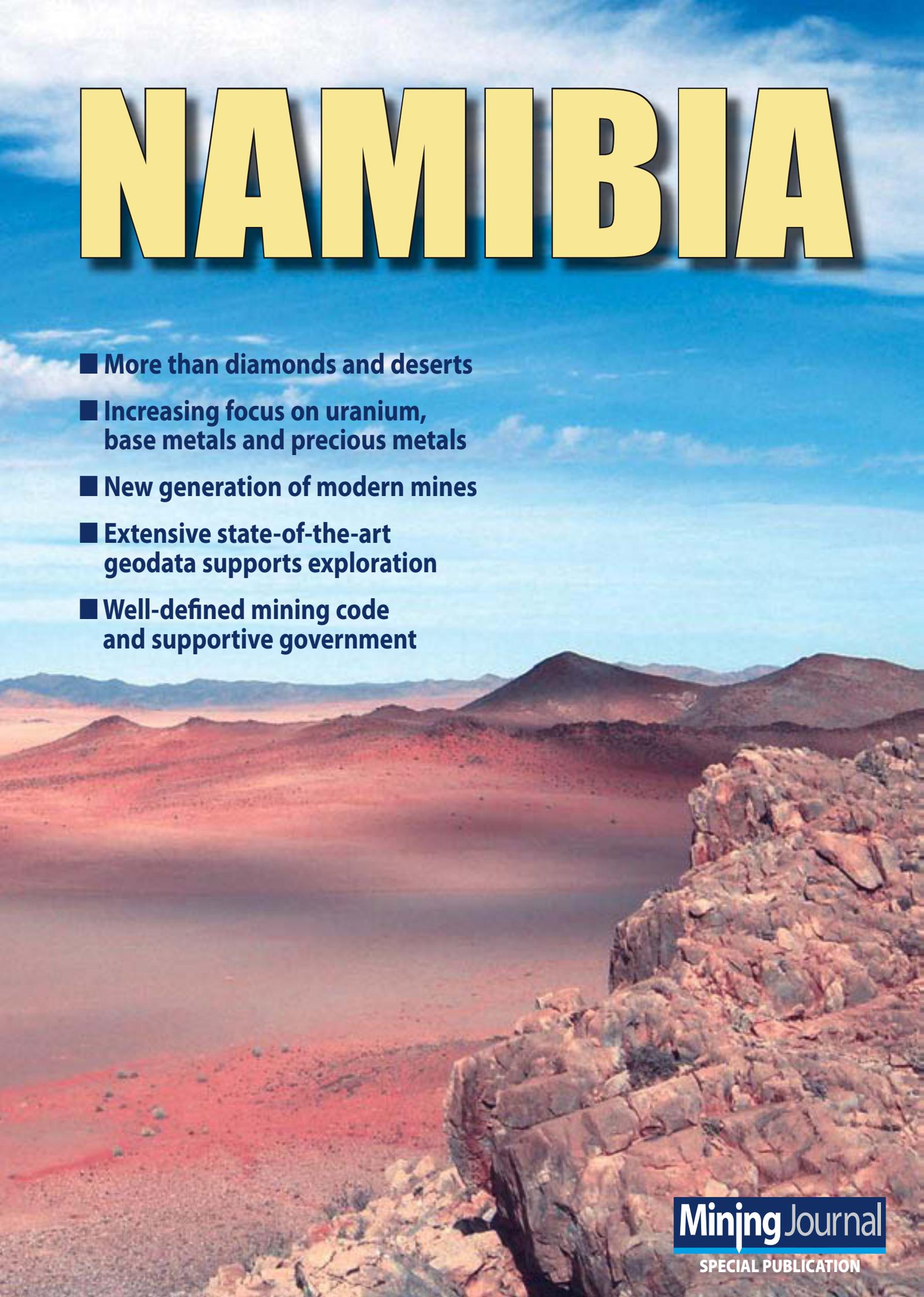


NAMIBIA



- More than diamonds and deserts
- Increasing focus on uranium, base metals and precious metals
- New generation of modern mines
- Extensive state-of-the-art geodata supports exploration
- Well-defined mining code and supportive government

Exploration opportunities abound in a stable country, rich in minerals

SITUATED in southwestern Africa, Namibia covers an area of some 825,400 km² and has a population in the order of 1.83 million, of which around one-third is urban. While the official language is English, a number of indigenous languages are also spoken, as well as German and Afrikaans.

With the Kalahari Desert in the east and the Namib Desert in the west, Namibia has a predominantly arid to semi-arid climate, with sub-tropical conditions in the far northeast. The topography rises from the coastal plains bordering the Atlantic Ocean to the central highlands around Windhoek. Some 15% of the country's total surface area consists of designated nature reserves and protected areas to safeguard its unique wildlife and landscapes.

Windhoek is the country's administrative, judicial and legislative capital. Other major growth centres include Oshakati, Ondangwa, Grootfontein, Tsumeb, Rundu, Katima Mulilo, Swakopmund, Walvis Bay, Rehoboth, Keetmanshoop, Okahandja, Mariental, Otjiwarongo, Luderitz and Gobabis. The Namibian Constitution entrenches multi-party democracy, and lays down the division of power between the executive, legislature and judiciary. Since independence in 1990, Namibia has built a strong democratic foundation, committed to a free-market economy. Presidential and local authority elections are held on a regular basis, and are conducted freely and fairly.

The national currency, the Namibia dollar (N\$), is linked to the South African rand, which also serves as legal tender in Namibia. The country's major commercial banks (such as Bank Windhoek, FNB Namibia Holdings, Standard Bank of Namibia and Nedbank Namibia) have a nation-wide network of branches, and are capable of providing international services, as well as specialised merchant-banking facilities.

Per capita GDP at current prices was N\$16,509 in 2003, and per capita GDP at constant prices for the same period was N\$8,401. In 2004, the inflation rate decreased to 4.6% from an average of 7.3% in 2003. The most important sectors of Namibia's economy are mining, fishing, agriculture and tourism, with more

than 50% of export earnings deriving from minerals (of which around 70% are from diamonds).

There is a well-developed physical infrastructure, with over 42,000 km of roads that connect the major towns and link Namibia to neighbouring countries. In addition, a well-established rail network runs between major Namibian cities, the South African border and the country's two ports at Walvis Bay and Luderitz. Namibia's international airport is situated some 50 km from Windhoek and provides a number of daily flights, mostly to sub-Saharan Africa, but also to Europe, and most local centres have facilities for smaller aircraft.

Namibia also has a modern telecommunications infrastructure, which is 98% digital and provides direct-dialling access to most of the world. Namibia Post has offices and agencies throughout the country, and the water and electricity infrastructure, which is currently being extended into remote rural areas, is rated one of the best on the African continent.

Namibia's social infrastructure includes one of the best doctor/patient ratios in Africa. State-run hospitals are located in all major centres, with additional private facilities in Windhoek, Otjiwarongo, Tsumeb, Walvis Bay and Swakopmund. Apart from a widespread system of primary and secondary schools, which accounts for a literacy rate of more than 80%, the country boasts a number of colleges, technicons and other tertiary educational institutions. Namibia's highest institution of learning is the University of Namibia, in Windhoek.

NATIONAL MINERALS POLICY

Published in 2002, Namibia's minerals policy established the guiding principles and direction of government in relation to mining-sector development. The government has long recognised the significant contribution made by the mining industry to the country's social and economic development, and acknowledges that exploration and the development of mineral wealth is best undertaken by the private sector. To achieve a sustained contribution from the mining sector to the economy, the government has created a conducive and enabling legislative, fiscal and institutional environment to attract private sector-driven exploration. This

includes a competitive policy and regulatory framework, security of tenure and the provision of national geo-scientific data.

The minerals policy addresses a wide range of issues pertinent to the mining sector including: economic and development policy; a review of the mining industry as a whole; value addition; marketing; the environment; human resources; governance (including transparency); and research and development. Formulated following wide-ranging consultations with all stakeholders, the country's minerals policy is enabling the Ministry of Mines and Energy to revitalise and promote the mining industry, backed by mining legislation that enhances Namibia as an attractive investment destination.

In addition, the policy clearly states that the government will encourage, promote and invest in research and development in the search for innovative solutions to the challenges faced by the mining sector. The pivotal role played by the Geological Survey of Namibia in carrying out geoscientific research and development has led to an increase in the number of its operational divisions from three to six. The survey's staff is being increased over a five-year period, with the government also allocating funds in the development budget for a number of projects aimed at improving the country's geological and geophysical database.

MINERAL SECTOR ADMINISTRATION

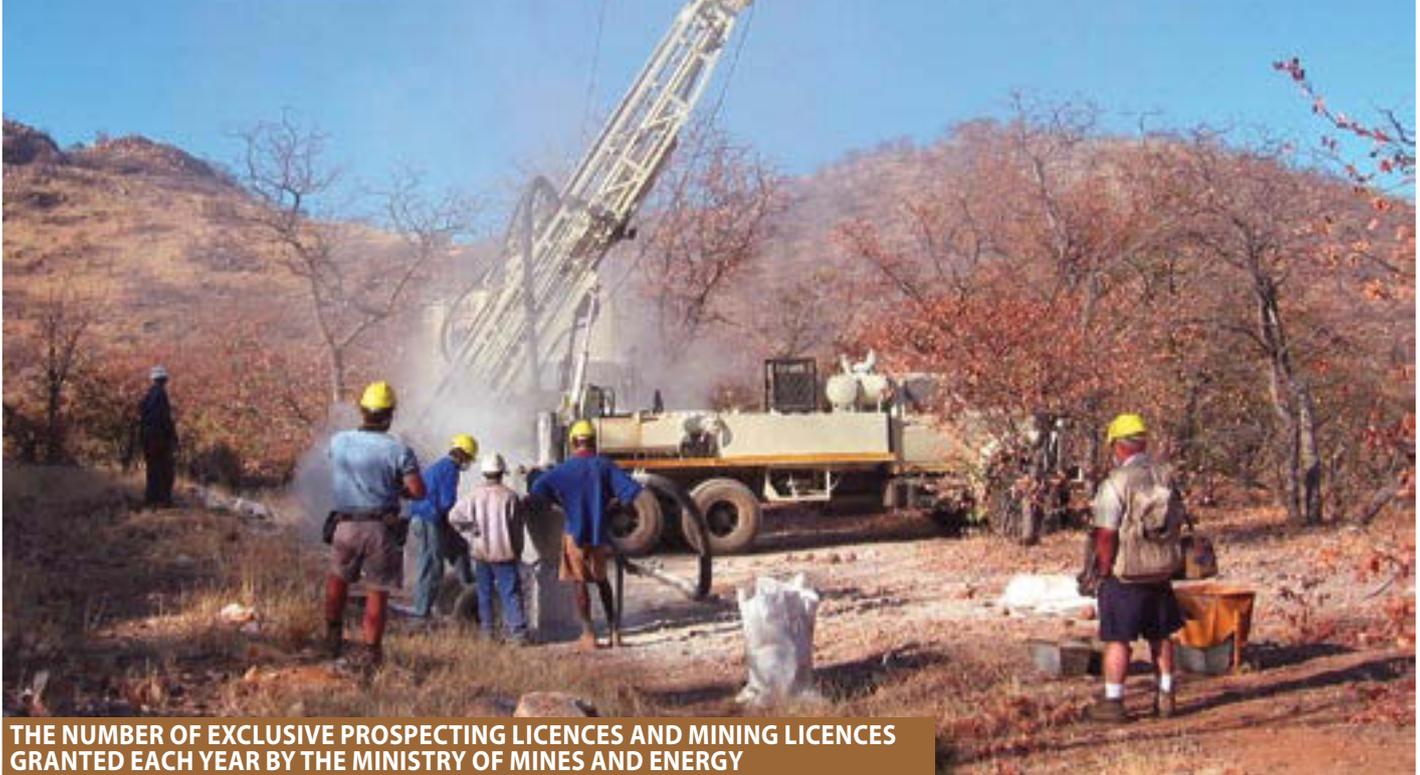
Operating under the 1992 Mining Act, the Mining Commissioner's office of the Ministry of Mines and Energy issues the following five licence types related to exploration and mining:

- **Mining Claim:** Available only to Namibian citizens for the development of small-scale mines and mineral deposits, mining claims are valid for three years. Two-year extension periods are possible provided that the claim is being developed or worked.
- **Reconnaissance Licence:** Designed for regional, mainly remotely-sensed exploration, a reconnaissance licence is valid for six months on a non-renewable basis. This licence facilitates the identification of exploration targets and is only exclusive in special cases.
- **Exclusive Prospecting Licence:** This three-year

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Exploration drilling at Bafex Exploration (Pty) Ltd's Tevrede iron oxide-copper-gold project, under option to Boulder Mining Corp and Springbok Resources Ltd



THE NUMBER OF EXCLUSIVE PROSPECTING LICENCES AND MINING LICENCES GRANTED EACH YEAR BY THE MINISTRY OF MINES AND ENERGY

	1997	1998	1999	2000	2001	2002	2003	2004	2005 (Jan-June)
EPL	89	78	48	97	148	90	96	87	43
ML	9	4	8	5	4	8	12	2	1

Source: Directorate of Mines, 2005

licence allows systematic prospecting in areas of up to 1,000 km². It gives exclusive exploration rights to the land and may be extended twice for two-year periods if demonstrable progress is shown. Renewals beyond seven years require special approval from the Minister.

■ **Mining Licence:** This gives the holder the exclusive mining right in the licence area for a period of 25 years or the life of the mine, with renewals valid for 15-year periods. The holder is required to demonstrate financial and technical ability to develop and operate a mine. A mining licence also gives the holder the exclusive right to approve the development of other mines on the same property.

■ **Mineral Deposit Retention Licence:** This allows, in certain circumstances, an exploration company to retain tenure on a prospecting licence, mining licence or mining claim without mining obligations. It is valid for five years, with two-year renewal periods. The licence-holder must, however, meet work and expenditure obligations and submit regular project reviews.

A number of major companies, including BHP Billiton, Anglo American, Teck Cominco, Rio Tinto, De Beers and others, have realised the great potential that still exists in Namibia for the discovery of new mineral deposits, a fact that is reflected in the number of exploration licences issued by the Ministry of Mines and Energy. On average, the Ministry issues some 90 Exclusive Prospecting Licences (EPLs) and 6 Mining Licences (MLs) each year (as shown in the table above). Recent statistics indicate that around 500 EPLs are currently operating or under consideration.

The bulk of exploration and mining in Namibia is focused on diamonds, precious metals, base metals, industrial minerals and, more recently, on uranium. Namibia also has several active dimension-stone quarries and processing plants. Furthermore, companies are actively exploring for fossil fuels, and the offshore Kudu gas field will be exploited in the near future. With the recovery in the global economy and improvements in commodity prices, renewed interest in the identification of new mineral deposits is expected, as well as the reassessment of those already known.

NAMIBIA'S GEOLOGY

Namibia's varied geology encompasses rocks of Archaean to Phanerozoic age, thus covering more than 2,600 million years of Earth history. Nearly half the country's surface area is bedrock exposure, and the remainder is covered by young surficial deposits of the Kalahari and Namib Deserts.

Metamorphic inliers consisting of highly-deformed gneisses, amphibolites, metasediments and associated intrusive rocks occur in the central and northern parts of the country, and represent some of the oldest rocks of Palaeoproterozoic age (~ 2,200-1,800 Ma) in Namibia. The Kunene and Grootfontein Igneous Complexes in the north, the volcanic Orange River Group and the Vioolsdrif Granite Suite in the south, as well as the volcano-sedimentary Khoabendus Group and Rehoboth Sequence, also belong to this age group.

The Mesoproterozoic (1,800-1,000 Ma) is represented by the Namaqua Metamorphic Complex, which comprises granitic gneisses, metasediments and granitic/metabasic intrusions, and by the volcano-sedimentary

Sinclair Sequence of central Namibia, with its associated granites (for example, the Gamsberg Suite).

The coastal and intracontinental arms of the late Proterozoic Damara Orogen (800-500 Ma) underlie large parts of northwestern and central Namibia, with stable platform carbonates in the north and a variety of metasedimentary rocks pointing to more variable depositional conditions further south. Along the southwestern coast, the volcano-sedimentary Gariep Belt is interpreted as being the southern extension of the Damara Orogen. During the later stages of orogenic evolution, the shallow-marine clastic sediments of the Nama Group, which covers much of central-southern Namibia, were derived from the uplifted Damara and Gariep Belts.

Sedimentary and volcanic rocks of the Permian to Jurassic Karoo Sequence occur in the Aranos, Huab and Waterberg Basins, in the southeastern and northwestern parts of the country. They are extensively intruded by dolerite sills and dyke swarms which, together with predominantly basaltic volcanism (such as the Etendeka Plateau) and a number of alkaline subvolcanic intrusions (examples include Brandberg, Spitzkoppe and Erongo), mark the break-up of Gondwana, and the formation of the South Atlantic ocean during the Cretaceous. The most recent chapter of Namibia's exciting geological history is represented by the widespread Tertiary to Recent (less than 50 Ma) sediments of the Namib and Kalahari Sequences.

METALLOGENIC FOCUS

Targets for mineral exploration have been identified throughout the stratigraphic column. Metamorphic complexes host a variety of prospective environments, such as copper-molybdenum porphyry, volcano-exhalative base metals and gold, volcanogenic copper, sedimentary-exhalative lead-zinc, shear-zone gold, and beryllium-niobium-tantalum pegmatites. Meso- to

TOTAL DIAMOND PRODUCTION 1990-2004 (ct)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total production (ct)	779,395	1,134,270	1,326,114	1,314,018	1,130,768	1,569,283	1,486,457	1,418,213	1,439,605	1,638,701	1,551,591	1,594,302	1,549,599	1,489,877	2,036,741
Namdeb, incl De Beers															
Onshore	-	-	-	-	-	-	-	-	-	716,100	652,746	841,789	696,914	807,139	992,872
Offshore	-	-	-	-	-	-	-	-	-	573,676	576,471	542,915	513,053	602,037	865,511
Inshore	-	-	-	-	-	-	-	-	-	-	91,091	99,057	65,932	4,580	-
Total Namdeb production	-	-	-	-	-	1,340,631	1,357,775	1,359,100	1,275,228	1,289,776	1,320,308	1,483,761	1,275,899	1,413,756	1,858,383
Namco															
Diamond Fields Namibia	-	-	-	-	-	-	-	-	98,857	256,445	220,000	85,592	235,616	liquidation	liquidation
Beach contractors	-	-	-	-	-	-	-	-	5,802	6,692	0	16,470	25,401	16,762	43,856
Ocean Diamond Mining	-	-	-	-	-	-	-	59,113	59,718	73,327	-	-	-	-	-
Diaz Point Expl	-	-	-	-	-	-	-	-	-	12,461	11,283	8,479	12,683	9,971	-
Samicor	-	-	-	-	-	-	-	-	-	-	-	-	-	3,808	134,502

Neoproterozoic rocks locally contain extensive red-bed copper, and calc-alkaline granitoid intrusives of that age have potential for porphyry and hydrothermal copper, as well as for vein-type gold mineralisation. The location and metallogenic association of the various significant deposit types are shown on the map on page 2, and individual deposits are referenced below.

In the Neoproterozoic Damara Orogen and Gariiep Belt, mineralisation is associated with successive phases of intracontinental rifting (copper, graphite), spreading and the formation of passive continental margins (volcano-exhalative base metals, such as Rosh Pinah¹ and Skorpion² (see map on page 2 for numerical references); sedimentary-exhalative lead-zinc, as at Tsongoari³; and glacio-marine iron-manganese (of which Otjosondul⁴ is an example). Besshi-type copper-pyrite (as at Otjihase^{5a} and the Matchless mine Western Extension^{5b}) is related to mid-ocean ridge development, whereas subsequent subduction led to the localised enrichment of carbonate-hosted base metals (such as Tsumeb⁶ and Kombat⁷), uraniferous granites (Rössing⁸), and rare-metal and tin pegmatites (Uis⁹ and Rubicon¹⁰), as well as skarn tungsten and gold (Navachab¹¹).

Coal measures are hosted in Permian rocks of the Karoo Sequence, and Cretaceous anorogenic complexes contain a variety of semi-precious stones, fluorite (Okorusu¹²), apatite, rare-earth elements, iron and base metals. Following the discovery of the offshore

Kudu gas field¹³ of Cretaceous age, recent hydrocarbon exploration has intersected oil-prone source rocks in boreholes. Tertiary epigenetic uranium mineralisation occurs in calcretes above the basement rocks. Salt is produced by solar seawater evaporation (as at Walvis Bay and the Swakopmund salt works¹⁴).

The major growth area of Namibia's mining industry is offshore diamond mining, and the country features among the world's top-five producers. Tertiary and Quaternary diamondiferous deposits are currently exploited along the southwestern coast, offshore and onshore¹⁵, by techniques unique to Namibia.

New mine developments and significant economic mineral deposits receiving considerable exploration interest, and described elsewhere in this review, include Langer Heinrich¹⁶ (uranium), Haib¹⁷ (copper), Ondundu¹⁸ (gold), Tsumkwe kimberlites¹⁹ (diamonds), Otjitombo²⁰ (gold-copper) and Otjikoto²¹ (gold).

DIAMONDS

Namibia is world-renowned for its gem-quality placer diamonds that occur along the Orange River as well as onshore and offshore along the country's coastline. Diamonds typically occur as placers within raised and submerged beach terraces, gullies in the bedrock, and eluvial deposits in wind corridors within southern Namibia. As onshore diamond reserves are depleting, future diamond production will predominately come

from the seabed. Mid-water to deep-water mining operations require sophisticated marine vessels and crawlers that are capable of retrieving diamondiferous sands and gravels from the sea-floor.

Namdeb Diamond Corp (Pty) Ltd and De Beers Marine are the major diamond-producing companies in Namibia. Other diamond producers include Samicor (Pty) Ltd (Island Diamonds) and Diamond Fields Namibia (Pty) Ltd. A joint venture between Samicor and Diamond Fields recovered over 31,000 ct of diamonds from its concession area in a three-month period in mid-2004, since when Diamond Fields has acquired its own vessel, which resumed mining offshore Luderitz in June this year.

Namdeb: Namdeb Diamond Corp (Pty) Ltd is a joint venture between the Government of Namibia and De Beers Centenary AG. In 1994, when the architects of Namdeb laid the foundation for its establishment, their vision was of a Namibian company that would be unrivalled in its contribution and commitment to Namibia. Today, Namdeb has established itself firmly as Namibia's most important economic asset, benefiting Namibians from all walks of life. The company contributes approximately 10% to the country's GDP and accounts for more than 30% of export revenues.

Namdeb's diamond production reached unprecedented levels in 2004, exceeding 1.9 Mct, one of the



DFI :TSX

Diamond Fields International Ltd. (TSX:DFI – the Company) is an internationally active mining and exploration company pursuing diamond, nickel and gold opportunities worldwide. The Company's corporate strategy is:

- Maximize cash flow from its Namibian marine diamond concessions
- Systematic exploration and development of its international mineral properties
- Acquisition of promising mineral projects worldwide

Corporate Head Office:

Diamond Fields International Ltd.
Suite 1600 – 777 Dunsmuir Street
P.O. Box 10425, Pacific Centre
Vancouver, BC, Canada V7Y 1K4

Tel: 1-604-682-2113
Fax: 1-604-688-0078
www.diamondfields.com
Symbol : DFI :TSX

highest levels of production in the history of diamond mining in Namibia. A significant contributor to Namdeb's excellent performance was the record-setting offshore production in Atlantic 1, where De Beers Marine Namibia operates as an exclusive prospecting and mining partner of choice to Namdeb – contributing in excess of 840,000 ct.

Namdeb continues to invest substantial capital on an annual basis to find new reserves and discover new ways of economically mining and treating previously uneconomic reserves, thereby extending the life of the land operations, with several such projects being progressed during the first half of 2005.

For example, Namdeb's Elizabeth Bay liberation plant project has extended the life of the current Elizabeth

Bay mine by seven to ten years by constructing crushing and milling capacity to permit the treatment of wet, cemented and clay-rich ores. In addition, the company has constructed a new, improved recovery plant as well as new workshop facilities, offices, change houses and a state-of-the-art central control building. Construction of the N\$450 million plant was completed in 2004 and commissioning has progressed during 2005.

Namdeb's Pocket Beaches Phase 2 project follows on from the Site 2 project, which was commissioned in 2004, and seeks to use the same project and operational philosophies to develop the Site 11 and 12 resources, 60 km further north. The successful innovative concepts from Site 2, such as a compact mobile treatment plant, new work patterns, a bus-in/bus-out scheme based on

a rotational shift pattern, a moveable accommodation camp and site-specific environmental procedures will be repeated. The significant differences are that the resource lies almost 20 m below sea level, very close to the shoreline. This requires dredging and measures to reduce seepage water before ore mining can take place. Following the completion of an extensive feasibility study, Namdeb has approved the project, at a capital cost of N\$217 million.

Elsewhere, Namdeb carried out its Chameis Bay dredge trial in February 2005. The trial objectives were to test the launch, sinking, stability and reclamation of a submarine pipeline, dredging gravels from a bedrock footwall in shallow water, pumping gravels through the pipeline, reclamation of the gravels on land and their subsequent treatment to extract diamonds, and an assessment of the environmental impacts related to this work. All these aspects were positive and the trial was regarded as a success. The next phase of this project, planned for early 2006, is to test the technology in the deeper water of the Atlantic 1 licence area.

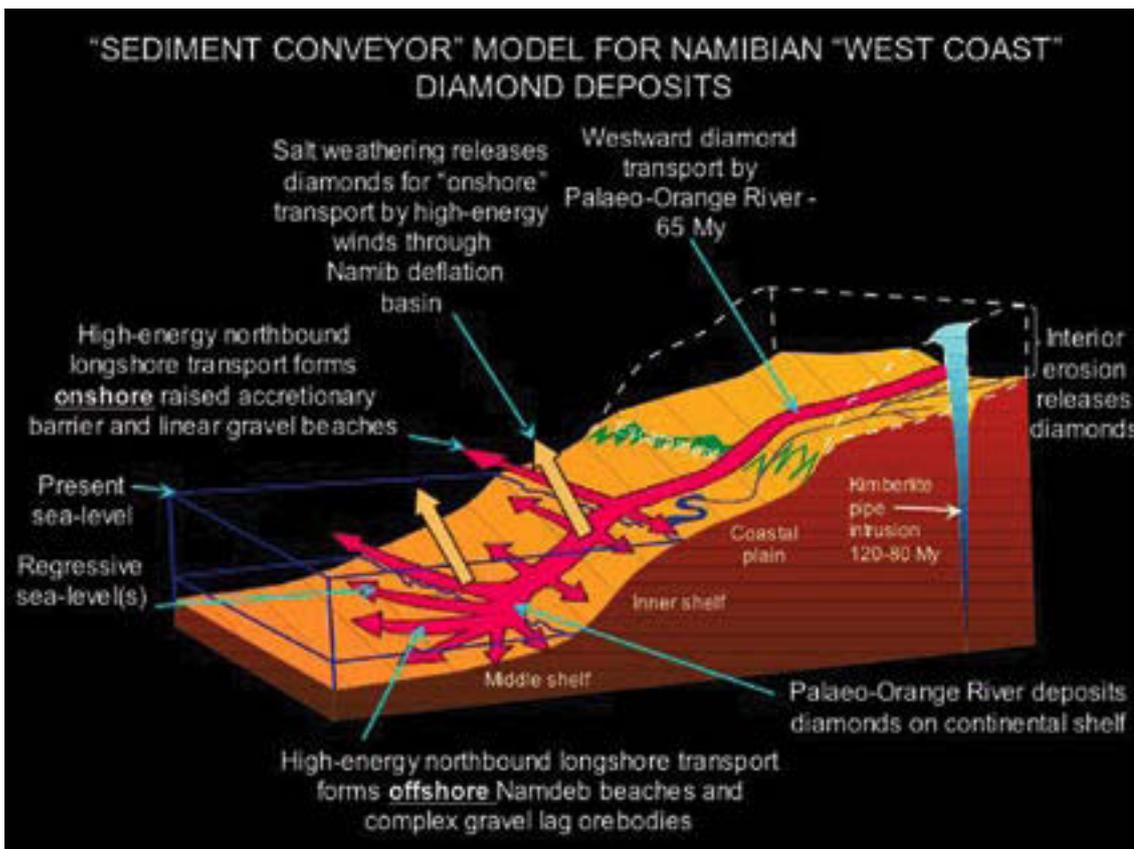
Namdeb has also been focusing on recovery improvements, and its Optimised Recovery By Innovative Technology (ORBIT) project was approved during the first part of 2005. ORBIT increases the recovery tailings retreatment capacity by 350% by using wet X-ray machines and extra dense media separation (DMS) capacity, as well as creating the capacity for finally purging recovery tailings by using optical sorting technology. The project is on schedule for commissioning in the first quarter of 2006. In addition, the company has launched a feasibility study for a new Geological Sampling Recovery project.

Following a fire on its existing floating treatment plant in January 2005, Namdeb began a feasibility study to determine the optimum future for this system. Indications are that the plant will be refurbished with modifications to create an improved system overall, with the project likely to be submitted for approval before the end of 2005.

Today, Namdeb stands out as a shining example of what is achievable through a smart



De Beers Marine Namibia's Debmar Pacific mining vessel



Debmar Pacific uses drill bits of up to 6.8 m diameter to mine the ocean floor at depths ranging from 90-140 m

partnership between the Namibian Government and De Beers, a partnership that has ensured that Namibia's diamonds continue to make a lasting contribution to the nation and its people.

De Beers Marine Namibia: The marine diamond-mining company, De Beers Marine Namibia (DBMN), is 70%-owned by De Beers and 30% by Namdeb. The company mines diamonds from the sea floor off the southwest coast of Namibia in marine mining-licence areas held by Namdeb.

DBMN was first registered as a Namibian company in 1985, but only became fully operational in 2001 following an agreement between the government and De Beers. Most of the functions of the previous De Beers Marine, which operated from South Africa, were moved to Namibia. Despite unfavourable exchange rates, DBMN has been able to increase its production by about 60% between 2001 and 2005.

Developing and mining a deep-sea mineral resource presents unique challenges. DBMN has risen to meet these challenges by utilising state-of-the-art geosurvey, sampling and mining techniques.

Diamonds in the mining areas are present in laterally extensive, but thin gravel deposits (on average 300 mm thick) throughout large areas of the mining licence. The diamonds within these gravel deposits were eroded from kimberlites present on the southern African hinterland cratonic areas and then transported to the coastal areas, principally through the palaeo-Orange River drainage system, along with other clastic material eroded from the hinterland.

A sustained high-energy coastline, a strong southerly wind regime and the northward-flowing Benguela current facilitated the removal of fine material to deepwater areas, whereas sandy material has been pinned onshore by wave action and then transported northwards in sand dunes by means of the strong southerly winds. The remaining coarse clastic gravel (including diamonds) has been reworked over millions of years by various coastal-margin processes, resulting in the formation of a diamondiferous coarse clastic lag.

In order to maintain reserve levels to support present and future anticipated production, DBMN carries out ongoing exploration and resource development operations. Marine geophysical data are interpreted by a team of geologists and geophysicists in order to generate targets for new resource development.

“The rehabilitation of marine diamond-mining environments occurs naturally, unlike the rehabilitation of land-based mines”

Geophysical data sets are acquired by DBMN's technical partner based in South Africa, De Beers Marine (Pty) Ltd (DBM), by means of state-of-the-art survey equipment including an autonomous underwater vehicle (AUV) equipped with simultaneous swath-bathymetry, sidescan sonar and sub-bottom profiler payloads. The AUV is deployed from a mother vessel and undertakes an untethered pre-programmed survey mission just a few metres above the sea-floor, before rising to the surface to be recovered and then recharged.

During this time, survey data are downloaded for processing and the vehicle is re-programmed for the next mission. As much as 30 km-line of data can be acquired, producing sea-floor image maps to a resolution of 50 mm. The AUV offers an extremely quiet and stable platform from which to collect high-quality geophysical data, which translates to better-quality geological interpretation, more successful exploration efforts and appropriate guidance to mining operations.

Geophysical targets are subsequently sampled by means of specialist vessels (chartered from DBM) in order to establish and quantify the presence of mineralisation. Sample data are interpreted together with the geophysical data, and thereafter estimated into a resource database from which mine plans are generated.

In 1996, 1997, 1999 and most recently in March 2005, a two-person submersible has been used in order to undertake direct visual observations of the sea-floor in the mining and resource development areas of the various mining licences. These missions have been carried out for the purposes of ground-truthing geophysical records in order to enhance the mineralisation models, and to study the efficiencies of various mining tools, as well as to undertake environmental studies.

Extensive sampling, geophysical data acquisition and submersible observations over many years have resulted in the Namibian southern continental shelf being one of the most intensively studied continental shelves in the world, from a geological and environmental viewpoint.

The mid-continental shelf in the mining area comprises various flat-lying Eocene, Miocene and Cretaceous marine sediments that have been variably eroded to produce a highly variable topography. Diamond-bearing gravels are distributed unevenly across this topography, resulting in extremely variable geotechnical conditions for mining. For this reason, various mining tools and beneficiation plants are variably suited to different portions of the resource. As such, rigorous mine planning routines are necessary to optimise resource depletion.

Mining takes place on the ocean floor at water depths ranging from 90 to 140 m. DBMN operates a fleet of five mining vessels, of which it owns four and time-charters one. The mining system used on four of the vessels (*Debmar Atlantic*, *Debmar Pacific*, *!Gariap*

and *Grand Banks*) is airlift-drill technology, with a large (up to 6.8 m)-diameter drill-bit mining out overlapping circles on the seafloor. The drill vessels move from hole to hole by means of heaving on a four-anchor spread. The fifth vessel (*Ya Toivo*) uses a 220 t track-mounted crawler that moves horizontally along the sea-floor, sucking up diamond-bearing gravels by means of a boom-mounted suction nozzle, mining lanes that are 13 m wide. DBMN is currently investigating the use of trailing suction-hopper dredge technology in the Atlantic 1 licence area, having successfully completed a dredging trial in January 2005 in shallower water.

Diamonds are extracted from the gravel by means of a multi-stage process. The gravel is dewatered and undersize/oversize removed by means of vibrating primary screens. After the removal of shell material from the plant feed by means of various comminution technologies, the gravel is fed through DMS cyclone pumps to produce a heavy, diamond-enriched concentrate that passes through an X-ray circuit where luminescent material (including diamonds) is separated for final hand-sorting.

During 2004, DBMN mined over 4.5 km² of sea-floor and produced 840,000 ct. These figures represent an increase of approximately 40% compared with the previous year.

The rehabilitation of marine diamond-mining environments occurs naturally, unlike the rehabilitation of land-based mines, which takes place once the mining has been completed in a particular area. DBMN's environmental research focuses on greater knowledge of the natural variability of the environment, understanding the consequences of marine mining, and monitoring changes over time.

The company has 565 employees, of whom about 475 are sea-going and the rest are based at its head office in Windhoek. The Namibianisation of DBMN's workforce is a key initiative that is being driven at the highest level. The workforce is currently 64% Namibian, a major increase from 18% in 2002, and the company has launched a number of initiatives aimed at achieving the target of a 90%-Namibian workforce by 2008.

In addition to its production achievements, De Beers Marine Namibia recently received its fourth NOSCART Platinum Award from the NOSA Certification Authority. The NOSCART Award is the highest award presented by NOSA International to companies that display excellence in the management of their safety, health and environmental-control programmes.

URANIUM

With the expected increase in global consumption of uranium and its escalating price from US\$10/lb in 2003 to more than US\$25/lb in 2005, uranium exploration in Namibia is once again in full swing. Namibia is one of the world's principal uranium producers, with **Rössing Uranium Ltd's** mine currently accounting for more than 7% of world uranium production and for 10% of Namibia's total exports. In addition, **Paladin Resources Ltd** has recently been granted a mining licence to start developing the Langer Heinrich uranium deposit.

The large open-pit Rössing uranium mine, situated some 90 km northeast of Walvis Bay, started operations in 1976. Rössing currently produces about 7.7% of the world's uranium as uranium oxide (U₃O₈), supplying nuclear-power utilities throughout the world. The orebody is an enormous, low-grade (300 ppm U₃O₈) alaskite-hosted deposit in which the uranium occurs mostly as uraninite (55%) and beta-uranophane (40%) in the form of interstitial grains and crystal inclusions in minerals; betafite makes up the remaining 5%.

Planning is now under way to expand the current mining capacity and extend the mine life to 2017. On



the operations side, production will be increased to 3,800 t of uranium oxide during 2005 to counteract the negative economic impacts of the weak US dollar, in which Rössing's uranium is sold. On activities closer to home, the work of the Rössing Foundation in the mine's neighbouring town, Arandis, has been expanded and now includes various capacity-building projects for the residents, local government and business. Working closely with the Arandis community, the Rössing Foundation is striving to ensure an economically independent and self-sustaining town.

The mine has more than 800 employees, of whom 96% are Namibian citizens. Rössing is part of the Rio Tinto group, which currently holds 68.6% of Rössing's equity.

The Langer Heinrich deposit lies 85 km east of Swakopmund. It is owned by **Langer Heinrich Uranium Pty Ltd**, a wholly-owned subsidiary of Paladin Resources Ltd. The deposit consists of carnotite (a potassium-urananyl-vanadate) in calcreted Tertiary alluvial sediments filling an east-west channel that drains metamorphic and granitic rocks of the Proterozoic Damara Orogenic Belt. The mineralisation outcrops in several places in its eastern part, but deepens down-channel to the west. Carnotite occurs in small patches and lenses around grains and pebbles, or is finely disseminated. Several discontinuous, tabular mineralised bodies of economic interest occur over an area measuring 15 km by 500 m, with mineralisation occurring in a zone above and below the water table. The thickness of the mineralised zones varies from less than 1 m to 15 m, and may locally exceed 30 m.

Exploration drilling in the past year has confirmed reserves of 22.1 Mt averaging 703 ppm U_3O_8 , and further drilling has been under way during late 2005 to extend the deposit. Extensive studies have also established baseline environmental information, which will be

used as reference data for ongoing monitoring of the project. Following the granting of a mining licence in July 2005, credit approval was quickly obtained for the project, and construction has begun, with initial mining expected in the third quarter of 2006. Mining will be by open-pit methods, followed by dry screening, milling of the fine fraction, and uranium extraction by alkaline leaching. Tailings will be returned to the open pits, restoring the ground surface to its original contours. Approximately 1,100 t/y of U_3O_8 will be produced, giving a milling life of at least 15 years based on currently known reserves.

BASE AND PRECIOUS METALS

Namibia ranks among the top five countries in Africa in terms of its zinc, copper and lead reserves and production. Whereas the overall decrease in base- and precious-metal production in 2004 can be linked to the strength of the Namibian dollar against the US dollar, the drop in copper and lead production was attributed to **Ongopolo Mining and Processing Ltd** not having sufficient copper concentrate for its smelter. Ongopolo is now actively exploring for new ore reserves. **Anglo-Gold Ashanti Ltd's** Navachab mine also experienced a drop in gold production during 2004, reflecting both problems in renewing the mine's contract with a local construction company, and fluctuating gold prices for the period 2003-04.

COPPER-LEAD

Ongopolo is currently the only copper producer in Namibia, mining Besshi-type cupriferous pyrite ore from the recently-opened Matchless mine Western Extension (1.35 Mt at 2.12% Cu) some 30 km west of Windhoek, and from the Otjihase mine (10.3 Mt at 1.8% Cu) 30 km east of Windhoek. Copper concentrate is transported by rail from Otjihase to the Tsumeb smelter to produce

blister copper. Other copper-lead deposits investigated during recent years include: the new Tsumeb West mine (still being investigated); the Asis Far West mine; the Khusib Springs mine; and the Tschudi deposit. All these deposits are situated on the carbonate platform of the Otavi Mountainland.

The Tsumeb copper smelter receives copper concentrates not only from Ongopolo-owned mines in Namibia, but also from Zambia, Chile, South Africa and Zimbabwe. The potential exists to identify and develop new copper deposits as well as to re-evaluate known deposits.

The Haib copper deposit is a very large porphyry sulphide resource of some 1,300 Mt averaging 0.23% Cu. There are small quantities of molybdenum, gold, silver and other by-products associated with the sulphides. A considerable amount of geological, engineering and metallurgical work has been completed at Haib, with 45,000 m of drilling having been undertaken by a number of companies over the years.

As of late 2005, **Copper Resources Corp** (CRC) and its partners were in the final phase of appointing an engineering consultant to complete a full assessment of the available data, while identifying a commercially viable extractive process for the project. CRC states that it has no preconceptions in relation to appropriate extractive technology, and wishes to adopt a totally holistic open approach to technology selection. The study will take about 12 months to complete.

ZINC-LEAD

Zinc is mined in southern Namibia at two operations, Skorpion, wholly owned by **Anglo Base Metals (Namibia) (Pty) Ltd**, and Rosh Pinah. Southern Namibia, in particular the Gariep Belt, is highly prospective for Rosh Pinah-type massive sulphide deposits, as well as for Skorpion-type non-sulphide zinc deposits. Major

The processing plant at Anglo Base Metals (Namibia) (Pty) Ltd's Skorpion zinc mine



MINERALS AND METALS PRODUCTION 1991-2004

BASE AND RARE METALS GROUP

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Arsenic trioxide (75% As)	t	2,055	1,804	2,300	2,290	2,775	1,661	1,302	1,297	233	0	-	914	880	389	-
Cadmium refined (47% Sb)	t	45	67	29	13	19	15	7	2,148	0	0	-	-	-	-	-
Copper concentrate 30%	t	-	116,772	115,178	109,774	97,886	81,646	57,095	66,879	22,819	0	19,095	45,368	63,997	64,869	44,606
Copper metal content	t	-	31,327	31,285	29,308	27,373	22,530	14,904	17,879	6,500	0	-	12,594	-	-	-
Copper blister (99% Cu)	t	29,974	31,923	37,531	34,788	30,055	29,784	20,705	24,997	8,739	0	5,082	27,015	17,850	26,306	-
Pyrite concentrate (50% S)	t	-	126,119	164,190	113,703	121,634	103,140	90,735	94,585	28,174	0	11,967	56,994	3,633	31,786	3,658
Sulphur content	t	-	63,060	82,095	56,852	60,817	51,330	45,338	46,476	12,855	0	-	28,606	1,874	-	-
Sodium antimonate	t	-	21	11	13	29	0	0	0	0	-	-	-	-	-	-
Tantalite concentrate (16% Ta)	kg	-	0	0	2	0	112	0	0	0	-	-	-	-	-	-
Tin concentrate (67% Sn)	t	-	17	18	6	4	18	-	0	0	-	-	-	-	-	-
Tin content	t	-	11	12	4	3	12	0	0	0	-	-	-	-	-	-
Zinc concentrate (52% Zn)	t	-	68,098	68,571	34,557	64,568	59,207	66,109	74,632	78,670	69,193	73,535	70,610	77,587	107,920	123,272
Zinc metal content	t	75,225	35,420	35,657	17,970	33,575	30,209	34,377	40,519	42,142	34,639	39,137	31,803	42,685	60,500	-
Refined zinc	t	-	-	-	-	-	-	-	-	-	-	-	-	35	47,436	119,205
Manganese ore	t	-	0	0	0	0	98,385	92,647	39,671	0	-	-	-	-	-	-
Lead concentrate (30% Pb)	t	-	50,585	49,807	36,355	43,806	57,105	58,197	32,378	24,295	19,283	20,665	26,182	24,140	31,453	27,188
Lead metal content	t	-	15,176	14,942	10,907	13,142	16,084	15,349	13,577	13,303	9,361	11,114	13,025	13,190	18,782	-
Lead refined	t	35,583	33,367	31,655	31,236	23,813	26,752	18,845	1,530	236	-	-	-	-	-	-

DIMENSION STONES GROUP

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Dolomite	t	-	-	-	1,404	1,858	2,005	5,401	7,635	7,949	4,360	9,812	7,708	12,602	12,602	18,485
Granite	t	6,522	7,890	7,313	2,952	11,585	4,518	5,218	6,675	6,665	7,222	5,514	3,965	4,572	4,572	41,456
Marble	t	12,608	10,031	598	13,359	12,061	16,935	12,673	13,743	9,807	11,221	8,218	4,862	880	880	10,830
Blue sodalite	t	-	0	0	354	1,143	465	559	1,598	503	429	209	46	1,691	1,691	492
Picture stone	t	-	-	-	-	-	-	-	-	-	-	145	98	15	15	72
Conglomerate	t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	398
Aragonite	t	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

INDUSTRIAL MINERALS

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Fluorspar	t	26,896	21,727	28,914	33,487	49,852	36,889	32,285	23,208	42,139	57,700	59,846	73,933	73,380	79,281	104,767
Polucite	t	-	-	-	10	-	-	-	-	-	-	-	-	-	-	-
Coarse salt Walvis Bay	t	-	-	-	-	-	320,000	258,721	432,290	434,198	429,230	482,000	500,441	552,000	567,000	-
Coarse salt Swakopmund	t	-	-	-	-	-	60,000	43,550	47,270	61,915	60,100	32,077	58,000	54,729	84,818	-
Coarse salt total	t	115,343	99,365	73,043	60,338	60,721	380,000	302,271	479,560	496,113	489,330	514,077	558,441	606,729	651,818	734,000
Fine salt	t	-	430	100	72	1,039	1,670	1,715	5,854	5,223	7,220	4,347	11,250	9,640	11,099	-
Rock salt	t	-	3,596	-	-	490	2,647	3,171	5,008	6,025	6,220	4,585	6,400	5,631	11,421	-
Table salt	t	-	21	21	99	2,026	1,987	2,068	-	-	-	-	-	-	9,188	-
Lithium minerals	t	1,210	1,019	1,048	465	1,269	2,084	-	-	-	-	-	-	-	-	-
Wollastonite	t	-	132	3,891	1,353	1,244	951	286	-	280	347	471	534	679	497	-
Quartz	t	107	92	-	-	-	-	8,410	-	-	-	-	-	-	-	-
Bentonite	t	-	-	-	-	-	-	-	-	58	-	58	4	-	-	-
Sepiolite	t	-	-	-	-	-	-	-	-	-	-	-	-	327	451	-

PRECIOUS METALS GROUP

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Gold bullion	kg	1,399	1,708	1,865	1,790	2,188	1,883	2,015	2,301	1,855	2,008	2,399	2,694	2,650	2,298	2,068
Gold blister	kg	174	142	160	163	242	216	130	116	27	-	18.48	157	165	127	-
Silver in blister	t	90	91	89	72	62	66	42,3	41	14	-	8.79	18.15	12.02	18.14	-
Contained silver (Rosh Pinah)	t	-	-	-	-	-	-	-	4.97	5.97	9.67	-	31.97	23.57	26.96	-

PRECIOUS STONES GROUP

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Diamonds	ct	779,395	1,186,874	1,549,260	1,141,352	1,312,348	1,381,757	1,402,129	1,416,334	1,467,272	1,638,701	1,551,591	1,594,302	1,549,599	1,481,489	2,036,741

SEMI-PRECIOUS STONE GROUP

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Blue agate	kg	61,180	38,380	61,000	106,000	152	73	163	175	160.9	95	116	138	190	153,269	-
Amethyst	kg	27,999	247,924	247,658	299,219	162	47	19	23	0	-	-	-	-	26,359	-
Chalcedony	kg	0	0	0	6	60	0	0	17	13	-	41,685	176,000	215,000	71,011	-
Chrysocolla	kg	900	5,382	6,482	2,150	1,986	7,185	-	0	900	-	1700	2685	13	-	-
Rose quartz	kg	467,995	253,000	7,016	266	402	320	139	220	454	-	40	30	-	49,260	-
Tourmaline	kg	1,183	1,216	5,069	277	0	0	437	53	0	-	302	-	-	179	-
Garnet	kg	-	0	0	0	0	200	130	5	62	-	20	-	-	-	-
Pietersite	kg	-	0	0	0	0	16,744	4,271	4,116	13,796	-	5,583	5,370	-	26,090	-
Diopside	kg	109	52	1,012	300	149	55	476	0	0	-	-	-	-	-	-

NUCLEAR FUEL MINERALS GROUP

COMMODITY	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Uranium	t	-	3,185	2,190	1,968	1,896	2,007	2,892	3,425	3,278	3,171	3,201	2,640	2,751	2,401	3,582

Production figures courtesy of Directorate of Mines



companies including BHP Billiton, Teck Cominco and Anglo Base Metals are actively exploring for zinc in this part of Namibia.

Rosh Pinah Zinc Corp Pty Ltd (RPZC), owned by Kumba Resources Pty Ltd (95%) and PE Minerals (5%), started its mining activities in 1969 on the basis of ore reserves sufficient for a four-year mine life. Exploration has increased the reserve over the years and the mine is still going strong, although known ore reserves had been depleted to a mere 3.7 Mt by early 2005, representing a residual mine life of just over five years.

The company is now focusing on extending the mine's life to ten years and beyond, a time frame that would enable it to make long-term decisions that would benefit all its stakeholders. RPZC's new strategy, 'Modified Focus', entails intensified exploration activities within, and immediately adjacent to, the existing mine infrastructure, and very little activity in the company's other exploration licence areas.

Implementing the Modified Focus has had several implications for the mining operations, with a near-doubling of exploration development needed early on in order to provide access to drill sites. Roads have also been constructed to give access to surface drill sites that can target more distant anomalies identi-

fied since 2003 and which cannot be reached from underground.

Since May 2005, when the project began, nine drill rigs have been put to work, of which three are on surface and six are drilling possible targets from underground tunnels. The exploration programme will be re-assessed on an ongoing basis, with promising intersections of well-mineralised ore already having been made. Follow-up exploration is now in progress to delineate the reserve gains for the future.

Meanwhile, the Skorpion zinc mine and refinery produced its first metal in May 2003, with the first consignment of zinc being exported from the port of Luderitz two months later. One of the lowest-cost zinc producers in the world, the mine is designed to produce 150,000 t/y of special high-grade zinc over a mine life of at least 15 years. A US\$454 million development, and the largest investment in Namibia since independence, Skorpion should contribute some 4% to the country's GNP, and will provide valuable hard-currency export earnings.

The complex consists of an open-pit mine and a hydrometallurgical refinery, together with its associated infrastructure. With significant investment also having been made in housing and social infrastructure in Rosh

Pinah, the town is thriving and is attracting investor interest from many sectors of the economy, with new shops, banks and other businesses opening up to take advantage of the wealth created by Skorpion. As a result, the project has had a dramatic impact on the regional development of southern Namibia.

Skorpion has some 600 employees and provides a further 250 jobs to contractors, as well as numerous jobs in the service sector. Anglo American has invested heavily in manpower training and development, with 90% of the mine's employees being Namibians. Of these, 14% are women, an unusually high percentage in what has traditionally been a male-dominated industry.

The mine is a 24-hour operation, with production being driven by selective-mining methods. Current annual production involves the extraction of some 4.8 Mt of waste and 1.4 Mt of ore, with the ore feed to the plant being controlled to maintain a head grade of around 11% Zn.

The orebody at Skorpion is unique compared to conventional zinc or lead-zinc mines in that its ore mineral assemblage is made up exclusively of zinc oxides. Ore minerals include sauconite, hemimorphite, smithsonite, hydrozincite and tarbutite, with a new mineral named 'skorpionite' having recently been discovered in the



Namibian Stone Processing (Pty) Ltd operates the first modern integrated marble and granite cutting and polishing plant in Namibia

mine. As opposed to conventional sulphide deposits, the typical Skorpion ore is relatively inconspicuous to the naked eye, with zinc oxide minerals forming pervasive impregnations in highly weathered meta-sedimentary and meta-volcanic rocks.

The unique nature of the Skorpion orebody is explained by periods of intensive tropical to sub-tropical weathering during late Cretaceous and Tertiary times, which transformed a primary volcanic-hosted massive sulphide deposit into an oxide orebody. Remnants of primary sulphide minerals are still found at depth, but are not currently part of the mineable reserve.

On a regional scale, the Skorpion orebody lies within the Neoproterozoic Gariep Belt, an ancient tectonic rift system that was filled by various volcanic, siliciclastic and carbonate rocks. Primary ore formation appears to be strongly associated with periods of volcanic activity in the Gariep Belt, dating back some 740 million years. The Gariep rocks have been subjected to several phases of deformation, and the structural framework of complex folding, thrusting and late-stage faulting has been an important factor in the formation of the present Skorpion orebody.

Having adopted internationally recognised standards for environmental management, Skorpion has already achieved ISO 14000 certification.

GOLD

Namibia's main precious metal, gold, is currently mined and processed at the Navachab mine, situated a few kilometres from the town of Karibib in central-western Namibia. Wholly owned by **AngloGold Ashanti Ltd**, Navachab was developed in the late 1980s, the deposit having been interpreted as a skarn deposit with a mine life until 2003. However, following subsequent appreciation of the significance of associated sheeted auriferous quartz veins and a reinterpretation of the occurrence as a mesothermal gold deposit, exploration located additional resources in both the hanging-wall and the footwall. This has prolonged the mine's life to 2013 and, depending on economic conditions, this may be extended even further.

Minor amounts of gold are also recovered as a by-product from the smelting of copper concentrates from Otjihase and Matchless at Tsumeb. The main styles of gold mineralisation in Namibia are associated with replacement skarn, stockwork quartz veins (Navachab) and turbidite-hosted gold veins (Ondundu). Several exploration companies exploring for precious metals in Namibia have reported gold mineralisation associated with iron oxide-copper-gold (IOCG) deposits, auriferous pegmatites, tourmaline-hosted breccias and epithermal shear zones.

Further potential exists for the discovery of new

gold deposits; in recent years the Otjikoto, Onguati and Otjimbojo occurrences have been found. The Otjikoto gold deposit, which is situated some 300 km north of Navachab, is reported to have a similar style of gold mineralisation.

DIMENSION STONE

Dimension stone is an important building material and a valuable natural resource. Namibia has numerous deposits of good-quality dimension stone, displaying a variety of attractive colours, patterns and textures. The main rock types quarried are marble, granite, dolerite, picture stone, conglomerate and sodalite.

The Namibian dimension-stone industry is dominated by international companies such as R E D Graniti Ltd, Marline Granite Ltd, Eastern Granite and Stone Africa. Locally-owned quarry companies include Marmorwerke Karibib, Savanna Marble, Okatji Marble, Namibian Stone Processing and several small-scale slasto (split-slate) and slate quarries.

Until recently, Namibia exported first-grade blocks of marble, granite and other dimension-stone varieties to first-world countries such as Germany and Italy to be cut and polished. These value-added products (such as tiles and ornaments) were eventually sold all over the world at premium prices, with no benefit to the Namibian economy, which received less than 10% of the final value of a unique natural resource. The Namibian Government has now put into place incentives for local entrepreneurs to harness and utilise local resources to the point of value addition and direct export.

Namibian Stone Processing (Pty) Ltd was created through this programme; the company owns the best equipment available in the market, and operates the first modern integrated marble and granite cutting and polishing plant in Namibia. The processing plant was officially launched by the country's President in July 2005, as one of the first mass-production units to be fully initiated, financed and managed by domestic resources.

At full capacity, the plant will produce some 21,000 m²/mth of polished tiles. The market is currently aimed at the SADC region; however, an expansion to include European, American and Middle and Far Eastern countries is envisaged for the future.

Mineral exploration

IN ADDITION to the zinc mining and refining activities at Skorpion, the exploration arm of Anglo American's Base Metals Division, **Ambase Exploration Namibia**, is stepping up its prospecting activities in the area. The exploration team is now expanding its search, having reached a reciprocal rights agreement with its neighbour, RPZC, that will permit access to RPZC's mineral tenements in the Sperrgebiet. This will allow the search for non-sulphide zinc deposits to extend into areas of favourable Gariep stratigraphy that have received little attention in the past on account of their inaccessibility. RPZC will, in turn, be able to apply its expertise to search for sulphide zinc deposits on Skorpion's exploration ground.

In co-operation with RPZC, Ambase has recently flown Anglo's proprietary Spectrem airborne EM system over large tracts of dune-covered ground, 30-60 km southwest of the Skorpion mine.

Avdale Namibia (Pty) Ltd is a wholly-owned subsidiary of African Rainbow Minerals (ARM), previously known as Anglovaal Mining. In 1997, Avdale was awarded 13 EPLs, covering 1,060,000 ha, in an area stretching from Tsumeb in the north to Otjiwarongo in the south, and from Outjo in the west to Grootfontein in the east. This ground-holding has now been reduced to



Helio Resource Corp has exclusive prospecting licences covering some 230,000 ha

electromagnetic and magnetic (AEM) survey completed earlier in 2005 using the Spectrum 2000 AEM System. This high-resolution survey covered some 70 km of strike of the target host package, and was flown at a 200 m line spacing. Work at Otjikoto will focus on extending the current resource base and on follow-up exploration targets in the immediate vicinity of the deposit.

JUNIOR ACTIVITY

Canadian junior, **Forsys Metals Corp**, has a diverse portfolio of exploration and development projects in the country through its local subsidiary, **Westport Resources Namibia (Pty) Ltd**. The company's most advanced project is its Valencia uranium deposit, 30 km east of Rössing. This resembles Rössing geologically, and Westport is now evaluating the resource under Canadian NI 43-101 criteria ahead of possible further exploration and/or development.

four EPLs covering 308,000 ha.

Copper, zinc and gold were initially the main exploration commodities. Target host lithologies were the northern Carbonate Platform, northern Rift-margin and Northern Zone of the inland branch of the Pan-African Damara Orogen. The terrain is extensively covered by a thin veneer (5-20 m) of calcrete. To date, the main exploration methodology has been the ground follow-up of targets generated from data compiled from various phases of airborne magnetic surveys. Ground follow-up consisted mostly of ground magnetic surveys, gradient-array IP surveys, reverse air-blast, reverse-circulation

and core drilling. This work resulted in the discovery of the Otjikoto gold deposit, in essence a sheeted vein system hosted by albitised host rocks that has many similarities to the deposit being mined at Navachab. To date, some 40% of the approximately US\$9 million spent on the project has been expended on detailed work carried out at the Otjikoto deposit, which was a greenfields discovery made by Avdale.

During the next 12 months, the company plans to spend some US\$3-4 million on exploration at its four EPLs. Regional exploration will focus on the ground follow-up of targets generated from an airborne

Westport's Ondundu gold project in north-central Namibia, which incorporates significant black economic empowerment (BEE) interests, is under advanced investigation as a medium-sized selective open-pit operation in the vicinity of old workings, and prospective geology in the surrounding area is being explored. Additional drilling is planned at the Elbe polymetallic (Cu-Zn-Ag-Au) deposit, located near Okahandja, to define better the geometry and extent of the deposit, and in particular to redress the historical neglect of its gold content.

Meanwhile, the Sperrgebiet base-metal project, located north of the Rosh Pinah and Skoropin mines

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in the far south of Namibia, was recently returned to the company by its former joint-venture partner, Teck Cominco. The licence is under renewal application and, once renewed, the company intends to carry out further detailed geological and stratigraphic mapping and to test-drill targets.

In northern Namibia, Westport holds an exclusive reconnaissance licence for diamonds. A limited initial airborne geophysical survey has confirmed the presence of prospective cross-cutting structures as well as proving that the depth of cover is considerably less than originally thought, and well within the limits needed for mounting an exploration campaign.

Through its Namibian operating subsidiary, **Bafex Exploration (Pty) Ltd**, Toronto-listed **Helio Resource Corp** has been granted eight EPLs covering some 230,000 ha that host a variety of exploration targets, including Navachab-style gold, Copperbelt-style Cu-Au-Ag-Co, iron oxide-copper-gold, oxide zinc and Cu-Ni-PGM. Helio has optioned four of its Namibian projects to three different partners, most notably Teck Cominco, with its partners committed to spending C\$2.2 million before June 2006.

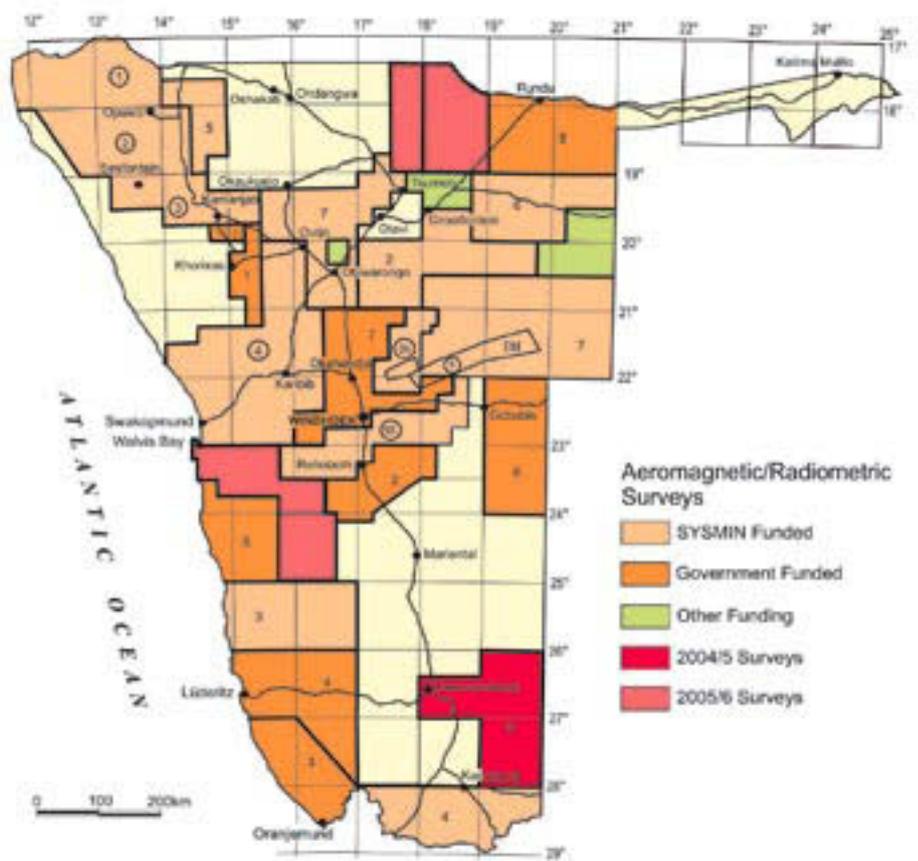
Otjitombo is the most advanced of the four projects where Helio has complete control. Located near the town of Opuwo in northwest Namibia, Otjitombo is host to widespread copper mineralisation bearing many similarities to that found in the Zambian and DRC Copperbelt. The company recently completed a 4,700 m combined reverse-circulation and diamond-drill programme. The most significant results to date include: 39.8 m averaging 1.03% Cu and 0.12g/t gold; 32 m at 0.97% Cu and 0.11g/t Au; and 22 m at 1.06% Cu and 0.26 g/t Au. Copper sulphide mineralisation has been intersected in multiple holes in an area covering 10 km², indicating that the mineralising system is very large. IP geophysical coverage of the main target area shows the presence of several large IP anomalies that remain to be drill tested. A second round of drilling is planned to commence before the end of 2005.

Elsewhere, a three-stage option agreement allows Teck Cominco to earn up to a 75% interest in the Vredelus gold project by carrying all costs to the completion of a feasibility study. A significant drilling programme was scheduled to begin in October 2005. The project is located within the same belt that hosts the Navachab gold mine.

The company also has three other properties under option agreements. The Tevrede IOCG project is optioned to **Boulder Mining Corp** and **Springbok Resources Ltd**, and a 5,000-10,000 m drilling programme began in September 2005. At the Leicester Cu-Au-Ag project, optioned to **Yale Resources Ltd**, several significant targets have been generated, the largest of which is a 7 km-long coincident IP and copper-in-soil anomaly. At the Otjimakuru gold project, immediately west of Vredelus, and also optioned to Yale Resources, soil sampling and IP geophysical surveys are continuing, with a view to generating drill targets for early 2006.

In addition, Helio is carrying out detailed soil sampling over eight different targets, covering 80 km², on the Tevrede South and Honib IOCG projects. Grab samples from veins at Tevrede South have returned up to 23% Cu, 430 g/t Ag and 0.12 g/t Au, and a newly-discovered mineralised zone on Honib returned 6.5% Cu, 160 g/t Ag and 1.1g/t Au over a 3 m channel sample.

Meanwhile, **Kudu Minerals** is a young Namibian exploration company with exclusive mineral rights in northern-central Namibia, exploring for Tsumeb-Kipushi-type polymetallic base-metal targets. Nine targets will be drilled by the end of 2005 in the 28,000 ha EPL area, situated within the northern Damaran carbonate platform.



The Geological Survey of Namibia

FOUNDED in 1903 when the first government geologist set up office in Windhoek under the then colonial regime, the Geological Survey of Namibia (GSN) celebrated its 100th anniversary in September 2003. Since independence in 1990, the Geological Survey has been one of five directorates that function within the Ministry of Mines and Energy, the other four being the Directorates of Mines, Energy, Diamond Affairs and Administration and Finance. The Geological Survey encompasses six divisions: Regional Geoscience, Geophysics, Economic Geology, Geochemistry and Laboratories, Engineering and Environment, and Geo-information.

The **Regional Geoscience Division** is currently carrying out a number of mapping projects in areas of Meso- to Neoproterozoic basement rock and also in the Cenozoic Namib Desert. The mapping covers terrain for which no detailed maps exist so far, or where revision mapping has become necessary because of fresh geological knowledge. Some of the projects currently in progress are being carried out in cooperation with foreign research institutions. To date about 45% of the country's surface area has been geologically mapped at a scale of 1:250,000 or less, although part of that figure falls within the category of reconnaissance mapping or air-photo interpretation, with only sporadic ground checking.

DIGITAL GEOLOGICAL MAPS

In response to the increasing demand for digital data, an effort has been made to digitise printed and manuscript maps, and make them available in a widespread digital format. Since 1992, seventeen 1:250,000-scale maps have been compiled, mostly from 1:50,000 or 1:100,000-scale manuscripts, and five already-printed maps were converted into digital format by scanning and vectorising. The detail and accuracy of these maps, which are obtainable on open file in digital format or as colour plots, vary according to the quality of the base maps available.

The division also has a geo-chronological database, based on ArcView software, which currently contains some 1,850 radiometric data entries, as well as holding GIS and remote-sensing data. Whereas airborne geophysical data are especially useful in sand-covered areas to determine the underlying geology, satellite imagery and aerial photographs are employed in areas of good outcrop and little or no vegetation. The Geological Survey has Landsat TM 5 and TM 7

coverage for the entire country, and recently obtained additional ASTER (80% coverage) data.

AIRBORNE GEOPHYSICS

In 1994, the **Geophysics Division** began a programme of high-resolution airborne geophysics, with a 200 m line spacing and a flight height of 80-120 m. By the end of 2004, this had covered more than 60% of the country.

The project, initially, funded by the European Union through the Sysmin programme, and, since 1996, funded annually by government, has generated nearly

“The Geological Survey of Namibia celebrated its 100th anniversary in September 2003”

3 million line-km of magnetic and radiometric data at a cost exceeding N\$90 million. Sold to industry at a fraction of the acquisition cost, the data from these surveys have contributed towards increased exploration.

Other airborne geophysics carried out has included airborne electromagnetic and gravity surveys over promising targets concealed by Kalahari sediments. These surveys have been undertaken in order to determine the thickness of these sediments and to establish the benefits of this technology to exploration in Namibia.

Also, airborne hyperspectral test surveys have been carried out over several selected sites in central Namibia, covering some 2,500 km². First results have been encouraging.

A data-retrieval system has been established to facilitate easy access to these data, and in 2001 a geophysical interpretation unit was formed with the assistance of France's Bureau de Recherches Géologiques et Minières (BRGM) and Germany's Federal Institute for Geosciences and Natural Resources (BGR) to train Namibian geologists in the use of geophysical data in geological mapping.

Apart from the airborne survey programme, detailed ground gravity surveys have recently been carried out in the Rehoboth and Grootfontein areas. Namibia has a national network of gravity reference points, and the establishment of a national seismological network, incorporating existing stations at Tsumeb and Windhoek, is part of the current national development plan.

ECONOMIC GEOLOGY AND INFORMATION

The GSN's **Economic Geology Division** has initiated a programme to compile mineral exploration data on open file in summary reports, on the basis of 1:250,000 topographic maps. These reports include detailed geological descriptions of all known mineral occurrences within the area, as well as details of the exploration work carried out and the results obtained.

Seven reports have been completed to date, with three more nearing finalisation. Mineral locations verified in the course of this compilation are used to update the 1:1,000,000-scale *Mineral Map of Namibia*, a first draft of which was made available to the public in 1998.

The Earth Data Namibia database is another project that was conceived to aid potential mineral investors and researchers in accessing the wealth of information ac-

cumulated over more than 100 years of mineral exploration in Namibia. The database is a customised software package created to manage the geological and related data held by the Geological Survey. It has been designed as a client-server-solution within the GSN's local area network, both for internal use and as a tool to provide open-file mineral exploration data and other geological data to the public.

The Earth Data Namibia project started in 2001, with scientists of the Economic and Regional Geology Divisions, in co-operation with Beak Consultants of Freiberg, Germany, designing the database. This included scanned documents and maps of open-file exploration reports, together with their metadata, as well as a GIS function to display licence areas, mineral deposits and basic topographic information.

Since then, further modules have been added to allow the incorporation of other geological data, such as geochemical assays, borehole logs and literature. Hence, the system now contains spatial and factual data on mineral deposits and occurrences, exploration and mining licences, drilling, geochemistry, geological reports, maps and other printed material, as well as related topographic and topo-cadastral information, together with metadata about scanned archival documents.

A series of prospectivity maps for the most important mineral commodities found in Namibia has been initiated, with the preparation of a 1:2,000,000-scale map, showing the potential for kimberlitic diamonds. A prospectivity map for gold is currently in preparation.

The National Core Archive, also part of the GSN's Economic Geology division, currently houses core from more than 400 diamond-drill holes, as well as numerous percussion-chip sections. Representative and informative sections from new drilling projects are being added to the core archive whenever possible, in order to keep a record for the future.

GEOCHEMICAL DATA, LABORATORIES AND PUBLICATIONS

The GSN initiated its Regional Geochemical Survey Programme in 2000, with the aim of eventually establishing a geochemical background for the entire country. Some 1,700 stream-sediment samples, representing catchments of approximately 10 km² on average, were collected from part of the Rehoboth area during 2001 and 2002, with a further 7,500 samples gathered from the Windhoek, Okavandja and Omaruru areas during following years.

Survey designing for the Walvis Bay and Fransfontein districts in central Namibia is in progress. The samples collected so far are awaiting processing and analysis at the organisation's laboratory complex, which is one of the best equipped in Africa.

Digital compilation of archival geochemical data, supplied by various mineral exploration companies as part of the licensing regulations, started in 1998. Once the mostly analog data have been digitised and geocoded into a GIS-usable format, these data will also be added to the Earth Data Namibia database.

Other GSN projects have focused on the assessment and rehabilitation of abandoned mine sites, the investigation of potential waste-disposal sites, geotechnical mapping of the Windhoek municipal area, and an assessment of pollution resulting from current mining and mineral processing activities. Some of these projects have been carried out in co-operation with Germany's Bundesanstalt für Geowissenschaften und Rohstoffe (BGR).

The GSN has established highly sophisticated environmental and rock/soil-mechanics laboratories during the past five years, allowing it to evaluate the suitability of rocks and soils for various engineering purposes. In addition, an environmental laboratory has been equipped to assess and monitor pollution levels, and to make sure that these are in line with the relevant legislation.

The GSN's Geo-information division encompasses the National Earth Science Museum, the National Earth Science and Energy Information Centre and the Cartography subdivision. The division has the task of disseminating Earth science-related information to the public, researchers and other stakeholders. Founded in 1994, the National Earth Science Museum houses international-standard displays on mining, palaeontology and mineralogy.

The National Earth Science and Energy Information Centre was established in 1994, and houses more than 3,000 books and 60 periodicals (some of them going back more than 30 years) on topics ranging from palaeontology to ore-deposit research.

With the launch of the Earth Data Namibia database in 2001, four computer terminals were installed at the Centre to enable clients to access the stored mineral exploration data.

Apart from its maps, the GSN publishes its own journal, *Communications of the Geological Survey of Namibia*, devoted mostly to subjects of local but also of regional interest; memoirs and bulletins of the Geological Survey of Namibia appear at irregular intervals. In addition, the organisation publishes an annual report to keep mineral investors, policy-makers and the general public informed about its unceasing effort to improve the knowledge of Namibian Earth sciences.

The GSN's cartography subdivision produces its regional geological and thematic maps, and is wholly digital. It is equipped with state-of-the-art computer hardware and output devices, as well as up-to-date CAD and GIS software.

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The Minerals Development Fund of Namibia

A SEMI-GOVERNMENTAL institution based in the Ministry of Mines and Energy, the Minerals Development Fund of Namibia (MDF) was established in 1996 in order to support the local mining sector through, amongst other measures, the provision of low-interest loans to viable local mining ventures, financing geological exploration and mapping, and the provision of scholarships to Namibian students in mining-related subjects in order to enhance national capacity in this field.

The MDF operates as a revolving fund whereby an initial capital injection of €40 million provided by

the European Development Fund to mining ventures in Namibia is currently being repaid into the MDF. Repayments from the initial beneficiaries, which included Okorusu Fluorspar and Ongopolo Mining and Processing Ltd, the sale of geological data by the Geological Survey, and interest earned on the MDF's bank account, currently constitute the fund's only sources of revenue.

Repayments from the larger beneficiaries currently exceed 90%, compared with new beneficiaries whose repayment rates are often lower than 30%. Considering that most of the earlier beneficiaries are nearing completion of their repayments, the MDF is investigating additional sources of funding that would ensure long-term financial sustainability.

These include additional direct capital injections into the fund, long-term high interest-earning investments, and co-financing with similar local and international bodies in order to extend the MDF's capital base.

Some of the more than 45 new MDF beneficiaries have included Namibian Stone Processing, building material and paint manufacturing, small-scale diamond diving and gemstone mining and processing.

The MDF is also making concerted efforts to provide relevant mining-related training to beneficiaries, particularly small-scale miners, so as to improve their performance and contribution to MDF coffers. The MDF takes the view that a viable small-scale mining sector would go a long way in alleviating poverty and strengthening the national economy.

Key contacts

Although Namibia has one of the oldest mining industries in Africa, its mineral potential remains to be fully developed with modern exploration techniques. Namibia's mining industry has played a vital role in the development of the country, and the government, keen to diversify further the mining sector and to attract new investment, has recently put into place many incentives to make Namibia one of the most attractive regions in Africa to carry out exploration and to develop new mines.

For further information on investing in Namibia's mining sector, please contact the following institutions:

Ministry of Mines and Energy Permanent Secretary: Joseph S Iita

Private Bag 13297
Windhoek
Tel: +264 61 284 8111
Fax: +264 61 238 632

Mining Directorate

Director: Asser Mudhika Mining Commissioner: Mr E Shivolo

Private Bag 13297
Windhoek
Tel: +264 61 284 8111
Fax: +264 61 284 8366

Minerals Development Fund Technical Adviser:

Dr E Shanyengana
Private Bag 13297
Windhoek
Tel: +264-61-284 8245
Fax: +264-61-284 8362

Directorate of Diamond Affairs Diamond Commissioner:

Kennedy Hamutenya
Private Bag 13297
Windhoek
Tel: +264-61-284 8320
Fax: +264-61-284 8380

Geological Survey of Namibia Director: Dr GIC Schneider

Private Bag 13297
Windhoek
Tel: +264 61 284 8111
Fax: +264 61 249 144
Website: www.gsn.gov.na

Chamber of Mines

P O Box 2895
Windhoek
Tel: +264 61 237 925
Fax: +264 61 222 638

Namibia Investment Centre, Private Bag 13340, Windhoek

Tel: +264 61 283 7335 Fax: +264 61 220 278

Published by:

Mining Communications Ltd
Albert House
1 Singer Street
London EC2A 4BQ
Tel: +44 (0)20 7216 6060
Fax: +44 (0)20 7216 6050
E-mail: editorial@mining-journal.com
www.mining-journal.com

Supplement editors: Roger Ellis and Simon Walker
Design and production: Bree Freeman
Printed by Stephens & George, Merthyr Tydfil, UK
© Mining Communications Ltd 2005

Front cover: Westport Resources Namibia's exploration programme includes its Sperrgebiet base metals project in the far south of Namibia

This supplement was organised and sponsored by the Geological Survey of Namibia. Contributions from companies and advertisers are gratefully acknowledged.

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FORSYS
METALS CORP

EMAIL: INFO@FORSYSMETALS.COM
ADDRESS: 3670 • 130 KING STREET WEST,
TORONTO ONTARIO, CANADA M5X 1A9
PHONE: (416) 601-1286 FAX: (416) 601-6865

WESTPORT RESOURCES
NAMIBIA (PTY) LTD.

EMAIL: WRN@FORSYSMETALS.COM
ADDRESS: 63 CALCIUM STREET WEST, PROSPERITA
P.O. BOX 40155 AUSSPANNPLATZ WINDHOEK, NAMIBIA
PHONE: +264 (0)61 219 462 FAX: +264 (0)61 219 267

WWW.FORSYSMETALS.COM