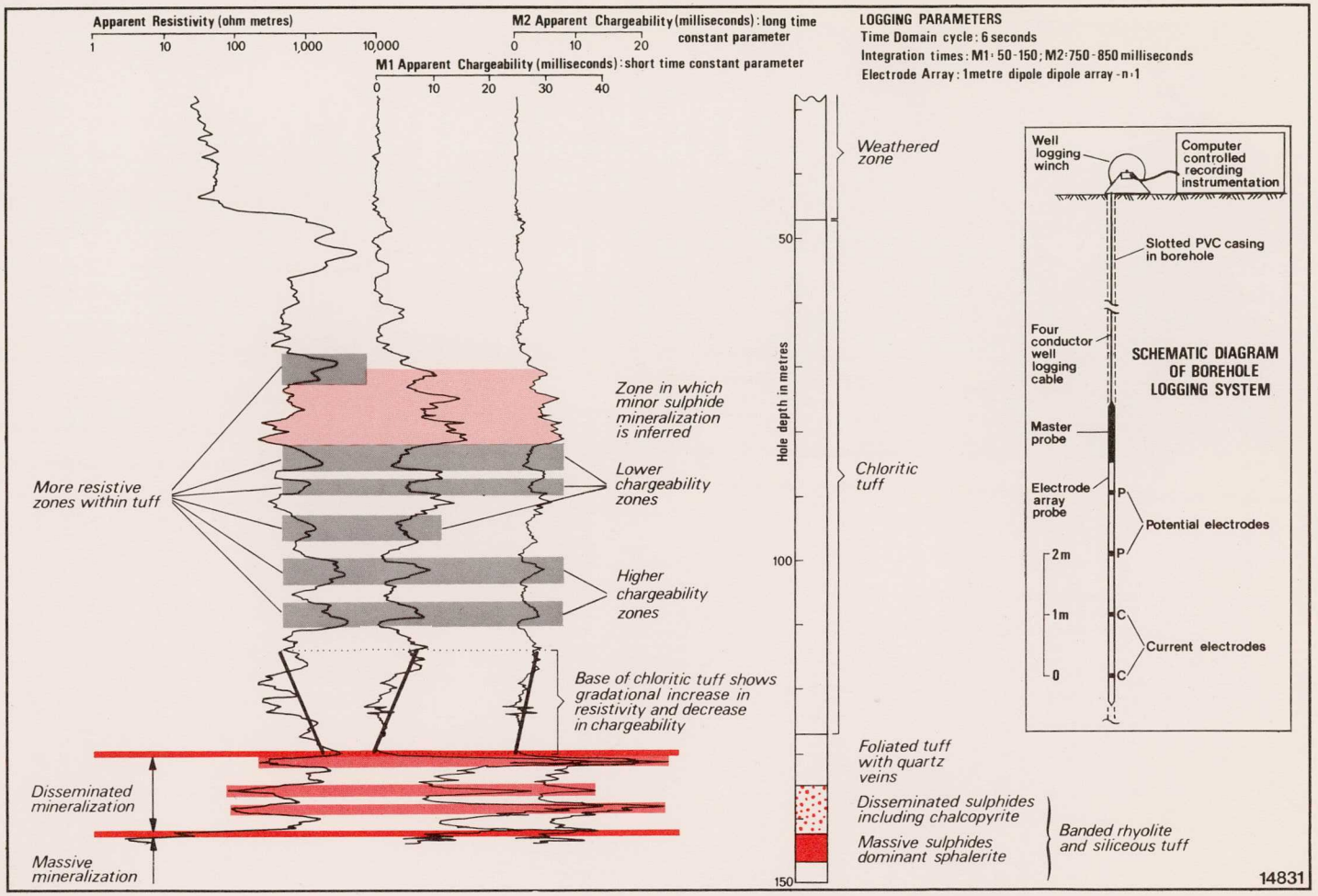
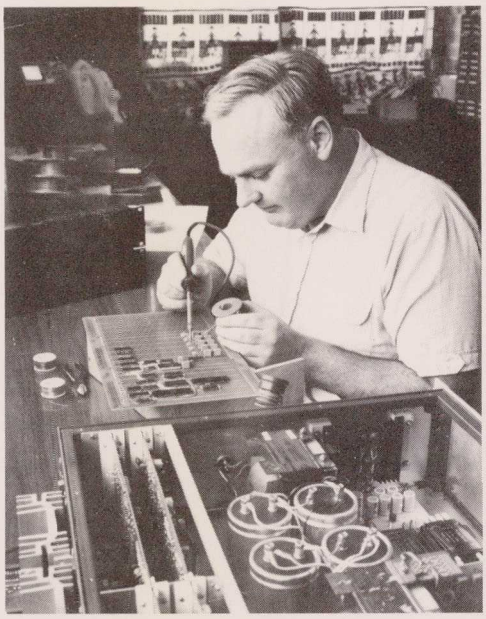


Figure 1. Continuous logging measurements of a borehole at Mount Bulga, near Orange

shows an apparent resistivity log plotted on a logarithmic scale and two apparent chargeability or IP logs which represent short and long-time constant IP parameters.

The geological log for this hole is very sparse in its description of the core. It is readily seen that the continuous apparent resistivity and IP logs yield a wealth of information on the variations in electrical properties of units such as the chloritic tuff which is geologically logged as a thick homogeneous unit. The massive sulphides are detected as a very low resistivity excursion on the logs. The IP measurements also suggest that sulphides occur in sections of the hole that have not been recognized as sulphide-bearing on the geological log.



David Daggar, Technical Officer of the Geophysics Section, designed and constructed all instrumentation for the project. He is seen here constructing the digital receiver module

Strong IP anomalies on the M1 log are related to the major concentrations of sulphides below about 130 m. The M2 log shows that the polarizable material causing these anomalies has a long time constant which is typical of this type of sulphide mineralization.

The final logging system is now nearly complete, and extensive borehole logging surveys will be conducted in 1984 to test this new automated equipment and demonstrate its benefits to the Australian exploration industry.

For further information contact E. Tyne, Geophysicist, on (02) 240 4169.

COMMODITY REVIEW — CLAY

New South Wales possesses considerable clay resources, and their exploitation makes a substantial contribution to the economy of the State.

Most clay types are already produced in large quantities. However, potential still exists for further development and investment to meet future demand.

It should be emphasised that a number of factors strongly influence the economics of clay mining — in particular, transportation, land acquisition, processing, fuel costs, and capital investment.

INTRODUCTION

Clay can be broadly defined as a natural, earthy, fine-grained material composed largely of crystalline, hydrous silicate minerals, i.e. the clay minerals. Most clays can be assigned to one of three main groups:

* **low-cost clay**
* **kaolin**
* **bentonite (and fullers earth)**

These clay groups will be reviewed in this and subsequent issues of *Minfo*.

Low-cost clays

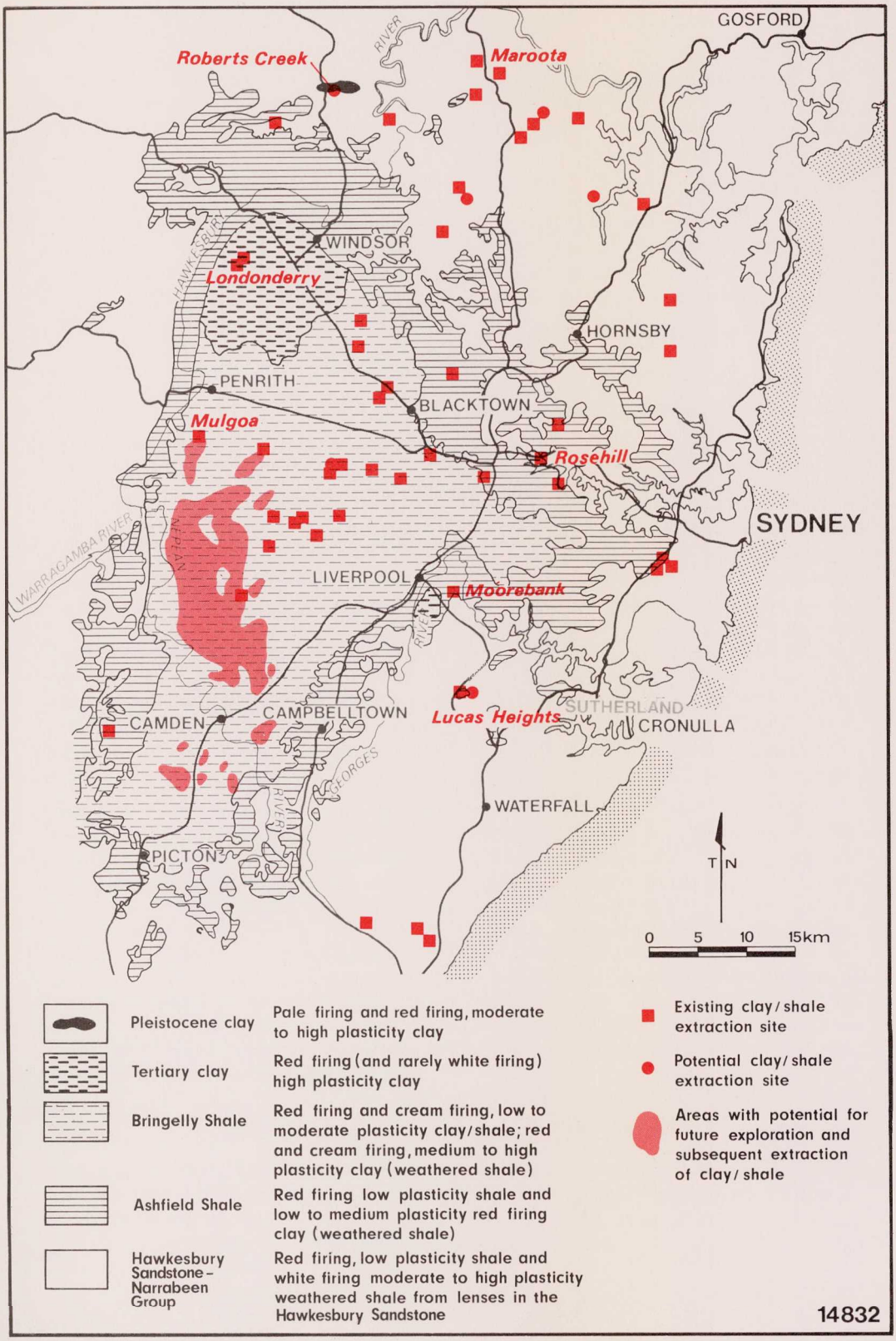
Low-cost clays are clays valued at less than $10.00 per tonne ex-pit. They are used in the manufacture of structural clay products such as bricks, pipes, roofing and quarry tiles, in some ceramic ware, and in low-grade refractories. The demand for low-grade refractories however, has declined in recent years because of a trend towards the use of medium and heavy-duty refractories. Low-cost clays are used in the manufacture of Portland cement, and may be used "raw" as packing for explosives in blast holes. They can also be bloated to form a lightweight aggregate.

Most of the low-cost clays produced in New South Wales (about 90%) is used in the manufacture of bricks, pipes, and tiles. Deposits of clay and shale suitable for these and other applications occur widely throughout the State. However, the low unit value of these materials requires that quarries and associated manufacturing plants be located close to markets to minimize transport costs. As a consequence, production is concentrated around major population centres. The Triassic and Permian shales of the Sydney Basin are the most significant resources of low-cost clays as they supply the large urban markets of the central coast region. The Sydney region is by far the largest of these markets and it is the low-cost clays within this region which will be discussed in this article.

STRUCTURAL CLAY/SHALE RESOURCES OF THE SYDNEY REGION

The demand for a particular type of structural clay/shale is largely dependent on two ceramic properties — plasticity and fired colour. Plasticity, which is the ability of a clay to be moulded, is important as it affects the suitability of the material for the

Figure 2. The structural clay/shale resources of the Sydney region



Selective extraction of clay/shale in the Bringelly Shale at Badgerys Creek (Boral Bricks (N.S.W.) Pty Ltd)

particular manufacturing process involved. Fired colour is important in marketing the finished product. To produce the wide variety of product colours demanded by today's consumers it is generally necessary to blend two or more types of clay/shale with different fired colours. On the basis of plasticity and fired colour the clay/shale resources of the Sydney region (figure 2) can be grouped as follows :

* **Red-firing, low-plasticity clay/shale.** This material is mainly used for "older style" dry press brick manufacture and is primarily extracted from the **Ashfield Shale.**

* **Red-firing, low to moderate-plasticity clay/shale.** This material, mainly used in the manufacture of extruded bricks, is wholly extracted from the **Bringelly Shale.**

* **Cream-firing, low to moderate-plasticity clay/shale.** This material is almost wholly obtained from the **Bringelly Shale.**

* **White-firing, low to moderate and high-plasticity clay/shale.** This material is extracted from weathered shale lenses within the **Hawkesbury Sandstone** and from clay lenses within the Tertiary **Maroota sand deposit.**

* **Red-firing, medium to highly plastic clay/shale.** This material is mainly used in the manufacture of pipes and tiles. Tertiary clay deposits at **Londonderry, Moorebank,**

and **Rose Hill** are the major source. Some material is obtained from weathered shales in the Bringelly Shale.

PRODUCTION

For many years, the manufacturers of bricks, pipes, and tiles used the red-burning Ashfield Shale which was readily available within the metropolitan area and which, because of its low plasticity, was ideally suited to the labour intensive dry press method of brick manufacture then in use.

Sterilization of clay/shale resources by continual urban expansion and the exhaustion of many inner city brick pits have forced many manufacturers to locate their plants and quarries to the west of Sydney, on the Bringelly Shale. Modern brick-manufacturing plants now mainly use Bringelly Shale, with automated extrusion equipment producing a wider range of lighter coloured bricks in keeping with today's fashion.

Statistics on clay/shale production in the Sydney region during 1982/1983 are given in table 1.

TABLE 1

PRODUCTION OF CLAY/SHALE IN THE SYDNEY REGION 1982/1983

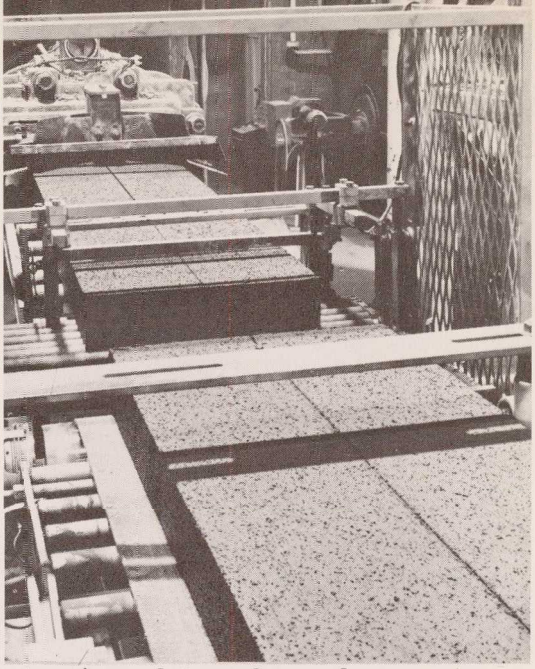
Clay/shale type	Quantity extracted ('000 tonnes)
Red-firing low plasticity (predominantly Ashfield Shale)	579
Red-firing low-moderate plasticity (Bringelly Shale)	610
Red-firing plastic clay/shale (predominantly Tertiary clay)	90
Cream-firing low to moderate plasticity (almost entirely Bringelly Shale)	507*
White-firing Hawkesbury Sandstone shale and Tertiary clay	28
Total pale-firing (i.e. white and cream-firing) clay/shale	535
Total all types	1815

*These production figures have been obtained from annual returns submitted to the Department by clay/shale producers. As these returns do not distinguish between red and cream-firing Bringelly Shale the relative proportions have been estimated on the basis of information obtained from the relevant producers.

THE FUTURE FOR STRUCTURAL CLAYS IN THE SYDNEY REGION

Demand

The demand for bricks, pipes, and tiles, and hence the demand for clay/shale, has increased as the population of the Sydney region has grown. The Department of Mineral Resources has estimated that, assuming an average annual demand of 2.3 million tonnes, the Sydney region will require, on average, approximately 1.4 million tonnes of red-firing clay/shale annually, 690 000 tonnes of pale-firing clay/shale (comprising 520 000 tonnes of



Extrusion of two clay columns prior to wire cutting into individual bricks at Zacuba Brickworks Pty Ltd, Cecil Park

cream-firing Bringelly Shale and 170 000 tonnes of white-firing clay/shale), and 180 000 tonnes of plastic red-firing clay. Total requirements to the year 2000 would be approximately 28 million tonnes of red-firing clay/shale, 14 million tonnes of pale-firing clay/shale, and 3.6 million tonnes of plastic red-firing clay. These estimates are considered to be conservative and should probably be regarded as indicative of minimum requirements.

Secured reserves of clay/shale within the Sydney region are estimated to be 133 million tonnes, of which 20 million tonnes are pale firing (comprising 19 million tonnes cream-firing and 600 000 tonnes white-firing clay/shale). Of the cream-firing reserves, 7.5 million tonnes are controlled by two manufacturers who supply only their own plants.

Conclusions drawn from these figures indicate that, in total, secured reserves of clay/shale are sufficient for the next 50 years. However, secured reserves of cream-firing material are sufficient for less than 30 years, and, more importantly, deposits supplying premium quality white-firing clay/shale from lenses within the Hawkesbury Sandstone will be exhausted in the very near future. In addition, available reserves of both red and pale-firing material are unevenly distributed amongst manufacturers and clay/shale producers.

Exploration

In a study completed in 1980 (Corkery et al. 1980), twenty-one areas in the western Sydney region were identified by the Department as being prospective for the discovery and extraction of economically significant deposits of pale-firing clay/shale (see figure 2).

Within one of these areas, in 1981 the Department identified a major resource of pale-firing clay/shale at **Mulgoa**, near an existing quarry which was then a major source of pale-firing clay/shale but has since been worked out. Reserves within the recommended extraction site at Mulgoa comprise 26 million tonnes of clay/shale, of which 16 million tonnes are pale firing. A further 5 million tonnes of pale-firing material had previously

been identified on two adjoining sites by private interests. A number of development applications were lodged over the resources, and following a Commission of Inquiry in late 1983 approval was granted for extraction of part of the area, containing approximately 9 million tonnes of pale-firing material.

More recently, the Department commenced an investigation of the other areas of Bringelly Shale in the **Penrith - Camden** area previously identified as potential sources of light-firing clay/shale. The assessment is being undertaken to identify those areas with the optimum potential for future extraction. It is hoped that appropriate planning action can be initiated to prevent resource sterilization and thereby assure the continued supply of adequate resources of clay/shale to the Sydney region in the medium to long term.

As pale-firing shale from the Bringelly Shale does not normally fire lighter than cream to buff in colour, there is an urgent need to identify substantial resources of white-firing clay/shale or clay. If no such resources can be identified and made available in the near future, all of the Sydney region's requirements of white-firing clay/shale will have to be imported. Alternatively, all white to cream-coloured bricks and quarry tiles will have to be imported. Either alternative would significantly increase the price of such products and may affect their availability. With this in mind, the Department has recently investigated a deposit at **Lucas Heights.** This deposit appears to be in the only significant, unsecured Hawkesbury Sandstone shale lens for which development consent seems likely to be obtained. Ceramic testing of drillcore samples from this investigation is still in progress. A large deposit of Pleistocene clay at **Roberts Creek**, near Wilberforce, had been regarded, until recently, as a potential major source of white-firing clay. However, reconnaissance drilling, sampling, and testing by the Department in 1982 indicated that the deposit does not appear to contain substantial resources of white-firing clay, and should be primarily regarded as a potentially large source of cream and red-firing clay. Further assessment is required to more fully evaluate the potential of this deposit.

The Department is continuing to investigate the possibility of satisfying the demand for white-firing clay from other, as yet undefined, sources.

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Etheridge, L., 1982. Clay/shale resources of the Sydney region Position paper. *New South Wales Geological Survey — Report GS 1982/011* (unpubl.).

For further information contact I. Paterson (Geologist) on (02) 240 4776.

WORLD GOLD MARKET — FUTURE TRENDS

The search for gold in New South Wales continues to gain momentum as world gold prices remain attractive. Indicated resources of gold within the State have increased significantly over recent years, new discoveries being dominated by those of the Parkes region (refer *Minfo 2*, p. 4). The State now ranks favourably as a potential future supplier to the world gold market.

Preoccupation with the fluctuating fortunes of the gold price continues to be a constant feature of the world gold market. Traditionally the price of gold has fluctuated mainly as a result of world political events, international stability, and disturbances to Middle East oil supply. However, the key factors that have recently influenced the gold price include inflation, interest rates, and monetary policy restraints — particularly in the United States.

Inevitably, problems arise in the interpretation of the future of the world gold market and gold price. With this in mind, **The South African Chamber of Mines*** commissioned a study to assess the general implications to the future gold market of various factors involving trade in gold for industrial and investment purposes. The study was undertaken by the **Economic Consulting Service Inc.** (ECS) of Washington, D.C. The key issues raised in their report World gold market in the 1980's have been analyzed and presented in *Mining Survey, 1/2,* 1983.

ECONOMIC ENVIRONMENT

Concern remains about the level of international debt; however, if the world economy holds together the international credit problem is manageable. The Organization of Petroleum Exporting Countries (OPEC) collectively are expected to go into deficit. The economic growth of third-world countries will be impaired in the event of a growing protectionist framework or a breakdown in trade relations, particularly between Japan and the United States and Western Europe. In these circumstances gold assumes its traditional role as a non-defaulting asset.

CHANGES IN GOLD'S MONETARY FUNCTION

At present, the only official monetary function of gold is to serve as an asset in official monetary reserves. The ECS report states that there is virtually no prospect that any nation or group of nations will, in the foreseeable future, attempt to limit money supply through a convertible gold standard with a fixed price of gold.

The ECS report concludes that the the principal monetary role of gold in the future will be to:

*This article is published with the permission of The South African Chamber of Mines

* Enhance a country's ability to borrow
* Provide a contingency reserve for use in times of trade and political uncertainty
* Contribute to a country's domestic confidence and world standing
* Be a reserve asset, which will vary widely from country to country, depending on need
* Allow small, soundly financed countries to view gold as one of a number of alternative instruments to be considered in active management of this reserve portfolio

GOLD FLOW INTO AND OUT OF OFFICIAL MONETARY STOCKS

Over the period from 1968 to 1981, net sales of monetary gold stocks added 10.7% to world market supply. Central banks, monetary authorities, and the International Monetary Fund were net purchasers of gold in 6 years and net sellers in 8 years. The ECS considers that changes in monetary stocks will continue to exert a significant impact on the market price.

The United States Treasury continues to hold the world's greatest gold reserves. The likelihood that the United States will resume larger gold sales in the near to medium future is slim, but the ECS noted that gold sales might be a means of reducing the United States deficit or moderating any future decline in the international value of the dollar.

The Japanese monetary authorities possess the financial strength to purchase gold in the market place and could certainly trigger a speculative boom. Any increase in official holdings however, is more likely to be achieved through commodities for gold swaps with the Soviet Union or purchases from countries experiencing balance of payments difficulties.

Towards the end of the decade, several East Asian countries with substantial balance of payments surplus may invest part of their national wealth in gold.

CHANGING STRUCTURE OF THE WORLD GOLD MARKET

The ECS report concludes that there will be no major changes in the structure of the gold market in the 1980's.

Since 1968, major structural changes to have taken place include the removal of trading and ownership restrictions, development of future markets, massive growth in offtake of gold coins, close linkage of gold and currency dealing in the international money market, involvements of the major banks, and increasing central bank gold dealings with the private market. The gold market of the 1980's, however, the ECS submitted, is now entering a mature phase in which institutional practices have settled into the market fabric, with all the advantages and

disadvantages that this implies.

On futures, the ECS noted that a more liquid gold market, such as exists in the United States future system, is not necessarily conducive to price stabilization; indeed the reverse may be true. Futures activity moves the price faster and farther in the direction to which weight of market opinion is moving. Second dealer arbitrage can add to the supply or demand for gold, depending on the relationship between interest rates and the spread between spot and future gold prices.

An important change in the market structure, particularly in the United States, has resulted from the close relationship that has developed between the precious metals and money markets. "Hybrid" market institutions which blend financial and commodity expertise have developed in recent years. A parallel trend has been the growing involvement of the major United States money-centre banks in the gold market.

GOLD PRICE ANALYSIS AND PROJECTIONS

This is always the most sensitive issue in any major gold study. The ECS has assumed an equilibrium in the gold market to be:

* an annual supply of 1280 tonnes; 975 tonnes from the free market and 305 tonnes from the centrally planned economies, and
* an annual private investment demand of 386 tonnes, with a market clearing price of $US400 per ounce at the beginning of 1982.

From this base, the ECS has constructed its forecast to 1990. The scenario with the highest probability is the "muddle through" approach which assumes no economic disaster or runaway success. The main macro-economic inputs are **world inflation of 6%, real world interest rates of 4%**, and an increase in the **average world gross national product of 2%.** This scenario yielded an **average nominal 1984 gold price of $US552** ($US480 real) **building up to $US1010** ($US644 real) **in 1990.** With increasing gold supply, the respective forecasts are $US552 ($US465) in 1984 building up to $US914 ($US582) in 1990.

If higher oil prices are a thing of the past and world financial collapse recedes into the background, the key to understanding the outlook for the gold price, according to the ECS report, will be:

> **"The demand for, and price of, gold is highly dependent upon growth in real world incomes. Therefore, demand for gold is expected to rise in the 1980's unless complete economic stagnation occurs. The more rapid the growth in real world income, the stronger the world gold market. Given that the supply of gold is relatively fixed, the stronger demand should be reflected in the price."**

GIBSONVALE REVISITED

Metals Exploration Ltd propose to recommence tin mining in the Gibsonvale area from May 1984, by treating old tailings and working a rich deep lead system.

The Gibsonvale alluvial tin deposit is located approximately 64 km northwest of West Wyalong (population 6000) in central New South Wales (figure 3).

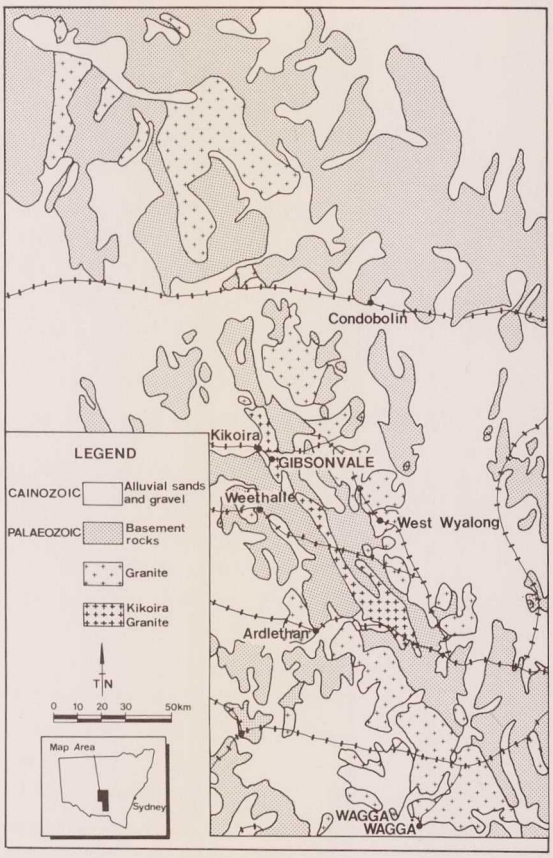

Figure 3. Locality diagram, Gibsonvale alluvial tin deposit

GEOLOGY

The Gibsonvale tin field lies within a "tin province" stretching for 480 km from Mount Tallebung in the north through Ardlethan and Walwa to Mount Willis in the south.

The basement rocks in the area are Ordovician metamorphics which have been intruded by more than one phase of the Kikoira Granite.

The main phase of the granite is a coarse-grained, grey, porphyritic, biotite-muscovite granite. A younger, aplitic phase of the granite, which intrudes the main body, probably introduced most of the tin mineralization into the system as narrow quartz and quartz-tourmaline veins. Greisenization of the mineralized granite at Gibsonvale is extensive.

The altered granite has readily weathered and released the tin mineralization into deep lead systems. The alluvial cassiterite is widespread throughout the basal sand, gravel, and boulder wash.

MINING ACTIVITY

Lode tin was first discovered in outcroping granite at Gibsonvale in 1906. Departmental records show that from 1939 to 1963, 4500 tonnes of alluvial tin concentrate were extracted by underground mining methods, with the majority of production occurring in the period from 1939 to 1945.

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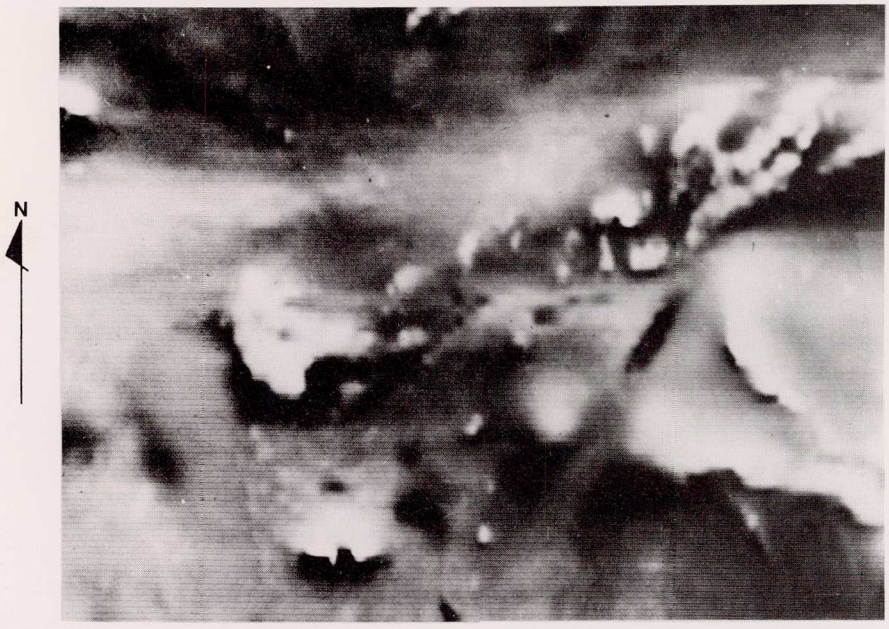


Figure 9. Bourke 1:250,000 sheet. Aeromagnetic data displayed as a light/shadow image (magnetic highs are bright, magnetic lows are shadow areas)

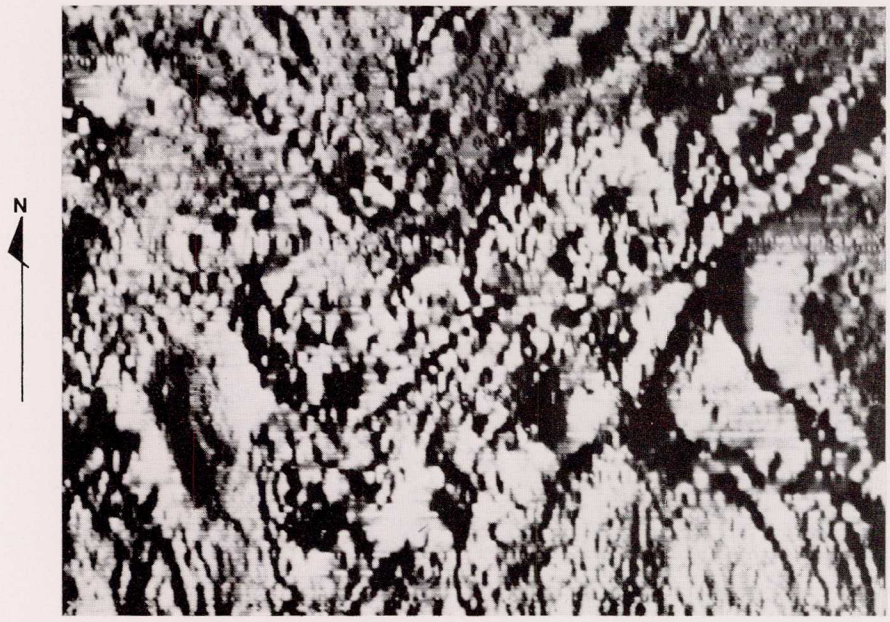


Figure 10. Bourke 1:250,000 sheet. Image enhancement of aeromagnetic data. The "sun" is at geographic east

CORRIGENDUM

AEROMAGNETIC SURVEYS in *Minfo 4*, p. 48

Please note corrected northerly orientation for the above images

Open cut mine within the Gibsonvale alluvial tin deposit

In 1967 Metals Exploration N.L. carried out a detailed drilling programme and feasibility study of the deposit. Production from open cut mines commenced in 1968, and by 1974 Metals Exploration had produced 3771 tonnes of 70% Sn concentrate from 960 000 m^3 of wash overlain by 12 300 000 m^3 of overburden. Mining ceased in 1974 due to the poor economic conditions.

PROPOSED MINING PLAN

The new mining venture will be undertaken in two phases:

* Phase 1—retreatment of tailings from the previous operation and mining of remnant areas of shallow lead. This phase will take approximately 12 months from May 1984.

* Phase 2—new mining of the deep lead system. The proposed new mining plan is based on a deep lead tributary system which merges with the main lead system mined from 1969 to 1974. In general the overburden depth varies from 25 m to 35 m. However, a redistribution or lifting of the present tin quota system is necessary before economic mining at these depths can proceed.

REFERENCE FOR FURTHER INFORMATION

Campi, D., McGain, A., and Ellem, C., 1976. Gibsonvale alluvial tin deposits, N.S.W., *in* Economic Geology of Australia and Papua New Guinea. 1. Metals. *Australasian Institute of Mining and Metallurgy—Monograph 5*, 1049-1053.

NEWNES PLATEAU — A SAND RESOURCE

As part of a programme to assess the sand resources of the Sydney region, a detailed study of the Newnes Plateau is currently being undertaken by the Department of Mineral Resources (Pecover in prep.). The aim of the study is to provide information to planning authorities so that proper account is taken of these resources in future land use planning*.

Total construction sand requirements of the Sydney region to the year 2000 are estimated to be in the order of 300 million tonnes (Wallace). While current sources of coarse to medium-grained sand are adequate up to the end of this century, the region faces a shortage of fine to medium-grained sand. Deposits which have the potential to supply this type of sand currently face conflicting land use and environmental constraints which may preclude their development as major long-term sources of supply. However, deposits on the Newnes Plateau are capable of providing large quantities of fine to medium-grained construction sand from bulk tonnage, integrated extraction and processing operations. The sand is suitable for a wide range of construction and industrial applications such as glass sand, foundry sand, filter sand, and specialized industrial filler sands.

An estimated half a billion tonnes of readily extractable friable sandstone are known to exist on the Newnes Plateau.

GEOLOGY

Much of the Newnes Plateau is covered by thick sequences of friable sandstone which belongs to the Banks Wall Sandstone, the uppermost sandstone unit of the Grose Subgroup within the Triassic Narrabeen Group, Sydney Basin.

Friable sandstone can be defined as a sandstone that is crumbly and easily disaggregated. The sandstone can be quarried without blasting, and can be processed without crushing. Petrographically, friable sandstone exhibits a high porosity and is poorly cemented with a low grain to grain co-efficient of adhesion.

The Banks Wall Sandstone is composed primarily of quartz (50 to 80%), kaolinitic clay (5 to 30%), and a small percentage of lithic fragments. The cement is composed of kaolinitic clay, microcrystalline quartz, and in some cases, minor carbonate. The quartz grains are poorly rounded and commonly are faceted, a property that aids in the manufacture of concrete products such as pipes, culverts, and masonry blocks. The sandstone is generally poorly sorted, with a grainsize ranging from a few microns to several centimetres.

Numerous lenticular claystone horizons and ferricrete bands occur throughout the Banks Wall Sandstone. Rock fragments, which are generally well rounded, include chert, quartz, chloritic - sericitic rocks of various types, and vitric tuff.

*Refer to p. 26 of this issue for details of land use on the Newnes Plateau

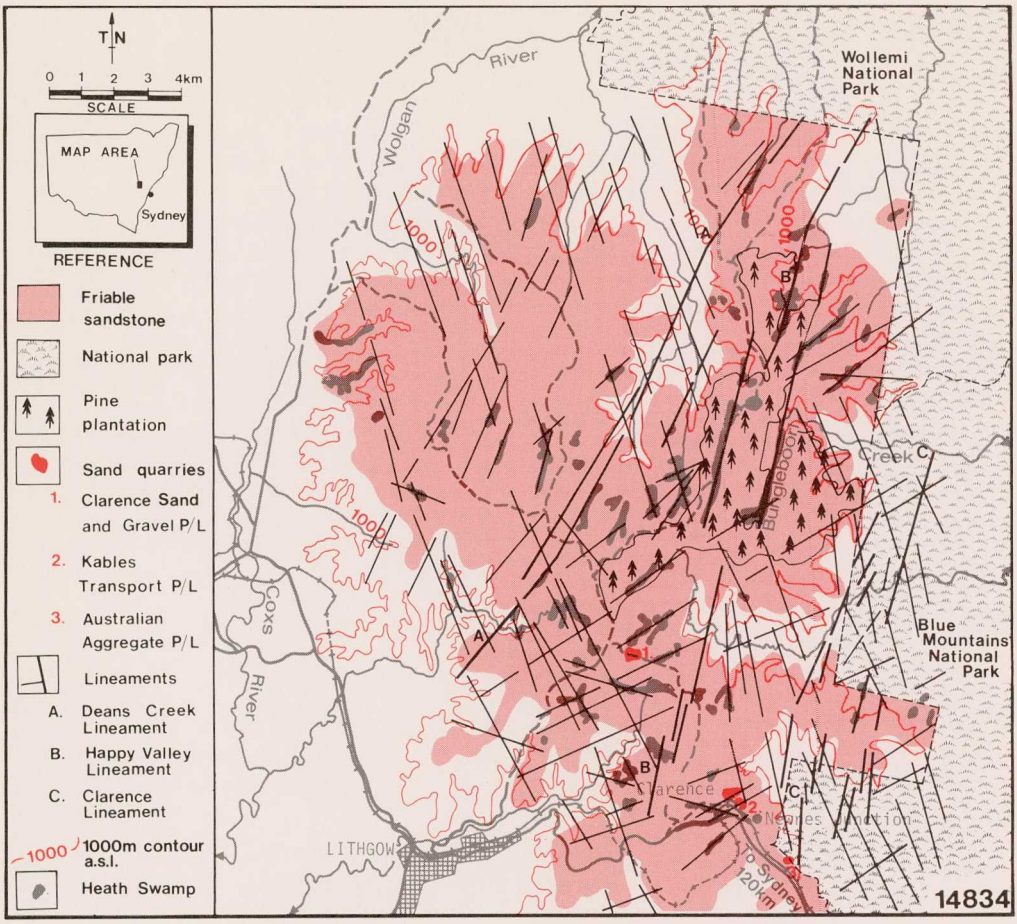


Figure 4. Friable sand resources on the Newnes Plateau

The distribution of friable sandstones on the Newnes Plateau and adjacent highland areas can be correlated with the regional fracture pattern development along the western margin of the Sydney Basin. The major lineament trends are shown on figure 4. Major structural features such as the Deans Creek and Happy Valley Lineaments have strongly influenced past and present drainage on the plateau. Drilling and field investigations by the Department in the vicinity of these two lineaments have revealed areally extensive deposits of friable sandstones, in places, over 100 m thick.

SAND RESOURCES

At present there are three sand mining operations on the Newnes Plateau producing approximately 250 000 tonnes of sand per year (figure 4). Most of this production is supplied to the local Blue Mountains region and to the Sydney market. A range of construction sand products are produced from these operations, including sand for:

* Moulded concrete products
* Ready mix concrete

* Mortar
* Filling

The variable grain size and roundness characteristics, together with a certain degree of "sharpness", make the friable sandstones of the Newnes Plateau ideally suited to the production of a wide range of high-strength and precast moulded concrete products. As the range and quantity of these concrete products increases, so too will the importance of the sand from the Newnes Plateau. In addition, specialist sands for use as fillers in plaster and ceramics are produced. Minor amounts of gravel for filling, decoration, and road base are also sold on a regular basis.

The high variability of grain size gives the friable sandstone deposits on the Newnes Plateau the potential to produce a wide range of additional construction sand and specialist sand types for use in such applications as :

* Glass making
* Foundry sand
* Industrial fillers
* Filter sands
* High-purity silica sand

In addition, high-crystallinity kaolinitic clays (currently being disposed of as tailings waste) show considerable potential for use in a wide variety of industrial applications including:

* Paper coating
* Fillers in rubber, paint, and plastics
* Pharmaceutical products
* Ceramics
* Refractories

The utilization of this clay would overcome environmental problems normally associated with the disposal of clay tailings while at the same time making economic use of a valuable mineral by-product.

The friable sandstone deposits on the Newnes Plateau combine enormous size with the potential to yield virtually any type of sand if correctly processed. These two features point to the likelihood of the deposits becoming an increasingly important source of supply to the Sydney region in the future.

REFERENCES

Pecover, S.R., in prep. Geological investigation and resource assessment of friable sandstone deposits in the Newnes Plateau-Bell-Blackheath area, western Blue Mountains, New South Wales. *New South Wales Geological Survey — Report* (unpubl.).

Wallace, I., 1980. Construction sand resources for Sydney 1981-2020. Position paper. *New South Wales Geological Survey — Report GS 1980/292* (unpubl.).

EXPLORATION LICENCES

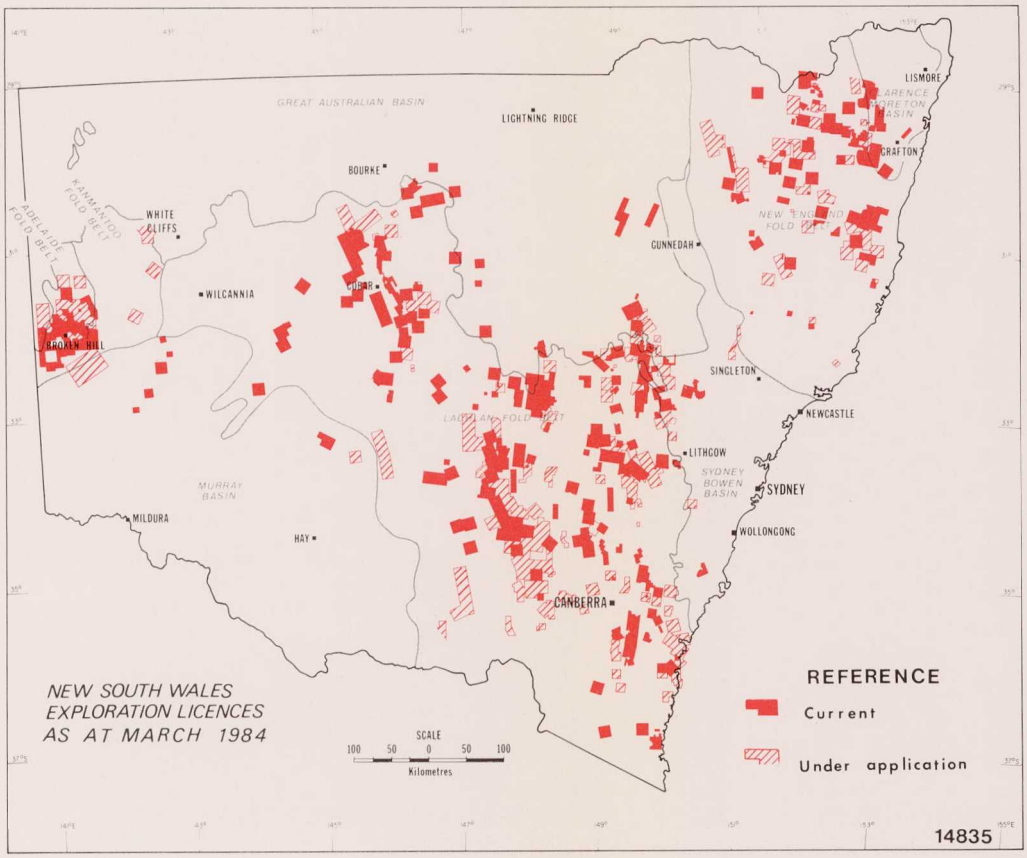
Exploration Licences granted January–March 1984

No.	Holder	Area (km^2)	Expiry	Mineral group*
2143	Esvale Pty Ltd	242.0	04.01.86	1
2144	Preussag Aust. Pty Ltd	256.0	04.01.86	1
2145	Teck Exploration Ltd	60.0	04.01.86	1
2146	Noranda Aust. Ltd	255.5	04.01.86	1
2147	Nubola Pty Ltd, Nicron Resources Ltd, Petrocarb Exploration N.L.	16.0	10.01.85	1
2148	CRA Exploration Pty Ltd	171.0	15.01.86	1
2149	CRA Exploration Pty Ltd	232.0	15.01.86	1
2150	Lachlan Resources N.L.	144.0	16.01.86	1
2151	Lachlan Resources N.L.	239.0	16.01.86	1
2152	Talisman Mining & Exploration Pty Ltd	64.0	24.01.86	6
2153	Sunshine Gold Search Pty Ltd	137.0	06.02.86	1
2154	Sunshine Gold Search Pty Ltd	245.0	06.02.86	1
2155	Sunshine Gold Search Pty Ltd	166.0	06.02.86	1
2156	Sunshine Gold Search Pty Ltd	144.0	06.02.86	1
2157	Sunshine Gold Search Pty Ltd	128.5	06.02.86	1
2158	Sunshine Gold Search Pty Ltd	182.0	06.02.86	1
2159	Sunshine Gold Search Pty Ltd	13.0	06.02.86	1
2160	Sanidine N.L.	174.75	06.02.86	1
2161	Lachlan Exploration Ltd	144.0	06.02.86	1
2162	Australian Occidental Pty Ltd	144.0	06.02.86	1
2163	Western Mining Corp. Ltd	65.42	06.02.86	1
2164	Australian Pacific Resources N.L.	222.0	06.02.86	1
2165	Aberfoyle Exploration Pty Ltd	158.5	12.02.86	1
2166	CRA Exploration Pty Ltd	249.0	12.02.86	1
2167	CRA Exploration Pty Ltd	15.0	12.02.86	1
2168	Homestake Aust. Ltd	256.0	19.02.86	1
2169	Seltrust Gold Pty Ltd	255.96	23.02.86	1
2170	Seltrust Gold Pty Ltd	240.0	23.02.86	1
2171	Seltrust Gold Pty Ltd	256.0	23.02.86	1
2172	Seltrust Gold Pty Ltd	222.0	23.02.86	1
2173	The Shell Co. of Aust. Ltd	109.0	27.02.86	1
2174	Amoco Minerals Aust. Co.	240.0	27.02.86	1
2175	Genders Holdings Pty Ltd	64.0	27.02.86	1
2176	CRA Exploration Pty Ltd	256.0	23.02.86	1
2177	Duval Mining (Aust.) Ltd	80.0	11.03.86	1
2178	Seltrust Gold Pty Ltd	256.0	11.03.86	1
2179	Seltrust Gold Pty Ltd	239.0	11.03.86	1
2180	The Shell Co. of Aust. Ltd	58.8	11.03.86	1
2181	Seltrust Gold Pty Ltd	256.0	11.03.86	1
2182	Freeport of Aust. Inc.	240.0	12.03.86	1
2183	St Joe Aust. Pty Ltd	256.0	12.03.86	1
2184	St Joe Aust. Pty Ltd	256.0	12.03.86	1
2185	St Joe Aust. Pty Ltd	256.0	12.03.86	1
2186	Carpentaria Exploration Co. Pty Ltd	56.0	12.03.86	1
2187	Samedan Oil Corp.	64.0	11.03.86	1
2188	Samedan Oil Corp.	256.0	11.03.86	1
2189	Samedan Oil Corp.	64.0	13.03.86	1
2190	Samedan Oil Corp.	256.0	13.03.86	1
2191	Samedan Oil Corp.	256.0	13.03.86	1
2192	Challenger Resources Pty Ltd	9.0	18.03.86	1
2193	Challenger Resources Pty Ltd	62.5	18.03.86	1
2194	Getty Oil Development Co. Ltd	123.6	18.03.86	1

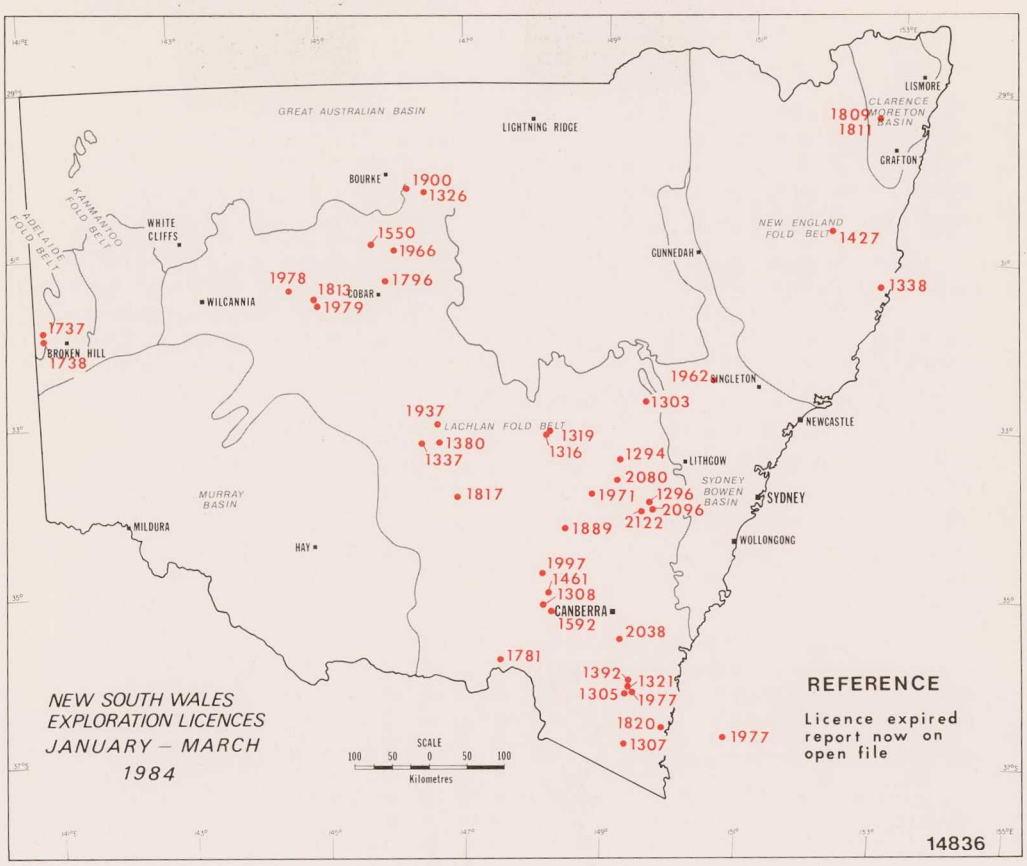
No.	Holder	Area (km^2)	Expiry	Mineral group*
2195	Sanidine N.L.	256.0	18.03.86	1
2196	Seltrust Gold Pty Ltd	180.2	20.03.86	1
2197	Seltrust Gold Pty Ltd	256.0	20.03.86	1
2198	Mineral Management & Securities Pty Ltd	69.0	22.03.86	1
2199	Epoch Mineral Exploration N.L.	117.6	22.03.86	1
2200	The Shell Co. of Aust. Ltd	179.0	22.03.86	1
2201	Seltrust Mining Corp. Pty Ltd	245.0	22.03.86	1
2202	Seltrust Mining Corp. Pty Ltd	253.0	22.03.86	1
2203	Seltrust Mining Corp. Pty Ltd	256.0	22.03.86	1
2204	Seltrust Mining Corp. Pty Ltd	144.0	22.03.86	1
2205	Seltrust Mining Corp. Pty Ltd	256.0	22.03.86	1
2206	Seltrust Mining Corp. Pty Ltd	246.0	22.03.86	1
2207	Sunshine Gold Search Pty Ltd	220.4	27.03.86	1

*Group 1 — Metallic minerals Group 6 — Diamond

Exploration Licences in force March 1984



Exploration Licences cancelled/expired January–March 1984



Reports on EL's that have terminated during the quarter and have been placed on open file include the following:

EL 1296 South of Bathurst Getty Oil Development Co. Ltd

This licence surrounded the old Burraga copper mine, but excluded leases covering the mine area. Initial but limited exploration was conducted by Newmont Holdings Pty Ltd. Getty took over with a substantial programme culminating in fourteen diamond and percussion drill holes. Widespread but low-grade mineralization was encountered. The best intersection was 5 m grading 0.15% Cu, 0.09% Pb, 3.43% Zn, and 12g/t Ag. Getty's work suggests that the Burraga mineralization is more likely granite related than volcanogenic.

EL's 1380, 1937 East of Lake Cargelligo Aberfoyle Exploration Pty Ltd

Aeromagnetics were used to locate northern subsurface extensions of the tin-bearing Kikoira Granite. Follow-up exploration identified a trend of tin-tungsten prospects in postulated cupola settings. Drill testing of three prospects intersected patchy low-grade scheelite and wolframite mineralization.

EL 1461 Gundagai BHP Minerals Ltd

Stream sediment sampling and airborne electromagnetics (EM) were conducted in the search for volcano-sedimentary massive sulphide deposits within the Tumut Trough. Follow-up work resulted in the drilling of two percussion holes which intersected weak pyrite mineralization.

EL 1592 Tumut BHP Minerals Ltd

Stream sediment sampling and airborne EM were conducted in the search for volcano-sedimentary massive sulphide deposits within the Tumut Trough. Limited follow-up of geochemical anomalies was not encouraging. A zone of tourmaline-sericite alteration was located but not fully evaluated.

EL's 1737, 1738 West of Broken Hill Chevron Exploration Corp.

Initial aeromagnetics suggested that stratigraphic equivalents of the Broken Hill host rocks (Suite 4) [Broken Hill Group] occur at shallow depth beneath Cainozoic sediments of the Mundi Mundi Plain. Stratigraphic drilling confirmed this interpretation, and a basement geology map was produced. Follow-up deep penetration induced polarization (IP) geophysics did not define any drill targets.

EL 1781 Southeast of Wagga Wagga The Shell Co. of Aust. Ltd

Stream sediment sampling and reconnaissance mapping were conducted over the Koetong Granite in the search for Ardlethan style tin mineralization. Eight tin and arsenic anomalies were evaluated without significant results.

EL's 1813, 1978, 1979 West of Cobar BHP Minerals Ltd
(plus part 1785)

Aeromagnetics and geological mapping were used to look for CSA or Elura type base metal deposits in postulated displaced continuations of fine-grained facies of the Cobar Trough sequence. Ground evaluation, including rotary air blast percussion drilling, attributed magnetic anomalies to maghemite in overburden.

EL 1900 Southeast of Bourke Metals Exploration Ltd

An aeromagnetic survey was conducted in the search for Doradilla type tin mineralization. A "thumbprint" anomaly was investigated with a single drill hole which failed to reach bedrock due to severe drilling problems. A weak copper-zinc anomaly was detected in unconsolidated sediments at the bottom of the hole.

EL 1962 Northwest of Singleton CRA Exploration Pty Ltd

Air photo interpretation followed by ground checking of twelve features was carried out in the search for diamonds. A large breccia pipe was located but soil sample analyses suggested basaltic rather than kimberlitic affinites. A bulk sample returned no diamonds.

EL 1966 North of Cobar BHP Minerals Ltd

The Tinderra Granite was explored principally for Ardlethan type tin mineralization. Reconnaissance soil geochemistry identified areas of weakly anomalous tungsten. Inspection of old gold workings to the north of the granite identified gold in weakly silicified and veined sedimentary rocks, but bedrock geochemistry gave no anomalous results.

EL 1971 Cowra Noranda Aust. Ltd

Reconnaissance mapping, rock geochemistry, and very low frequency (radio) EM traverses were conducted in the search for volcanogenic massive sulphide deposits. A copper prospect in chlorite and epidote-altered fragmental andesites was evaluated, without significant results.

EL 1977 East of Cooma Esso Exploration and Production Aust. Inc.

A DIGEM survey was flown in the search for volcanogenic base metals within a narrow belt of Silurian volcanic and sedimentary rocks. There were no significant anomalies, and ground reconnaissance failed to locate any favourable lithologies.

EL 1997 South of Cootamundra BHP Minerals Ltd

This area had previously been explored for volcanogenic base metals under EL's 1301 and 1320. EL 1997 was acquired to continue work on a specific area of interest, but further evaluation was prevented by denial of access to agricultural land.

EL 2038 Queanbeyan Plagolmin Pty Ltd

This licence was acquired to enable exploration for volcanogenic base metal deposits. Reconnaissance located an area of gossans at the contact between limestone and tuffs. Although geochemical results were encouraging, no further work was done because of the difficulties posed by "catchment area" restrictions.

EL 2096 South of Bathurst Getty Oil Development Co. Ltd

Reconnaissance for southern extensions of the Burraga style base metal mineralization did not locate any alteration, veining, or mineralization. Work on the adjacent exploration licence suggested that the Burraga mine mineralization may be granite related rather than volcanogenic in origin.

EL 2122 South of Bathurst St Joe Australia Pty Ltd

The lower portions of the Kangaloolah volcanic pile were evaluated for volcanogenic base metals. Reconnaissance located extensive siliceous "sinters" but geochemical results were low. Whole rock geochemistry showed that the host volcanics do not have significant element depletion indicative of hydrothermal activity.

Other Cancelled or Expired Exploration Licences

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

EL's 1305, 1307, 1308, 1316, 1337, 1338, 1392, 1550, 1796, 1809, 1811, 1817, 1820, 1889, 2080.

The following licences have terminated but are subject to flow-on title applications and reports remain confidential:

EL's 1294, 1303, 1319, 1321, 1326.

EXPLORATION LICENCES EXPIRED PRIOR TO JANUARY 1984

Reports that have now been placed on open file include the following:

EL 1562 East of West Wyalong Base Resources Ltd

This licence covers poorly outcropping extensions of an acid to intermediate

volcanic sequence being explored in adjoining licences. Limited sampling of the two volcanic outcrops located in this sequence gave some anomalous zinc results.

EL 1589 Northwest of Lake Cargelligo Electrolytic Zinc Co. of A'asia Ltd

This licence was acquired to enable search for repetitions of the Browns reef type base metal mineralization, or Cobar type deposits. Aeromagnetics and regional mapping were followed by detailed ground evaluation of prospects. Drilling of a magnetics anomaly intersected pyrite-pyrrhotite mineralization with minor base metals, in porphyritic rhyolite and tuff.

EL 1664 West of Grafton Key Resources Pty Ltd

Reconnaissance showed that the old Sir Walter Scott gold-silver workings are in altered, pyritic black chert spatially associated with basic intrusions. Regional stream geochemistry identified weak base metal anomalies associated with other pyritic chert horizons. These samples were not analyzed for gold.

EL 1750 North of Tumbarumba Southern Cross Exploration N.L.
Gulf Resources N.L.

Testing of auriferous quartz reefs in the Quartzville area gave only low gold and silver results. However, significant tungsten anomalies were identified (up to 0.25% W in channel samples). The high tungsten values appear to be spatially related to dolerite dykes intruding the quartz vein system.

EL 1752 Holbrook Southern Cross Exploration N.L.
Gulf Resources N.L.

Investigations of the old workings at the Billabong gold mine suggested that the mineralization is confined to a narrow shear zone in sediments. Costeans were dug but not sampled because of the limited extent of the shear and the associated quartz stringer zone.

EL 1764 South of Grenfell Australian Industrial Refractories Ltd

Exploration in the area surrounding the Thuddungra magnesite mine gave encouraging results. Significant magnesite mineralization (including high or refractory grades) was intersected in six of forty-five drill holes. Access was denied to other prospective areas covered by agricultural land. Exploration was terminated because of financial constraints.

EL 1767 Northwest of Broken Hill CRA Exploration Pty Ltd

Exploration was conducted for a variety of deposit types. Stream sediment geochemistry identified copper, lead, zinc, and tungsten anomalies associated with calc-silicates and carbonaceous metasediment horizons. Rock chip sampling confirmed the anomalies but they did not warrant further work.

EL 1909 North of Cooma Esso Exploration and Production Aust. Inc.

Regional mapping suggested a submarine environment for the eastern limb of the folded Silurian volcano-sedimentary sequence. Old prospects were reassessed for volcanogenic base metal potential without encouraging results.

EL 2025 Coolac Newmont Holdings Pty Ltd

Reconnaissance and prospect inspection suggested that gold mineralization is restricted to quartz-sulphide vein systems, with no dispersion into the host rock. No potential for exhalative or disseminated metasomatic gold mineralization was recognized.

COAL

DRAGLINE — A COAL NEWSBRIEF

THE AUSTRALIAN COAL MINING INDUSTRY — AN OVERVIEW

The last 12 months has seen a substantial review of all aspects of the Australian coal mining industry. On 30th March, 1983, the Commonwealth Government convened a National Coal Conference which was attended by State Government Ministers from New South Wales and Queensland and representatives of the coal producers, the coal mining unions, and the Joint Coal Board. The conference reviewed the current situation of the coal industry and the international marketing position.

The conference agreed to the immediate establishment of a representative Australian Coal Consultative Council to provide a new forum for continued discussion and review of the industry's situation. At its second meeting on 11th November, 1983, the Council decided to establish a management body called the National Research Group to co-ordinate four working parties to examine specific issue areas and to develop possible options for consideration by the Council.

The working parties, comprising representatives of government, the Australian Coal Association, and coal industry unions, have recently prepared comprehensive reports in the following areas:

* A study of the international factors affecting the market for Australian coal and the manner in which the industry has and should react to them.
* A study of the social and economic implications of new mine development and how it should be regulated.
* A study of Australia's coal reserves suitable for underground mining and the manner in which they can be best developed.
* The international competitiveness of the Australian coal industry, the factors affecting it, and how Australian industry competitiveness can be assisted.

Representatives of the Department of Mineral Resources were actively involved in each of the working parties.

The National Research Group, which is chaired by the Department of Resources and Energy in Canberra, is preparing an overview report for consideration by the Australian Coal Consultative Council at its next meeting scheduled for June 1984. Whatever options are recommended by the Council, this recent review of the Australian coal mining industry represents the first attempt, in recent years, to develop a national approach.

COAL MINING AND THE ENVIRONMENT — A TEST CASE

Coal has been mined from the outcrop of the Illawarra Coal Measures in the Western Coalfield for over a century. Most of the shallow coal has now been exhausted, and exploration and mining have been slowly progressing down-dip towards the centre of the Sydney Basin. The **Newnes Plateau**, northeast of Lithgow, is a major area for future expansion of the industry, particularly to replace some of the existing collieries near Lithgow that are nearing the end of their life. However, concern has arisen over the nature conservation values of the plateau and the possibility of coal mining activities affecting the adjoining national parks.

LOCATION AND GEOLOGY

The Newnes Plateau is the largest plateau area in the Blue Mountains, comprising 300 km^2 of natural bushland — all of it at an altitude in excess of 1000 m above sea level. The Triassic Narrabeen Group sandstones forming the plateau are underlain by Permian coal measures. The main commercial coal seams are the Katoomba seam at about 200 m depth and the Lithgow seam at about 400 m depth.

The plateau is bounded on the south by the Bells Line of Road and the main western railway line, on the west by the Coxs River Valley, on the north by the spectacular clifflines of the Wolgan Valley and on the east by the deeply entrenched Wollangambe River catchment. This area to the east is now covered by the Wollemi and Blue Mountains National Parks. The major watersheds on the plateau are the Wolgan River to the north and Wollangambe River to the east, both of which drain into the national parks (figure 5).

LAND USE

Most of the Newnes Plateau is covered by state forest which produces native hardwoods and introduced softwoods. About 2000 ha have been clearfelled for plantation pines. The only other commercial land use is sand extraction — six quarries have been worked in the area (refer to p. 16 of this issue). The plateau is used as access for active recreation such as bushwalking and rockclimbing, and the historic Newnes oil shale mining site in the Wolgan Valley attracts many campers and visitors. The old oil shale railway, which crosses the plateau from Newnes to Newnes Junction, also has heritage value. An important aboriginal cave painting site known as "Blackfellows Hand Cave" is a well-known tourist attraction. The Wolgan Valley has been classified as a scenic landscape by the National Trust.

COAL MINING

Clarence Colliery is the first, and so far the only, colliery to commence mining from the top of the Newnes Plateau. Operated by Coalex Pty Ltd, this large underground mine commenced

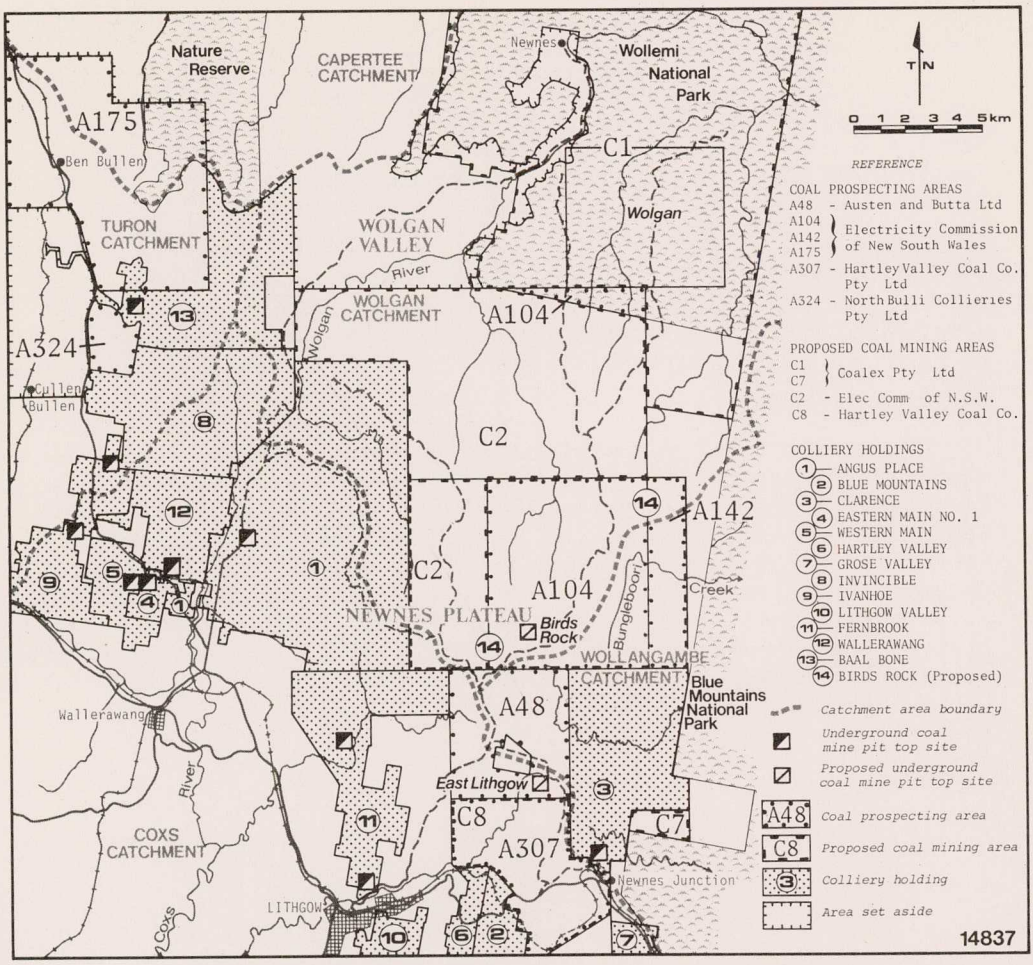


Figure 5. Locality diagram, Newnes Plateau

construction in 1977 and now produces 2 million tonnes per annum of export thermal coal.

A large part of the central plateau area has been allocated to the Electricity Commission of New South Wales for prospecting. Development consent was sought by the Commission in 1981 for the construction of Birds Rock Colliery. A Mining Warden's Inquiry in 1979 and an Environmental Commission of Inquiry in 1982 were held because of opposition by conservation groups and concern by the National Parks and Wildlife Service over the siting of the colliery pit top within catchments that drain into Wollemi National Park. Water pollution, mine subsidence, and impact on heath swamps were the major issues. Development consent was eventually granted by the Minister for Planning and Environment to

Birds Rock Colliery Pty Ltd, but development of the mine has been postponed for economic reasons.

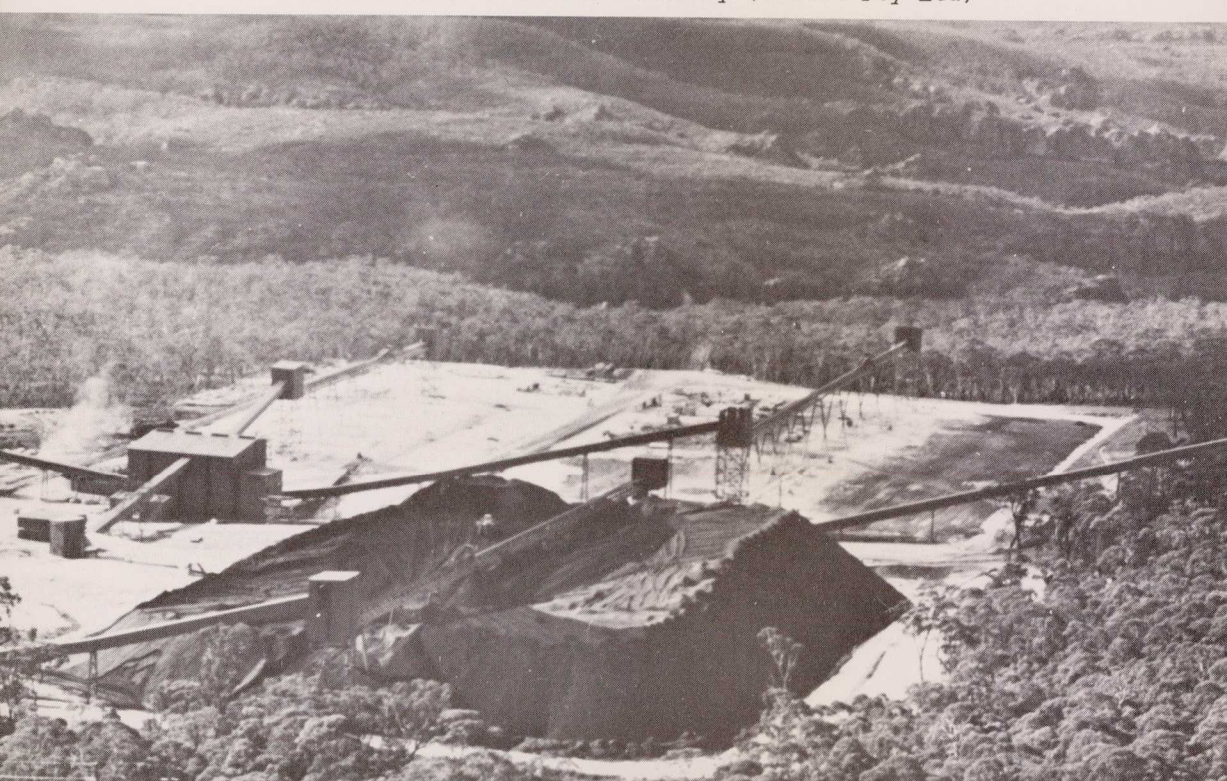
On the northern edge of the plateau, Coalex Pty Ltd defined a high-quality coking coal deposit which the company proposed to develop as the Wolgan Colliery. However, the company's Coal Lease Application Area was subsequently covered by the Wollemi National Park in 1977. Whilst the applications have been allowed to remain pending to the present time, the status of this application area is somewhat uncertain.

Austen and Butta Ltd are assessing the feasibility of developing a colliery on the southern margin of the plateau — to be known as East Lithgow Colliery.

DEPARTMENTAL STUDY

Having foreseen the potential for conflict between future coal mining and nature conservation, the Department of Mineral Resources commenced an environmental study of the Newnes Plateau area in 1978. This study, undertaken by the Department's Environmental Geology Section and Chemical Laboratory Branch, documented the natural characteristics of the area, defined the existing physical and chemical hydrology of streams draining the plateau, assessed the possible effects of future underground mining on the waters of the Newnes Plateau and of the national parks into which the streams of the plateau flow, and canvassed the main environmental issues likely to arise in public debate.

Aerial view of Clarence Colliery (Coalex Pty Ltd)



The Department identified through the study, and from public submissions to the Inquiries, the following major environmental issues which will need to be addressed by coal companies wishing to develop the Newnes Plateau.

1. Colliery pit tops and transport corridors will need to be sensitively sited so that noise and visual impact do not impair the wilderness experience for users of the nearby national parks nor interfere with legitimate recreational use of the plateau.

2. Friable sandy soils, relatively steep topography, and high-intensity rainfall, mean that clearing of vegetation should be kept to a minimum so that erosion and siltation of creeks are minimized—particularly during mine construction.

3. All runoff, process, and mine waters must be contained on site and treated to the high standards required for discharge into "Class P" protected waters. Water quality parameters likely to be of most concern are acidity, iron, sulphate, zinc, and suspended solids. In some circumstances it may be preferable for all discharges to be collected and transferred to less sensitive catchments.

4. The damming of creeks for mine water supply purposes must allow for continual release of water to the Wolgan Valley (for agricultural use) and to the national parks (for aquatic life and recreational use).

5. Heath swamps are of ecological significance (rare high-altitude plant species and wildlife habitat) and hydrological importance (continual water supply to creeks), and should therefore be protected from destruction during access preparation, mine construction, mining induced subsidence (alteration to water tables), and degradation of water quality.

6. Coal refuse disposal sites must be properly engineered and rehabilitated if spontaneous combustion (or bushfire ignition) and long-term leachate generation are to be avoided.

7. Major cliff lines, important rock formations, aboriginal caves etc., will require protection from mine subsidence.

8. The plateau is a bushfire-prone area; pit top facilities will need to be protected, and the intrusion of man into these natural areas must not create an additional fire risk.

COAL MINING AND THE ENVIRONMENT

The Department's study classified the various catchments on the Newnes Plateau according to their sensitivity to various types

of surface coal mine development, and concluded that with current technology and experience, coal mining could take place, with some restrictions, in all catchments on the plateau with little or no impact on water quality. Provided that strict controls are enforced and continual monitoring is implemented, underground coal mining and nature preservation are not seen as being incompatible in natural areas such as state forests and areas adjoining national parks.

The natural and man-made attributes, and the important resources of the Newnes Plateau, are many and varied, and all have to be weighed-up against each of the other land uses. A statement by the National Parks and Wildlife Service, that "This locality would provide an excellent opportunity to monitor the environmental impacts of the latest technological and operational innovations in coal mining on a sensitive land unit", places a big responsibility on existing and future coal mine operators in the area to "do the right thing". Otherwise the future of coal mining in this and other natural areas could be threatened.

REFERENCES FOR FURTHER INFORMATION

Johnson, M., 1982. Hydrochemistry of the Newnes area, western Blue Mountains. *New South Wales Department of Mineral Resources—Chemical Laboratory Report 82/1* (unpubl.).

Toyer, G.S., and Main, S., 1981. Environmental implications of future underground coal mining developments on the Newnes Plateau, N.S.W., with particular emphasis on regional water quality aspects. *New South Wales Geological Survey — Report GS 1981/242* (unpubl.).

CONTROL OF GAS BLOWOUT

Although methane is a potential resource in New South Wales, the intersection of pockets of methane gas while drilling for coal can be hazardous, and blowouts can occur, injuring drillers. However, the use of annular valves to control gas flows and prevent accidents adds considerably to the cost of drilling holes. In order to develop more specific guidelines for the use of these devices and so reduce unnecessary cost, the Coal Geology Branch of the Department of Mineral Resources is investigating instances where gas problems have been encountered.

Various groups involved in coal exploration have been requested by the Branch to supply details on the following:

* Name and location of borehole(s) with ISG co-ordinates where available.
* Rock formation and depth.
* When the gas flow/blowout occurred (year and month).

* Nature of the gas flow/blowout with closed-in pressure and other relevant data.

* Comments pertinent to this investigation.

The gas flow/blowout details will then be collated and interpreted in order to provide guidelines for the use of gas pressure control equipment.

Individuals and companies who have not already done so, are invited to provide an input to this investigation. Information should be directed to A. Galligan, Chief Coal Geologist. The Branch is grateful for any assistance, and contributions will be acknowledged in the final report which will be made available to the public.

REASSESSMENT OF COAL RESOURCES

The Department of Mineral Resources and the Joint Coal Board are currently undertaking a reassessment of the coal resources of New South Wales. The Joint Coal Board will assess the resources of colliery holdings, and the Department will assess all other areas, including coal-bearing areas not covered by exploration titles.

During the last 5 years there has been a vast amount of exploration carried out in the State —— by companies and the Electricity Commission of New South Wales in Authorisations and Coal Leases, and by the Coal Geology Branch of the Department in a number of Authorisations. Departmental drilling in areas such as A216 covering most of the Gunnedah Basin has indicated very large resources which were not included in previous estimates.

An updated assessment of the coal resources is required to provide information for:

* regional development plans,

* planning of infrastructure requirements,

* ensuring maximum utilization of the resources, and

* determining realistic estimates of the coal resources potentially suitable for surface and underground mining.

To collect the required information, the Joint Coal Board is visiting each colliery and collating the information obtained. The Department for its part has sent out a form requesting resource estimates for each Authorisation area. The information will be collated for each resource category on the basis of seam depth, thickness, and quality. In addition, an attempt will be made to determine a realistic estimate of the recoverable coal tonnage for each area. It is expected that the reassessment will be completed by the end of 1984.

COAL AUTHORISATIONS/EXPLORATION PERMITS MARCH 1984

AUTHORISATIONS

No.	Holders	Nearest town
A6	Dep. Mineral Resources	Campbelltown
A13	Coal & Allied Operations Ltd	Warkworth
A17	Barix P/L	Singleton
A31	Dombarton Colliery P/L	Bundanoon
A39	Consolidated Goldfields Aust. Ltd	Ravensworth
A44	Maitland Main Collieries P/L	Camberwell
A48	Austen & Butta Ltd	Lithgow
A72	Clutha Development P/L	Jerrys Plains
A81	Southland Coal P/L	Camberwell
A89	Bloomfield Collieries P/L	Singleton
A90	Consolidated Goldfields Aust. Ltd	Ravensworth
A93	R.W. Miller & Co. P/L	Beresfield
A94	R.W. Miller & Co. P/L	Beresfield
A102	Dep. Mineral Resources	Muswellbrook
A104	Electricity Commission of N.S.W.	Lithgow
A125	Preston Coal Co. P/L	Gunnedah
A128	Gollin Wallsend Coal Co. Ltd	Camberwell
A129	Carpentaria Exploration Co. P/L	Denman
A130	White Industries Ltd	Ashford
A134	R.W. Miller & Co. P/L	Beresfield
A136	Macdonald Brothers P/L	Mittagong
A138	Gollin Wallsend Coal Co. Ltd	Gunnedah
A139	Gollin Wallsend Coal Co. Ltd	Gunnedah
A142	Electricity Commission of N.S.W.	Lithgow
A157	Vickery Coal P/L	Boggabri
A168	Electricity Commission of N.S.W.	Muswellbrook
A169	Electricity Commission of N.S.W.	Muswellbrook
A170	Genders Mining P/L	Capertee
A171	Bayswater Colliery Co. P/L	Muswellbrook
A172	Bayswater Colliery Co. P/L	Jerrys Plains
A173	Thiess Bros. P/L	Muswellbrook
A174	Mount Sugarloaf Collieries P/L	Muswellbrook
A175	Electricity Commission of N.S.W.	Ben Bullen
A176	Muswellbrook Coal Co. P/L	Muswellbrook
A202	Ulan Coal Mines Ltd	Ulan
A203	Dep. Mineral Resources	Raymond Terrace
A204	Dep. Mineral Resources	Toronto
A205	Dep. Mineral Resources	Muswellbrook
A208	Genders Mining P/L	Capertee
A212	Barix P/L	Singleton
A216	Dep. Mineral Resources	Gunnedah
A219	Newcastle Wallsend Coal Co.	Bulga
A224	Dep. Mineral Resources	Coleambally
A225	Dep. Mineral Resources	Ivanhoe
A229	Dep. Mineral Resources	Singleton
A230	Dep. Mineral Resources	Rylstone
A231	Electricity Commission of N.S.W.	Robertson
A232	Western Main Collieries P/L	Capertee
A238	Electricity Commission of N.S.W.	Ravensworth
A239	Aust. Coal & Shale Employees Fed.	Warkworth
A248	Australian Iron & Steel P/L	Menangle
A250	Mitsubishi Development P/L	Oaklands

AUTHORISATIONS

No.	Holders	Nearest town
A254	Dep. Mineral Resources	Cooranbong
A255	Electricity Commission of N.S.W.	Wyong
A256	The Bellambi Coal Co. Ltd	Aberdeen
A262	Buchanan Borehole Collieries P/L	Warkworth
A263	Dep. Mineral Resources	Wollombi
A270	Dep. Mineral Resources	Oakdale
A272	R.W. Miller & Co. P/L	Beresfield
A275	Electricity Commission of N.S.W.	Toronto
A277	Wallamaine Colliery P/L	Swansea
A281	Dep. Mineral Resources	Camden
A285	Dep. Mineral Resources	Toronto
A286	Dep. Mineral Resources	Gulgong
A287	Austen & Butta Ltd	Bylong
A290	The Nardell Colliery P/L	Ravensworth
A293	Australian Iron & Steel P/L	Appin
A294	Clintons Nattai Collieries P/L	Oakdale
A298	Electricity Commission of N.S.W.	Robertson
A300	Coal & Allied Operations P/L	Abermain
A301	The Broken Hill Proprietary Co. Ltd	Belmont
A307	Hartley Valley Coal Co. P/L	Lithgow
A308	Southland Coal P/L	Camberwell
A311	B.M.I. Mining P/L	Gloucester
A315	B.M.I. Mining P/L	Gloucester
A321	Genders Mining P/L	Capertee
A322	Electricity Commission of N.S.W.	Bylong
A323	Electricity Commission of N.S.W.	Murrurundi
A324	North Bulli Collieries P/L	Ben Bullen
A325	Endeavour Resources Ltd Claremont Petroleum N.L. Basco Energy Inc. Charterhall Oil Aust. P/L	Casino
A326	Endeavour Resources Ltd Claremont Petroleum N.L. Basco Energy Inc. Charterhall Oil Aust. P/L	Casino
A341	Coal and Allied Operations P/L	Warkworth

EXPLORATION PERMITS

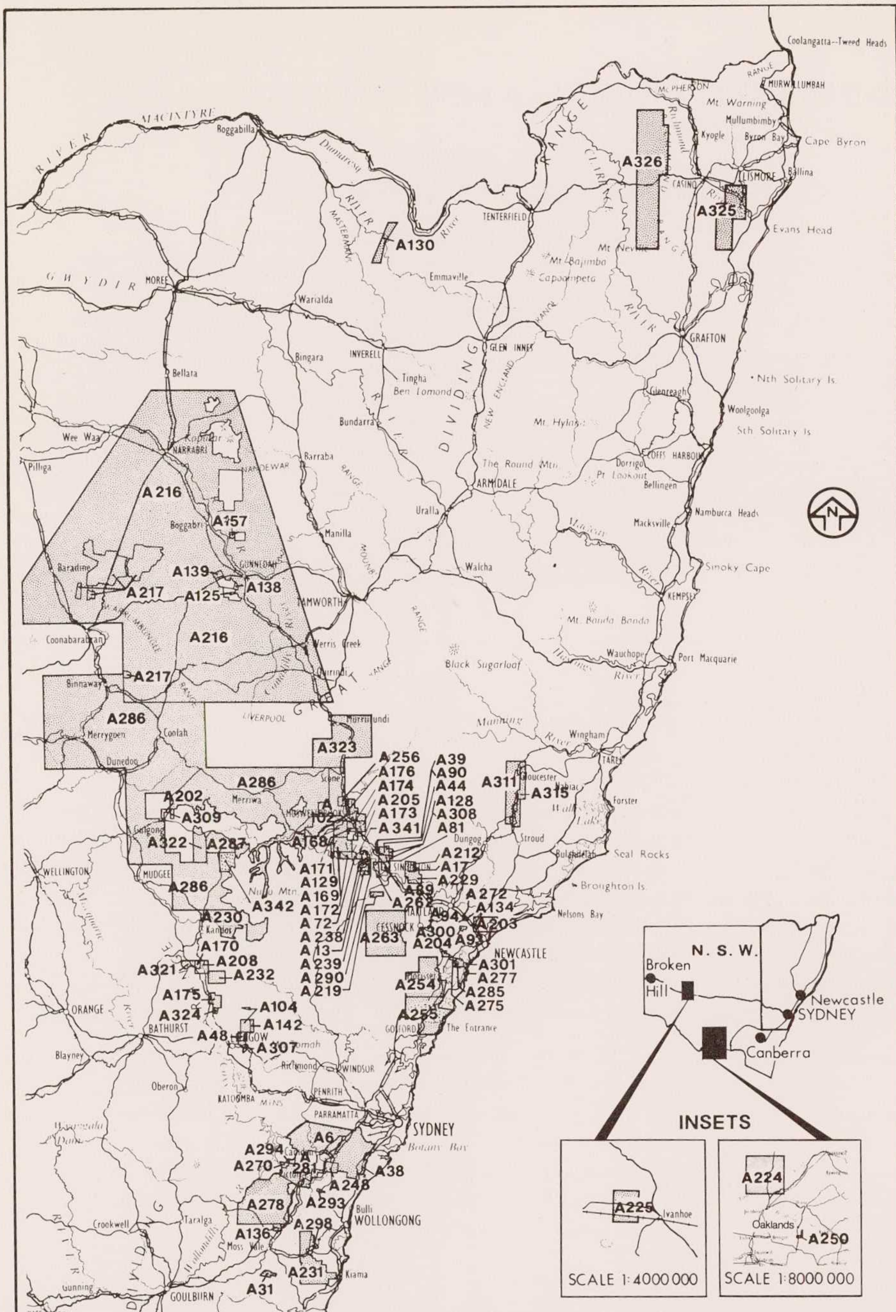
No.	Holders	Nearest town

Note: Coal lease applications have been lodged for areas within exploration permits which expired on 20th February, 1984.

AUTHORISATION APPLICATIONS

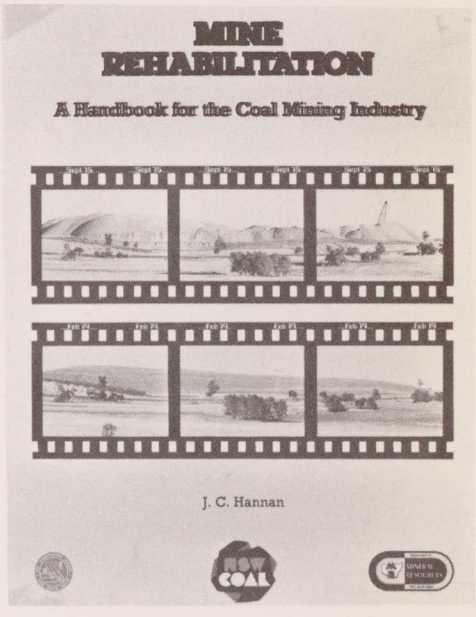
No.	Applicant	Nearest town
38	Bulli Main Colliery P/L	Heathcote
217	Dep. Mineral Resources	Baradine
278	Dep. Mineral Resources	Mittagong
309	Ulan Coal Mines Ltd	Ulan
342	Austen & Butta Ltd	Bylong

Note: Authorisations (granted under Section 20 or 21A of the Coal Mining Act, 1973) over colliery holdings are not listed.



SCALE 0 20 40 80 KILOMETRES	**N.S.W. COAL PROSPECTING AREAS** (AUTHORISATIONS/EXPLORATION PERMITS)	DEPARTMENT OF MINERAL RESOURCES, SYDNEY Charted to: MARCH, 1984

MINE REHABILITATION — A NEW HANDBOOK



In recent years, the coal mining industry has responded positively to community concern regarding what is environmentally acceptable, as evidenced by the production of an excellent new handbook, **Mine Rehabilitation** by **J.C. Hannon,** recently published by the **New South Wales Coal Association.** Although this well-written volume specifically addresses the legislative aspect of environmental responsibility as it affects New South Wales, it has relevance beyond any limitation set by territorial boundaries.

This book is a tribute to the coal mining industry and to all of those who have been involved in recognizing and accepting the changes which have led to rehabilitation standards achieving, and sometimes exceeding, community expectations. The challenge is to create a level of community affinity which identifies the results of coal extraction operations as being socially acceptable. This book goes a long way towards helping the industry to achieve this goal.

To ensure that we "get it right" it is necessary to plan. Also, we must recognize the various facets which make up a successful rehabilitation programme and, on completion, achieve a self-sustaining entity. These aspects are thoroughly addressed and set the tone for the remainder of Mr Hannan's book.

Soil to many of us in the industry is simply that top layer which contains all the essential ingredients necessary for rapid cover growth to satisfy visual inspection and receive the imprimatur of acceptance. The complexity of soil is well explained, as can be expected from an expert in this particular field.

Soils denuded of cover and exposed to the ravages of the Australian climate can be easily removed by erosion, creating problems and adding to the costs of rehabilitation. Excavated areas both before and after reshaping are similarly at risk. The means by which control can be achieved, to minimize both the loss of surface material and its deleterious effects on the environment beyond the mine site, are covered in detail.

The importance of establishing ground cover quickly, to reduce the danger of surface erosion as well as to improve the visual bareness of the landscape, is stressed, and the need to

For moderately large areas, the mulch spreader is an effective means of applying seed, fertilizer, chopped hay, and bitumen to steep or otherwise inaccessible sites. (Courtesy of Coal and Allied Operations P/L, Hunter Valley No. 1 open cut mine)

incorporate supportive systems is emphasized. The problems arising from having recreated the surface environment and how best to provide satisfactory ground cover in this new environment, are considered to be the most critical aspect of any rehabilitation programme. The chapter on revegetation provides the reader with a complete guide, allowing him to select and implement from a number of methods.

A rehabilitated mine site, though aesthetically pleasing, is still fragile and requires encouragement and attention to achieve self sustenance. To ensure that a relapse does not occur is of concern to the author, as it must be to all parties with a vested interest in the success of rehabilitation.

Having pointed the new ecosystem in the right direction, the author then puts forward his ideas on how to successfully resolve long-term viability of the rehabilitated sites.

Mr Hannan, in his introduction, modestly underestimates the extent to which he has covered rehabilitation. This book is much more than a "gardening guide", and he is to be congratulated in providing for the industry such an excellent and readable work. The book is well produced, with coloured plates, diagrams, and drawings which add clarity and reinforce the text.

It is, however, unfortunate that legislative changes occured while this book was being written. The New South Wales Coal Mines Regulation Act (1983), referred to in the recommendation for further reading, will now be the relevant Act during most of this book's life, rather than the 1912 Act to which the book continuously refers.

This book is highly recommended as a reference work for those involved in implementing mine rehabilitation, not only in the coal industry but for mining in general. The book will also be valuable to those for whom it will be an introduction during student days and to those involved in policy and decision activities related to mine rehabilitation.

The able assistance given to Mr Hannan by a number of recognized and authoritative contributors is acknowledged by the author. The three principal groups who have supported Mr Hannan, namely the New South Wales Coal Association, the Soil Conservation Service of New South Wales, and the New South Wales Department of Mineral Resources, are to be congratulated.

Having provided the manual for mine rehabilitation, let us hope that it may not be long before an equally authoritative work is published consolidating the handling of areas of concern on mine water, dust, and noise.

Mine Rehabilitation. A Handbook for the Coal Mining Industry, by **J.C. Hannon**, is available from the Central Enquiry Counter, Department of Mineral Resources, 8-18 Bent Street, Sydney. Price $25.00.

PETROLEUM

PETROLEUM EXPLORATION — UPDATE

One petroleum exploration licence was granted during the quarter to a consortium comprising Sydney Oil Co. (N.S.W.) Pty Ltd (25%), Manvane Pty Ltd (55%), Base Resources Ltd (25%), Seahawk Oil Australia N.L. (15%), and Reading and Bates Petroleum Co. (10%). This licence, PEL 267, covers most of the northern Sydney Basin (Hunter Valley area).

CLARENCE–MORETON BASIN

The 105 line km detailed seismic survey over the Braemar prospect (PEL 258) has been completed. The prospect identified from regional seismic data as a large structure situated 10 km south of Casino (refer *Minfo 2*, p. 46) has been confirmed and will probably be drilled during the second half of 1984. The Richmond Range seismic survey of 232 line km (PEL 259) has been completed across the Pillar Valley (southeast of Grafton). The results of the Richmond Range survey will be used to site the Department of Mineral Resources' stratigraphic hole (refer *Minfo 3*, p. 44). Tenders for this fully cored hole were called in late March 1984.

SURAT BASIN

Phase 1 of the Wee Waa seismic survey of 53 line km in PEL 239 was completed during January.

EROMANGA BASIN

Tenders for the Department's Eromanga Basin seismic survey (10 line km) to be undertaken in the Lake Stewart area (refer *Minfo 3*, p. 46) were called in late March 1984.

PETROLEUM EXPLORATION TITLES MARCH 1984

PETROLEUM EXPLORATION LICENCES

No.	Holder	Area (km^2)	Expiry date
PEL 182	G.E. Lukk & Associates P/L, Oil Co. of Australia N.L., Ampol Exploration Ltd, Tennscourt Oil P/L, Oakwood International Petroleum N.L.	12 870	14. 3.1985
PEL 211	Offshore Oil N.L.	9 000	4. 4.1985
PEL 212	Comserv (No. 779) P/L	8 820	20. 8.1984
PEL 213	"	3 750	20. 8.1984
PEL 214	"	10 000	20. 8.1984
PEL 216	"	3 583	20. 8.1984
PEL 217	"	7 200	17.10.1984
PEL 218	Bridge Oil Ltd, The Australian Gas Light Co., Project Oil Exploration Ltd, Consolidated Petroleum (Aust.) N.L. (Hartogen Energy Ltd), Weeks Australia Ltd	9 580	16.12.1984
PEL 221	"	9 780	15. 3.1985
PEL 223	"	9 900	16.12.1984

PETROLEUM EXPLORATION LICENCES

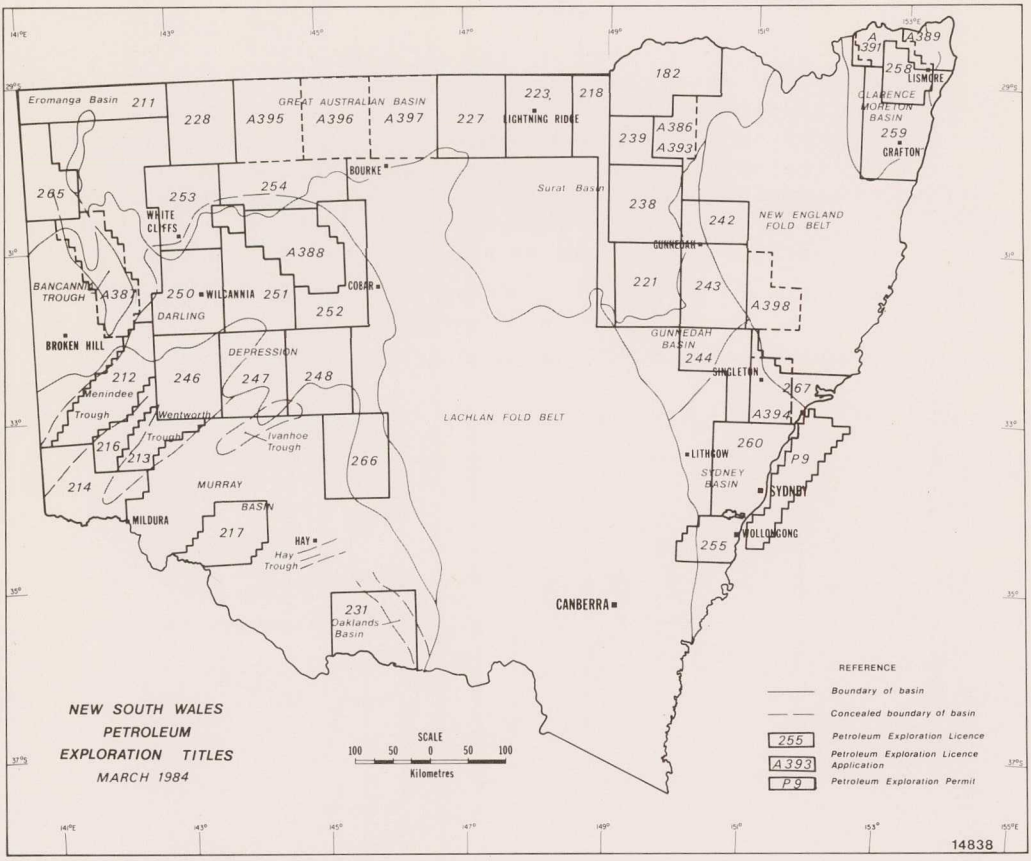
No.	Holder	Area (km^2)	Expiry date
PEL 227	"	9 900	16.12.1984
PEL 228	"	9 882	15. 3.1985
PEL 231	Meekatharra Minerals Ltd	10 000	10. 9.1984
PEL 238	The Australian Gas Light Co., Consolidated Petroleum (Aust.) N.L. (Hartogen Energy Ltd)	9 148	31. 8.1984
PEL 239	"	4 100	31. 8.1984
PEL 242	Frontier Resources Ltd	4 940	12.10.1984
PEL 243	"	9 708	12.10.1984
PEL 244	"	5 896	12.10.1984
PEL 246	Comserv (No. 779) P/L	9 550	14.11.1984
PEL 247	"	8 912	14.11.1984
PEL 248	"	9 246	14.11.1984
PEL 250	"	9 435	14.11.1984
PEL 251	"	9 968	14.11.1984
PEL 252	"	9 300	14.11.1984
PEL 253	"	9 450	14.11.1984
PEL 254	"	10 000	14.11.1984
PEL 255	The Australian Gas Light Co.	1 700	1.12.1984
PEL 258	Endeavour Resources Ltd, Claremont Petroleum N.L., Target Exploration Pty Ltd, Charterhall Oil Aust. P/L	3 951.29	6. 1.1985
PEL 259	Bridge Oil Ltd, The Australian Gas Light Co., Consolidated Petroleum (Aust.) N.L., (Hartogen Energy Ltd), Project Oil Exploration Ltd	9 695.41	6. 1.1985
PEL 260	The Australian Gas Light Co.	7 700	8. 9.1984
PEL 265	Kells Investments P/L	6 700	5.10.1984
PEL 266	Comserv (No. 779) P/L	9 500	22.11.1984
PEL 267	Sydney Oil Co. (N.S.W.) P/L, Manvane P/L, Base Resources Ltd, Seahawk Oil Aust. N.L., Reading & Bates Petrol Co.	6 815	20. 1.1985

PETROLEUM EXPLORATION LICENCE APPLICATIONS

No.	Applicant	Area (km^2)	Application date
PELA 386	Base Resources Ltd	4 015	24. 6.1983
PELA 387	Base Resources Ltd	10 000	24. 6.1983
PELA 388	Base Resources Ltd	10 000	24. 6.1983
PELA 389	Base Resources Ltd	7 293	24. 6.1983
PELA 391	Endeavour Resources Ltd, Claremont Petroleum N.L., Charterhall Oil Aust. P/L, Basco Energy Inc., Planet Resources Group N.L.	3 346	6. 9.1983
PELA 393	B.L. Ward	4 004	26. 9.1983
PELA 394	Frontier Resources Ltd, Interstate Construction P/L	4 620	19.10.1983
PELA 395	Mount Isa Mines Ltd	9 950	9. 4.1984
PELA 396	"	9 950	9. 4.1984
PELA 397	"	9 950	9. 4.1984
PELA 398	Suntala P/L	5 360	16. 4.1984

PETROLEUM EXPLORATION PERMITS

No.	Holder	Area	Issue date
PEP 9	ESP Offshore Pty Ltd, ESP Exploration P/L, Magnet Minerals Ltd	108 graticular blocks	1.10.1980 term 6 years



GENERAL

GEOLOGICAL SURVEY — RESTRUCTURE

In 1983 a review was undertaken of the work programme and organization of the Geological Survey of New South Wales, a branch of the Department of Mineral Resources. Arising out of this review a new structure has now been introduced.

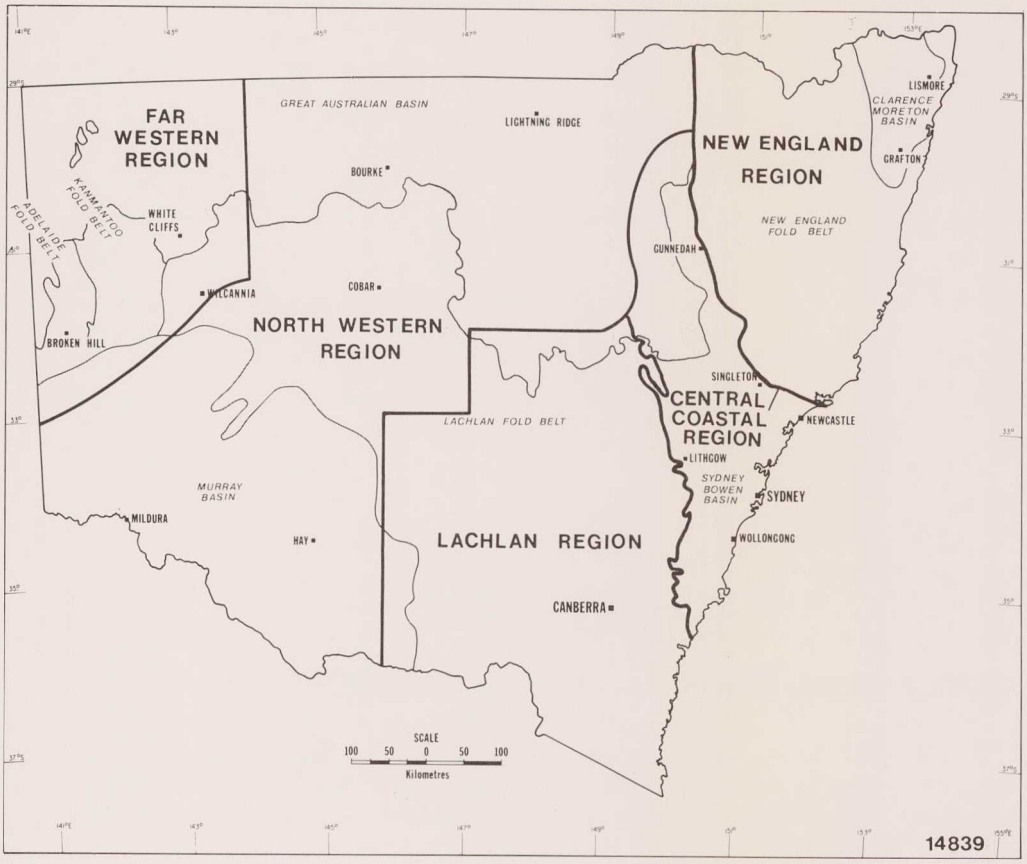
The main features of the new structure are as follows:

1. Creation of a series of five regional groups (figure 6), each of which will be multidisciplinary and responsible for all project and service work pertaining to a given region.

2. Retention of a number of centres of expertise to undertake specific project and service work of a non-regional nature and to provide specialist supervision to the regional groups in the fields of Metallic and Industrial Minerals, Regional Mapping, Geophysics, and Petroleum Geology (figure 7). Geophysicists will be allocated to the regions on a project basis.

3. Retention of the existing Mineral Economics, Environmental Geology, Specialist Services and Applied Research, Cartography, and Administration Sections.

Figure 6. The five designated regions of the Geological Survey



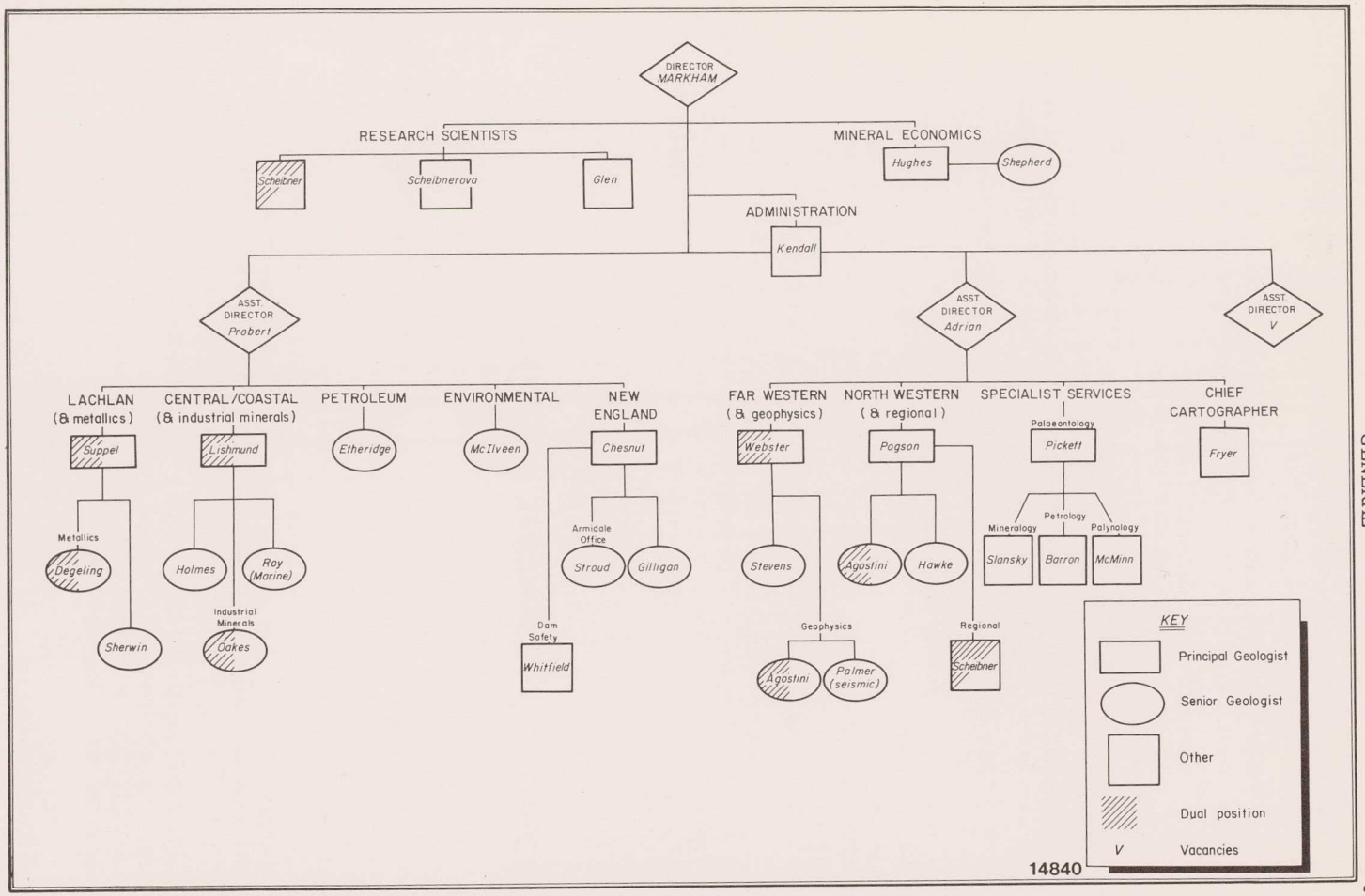


Figure 7. Simplified organization of the Geological Survey

The five designated regions (figure 6), together with their areas of responsibility, comprise:

* **New England region** — the whole of the New England Fold Belt, together with the Clarence-Moreton Basin.
* **Central and Coastal region** — the Sydney and Gunnedah Basins, together with the coastal zone.
* **Lachlan region** — the central and southern parts of the Lachlan Fold Belt.
* **North Western region** — the Great Australian Basin, Murray Basin, and northern part of the Lachlan Fold Belt.
* **Far Western region** — The West Darling region.

The new structure aims to provide a more effective interface between the regional groups and the mining and exploration industry. It will also provide staff of the regional groups with a wider range of work experience than that previously available in specialist sections. An initial review of the effectiveness of the new structure will be carried out in October 1984.

Names of the main contact officers for each of the regional and specialty teams are shown on the simplified organization chart (figure 7). You are invited to discuss any aspect of the Geological Survey's organization or activities with these liaison officers.

PROMOTING THE MINERAL INDUSTRY

An important function of the Department of Mineral Resources is to provide the country areas of New South Wales with information on the mineral resources of the State. Displays of minerals (supplied by the Geological and Mining Museum, Sydney) and photographs relevant to each area are installed for a period of 4 to 6 weeks in Council chambers, tourist information centres, and branch offices of the Department. Local schools are encouraged to attend, and are provided with coloured brochures and information leaflets on the minerals of New South Wales. They are also invited to attend the Geological and Mining Museum when in Sydney.

A very encouraging response has been received from exhibitions installed at Gunnedah, Mudgee, Armidale, Kempsy, Grafton, and most recently, at Bathurst for Heritage Week. Exhibitions will be installed at Dubbo and Inverell in the near future.

For further information contact John Priest, OIC Advertising and Promotions, on (02) 240 4337.

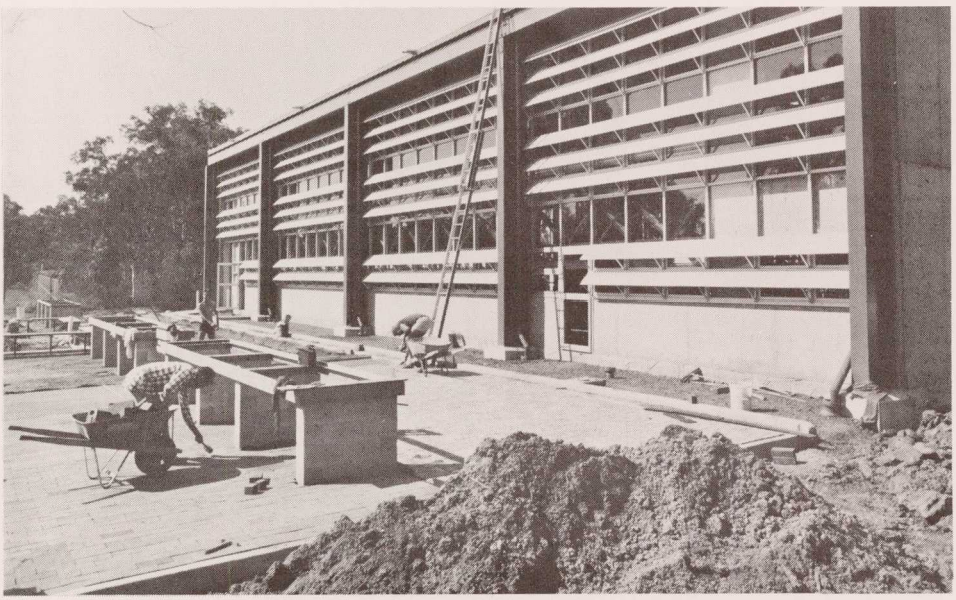
NEW CORE LIBRARY

The first stage of the new Department of Mineral Resources Core Library is nearing completion at Londonderry. The new centre has been designed, in consultation with the architect of the Public Works Department, to provide a modern storage facility with a highly mechanized and efficient retrieval system for core inspection and sampling.

The Core Library at present stores selected core, comprising 45% from coal drilling (various government departments and private companies), 45% metalliferous drilling, and 10% others including petroleum, stratigraphic, non-metallic, etc.

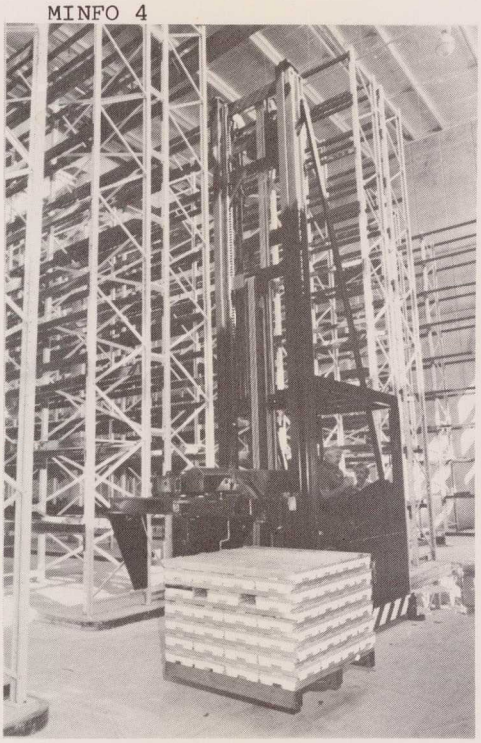
Stage 1 of the new centre is scheduled for completion in May 1984. This stage is essentially a giant warehouse, with core storage capacity in the order of 91,000 boxes. After completion of the core culling programme, this building should house most, if not all, of the drill core currently housed in the existing four, smaller core library buildings as well as the core stored on the ground. The old buildings, when vacated, will be taken over by the Department of Industrial Relations for use as testing stations and mine safety education/training areas.

Paving of the outdoor inspection area at
the new Core Library, Londonderry



The new core library building is designed to store core on pallets, which will be stacked ten high. A computer controlled, Lansing Bagnall Turret Truck will be used to gain immediate access to any pallet.

Two levels of individual box racking will be used for important core requiring a high level of access. Inspection benches with sinks will be available for visitors on both levels. On the northern side of the building a paved area with inspection benches is being constructed for outdoor inspection of core. The building is designed to allow the maximum use of sunlight, with many windows on the northern side.



Core racking system

Design of Stages 2 and 3 is now being undertaken, and they will be built as a unit in the near future. Stage 2 will provide a facilities building, containing indoor core inspection areas, core photography room, core cutting room, visiting geologists room, office and storeroom, showers and toilets, dual purpose amenities/microfilming room, publications store, plantroom, pallet cage storage area (storage of registered rocks, fossils, bulk brochures, etc.), and a large undercover loading/unloading bay which will also be used as a garage for core library vehicles. Stage 3 is to be a warehouse building identical to Stage 1 but is anticipated to house an additional 15% of core using the new modular core boxes. Each building will be connected by a common central access aisle.

The task of transferring 91,000 boxes of core to Stage 1 will begin in July 1984, after the Turret Truck is commissioned and the pallet racking system has been tested. The individual box racking system is not part of the current contract, and will probably be completed before Christmas 1984.

For further information contact Stan Kaluza, Technical Officer, Londonderry, on (047) 77 4316 or Dale Thompson, Senior Geologist, Sydney, on (02) 240 4537.

AEROMAGNETIC SURVEYS

Aeromagnetic maps are now available for most 1:250,000 sheet areas in New South Wales.

Figure 8 shows the coverage in New South Wales of surveys carried out by the Bureau of Mineral Resources Australia (BMR), and by the New South Wales Department of Mineral Resources (MRD). The areas not systematically covered by the BMR and MRD, the northern area (between Yantabulla and Moree/St George) and the Sydney Basin area, have been covered by aeromagnetic surveys undertaken for private companies exploring for petroleum (see figure 8). The results of these surveys are avaialable in the Department's *GS* report system. Release of data from the New England area was announced in *Minfo 2*, and the data from 1984 MRD surveys will be released later in 1984.

Processing of analog data obtained by the BMR has been under way during the last few years. The data have been converted to digital form, and, after removal of the International Geomagnetic Reference Field (IGRF), have been recontoured at a smaller magnetic contour interval. Reprocessed data for the Nymagee and Cobar 1:250,000 sheets are at present proprietary to Getty Oil Development Co. but will be released in May and December, respectively. The MRD has arranged for the reprocessing of the Bourke, Cargelligo, Narromine, and Forbes 1:250,000 sheets — table 2 is a list of plans available. Processing of the Bathurst and Goulburn 1:250,000 sheets is currently being undertaken for the MRD. The assistance of the BMR in making available the original analog records and flight line data is gratefully acknowledged.

Additional enhancement techniques can be applied to the data, when these are in digital form, as illustrated in figures 9 and 10. These figures have been produced for the MRD by the BMR, using image processing techniques similar to Landsat or photographic image processing.

Figure 9 is the aeromagnetic data displayed as a light/shadow image, with magnetic highs represented as bright areas and magnetic lows as areas of shadow. Figure 10 is an illustration of image enhancement, particularly of linear trends, using a process analogous to variable sun angle illuminations.

Interpretations of the aeromagnetic data are currently being made by officers of the Department. Reports available at present are:

* Nyngan 1:250,000 sheet — a preliminary geological interpretation from regional aeromagnetic data, by A. Agostini. *New South Wales Geological Survey — Quarterly Notes 54*, 13-23.

TABLE 2

NEW AEROMAGNETIC MAPS, CENTRAL WESTERN NEW SOUTH WALES

Sheet name	Sheet No.	Scale	Plan No.
BOURKE	SH 55-10	1:250,000	14619
Bourke	8037	1:100,000	14576
Mount Oxley	8137	1:100,000	14577
Gongolgon	8237	1:100,000	14574
Gunderbooka	8036	1:100,000	14575
Byerock	8136	1:100,000	14578
Glenariff	8236	1:100,000	14579
NYNGAN	SH 55-15	1:250,000	14366
Canonba	8335	1:100,000	14596
Mount Harris	8435	1:100,000	14600
Galargambone	8535	1:100,000	14597
Nyngan	8334	1:100,000	14595
Warren	8434	1:100,000	14599
Bundemar	8534	1:100,000	14598
NARROMINE	SI 55-3	1:250,000	14620
Tottenham	8333	1:100,000	14604
Dandaloo	8433	1:100,000	14605
Narromine	8533	1:100,000	14606
Boona Mount	8332	1:100,000	14601
Tullamore	8432	1:100,000	14602
Peak Hill	8532	1:100,000	14603
FORBES	SI 55-7	1:250,000	14622
Condobolin	8331	1:100,000	14613
Bogan Gate	8431	1:100,000	14616
Parkes	8531	1:100,000	14617
Wyalong	8330	1:100,000	14614
Marsden	8430	1:100,000	14615
Grenfell	8530	1:100,000	14618
CARGELLIGO	SI 55-6	PRELIMINARY	PLANS ONLY
Hillston	8031	1:100,000	14608
Cargelligo	8131	1:100,000	14610
Tullibigeal	3231	1:100,000	14612
Merriwagga	8030	1:100,000	14607
Rankins Springs	8130	1:100,000	14609
Ungarie	8230	1:100,000	14611

For a list of aeromagnetic maps available for the New England area see *Minfo 2*, p. 52.

* Interpretation of regional magnetic and gravity data of the Forbes and Narromine 1:250,000 sheets, by K.L. Tenison Woods. *New South Wales Geological Survey — Report GS 1983/200* (unpubl.).

The plans shown in table 2 are available as either paper or transparency dyelines, and may be purchased at the Central Enquiry Counter, Department of Mineral Resources, 23rd floor, 8-18 Bent St, Sydney (if ordering by post, see page 52). At current prices, the cost for each plan is

$ 4.00 + 7.5% sales tax for a paper dyeline, and

$21.00 + 7.5% sales tax for a transparency dyeline.

Bureau of Mineral Resources maps are available as paper copies only, and may be purchased as above.

Figure 8. Aeromagnetic surveys in New South Wales

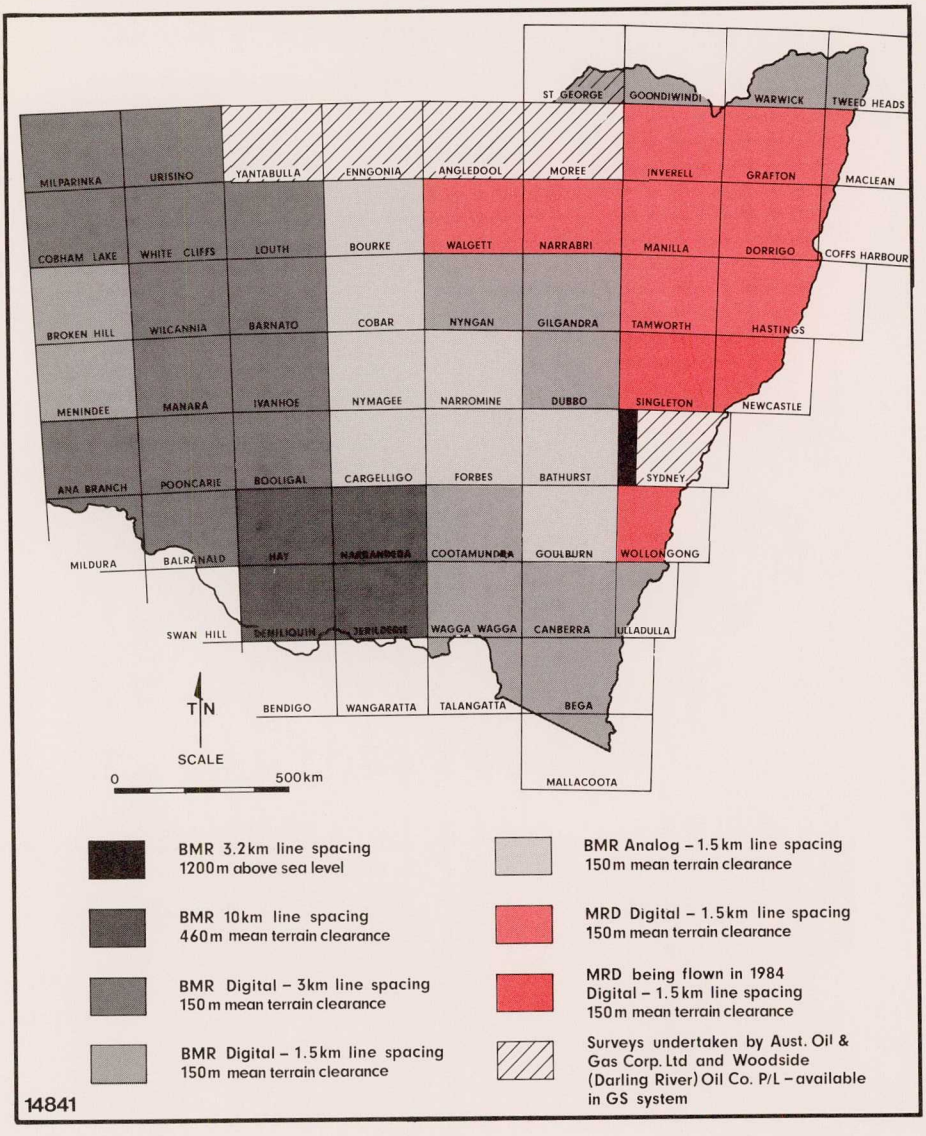


Figure 9. Bourke 1:250,000 sheet. Aeromagnetic data displayed as a light/shadow image (magnetic highs are bright, magnetic lows are shadow areas)

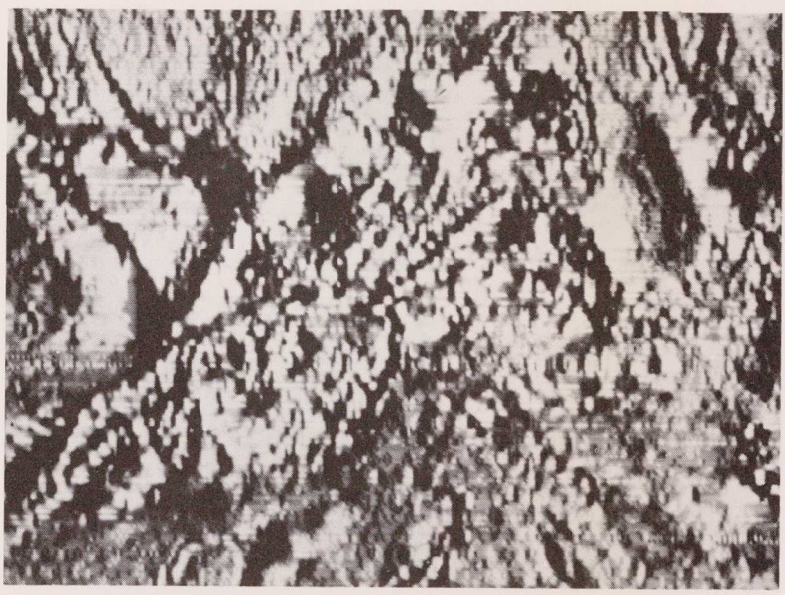


Figure 10. Bourke 1:250,000 sheet. Image enhancement of aeromagnetic data. The "sun" is at geographic east

BROKEN HILL 1:25,000 SHEETS

The Department of Mineral Resources has recently published the **Mount Gipps** and **Broken Hill 1:25,000 Geological Sheets.** These two geological sheets are the first of a series of twenty-three detailed geological maps of the Broken Hill area. The **Silverton** and **Pinnacles 1:25,000 Geological Sheets** are due to be published in July 1984.

Since 1974, the Geological Survey of New South Wales has been actively involved in investigations of the Broken Hill area. The main thrust of the work has been in geological and metallogenic mapping of the Willyama Supergroup (refer *Minfo 1*, p. 57). The entire Broken Hill Block and half of the Euriowie Block have been mapped at a scale of 1:12,000 for publication at 1:25,000 (figure 11).

The Willyama Supergroup rocks contain the Broken Hill orebody and approximately 3000 other known mineral deposits (most of these deposits being very small). The Willyama Supergroup is complexly folded and metamorphosed, and until recently there had been no satisfactory stratigraphic framework for the area. Mapping and interpretation by the Geological Survey of New South Wales have played a major part in the development of an overall stratigraphic model. It is now possible for exploration geologists unfamiliar with the area to rapidly gain an understanding of the local geology. This factor, together with the availability of detailed, consistent geological maps and mineral deposit data, permits exploration companies to progress quickly to more advanced stages of exploration, including drilling. Prior to the mapping programme, exploration companies had to expend considerable effort on semi-regional mapping, and even then had no satisfactory interpretative framework upon which to base exploration concepts.

The 1:25,000 scale maps are largely fact maps, showing the distribution of rock types. These maps were the main basis for stratigraphic interpretation, and the interpretation is shown in diagrams on the maps. The maps also show the locations of all pits and shafts, and the locations of exploration drill holes.

The new geological sheets are printed in colour and are available for $5 per sheet (plus handling charge, see p. 52). Most of the other sheets are available as dyeline copies of field sheets, at 1:12,000 scale (figure 11). In addition, unpublished reports are available for most of the 1:25,000 areas or sub-areas, and a number of published reports are available on various aspects of the geology, including rock types, stratigraphy, and mineral deposits (reports etc. are listed in *Minfo 1*, p. 58).

The maps and reports are available from the Central Enquiry Counter, Department of Mineral Resources, 23rd Floor, 8-18 Bent Street, Sydney, and from 32 Sulphide Street, Broken Hill.

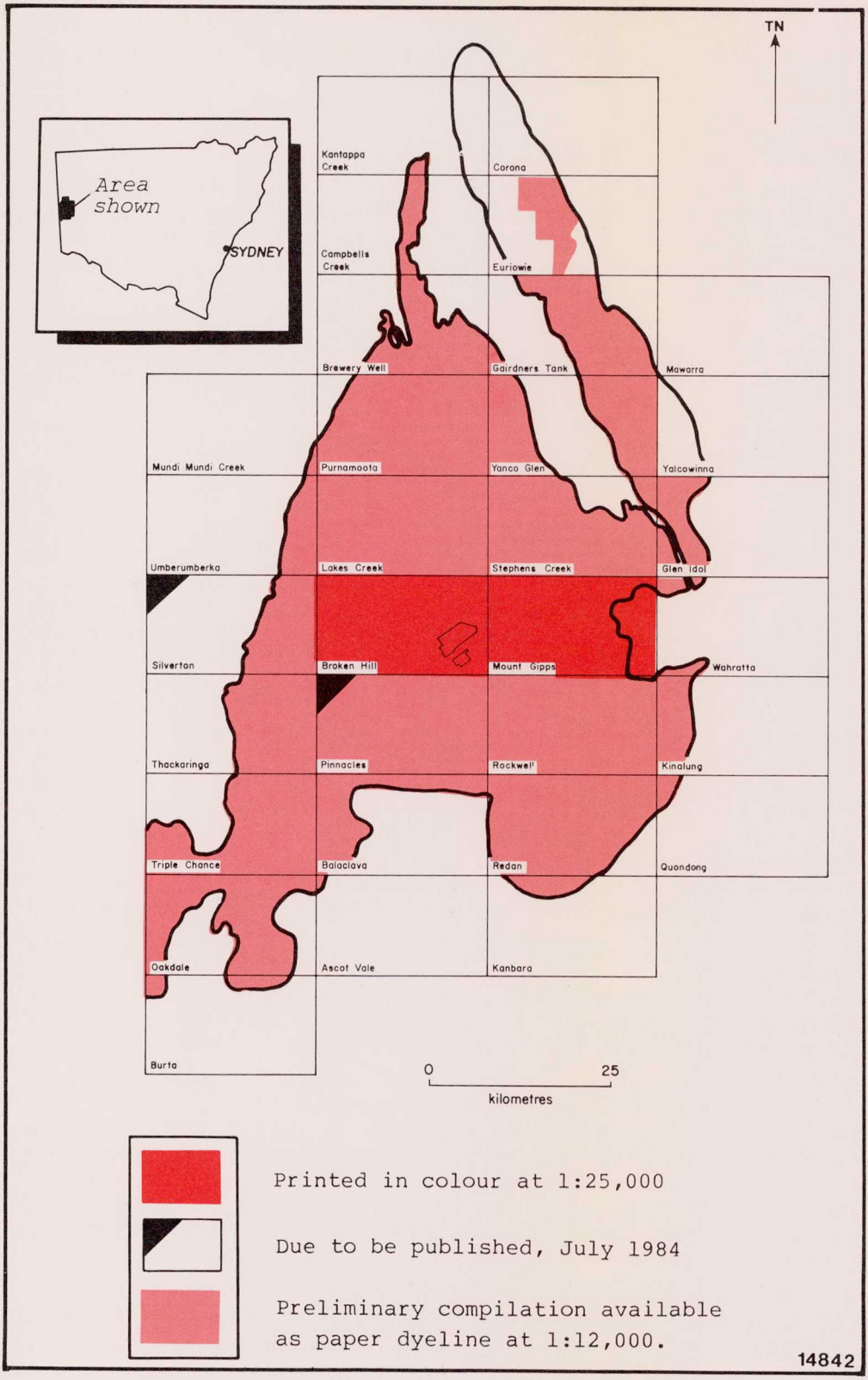


Figure 11. 1:25,000 geological sheets, Broken Hill area

REVIEWS OF NEW DEPARTMENTAL PUBLICATIONS

NEW SOUTH WALES COAL STRATEGY 1983 Volume 1 $ 5.00
Volume 2 $10.00

The 1983 coal strategy study was prepared by the Coal Resources Development Committee, a committee formed in July 1980 to develop an overall long-term strategy for the export of New South Wales coal. Members come from relevant Government departments, industry, and the unions.

New South Wales Coal Strategy 1983 differs from its predecessor, the 1981 report, and is presented in two volumes. The Strategic Plan proposed by the study is discussed in Volume 1, while Volume 2 contains a series of background papers on the industry.

In **Volume 1** the present position regarding the coal industry is briefly outlined, and the outlook for New South Wales coal is discussed in terms of future demand and production potential. A Strategic Plan is presented, covering infrastructure policy, mining methods and technological development, marketing support, industrial relations, resource management, existing mines, and regional development. Appropriate action is recommended, aimed at:

* promoting the cost competitiveness of the New South Wales coal industry, and
* ameliorating the effects of the industry restructuring that has been precipitated by the present cost/price squeeze.

Volume 2 looks in detail at the industry from 1981 to 1983, and then presents forecasts for 1990 and beyond. Aspects considered include exploration and resource assessment, industry production and costs, markets and demand forecasts, infrastructure, and socio-economic and environmental factors.

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Bentonite and Fullers Earth in New South Wales, by G.G. Holmes

This comprehensive study covers the nature, properties, origin, occurrence, uses and specifications, and production and consumption of bentonite and fullers earth. Detailed descriptions are given of all known occurrences in New South Wales. In particular, the occurrence of bentonite in coal measures in the Upper Hunter Valley and the Gunnedah Basin is examined in detail using information from recent coal exploration drill holes. Analytical test results and clay mineralogy are given for samples from these areas and from other significant deposits. The study indicates that there is moderate to good potential for locating and developing commercial sodium bentonite deposits in the Upper Hunter Valley and recommends prospective areas for further detailed evaluation.

PUBLICATIONS ISSUED JANUARY–MARCH 1984

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