



Geoscience information — at your fingertips!

The Geoscience Information Library's bibliographic database 'OLIB' is now accessible to public users via two PCs in the GSWA Library. If you want to find out what publications the Geoscience Information Library holds in geology, mineral and petroleum exploration, mining, explosives and dangerous goods, mining and industrial safety, environmental issues and much more, you can now access this information directly via the 'OLIB' database.

The database currently holds more than 5,700 titles including books, reprints, conferences, theses, symposia, proceedings and video recordings.

The search screens or OPACs (Online Public Access Catalogues) are very easy to use — just follow the instructions on the screen. Both character-based and Windows-based versions are available. Users can search by: author, title, subject heading, keyword, series name, ISBN and shelf number. Once you have retrieved a hit list of relevant titles you can display the full details of any title and see if the publication is currently available in the library.

The database also includes analytical indexing of relevant articles and conference papers within a publication including full details of author(s), title and subject terms. Western Australian localities, mine names and mineral names have also been included where an article is about Western Australian geology, mine sites or mineral deposits. Users can therefore not only search the holdings of the library, but the **content** of those holdings.

Data entry is controlled as much as possible using various authority control systems such as the National Library of Australia's authority listings for corporate authors and series names, whereas subject headings are controlled using the Australian Mineral Foundation's Thesaurus of Earth Science and Related Terms.

Searching the database is easy and numerous features make it a powerful information retrieval tool. These include **fuzzy matching** (logic) so a search using English or American spelling of a word will find all relevant titles for either spelling. You can also use the **wildcard (%)** to search for all titles beginning with a word or part of a word e.g. enter the term 'environ%' and you will retrieve all publications containing the terms environs, environment, environmental. Use **Boolean operators** — AND, OR, NOT — to refine your search. If you retrieve too many hits you can **filter** your search by

author, date or type of media. You can then **sort** your retrieved list by relevance, date, media type or title.

The card catalogue is now only used to record new serial titles added to the collection and will eventually be decommissioned as further data is taken up to the 'OLIB' database.

"Searching the database is easy"

All new books added to the library collection since October 1995 are entered on the 'OLIB' database and a work program is currently underway to add older book holdings. So if

you're looking for the latest publication on a subject, check out 'OLIB'.

Access to the 'OLIB' database is available during normal library opening hours (9.00am - 4.30pm Monday – Friday). If you require assistance in using 'OLIB' just call upon any of the library staff. □

Enquiries:

Brian Knyn (Librarian)

Tel: (09) 222 3165

email: b.knyn@dme.wa.gov.au

What's Inside ?

CHINA '96	2
MINEDEX	4
BUSH TELEGRAPH	5
MINERAL EXPLORATION	6
RECENT PUBLICATIONS	8

CHINA '96: 30TH INTERNATIONAL GEOLOGICAL CONGRESS

The Congress

The Director of the Geological Survey, Pietro Guj, and Franco Pirajno (Project Manager), attended the 30th IGC in Beijing. The Congress was well organized with the participation of some 6000 earth scientists from all over the world. Of these, approximately 95 were from Australia. Pietro presented a paper (co-authored with Bill Preston) entitled '*Exploration Investment: where and why*', in which a review of the current legislation and fiscal laws of developing countries was presented. The paper examined the levels of exploration investment in the developing countries with which Western Australia has now to compete. The authors reiterated the high prospectivity of Western Australia, the favourable legislation and fiscal regimes and the high quality of the service provided by the GSWA to the exploration and mining industry. This paper was highly successful, in that it attracted many questions, both on and off 'stage' from a wide range of conference delegates.

Franco, in co-authorship with Sandra Occhipinti, Cees Swager, Nick Adamides, and Leon Bagas, presented a paper entitled '*The tectonic evolution*

and mineral deposits of the Palaeoproterozoic Glengarry Basin, Western Australia'. This paper drew attention to the prospectivity of Proterozoic basins in WA, with particular reference to the Glengarry region of the Capricorn Orogen. In addition to the talks, posters were displayed showing the potential for petroleum and mineral deposits in our State. Also displayed were the results of a joint program between the GSWA and the Department of Geology and Mineral Resources of Zhejiang Province, as part of an exchange program with Zhejiang, Western Australia's sister province. The posters attracted a large number of delegates, with Pietro and Franco responding to several enquiries on many different fronts at the same time.

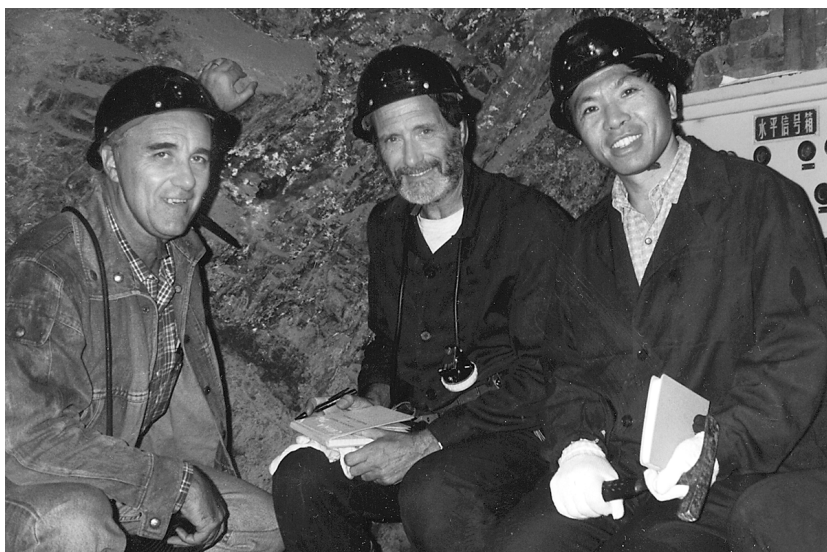
Visit to Xinjiang Province

At the invitation of the Tianjin Geological Academy and the Ministry of Metallurgical Industry, Pietro and Franco spent two and a half weeks in the remote Xinjiang Province, in the northwest of the People's Republic of China. They were accompanied by Dr Songfa Liu of the Australian Geological Survey Organisation, who was the precious link with the Chinese

hosts and colleagues. Professor Luo Zhenkuan of the Tianjin Academy was the official host and guide. The party flew from Beijing to Urumqi (capital city of Xinjiang) at the close of the Congress (14 August). The Xinjiang Uygur Autonomous Province is situated in northwest China, its area accounting for one sixth of the People's Republic. The Province is an important gateway located along the ancient Silk Road. It borders eight countries: Mongolia, Russia, Kazakhstan, Kirghizstan, Tajikstan, Afghanistan, Pakistan and India. Xinjiang has a multicultural population. At the end of 1993, the population was approximately 16 million, including the Uygur people (47%), the Han Chinese (37%), and other nationalities, such as the Kazak, Hui, Kirgiz, Mongolian, Xibo, Tajik, Manchu, Uzbek, Daur, Tartar and Russian.

Xinjiang has breathtaking scenery. Mountain ranges (e.g. the Tian, Kunlun and Karakorum Shan), with perennial snow and glaciers, rise to thousands of metres, straight out of the desert floor, where summer temperatures reach well over 40°C. A paradise for geologists, with superb rock exposures, providing clear examples of many controversial rock relationships for all to comment on, including the most argumentative geoscientist. From a distance, entire granite plutons can be clearly seen within country rocks, with starkly contrasting colours. Spectacular views of outcropping ophiolitic rocks and thrusts (e.g. the Tangbale ophiolite belt) can be enjoyed at several localities.

The physiography of Xinjiang is dominated by three economically important basins, the Turpan, Tarim and the Junggar, rich in natural resources, such as oil. These basins are surrounded by three great, roughly easterly trending mountain chains, the Altay in the north, the Tianshan in the centre and the Kunlun and Karakorum, in the south. The Tianshan (Tian = Heaven, Shan = Mountains) extends across the centre, separating the Province into two regions, southern



Underground Hatu gold mine. From left to right: Pietro Guj, Franco Pirajno, Songfa Liu.

IN BEIJING AND VISIT TO XINJIANG PROVINCE

and northern Xinjiang. The elevation of the Qiaogori Peak (also Austin or K2) in the Karakorum Mountains, is 8611 metres (second only to Qomolangma or Mt Everest), while the depression of the Aidin Lake in the Turpan Basin is 154 metres below sea level, the second lowest land area on Earth.

Much of the mineral wealth of the Province is contained within these mountains (Altay means gold), which geologically represent complex zones of collisions between a mosaic of continental fragments and island arcs. Collision and accretion of these terranes occurred during the Late Palaeozoic. These were reactivated and uplifted during the past 50 million years as a result of the collision of India with Eurasia.

Mine visits

Three mining areas were visited: Hatu–Saourtuhai, Kanguertag–Xitan and Jinouzhi.

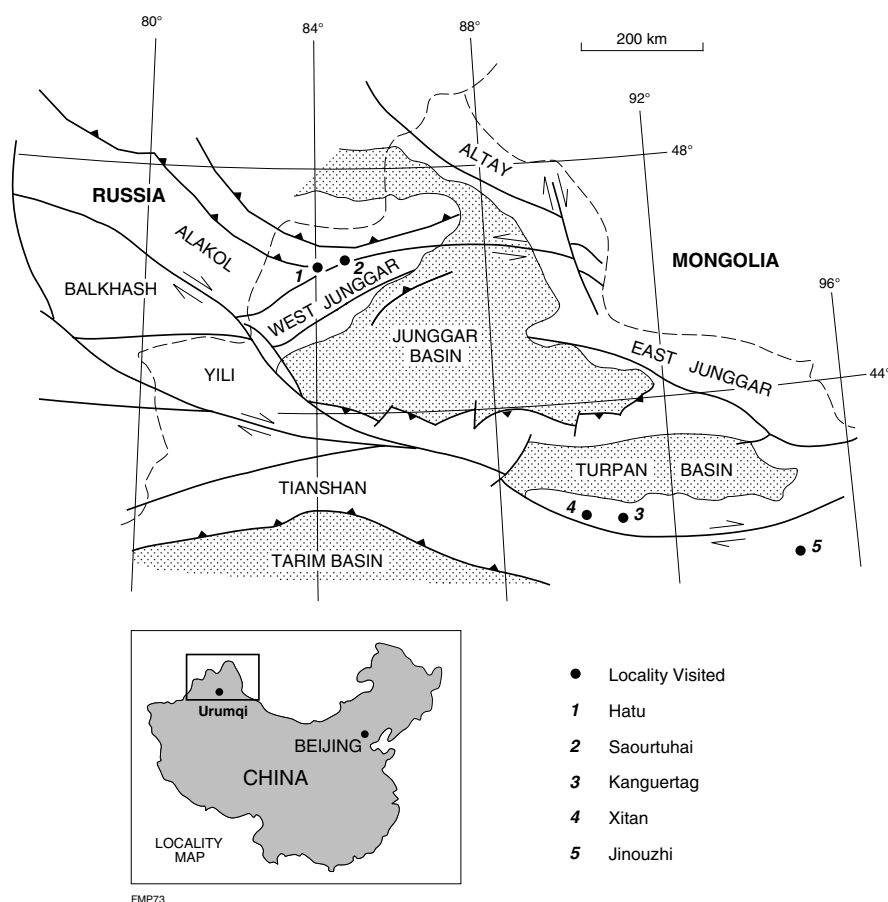
The Hatu–Saourtuhai area is located some 60 km north of the oil town of Karamai. The mining area, which includes gold and chromium deposits, is situated in the West Junggar terrane, on the northwestern margin of the Junggar Basin, and along a major sinistral northeasterly trending fault zone (Talabute Fault). Associated with the Talabute Fault is a melange zone (Tangbale Ophiolite Melange) containing ophiolitic, sedimentary and volcanic rocks. All rocks in the area are extensively tectonized, with no clear dominant tectonite fabric.

The Hatu gold deposit is hosted in Carboniferous metavolcanic rocks, it has an average grade of approximately 5 g/t (cut-off is 1.5 g/t), with a remaining resource of 600,000 tonnes. In addition, there are some 200 gold showings in the area. Saourtuhai No. 1 is a small but rich (30 g/t) gold deposit, that is hosted in a massive alteration zone, within metavolcanic rocks, and being exploited by local ‘garimpeiros’.

The origin of the gold deposits in this area is unknown. In all cases the mineralization is structurally controlled. In places, a spatial relationship with post-orogenic alkali-feldspar granite plutons is evident. The vein system, wall-rock alteration, mineral and metal associations of the Hatu mineralization are similar to some of the deposits in the Victorian Slate Belt.

Approximately 60 km to the west is the Saourtuhai chromium mine, located in ophiolitic rocks. Podiform chromite is the ore being mined, with a production rate of 60 tonnes per day.

The Kanguertag–Xitan area is located at the northeast margin of the Taklimakan desert, some 600 km southeast of Karamai, on the southern margin of the Turpan Basin, approximately 120 km south of the town of Shan Shan. The Kanguertag gold–copper–lead–zinc deposit, hosted in metavolcanic rocks (lavas and tuffs), is close to a major tectonic boundary between the South Tian Shan and North Tian Shan terranes. Major structures in the areas are the easterly trending Kanguertag and Yamasu Faults. At Kanguertag, gold occurs in quartz veins with grades of 5 to 6 g/t. Base-metal sulfides (Cu, Pb, Zn) occur at deeper levels. Wall-rock alteration, and metal zoning suggest a vein-type epithermal system. Xitan, located approximately 60 km to the west, is a very interesting gold deposit. It is located on the northwestern margin of a 20 km-diameter caldera-like structure and the mineralization is hosted in a breccia pipe. This breccia pipe could be the remnant of a hydrothermal



Terrane map of northern Xinjiang, showing positions of areas visited. Terrane map is modified after Coleman (1989), in *Tectonics*, vol. 8: pp. 621–635.



FIELDNOTES

explosion crater, similar to those that occur in the Taupo Volcanic Zone in New Zealand. The fragmented rocks in the breccia pipe are characterized by pervasive silicification and chloritic alteration. Stockwork veining contains free gold. Average grade is 7 g/t, with remaining reserves of about 5.5 Mt. The potential of this area is considerable, given that the rest of the caldera structure still remains to be explored using modern technology.

The Jinouzhi mining area is located just beyond the border between Xinjiang and Gansu Province, about 1 km north of the highway linking the towns of Hami and Liuyuan. The Jinouzhi gold deposit is hosted in granodiorite and monzogranite rocks and consists of a large northerly trending vein system, up to 5 km long, with a single vein up to 1.5 km long. The age of this deposit is possibly Devonian and grades range from 6 to 8 g/t gold. The granitoid

rocks are part of a large pluton that has intruded Upper Devonian sedimentary rocks of the South Tian Shan terrane.

During the field trip, which included mine visits, Pietro and Franco presented a series of lectures to the Xinjiang

Geological Survey in Urumqi and at the Tianjin Geological Academy in Tianjin. The lectures were ably translated to the audience by Songfa. The field trip covered some 1500 km by jeep and 1000 km by train, across the Xinjiang and Gansu Provinces.

Conclusions

The attendance by Pietro and Franco at the 30th IGC was successful in promoting Western Australia's prospectivity to the international geological community. Several copies of the presented posters were requested and distributed to conference delegates on return to Perth. The visit to the remote Xinjiang Province has once more underscored our excellent relations with Chinese mining and geological organizations (Ministry of Metallurgical Institute, Tianjin Geological Academy and provincial geological surveys) and with Chinese colleagues. The visit itself provided interesting information on mineralization styles that could have equivalent expressions in Western Australia (e.g. volcanic-hosted gold deposits), and also served to highlight opportunities for training and the use of expertise from the modern, highly skilled Australian mineral sector. □

MINEDEX : A WEALTH OF INFORMATION

The Geological Survey maintains a detailed inventory of mines and mineral deposits in WA through its MINEDEX database. The database is used both as a departmental administrative tool by a number of divisions of the DME and to satisfy the many enquiries from industry, the general public and various sectors of Government.

MINEDEX holds a wealth of information on mines and mineral deposits including:

- ◆ commodity groupings
- ◆ status and type of development or potential development
- ◆ project ownership
- ◆ mineral resources — individual deposits and State inventory totals
- ◆ locations by a variety of parameters
- ◆ tenement relationships
- ◆ notices of intent for development

Various combinations of these parameters can be used to search the database using terminals within the Department. At present searches can only be carried out by Geological Survey staff, however, future public access to MINEDEX is planned.

The locations of mine sites and deposits stored in MINEDEX are also displayed on DME's TENGRAPH, (tenement graphics) system and on a State geological base in the "Atlas of Western Australian Mineral Deposits and Petroleum Fields" (published in February 1996). A subset of the database including resources, locations and ownership has been published and is available as a Geological Survey Record (Record 1996/13, see Recent Publications, p. 8) accompanied by standard digital files in ASCII format or MS ACCESS tables.

Further developments in MINEDEX will be to include production data and to link production figures with known resources so as to provide total in-ground (pre-mining) resources of developed deposits. □

Enquiries on MINEDEX can be directed to: David Townsend 222 3598



Bush Telegraph

The *Mineralization Studies* group of the Geological Survey is dedicated to increasing the exploration potential of Western Australia by attempting to establish the regional and district-scale controls on ore deposits. A good understanding of these controls constrains conceptual models for ore genesis and helps to stimulate new approaches to exploration. Permanent members of the Mineralization Studies team are Wally Witt and Jane Westaway. The group is currently investigating the controls on gold deposits in the southeastern part of the Eastern Goldfields (Yilgarn Craton), an area that corresponds approximately to the KURNALPI and EDJUDINA 1:250 000 sheets. The results of the work will be published as a GSWA Report and map. These publications follow earlier reports on regional controls of gold mineralization in the Southern Cross greenstone belt and in the Menzies–Kambalda region.

Familiarity with a broad range of mineral deposits is an essential requirement for geologists working in the Mineralization Studies group. To this end, Jane Westaway will participate in an excursion to visit mineral deposits in southern Africa. Jane, who is based at the Kalgoorlie Regional Office, will join fifteen geologists from the University of Western Australia on an excursion that will be led by Professor David Groves, one of the world's leading economic geologists. Her enthusiasm for geology and mineral deposits is reflected in her decision to fund the trip herself during her annual leave. The excursion will visit world-class gold, platinum, nickel, chrome, coal and diamond mines in Zimbabwe and South Africa.

A temporary member of the group is Tracey Garner from the U.K. Tracey is in Western Australia to complete her thesis in partial fulfillment of an M.Sc degree at the

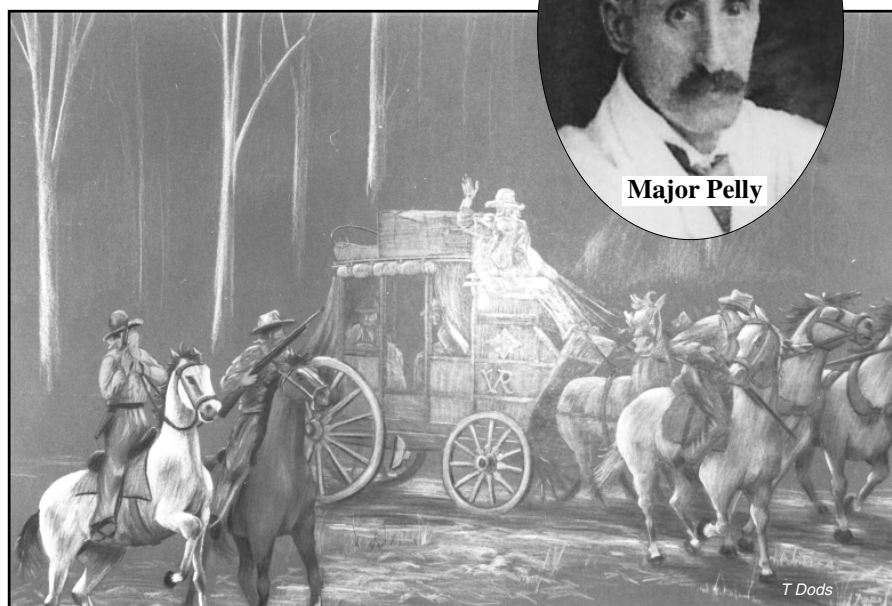
Canborne School of Mines in Cornwall. She has been mapping and logging core in the Gordons area, northeast of Kalgoorlie in an attempt to interpret the depositional setting of the felsic volcanic and volcanoclastic rocks that host gold mineralization at Gordons. Her work at Gordons will be incorporated into a new project which aims to produce a new style of geological map for the Kanowna–Gindalbie area. These maps will show the original depositional setting and depositional facies of the mainly volcanic rocks in this area, and will also portray the distribution of the various styles of alteration that the rocks have undergone. This information will assist in the identification of ancient environments that have the potential to host volcanogenic massive base-metal sulfide deposits. □

Did you know ?

After his appointment as Government Geologist in late 1896, Andrew Gibb Maitland employed a clerk/accountant known as Major Pelly.

After Pelly's death in 1899 through accidental poisoning, and as a consequence of the publicity given to the inquest, it was revealed through correspondence with an inmate of Pentridge Prison that 'Pelly' was in fact Frank Pearson, *alias* Frank Gordon, better known as 'Captain Starlight', a notorious bush ranger.

As Major Pelly however, he established a reputation as a reserved and courteous civil servant, and his services were held in high regard by Maitland. □



Major Pelly

T Dods



MINERAL EXPLORATION ACTIVITY IN WA : A STATISTICAL VIEW

Performance in many areas is increasingly being measured by some quantifiable statistic.

The state of the economy and Government performance is measured by information collated by the Australian Bureau of Statistics (ABS).

This information includes the CPI and the balance of trade. Levels of exploration activity in Australia are subject to a quarterly census by ABS and analysis by a variety of interested parties. In addition, a quarterly review is carried out by the Geological Survey to detect any discernible changes in the level of exploration activity and in the proportion being attracted to WA, in what is now a highly competitive global business.

The exploration dollar linked to the increase in resource inventory provides a rough measure of the exploration success rate for a number of commodities and can be used to gauge the prospectivity of a region. WA's success for gold discoveries has been high in recent years. Fears of this not continuing were allayed with the recent announcement of the Curara (Kirkalocka) half million ounce resource.

In terms of exploration activity, WA has attracted over 50% of the total Australian mineral

exploration dollar for almost ten years. In 1995/96, the average was 54% and in the second quarter of 1996, 52%.

Queensland, the next most significant area of activity, has just under 18% of the total. Expenditure in WA is currently around \$500 million p.a. and has progressively improved over the past three years.

Gold

Since the start of the gold boom in the early 1980s, exploration expenditure for **gold** has dominated in Western Australia. The contribution to total expenditure in 1995/96 was 71% with around 64% (\$93 million) in the June quarter of 1996. The high exploration expenditure in the search for gold has undoubtedly diverted some funds from other commodities.

Through the 1980s, gold moved from 'hand-to-mouth' operations (2–4 year supply) to currently have about fourteen years in reserve at current production levels of 205 t p.a. Au.

An equivalent of 11% of revenue from gold production in the State is being put back into exploration which is one of the highest levels of reinvestment in gold exploration in five years. Discovery rates continue to be good at about \$22 of exploration expenditure per ounce of gold

discovered over the last fifteen years of boom conditions for WA gold. This does, however, include extensions of resources at existing operations and not just 'greenfields' exploration discoveries.

Base metals including nickel

Exploration for base metals, including nickel, is now at an all time high (\$32 million for the June quarter of 1996), since funding was diverted to the search for gold in the 1980s.

Exploration has been relatively steady, fluctuating between \$40 and \$60 million p.a. but successes in terms of economically viable resources of **copper, lead, zinc** have been low over the period. Large, low-grade occurrences have been found (Magellan, Admiral Bay) and a few relatively small, rich orebodies (Cadjebut, Goongewa, Kapok, Nifty), but the elusive, large orebodies such as those at Mt Isa, Broken Hill or McArthur River are still to be found in WA.

A significant proportion of the base metals exploration effort is concentrated on **nickel**. There are now eight projects at the detailed evaluation/feasibility stage and there is significant exploration activity in the areas around existing mine sites. Interest in nickel laterites, the Voisey Bay greenfields discovery in Canada,

and the very high grade Silver Swan discovery, have all contributed to the high level of activity being sustained in this commodity.

Diamonds

The **diamond** search is continuing to attract a slightly lower level of interest than the last two years at around \$30 million expenditure p.a. Activity is concentrated in the Kimberley region, where expectations are high for a significant discovery in the North Kimberley Field.

Iron ore

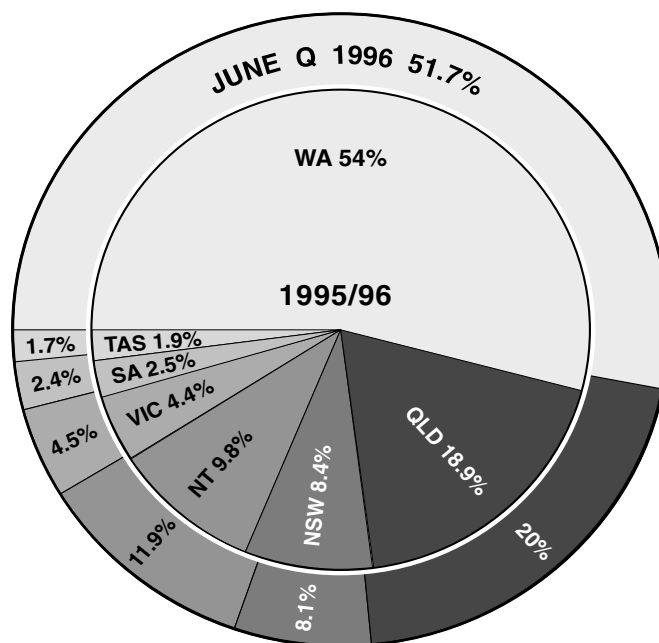
The **iron ore** exploration effort varies between \$12 and \$20 million p.a. Existing operators in the Pilbara region are primarily focused on establishing a wider diversity of product types and are also involved in the search for the elusive premium quality Brockman ores on which the State's industry was largely established.

Overall, Western Australia provides the major focus in Australia for exploration for gold (64% June quarter, 1996), nickel (38% for base metals in total), diamonds (68%), iron ore (100%) and heavy mineral sands (39%).

Whilst WA appears to be maintaining the interest of explorers within the Australian scene, many companies and commentators are suggesting that an increasing proportion of exploration funding is going **offshore**. Statistics have been

collated for the last two years by ABS and separately by the Mining Council of Australia. Both surveys indicate that the increase in overseas exploration, compared to expenditure in Australia by Australian companies, has grown by 5% between 1993–94 and 1994–95. Absolute figures are somewhat variable but a figure in the order of 25–30% of total budget is estimated for offshore activities. Whilst gold is significant in offshore work, base metals and diamonds show much more prominence than the levels targeted in Australia.

Great importance is placed on WA maintaining a significant share of the exploration dollar for the long-term future of our mineral-industry based State. Various incentives are being offered by governments both in Australia and overseas and new 'virgin' regions opened up to attract the limited investment funds from an increasingly globally based mining and exploration sector. □



Mineral exploration in Australia
by state 1995, 2nd Q 1996



SOME RECENT PUBLICATIONS

Onshore Northern Perth Basin Gravity Project

RECORD 1995/6 by R.P. Iasky and S. Shevchenko \$20.00

North West Cape petroleum exploration — analysis of results to early 1995

RECORD 1996/3 by A. Crostella \$20.00

Compilation of SHRIMP U–Pb zircon geochronology data, 1995

RECORD 1996/5 by D.R. Nelson \$25.00

Basic raw materials of the Shark Bay World Heritage Area

RECORD 1996/9 by D.B. Townsend \$25.00

..... Map only \$8.00

Mineral Resources and Locations, Western Australia: Digital Data from Minedex

RECORD 1996/13 by D.B. Townsend \$50.00

SCHEDULE OF PETROLEUM EXPLORATION WELLS — PERTH BASIN

(Summary sheets of open-file data for 167 wells drilled in the Perth Basin) Hardcopy and digital data \$100.00

1:100 000 GEOLOGICAL SERIES MAPPING

COCANARUP by W.K. Witt \$10.00

RAVENSTHORPE by W.K. Witt \$10.00

1:250 000 GEOLOGICAL SERIES MAPPING

MOUNT BRUCE by A.M. Thorne and I.M. Tyler \$10.00

ROY HILL by A.M. Thorne and I.M. Tyler \$10.00

KURNALPI by C.P. Swager \$10.00

NEW RELEASE GEOPHYSICAL DATA

SIR SAMUEL 1:250 000 TMI IMAGES (6 x 1:100 000 or 1:250 000) per image \$300.00

WEST PILBARA TMI CONTOUR MAPS (8) preliminary edition per sheet \$40.00

MERLINLEIGH SUB-BASIN TMI IMAGES (4) per image \$250.00

MERLINLEIGH SUB-BASIN GRAVITY IMAGES (2) per image \$100.00

SAVORY BASIN GRAVITY IMAGES (2) per image \$100.00

Products are available from:



Information Centre
First Floor, Mineral House
100 Plain Street EAST PERTH 6004
Telephone (09) 222 3459
Facsimile (09) 222 3444