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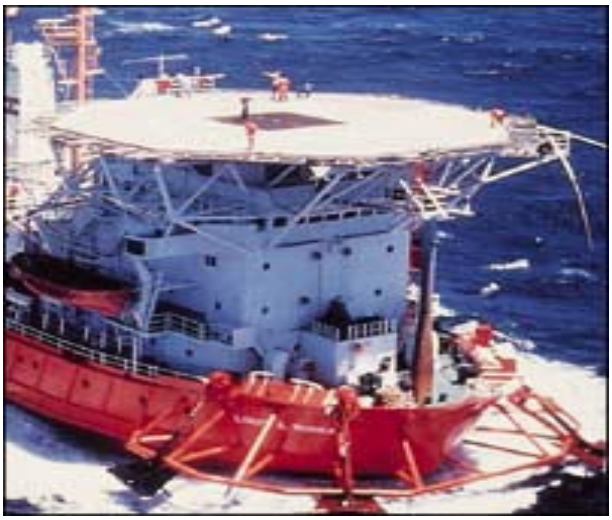
Namibia: Abundant Exploration Opportunities

COUNTRY SUPPLEMENT



DebMarine diamond recovery vessel. Offshore diamond recovery is set to increase its share of total output

Namibia is currently developing one of southern Africa's most dynamic mineral industries, a trend that is set to continue well into the next century. Since 1992, exploration expenditure has increased by more than 500%, and today more than 60 companies are actively exploring the exciting potential of Namibia's mineral sector. Recent exploration and investment initiatives have already led to the proposed development of two major base metal projects at a cost of over US$750 million; these will more than treble the value of base metal production in Namibia by 2000. This has been made possible because of fair and transparent mining regulations and taxes, well-developed power and transport infrastructures and an established democratic government, in a country with strong mining traditions and world-class mineral deposits.

Namibia first featured in a *Mining Journal* supplement in October 1992. Since then there have been considerable changes. The Government, well aware of mining's importance to Namibia's economy, has brought in a substantial package of incentives designed specifically to encourage exploration. These cover issues such as taxation, land access and rights of tenure. In addition, an excellent range of high- quality geological information is readily available to exploration companies. This new supplement provides the international financial and exploration community with a review of the progress and success achieved over the last five years, and of the opportunities awaiting potential investors in this dynamic and geologically prospective country.

Situated in the western half of the southern African subcontinent, Namibia encompasses an area of over 824,000 km². It has a hot and dry climate. Rainfall is extremely variable, ranging from less than 200 mm in the south to about 800 mm in the northeast. With less than 50 mm average annual rainfall, the coastal Namib Desert is one of the most arid places on Earth. Only the Kunene, Okavango, Zambezi and Chobe/Linyanti rivers, along Namibia's northern border, and the Orange River, which forms the southern frontier, are perennial. The Kalahari Desert, with an average rainfall of less than 200 mm, extends over the eastern part of the country, bordering Botswana and South Africa. It is separated from the Namib by a high inland plateau that reaches elevations of over 2,000 m and is covered by shrub and mixed tree savannah.

A NEW NATION

Dunes in the Namib Desert. Namibia hosts a fascinating range of wildlife, much of which has evolved especially to survive in the arid desert environment

The majority of Namibia's 1.6 million population lives in the rural north and in the towns of the central and coastal regions; in southern Namibia the population density is less than one person per square kilometre. Indigenous populations have been living in the area of modern Namibia for hundreds of years and there is ample archaeological evidence of ancient settlements, including ore smelting activities.

Portuguese adventurers first landed on the Namibian coast in 1484 on their way around the Cape of Good Hope. However, it was only 400 years later that systematic exploration took place when Germany claimed the region as one of her colonies. The German protectorate of South West Africa existed from 1884 to 1915, after which the country was entrusted to the newly-formed League of Nations. Administration of the region passed to South Africa after the Second World War, before Namibia achieved its independence in March 1990.

The country's prospectivity for minerals has long been recognised. As early as 1855, copper production began at the Walvisch Bay Mining Company's Matchless mine, just west of Windhoek. By the turn of the century, further base metal mines had been developed at Tsumeb in the north of the country and, eight years later, some of the highest-quality alluvial diamonds in the world were discovered near Lüderitz.

These, and more recent discoveries, created the basis for an important mining industry that underpins the modern Namibian economy by providing about 60% of Namibian exports and 15% of the country's GDP.

Today Namibia is a thriving democratic state whose President, Dr Sam Nujoma, was sworn in following the first national elections late in 1989 and was returned as President in 1994 after the country's second multi-party elections. His Government has adopted policies aimed at improving living standards and employment opportunities for all Namibians.

While current objectives aim for economic diversification, mining's importance as a cornerstone of the economy is appreciated by a Government eager to promote foreign investment and to expand its mining sector. The Ministry of Mines and Energy is striving to improve the technical infrastructure in what has become one of Africa's most attractive exploration and mining environments. Its Directorate of Mining is busy streamlining licence procedures and bringing licence holdings into an accessible GIS-based format.

The Geological Survey of Namibia, already in possession of one of the most extensive geological archives in Africa - including a complete inventory of previous exploration work that stretches back almost a century - is incorporating the results from modern surveys in order to optimise information on the country's geological potential. Furthermore, high-resolution geophysical data acquisition and prospectivity survey programmes now under way continue to identify exploration targets, especially in areas where thick sand cover obscures the bedrock geology.

Well-developed Infrastructure

Namibia's strong history of mining and associated industrial development has provided the country with an infrastructure that is one of the best developed in Africa. Its capital, Windhoek, is among the fastest growing cities in the world, whilst the country's excellent road system, extending over 40,000 km, is one of the most extensive in Africa. The railway network of more than 2,400 km of track currently links many of the major mining areas and towns, and facilitates the transport of goods to foreign markets. Plans for further development include railway links into Angola, Zambia and Tanzania.

The deep-water port at Walvis Bay is a regular port of call for major shipping lines and continues to attract investment. Profits have increased by over 70% during the last year, and its container and bulk mineral handling facilities are continuing to improve through the installation of new machinery. A US$12 million European Investment Bank loan for a new container terminal includes plans to dredge the port and increase its depth by 25%. There is the further possibility of a US$35 million World Bank loan to develop the existing Export Processing Zone.

Air travel in Namibia continues to grow and there are over 330 private and public airports and airstrips throughout the country. Namibia's international airline - Air Namibia - flies to over 20 destinations in southern Africa and Europe.

The port of Walvis Bay provides Namibia with a modern outlet to world markets

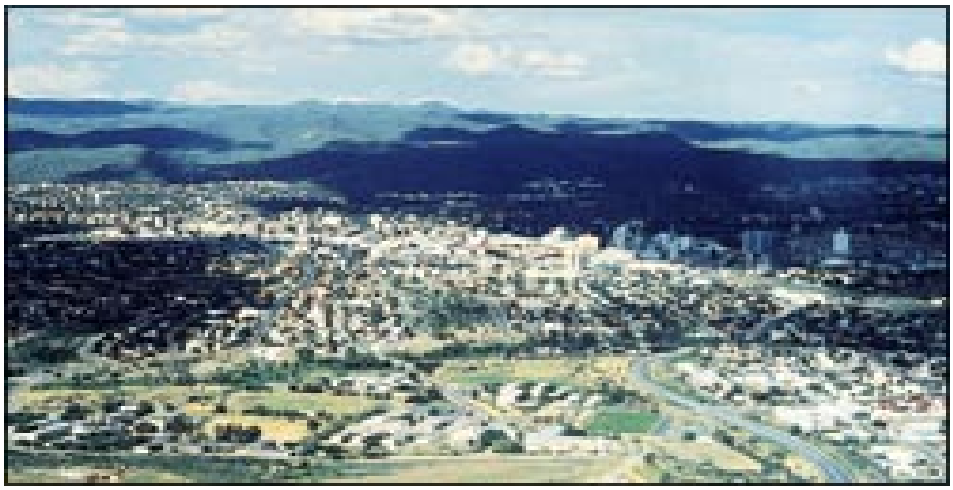
INFRASTRUCTURE

Namibia benefits from an extensive and reliable electricity supply. The national agency, Nampower, produces electricity priced at 1.8 USc/kWh, one of the lowest costs in the world, thus offering a major financial incentive to energy-intensive mining and mineral processing activities. Electricity is generated at the 240 MW Ruacana hydro-electric plant on the Kunene River and at the 120 MW coal-fired Van Eck power station near Windhoek.

A transmission agreement with South Africa's Eskom enables Nampower to draw on additional supplies at times of peak load. A 450 MW hydro-electric plant is planned at Epupa on the Kunene to meet long-term demand. These facilities guarantee that electricity shortages so typical of many African countries are not a problem in Namibia.

Investment in Namibia's energy sector is at a peak since independence. The proposed US$700 million development of the Kudu gas field could allow Namibia to become a major energy producer by 2002.

The field, located some 170 km off the Orange River mouth and believed to be among the largest in the world, was delineated by Shell, in partnership with Texaco and the South African company Engen, after the award of an exploration licence in May 1993. Expectations are that a pipeline to Oranjemund would deliver 100 Mft³/d of gas, with resources sufficient to supply a 1,750 MW power station for 30 years. Further offshore, hydrocarbon exploration is being carried out by Norsk Hydro who, with partners Statoil and Saga Petroleum, has spent over US$45 million on offshore drilling since 1992. Other licence holders include Sasol, Ranger and Chevron.



Windhoek, Namibia's capital, is the country's business and commercial centre as well as being the seat of government

An Inviting Business Environment

Mining is the backbone of the Namibian economy, having yielded export earnings of over US$700 million and tax revenues of US$72 million during the 1996-97 fiscal year. Although foreign investment has increased dramatically since independence, the Government is continuing its efforts to promote a favourable investment climate for international mining and exploration companies. This has led to many initiatives and incentives.

The launch of the First National Development Programme at the end of 1995 has been complemented by a concerted investment promotion and industrialisation programme. This includes the Export Processing Zone (EPZ) regime and the creation of an Offshore Development Company, as well as the upgrading of the Namibia Investment Centre and its offices overseas.

Moreover, the establishment of a country-wide Industrial and Small- to Medium-sized Enterprises Park programme has encouraged private investment into Namibia's growing small-scale mining sector. Apart from stimulating foreign and domestic investment and expertise within the mining sector, these initiatives have also boosted investment into the financial, legal and commercial ancillary services available in the country's major towns and cities.

The EPZ special incentive is designed to aid Namibia's export industry. It has been devised to benefit export-orientated manufacturers, addressing markets such as the United States and Europe with which Namibia has preferential trade agreements.

An EPZ business park is being developed in Walvis Bay, but factories elsewhere in the country may also be granted EPZ status. Enterprises with EPZ status do not pay corporate tax, duties on imported goods, and stamp, sales and transfer duties on EPZ activities.

Whilst primarily aimed at manufacturers, mining can also benefit from these measures where beneficiation and value-addition are built into mineral exploitation plans. The granting of EPZ status to a proposed US$20 million ferro-manganese plant, intended to process ore from

The Tsumeb smelter, a key factor in adding value to Namibia's mineral wealth

Cranford Namibia's Otjosondu mine in a joint venture headed by South Africa's Purity Manganese, is an indication of Namibia's determination to promote further downstream processing of mining products. Companies interested in developing the country's mineral resources can obtain full information on these incentives from the Namibia Investment Centre.

Namibia has a favourable tax regime for mining. Taxation is based on a sliding scale designed to relieve the burden on developing mines, and only reaches higher levels when mines are operating profitably. In practice, taxation equates to a base rate of 25% with a theoretical maximum of 55%, although most operating mines pay around 35%. A special tax rate of 55% is levied on diamond mining, with an additional 10% royalty payment. Deductible allowances include all exploration expenditure, development expenditure (equalised over three years), and contributions to environmental rehabilitation funds.

In addition to strong government support for the mining industry, Namibia has an active Chamber of Mines that represents over 95% of the mining companies operating in the country. Several committees within the Chamber oversee matters of health and safety, labour relations, exploration expenditure, production statistics and technological exchange. They also act as a channel for communication between the industry and the Government. Exploration and mining companies new to Namibia can benefit greatly from the expertise and information available to members of the Chamber of Mines.

The Namibian Institute of Mining and Technology (NIMT), established after independence through donations of over US$1 million from Rössing Uranium, is a major initiative to foster the training of skilled personnel for the mining industry. Located at Arandis, NIMT now has extended its role to cover the agricultural, fishing and manufacturing sectors, and plays a vital part in the development of the country's human resources.

Dimension stone is becoming increasingly important in export markets

MINERAL LICENSING

Streamlining the Law

Competition for mineral sector investment in Africa has never been stronger and, with over US$500 million invested in sub-Saharan Africa (excluding South Africa) during the last year, the stakes are high. Spurred by a flourish of activity by both Canadian and Australian companies, and by the emergence of South Africa's mining houses on to the world stage, since independence the Ministry of Mines and Energy has continued to update its mining law and investment policy.

The Minerals (Prospecting and Mining) Act was tabled in 1992 and promulgated in 1994. The Government has since put great effort into making the country's package of information and incentives even more attractive. This will be further enhanced by the current round of revisions to the Minerals Act, not least by freeing substantial areas of Namibia still held as mining claims for modern exploration techniques.

These new revisions remove some of the more onerous reporting duties on exploration companies, placing activity within licence areas as the main criterion for the retention of a licence. The Act is regarded as fair and transparent, and has the benefit of being overseen by Namibia's independent judiciary.

The Government of Namibia, through the Ministry of Mines and Energy (MME), is the sole regulatory agency for exploration and mining in the country. All mineral rights are vested in the State, so that prospecting and mining may only be undertaken under a licence issued by the Mining Commissioner.

The Government has no legal powers to acquire an interest in a mining property or other mineral operation against the wishes of the owner, and can only participate at the request of the company concerned. Ownership rights held by both domestic and foreign companies are protected against expropriation by the Namibian constitution.

Aware of the importance of efficient licence management, the MME is currently updating and streamlining the issuing of licences to mining and exploration companies. This will be achieved through the implementation of a GIS-based data storage and retrieval system.

Namibia's coastline hosts Africa's largest solar salt industry

The Ministry is also aware of the problem of "landlocking", which arises principally from the retention of mining claims. The new Minerals Act contains provisions specifically designed to curb this practice, and as of April 1997 (the end of the three-year period since the promulgation of the Act), claim holders who are not able to demonstrate the required activity on a claim will lose their rights, thus releasing the land to other prospectors and developers.

The effectiveness of the Minerals Act can be seen in the number and types of licences and claims registered between 1990 and 1995. During this period, the number of mining claims fell drastically while prospecting licences experienced a major increase.

Modest annual licence fees do not represent a barrier to exploration and mining. Fees range from N$50 (US$10) for mining claims to N$1,000 (US$200) for an exclusive prospecting licence covering an area of 100 km². Mining licence fees range from N$1,000 (US$200) for a mine with a gross annual revenue of less than N$10 million (US$2 million), to N$5,000 (US$1,000) for those with a gross revenue exceeding N$10 million.

While the State holds all mineral rights in Namibia, vast tracts of land are owned privately. This form of tenure has been in existence for many decades and results from the original division of the land at the time of European colonialisation. Thus exploration and mining on privately held land requires permission of access from the owner. The Namibian Chamber of Mines has drawn up a model agreement for companies and landowners to assist in negotiations. An Ancillary Rights Commission within the Ministry of Mines and Energy has also been established under the Minerals Act, to provide arbitration in disputes.

Mineral Licences

The Minerals Act allows for various types of prospecting and mining licences, covering both small-scale and formal activity. A brief summary of each is given below.

Mining Claims

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 providing that the claim is being developed or worked. Up to a maximum of ten claims can be held at any one time.

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 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.

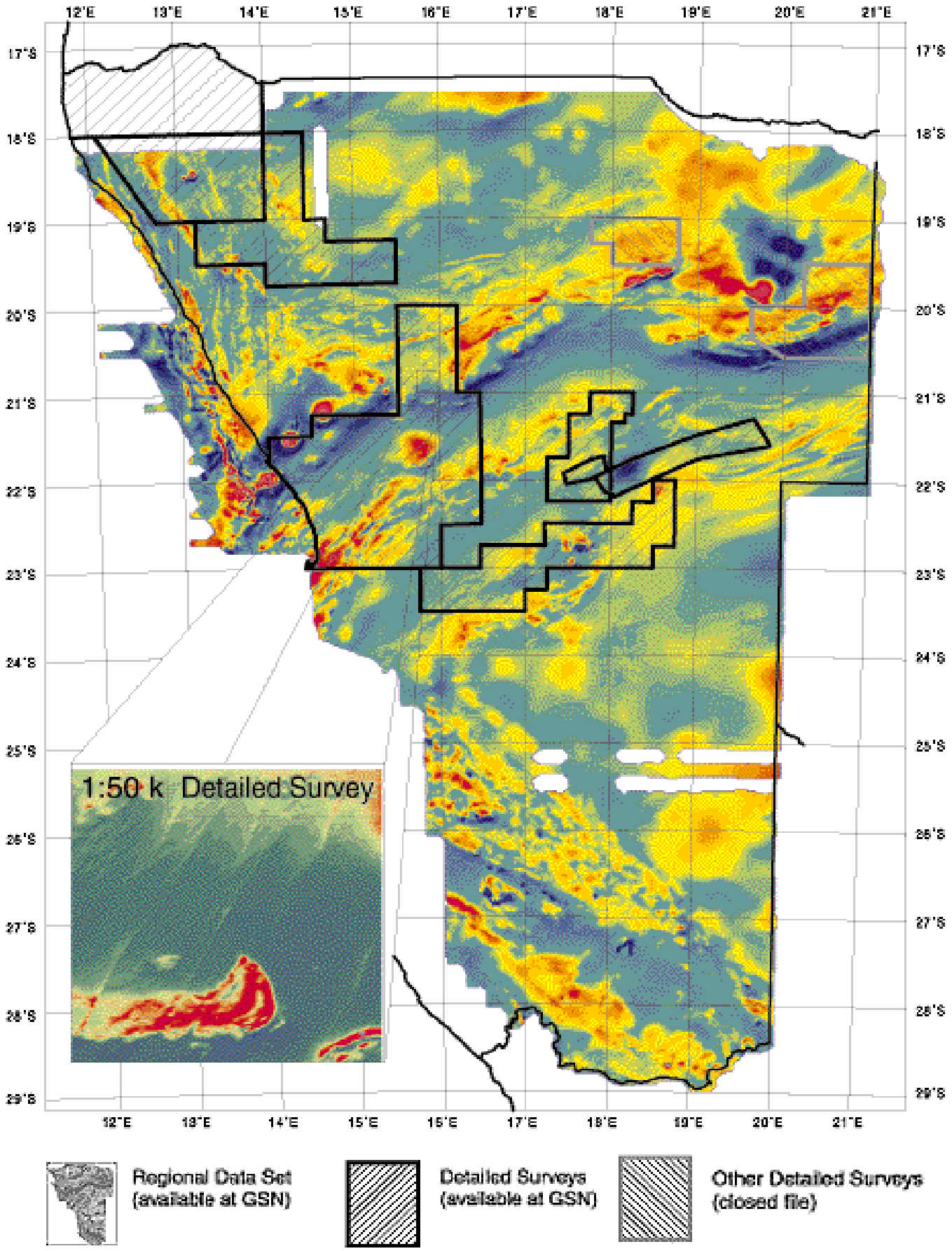
Mining Licence

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 the 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 an exploration company in certain circumstances 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.

GEOPHYSICAL COVERAGE



Composite aeromagnetic data set of Namibia. New high-resolution data are available of selected areas, and are planned to cover the whole country

The Geological Survey

The Geological Survey of Namibia (GSN) is the country's principal repository of geological data, possessing mineral records collected over the past 100 years. The Survey originated in 1903 when the German Colonial Office appointed government geologists to search for groundwater and to start geological mapping.

At independence, the Geological Survey became part of the Ministry of Mines and Energy. It is subdivided into three divisions; Regional Geoscience, responsible for geological mapping and geophysical surveys; Applied Geoscience, concerned with the exploration and assessment of mineral deposits and the provision of analytical services, as well as engineering and environmental geology; and Geotechnology, committed to the computation of all acquired data and their dissemination.

Of great importance to the promotion of mineral exploration is the Geological Survey's NAMDAT computerised data retrieval system. NAMDAT contains detailed information on over 1,500 known major and minor mineral occurrences throughout the country, drawn principally from reports submitted to the Ministry of Mines and Energy under the terms governing prospecting and mining licences. Data compiled from reports under current licences are held confidentially until the licences expire or are relinquished, after which they are placed on open file to assist other prospectors.

Comprehensive airborne geomagnetic survey data acquired during the period 1962-1992 have recently been co-referenced into a single data set in collaboration with the German Federal Institute for Geology and Natural Resources (BGR). Used in conjunction with a specially created digital terrain model, aeromagnetic data provide an effective tool in mineral exploration, as they not only characterise areas of known mineralisation according to their magnetic susceptibility, but also identify bedrock beneath thick non-magnetic sequences.

This is of great importance as 50% of Namibia is covered by young sediments of the Kalahari and Namib Deserts. Prospectors and geologists are now able to obtain a geological understanding of the rocks underlying these vast areas for the first time.

While the composite aeromagnetic data are an excellent regional tool, the GSN has recognised that a higher definition is needed for detailed targeting of exploration areas. To fill this need, the organisation has begun a programme of high-resolution airborne magnetic surveys. Carried out at a line spacing of 200-400 m and at altitudes of 80-100 m, and used in conjunction with radiometric measurements, they provide distinct signatures of mineralisation and their host lithologies.

Above left: High-resolution aeromagnetic surveys add new detail to the country's geophysical database
Above: The new headquarters of the Ministry of Mines and Energy and the Geological Survey in Windhoek

These surveys are jointly funded by the Namibian Government and the European Union through the SYSMIN mechanism of the Lomé Convention. Data are available at reasonable cost and the income generated is being recycled in a revolving fund to finance further airborne geophysical surveys.

In addition, the GSN has compiled a nationwide gravity map based on over 2,000 ground stations. All of these data sets add to the understanding of the country's complex geology and mineralisation styles, and when used together provide a powerful exploration tool.

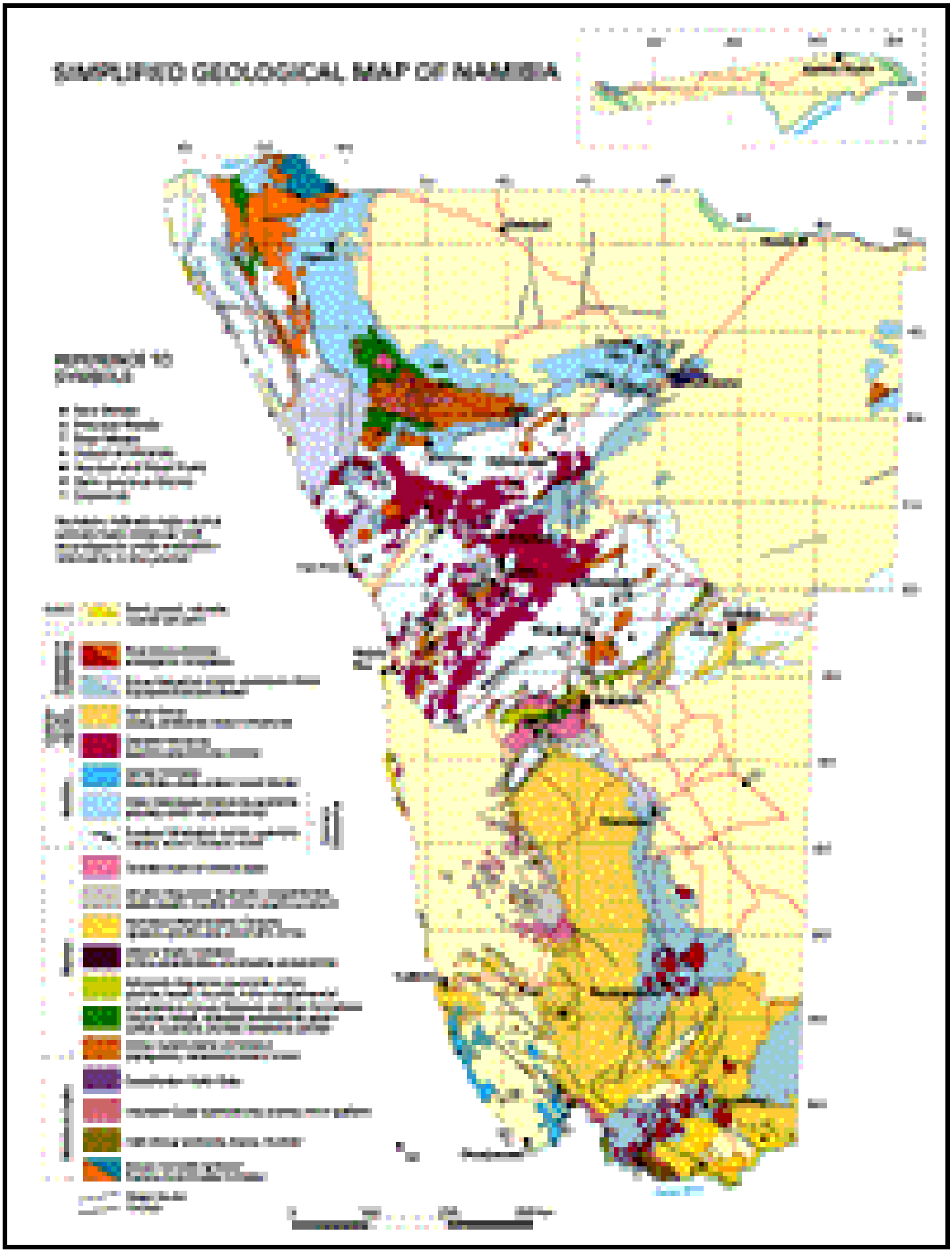
MINERALS DEVELOPMENT FUND

Namibia has a long history of mineral production, and is currently a major contributor to world supply of diamonds and uranium. In order to diversify the mining sector in the future, the Government is strongly supporting increased exploration.

Until recently, the international exploration community has perceived Namibia to have only limited prospectivity. Despite recent discoveries such as Navachab, Haib, Skorpion, Khusib Springs and Tschudi, which have shown this perception to be outmoded, the country has yet to receive its fair share of exploration investment.

Recognising the importance of inward investment to an industry vital to the country’s economy, the Government has further enhanced the package of assistance available to companies engaged in mineral exploration and development by the introduction last year of a Minerals Development Fund. The objective of this fund is to diversify the mining sector by providing finance, as loans and grants, as well as to support private exploration and development. The fund will also be used to develop national geoscience databases, thereby improving deposit modelling. Mineral industry training facilities and programmes will be expanded to increase the availability of professionally and technically trained Namibians, capable of holding senior positions within a growing mining sector.

NAMIBIA'S GEOLOGY



NAMIBIA'S GEOLOGY

Geology and Mineral Sector Opportunities

Isoclinal folding of turbidite sequences in the southern Kaoko zone of the Damara Belt

[Figures indicate locations on the geology map]

Southern Africa contains a number of highly prospective geological provinces, spanning a geological history that extends over 3,800 million years. The region south of the Kunene and Zambezi Rivers, covering Namibia, Botswana, Zimbabwe and South Africa, contains some of the world's most important gold, platinum, diamond and base metal deposits, as well as significant reserves of nuclear and fossil fuels, semi-precious stones and industrial minerals.

With a geological history related to the development of several cratonic blocks and surrounding mobile belts, and covering a timespan from late Archaean to Cainozoic, Namibia hosts a wide variety of mineralisation styles. Nonetheless, developing the country's potential as a major player on the world mining scene will require the application of modern exploration models and methods.

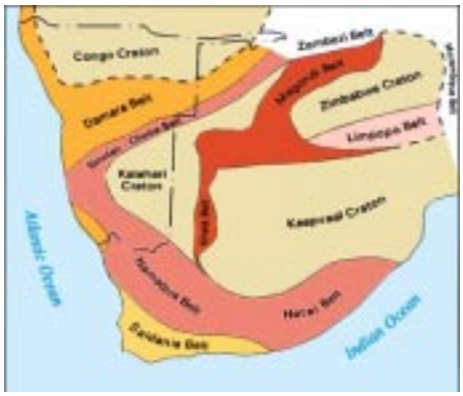
The Geological Survey has undertaken a review of Namibia's known mineralisation, and a provisional interpretation of its mineral potential is shown in the map on below. The compilation takes account of the wide variety of mineralisation styles that include Mississippi Valley-type (MVT) lead-zinc, volcanogenic massive sulphides (VMS), porphyry copper, sedimentary exhalative (SEDEX) lead-zinc, and skarn and shear-related gold.

Northern Namibia is underlain by the Congo Craton. Igneous and metasedimentary rocks of Late Archaean (2,600 Ma) to Lower Proterozoic age outcrop along its southern margin, while younger Late Proterozoic to Cainozoic strata cover it to the north. The Kalahari Craton, which underlies southeastern Namibia, is mainly of Lower Proterozoic age (2,200 to 1,800 Ma), although it probably contains Archaean remnants along its eastern margins. The craton is completely covered by platform sediments of the Nama Group (Late Proterozoic to Cambrian), the Karoo Sequence (Carboniferous to Jurassic) and the Cainozoic Kalahari Sequence, which attains thicknesses of up to 240 m.

In northern Namibia, the massively layered 2,100 Ma anorthosite-troctolite Kunene Complex intruded older granitic gneisses of the Epupa Metamorphic Complex, and contains bodies of massive titaniferous magnetite. It has been prospected for Fe, Ti, Cr, V and platinum group elements (PGE). Meanwhile, the 1,900 Ma Grootfontein Mafic Complex to the south of Grootfontein shows many characteristics conducive to the formation of massive or disseminated Cu-Ni-PGE-sulphide deposits.

Economically more interesting are the Mid-Proterozoic rocks of the Khoabendus Group and the Okapuka Formation of northwestern Namibia, and the Elim Formation of central Namibia. The Khoa-bendus, Okapuka and Elim successions consist of thick (basaltic and andesitic to rhyolitic) volcanics and metasediments (quartzite, chert, phyllite and minor marble) that may have formed in island arc or active continental margin settings.

Known mineral occurrences hosted by these rocks indicate their potential for VMS deposits. The Elim Formation carries numerous small copper occurrences, and shear zones within the lavas have been mined on a small scale for gold and copper. Iron formations at the top of this unit locally contain lead-zinc mineralisation. The volcanosedimentary Rehoboth Sequence outcrops to the south of Windhoek. The Gaub Valley Formation of the western Rehoboth area consists of biotite schists that are extensively intruded by metamorphosed dolerite dyke swarms. Shear zones in the schist are known to carry gold.



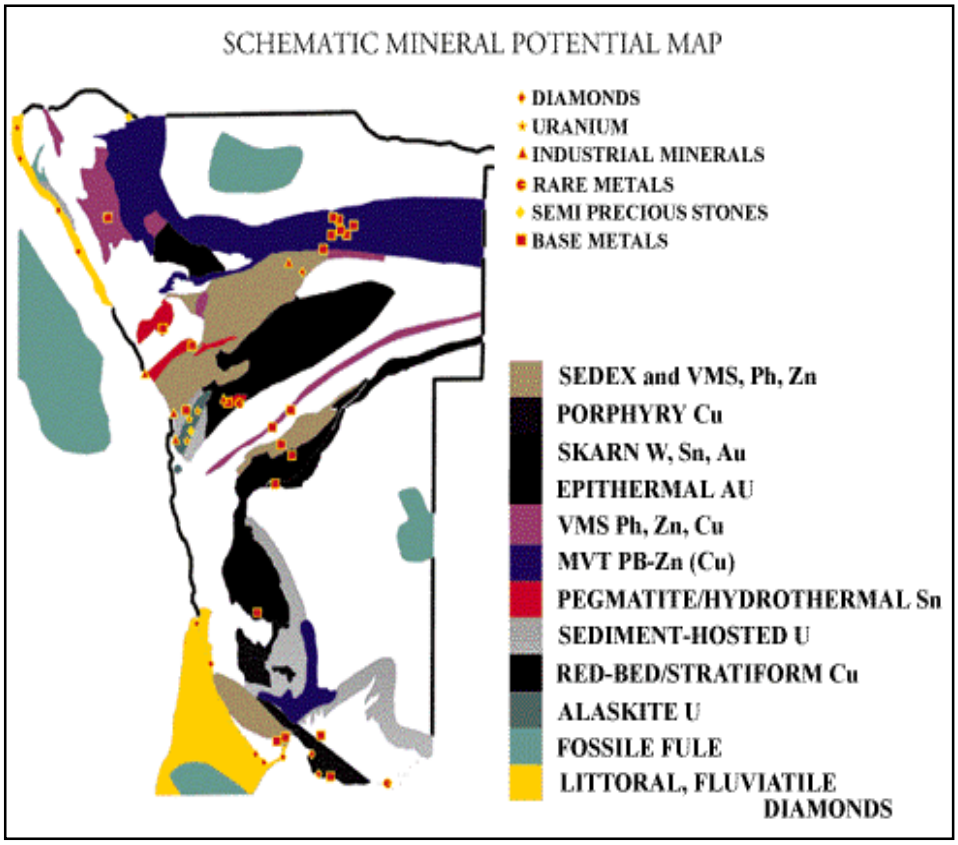
Simplified tectonic framework of Southern Africa.Namibia is underlain by the Congo and Kalahari Cratons, and by the mineral-rich Damara fold belt

The Mid-Proterozoic (1,400 to 1,200 Ma) Sinclair Sequence, comprising four cycles of clastic sedimentation and bimodal volcanism, forms an arcuate chain rimming the northwestern part of the Kalahari Craton, and contains numerous vein-type copper-lead-zinc and gold occurrences. Mafic intrusions along rifts may host nickel-copper sulphides and PGE mineralisation.

Upper Sinclair Sequence equivalents in the Rehoboth-Witvlei area are host to red-bed copper-silver mineralisation. This type of mineralisation was mined at the defunct Klein Aub mine [1] (5 Mt, 2 % Cu, 50 ppm Ag, up to 1ppm Au and minor PGE), while some 13 Mt of ore resources have been identified in playa lake settings in the Witvlei area. The largest of these occurrences has resources of 6 Mt containing 1.8 % copper.

Pre-tectonic metasediments of the c.1200 Ma Namaqua Metamorphic Complex

BASE METAL PROSPECTIVITY



in the Aus area contain magnetite quartzite which may have a similar age and origin to the South African Aggenys, Black Mountain and Gamsberg magnetite quartzite, and associated SEDEX/VMS lead-zinc deposits. There is therefore potential for SEDEX/VMS base metal deposits in terrigenous metasedimentary units of the Namaqua Metamorphic Complex.

Several porphyry copper-molybdenum deposits occur in the 1,950 to 1,800 Ma granites and granodiorites of the Vioolsdrif Suite, of which the Haib [2] (650 Mt, 0.37 % Cu) and Lorelei prospects, just north of the Orange River, are well-known. Future exploration in this area should be focused on highly metamorphosed porphyry copper-molybdenum deposits in recognisable Vioolsdrif intrusives within the Namaqua Metamorphic Complex.

In southeastern Namibia, post-tectonic pegmatites with ages of about 900 Ma carry tantalum mineralisation with minor beryllium and lithium (as at the Tantalite Valley mine [3]).

The Late Proterozoic Damara Sequence and Gariep Complex, and related plutonic rocks, evolved during successive stages of intracontinental rifting, continental rupture, spreading, subduction and continental collision between 1,000 and 460 Ma. They form part of the Pan-African orogenic belts that surround and dissect the African continent. A great number of mineral deposits and mineralisation styles are associated with each of these stages, while pre-Damara basement inliers, composed mainly of high-grade metamorphic rocks, are known to contain gold and base metal mineralisation.

The Damara Orogen comprises two coastal belts, divided into southern and northern arms, and a northeast-trending intracontinental branch that extends from the Atlantic Coast through Namibia into Botswana. The southernmost rift of the intracontinental branch, which can be traced from west of Rehoboth to the Witvlei area, is filled with terrigenous sediments (Nosib Group) including meta-evaporites with anomalously high sodium and boron of possible exhalative origin.

Horizons containing low-grade copper have been found within this unit. Anomalous gold values are recorded locally, and erratic gold mineralisation is present in younger quartz veins.

Thick peralkaline pyroclastics were deposited in the northern rift, which can be traced from Cape Cross to south of Grootfontein. Associated rift margin alkaline to peralkaline intrusives and carbonatite dyke swarms have potential for tin, rare earth element (REE) and fluorite mineralisation, while volcanogenic copper sulphides occur in lucititic lavas southwest of Grootfontein (the Askevold deposit). Further potential for VMS deposits may exist towards the east below Kalahari sand cover.

Passive continental margins formed on either side of the southern rift, as it developed into a Southern Zone ocean, and along the north-south trending proto-Atlantic ocean. Both volcano-exhalative and SEDEX deposits formed along these evolving continental margins as well as during synsedimentary faulting along the deepening northern rift. They are hosted in metasedimentary rocks of the Swakop Group.

The lead-zinc-silver-copper-barite deposits of Rosh Pinah [4] (14 Mt mined to date at 8 % Zn and 2 % Pb, with substantial reserves), Skorpion [5] (some 8.3 Mt at 10.9 % Zn) and Tsongoari [6] (barite layers up to 10 m thick) as well as banded iron formations in the vicinity of Wind-hoek (Tsatsagas, 4.5 Mt at 54 % Fe-oxide) are examples for volcano-exhalative occurrences probably associated with the cessation of volcanism.

Cupriferous and pyritic volcanogenic massive sulphides occur along the northern margin of the northern rift near the Summas Mountains. The northern rift contains up to 16 km of metasediments, and continuous synsedimentary faulting along its southern margin, the Omaruru Lineament, indicates potential for major SEDEX deposits.

Known deposits along the Omaruru Lineament are Namib Lead [7] (lead-zinc-silver) and Joumbira [8] (lead-zinc-copper). Exhalative tourmalinites are present in schists of the northern rift at Ondundu [9] and in association with copper northwest of Omaruru.

Spreading culminated in the formation of a mid-oceanic ridge in the Southern Zone ocean (Matchless Amphibolite Belt) which hosts several Besshi-type volcanogenic massive cupriferous pyrite deposits at Ongombo [10], Otjihase [11], Matchless [12], Gorob and Hope [13], as well as several smaller occurrences. Finally subduction occurred, leading to closure of the Southern Zone and proto-Atlantic oceans.

More than 200 plutons of granite (96 %) and minor diorite intruded the pre-Damara basement and Damara Sequence during subduction and continental collision. Rare metal pegmatites were em-placed between 550 and 460 Ma.

Lithium-beryllium- and semi-precious stone-bearing pegmatites occur mainly in

GOLD OPPORTUNITIES

the Karibib-Walvis Bay-Omaruru area, while tin pegmatites are concentrated in three northeast-trending belts (Uis mine [14], about 60 Mt, 0.13 % Sn), 80 to 185 km north of the subduction zone. A belt of post-tectonic tin and tin-tungsten lode deposits occurs still farther north between the defunct Brandberg West mine [15] and the Goantagab prospect [16], while post-tectonic uraniferous granites (Rössing mine [17] and several smaller occurrences) are present between 20 and 60 km to the north of the subduction zone. Scheelite skarns are developed locally in association with granitic intrusions.

Various post-tectonic hydrothermal deposits formed in the central part of the Damara Orogen. Lode gold is hosted in basement gneisses, the Nosib Group arkoses and the Swakop Group marbles; in the latter case garnet-pyroxene-biotite-vesuvianite skarns developed adjacent to the quartz veins (as at the Navachab gold mine [18], some 10 Mt, 2.2 g/t Au). The geological setting of this area warrants further exploration for Ernest Henry-type copper-gold deposits.

Quartz veins in biotite schists of the upper Swakop Group carry copper and molybdenum at Onganja [19] and gold at Ondundu [9]. At the defunct Khan mine [20] post-tectonic, pegmatitic pyroxene-hornblende-K-feldspar-quartz pods contain up to 6 % copper and may be related to evaporites in the Nosib Group or to high-temperature, dolomite-rich fluids. Syntectonic, Alpine-type serpentinites occur along the intensely deformed southern margin of the Damara Orogen.

Scanning a truck load of uranium ore for grade at Rössing

The extensive and thick carbonates of the Otavi Group in the northern part of the Damara Orogen form excellent targets for karst-related MVT-type lead-zinc mineralisation. Several deposits have already been

DIAMONDS AND HYDROCARBONS

The De Wet shaft at the now-defunct Tsumeb mine, which was worked for 95 years

(Berg Aukas [21], Abenab [22]). This region is also the type-locality for Tsumeb-type polymetallic mineralisation (Tsumeb [23], Khusib Springs [24] and Kombat [25]). In the same area, the Tschudi copper-silver prospect [26] (7 Mt, 1.6% Cu) occurs in arkoses of the upper Damara Sequence and can probably be related to red-bed type mineralisation.

During subduction, the Nama foreland basin formed to the south of the Damara Orogen on a major peneplain. The basal quartzite of the Nama Group is a target for unconformity uranium in the region east and southeast of Aus. In this same area, deep intra-Nama erosion of flat-lying limestones suggests palaeokarsting and hence potential for MVT lead-zinc deposits.

Anorogenic ring complexes emplaced at 500 Ma along the northeast-trending Kuboos-Bremen line in southern Namibia consist of alkali granite, syenite, nepheline syenite and carbonatite. Apart from known lead, zinc, molybdenum, silver, fluorite, apatite and zircon mineralisation, there is potential for tin and REE.

Karoo sediments of Carboniferous to Jurassic age that extend over parts of northwestern and southern Namibia are capped by extensive basalt flows and are heavily intruded by dolerite sills and dykes. Permian coal occurs in the Aranos Basin, in the Waterberg area, at the mouth of the Huab River on the northwestern coast and in the Ovambo Basin.

The Aranos deposit [27] has recoverable reserves of 300 Mt of steam coal. The Huab River deposit is a 10 m-thick layer of anthracite with 4 % volatiles at a depth of 700 m. All other deposits are very thin and erratic, with high ash contents. In the Engo Valley of northwestern Namibia, an unconformity uranium deposit of possible Tertiary age occurs in sandstones that interfinger with black shales along the edge of a Karoo glacial valley.

Late to post-Karoo anorogenic ring complexes, consisting mainly of alkali granite, syenite, foyaite, gabbro, pyroxenite and carbonatite, are present in three northeast-trending belts. Of these only the Okorusu Complex [28] is currently mined for fluorite, but mineralisation is known from many other places, including REE, tungsten, copper, apatite, iron and semi-precious stones.

An investigation of mid-Cretaceous kimberlites in central southern and northeastern Namibia indicates that they are barren or subeconomic, and basement model ages are only about 2,000 Ma. However, if indicated Archaean model ages for the basement north of the Damara Orogen are verified, this whole region would have potential for diamondiferous kimberlites. In addition, recent geophysical data give new indications of the western extent of the Kalahari Craton, and might therefore enhance the kimberlite diamond potential of northern Namibia.

The western part of the country is covered by up to 200 m- thick aolian and fluviatile sediments of the Namib Desert. Economically these are the most important host lithologies in Namibia, as they contain the extensive coastal and offshore alluvial diamond fields.

Diamonds occur along most of the Namibian coast but economic interest centres at present upon the area between the Orange River and L¨deritz [29]. The diamonds occur in up to six raised beaches, and on the continental shelf. Some 1.5 Mct were produced in 1996, with about one-third de-rived from marine concessions [30].

Mining of placer deposits modified by deflation processes is taking place at Chameis, in the Bogenfels-Pomona area, and at Elizabeth Bay. Raised mid-Tertiary fluviatile gravels occur sporadically along the banks of the Orange River and are mined at Auchas [31].

The greatest potential for oil and natural gas appears to be offshore. Four sedimentary basins containing between 4 and 7 km of sediment are currently being investigated by several international companies.

Recoverable dry gas (96 % methane) was intersected in Lower Cretaceous aeolian sandstones at a depth of 4.2 km in the Kudu wells [32], west of Oranjemund. A three-dimensional seis-mic survey of the area indicates that gas reserves could be as large as 10 trillion cubic feet.

A review of the comprehensive regional geophysical data has provided a better geological understanding of the country. In this context, the identification of the bedrock geology beneath the non-magnetic Kalahari Sequence has been of particular importance, as it allows extrapolation of geophysical characteristics between areas of known mineralisation and new prospective areas.

In addition, the data reveal the continuation of the Matchless Belt to the east,

DEVELOPMENT PROJECTS

Structures in the Damara Belt,one of Namibia's most prospective areas

and the western edge of the Kalahari Craton and its relationship to the surrounding mobile belt, as well as a number of circular anomalies related to anorogenic complexes within the Damara Sequence. High-resolution aeromagnetic surveys currently being flown and processed will further add to this understanding and boost Namibia's prospects for future significant mineral discoveries.

Broadening Namibia's Resource Base

The Haib and Skorpion prospects in the south are two of Namibia's most promising deposits, and serve to highlight the untapped potential of the country's mineral resources. Both deposits are currently subject to detailed feasibility studies with the aim of diversifying and expanding Namibia's mineral sector.

Haib was previously worked for small quantities of high-grade copper ore at the turn of the century. Hosted within rocks of the Namaqua Metamorphic Complex, it is a large-scale quartz-feldspar porphyry copper deposit containing a full range of minerals associated with hydrothermal alteration, including low-grade gold and molybdenum. Low-grade near-surface oxide ores represent an additional resource.

Mineable ore reserves at Haib are 650 Mt grading 0.37% copper. It is currently being evaluated by the joint venture partnership of Namibian Copper Mines and Great Fitzroy Mines NL of Australia, and a bankable feasibility study has recently been completed. When fully operational, the planned open-pit mine will be one of the largest in southern Africa.

Planned production will be 115,000 t/y of copper, 17,000 oz/y of gold and 880 t of molybdenum concentrate. A mine life of at least 25 years is envisaged. During this time, the Haib project will benefit from currently existing infrastructure, such as the main South Africa-Namibia highway, situated only 500 m from the deposit, and established powerlines guaranteeing adequate electricity supply, as well as the town of Noordoewer, a short ten minutes' drive away, as a source of labour. A permanent water supply, essential to mining activities, is provided by the nearby Orange River.

Capital costs for the project are estimated at US$600 million and are expected to be recovered within the first seven years of operation. Completion of construction and start of production are scheduled for the beginning of 1999, with production costs of less than US$0.50/lb of copper. The much smaller Lorelei porphyry copper deposit nearby is indicative of other promising targets that have been identified in southern Namibia.

The Skorpion zinc-oxide deposit is located some 20 km north of Rosh Pinah and 80 km northeast of Oranjemund. Lying approximately 10 m below surface, the deposit is up to 100 m thick and appears to be the oxidation product of volcanogenic massive sulphides. Hosted in the Gariep Complex, the original mineralisation is probably similar to Rosh Pinah and illustrates the high prospectivity of this area.

Skorpion is estimated to have reserves of 8.3 Mt grading 10.9% Zn. A favourable waste-to-ore stripping ratio of 1:1.85 has been calculated for open-pit mining, and expected production will be at a rate of 85,000 t/month of ore, amounting to some 100,000 t/y of zinc metal.

London-based Reunion Mining is currently evaluating the deposit, which was discovered by Anglo-American Corporation (AAC) in the early 1980s. In a four-year agreement with Erongo Mining and Exploration, a subsidiary of AAC, Reunion is entitled to earn a 60% interest by spending US$1 million on metallurgical testwork and feasibility studies. Studies to date have confirmed that the highly oxidised ore is amenable to leaching and solvent extraction for electrowinning.

A fully bankable feasibility study is due for completion by mid-1998. This involves a two-year development period with production starting in 2000, at a capital cost of US$155 million.

A Key Economic Sector

Mining has played a vital role in the development of the Namibian economy. The traditional large-scale exploitation of base metals and diamonds has had a profound effect on the national budget, and acts as a solid base on which to expand and diversify the mineral industry. Namibia's operating mines highlight the wide variety of metallogenic provinces within the country and point the way to future discoveries. Most operations have resulted from ground mapping surveys following distinct surface indications. Some mines date back to early exploration at the turn of the century.

Diamonds

Namibia hosts alluvial deposits of some of the finest gemstone-quality diamonds in the world. Diamond mining dates from the accidental discovery of a diamond by a railway worker at Kolmanskop station near Lüderitz in 1908, which was followed by a diamond rush. By 1913 the Namibian diamond fields accounted for 20% of world production.

In 1920, the various companies holding numerous claims were amalgamated by De Beers into Consolidated Diamond Mines (CDM), a company which was to form the mainstay of the Namibian diamond industry for many years. In 1994, CDM entered into a joint venture with the Namibian Government to form Namdeb Diamond Corporation Ltd.

While the deposits in the Lüderitz area soon became depleted, the beach deposits north of the Orange River mouth were discovered in 1928 and have supported large-scale mining since 1935. Starting as early as 1958, exploration of the seabed gained increasing importance in the 1980s, and today approximately one-third of the Namibian diamond production is derived from offshore deposits.

Namibia's diamonds originate from diamond-bearing kimberlites in central southern Africa, whose erosional products were transported by the Orange and other westward-flowing rivers to the Atlantic Ocean. This transport process proved to be highly selective, and only the highest-quality stones were able to survive the long journey, thereby accounting for the extraordinarily high share of 96% of gemstone-quality diamonds in the Namibian deposits.

DIAMOND PRODUCTION

Putting Prospectivity into Perspective

Backed by a variety of geological maps, digital geological and remotely sensed data and a better understanding of mineralisation controls on its varied deposit types, Namibia offers today's explorationist excellent prospectivity. Some US$90 million have been spent on exploration in Namibia during the last six years.

Despite all of this activity, Namibia's enormous mineral potential remains, in international terms, underexplored. Nonetheless, the increase in exploration expenditure recorded since 1994 indicates that this situation is changing as companies recognise the excellent prospects and favourable conditions that Namibia offers.

Expenditure more than doubled from 1994 to 1995 and grew by a further 24% in the following year to about N$118 million (about US$26 million). Further increases are expected as more ground becomes available with the freeing of mining claims as a direct result of the new legislation.

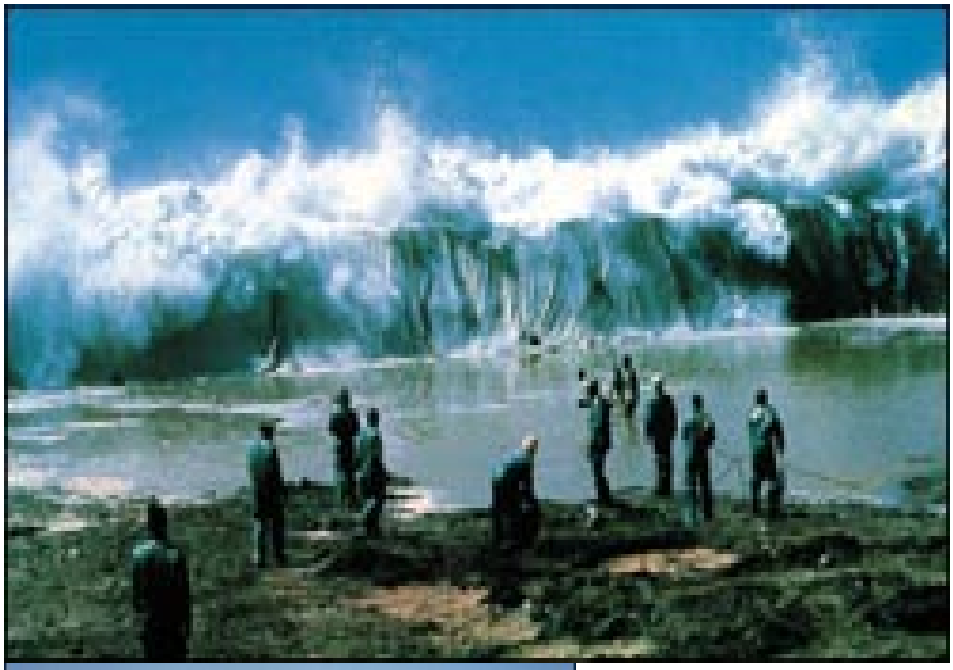
Nevertheless, expenditure in 1996 represented only about 6% of exploration money spent in Africa, which itself accounted for only about 12% of global exploration expenditure. With many companies now focusing their activities on Africa's untapped potential, Namibia can expect to receive a greater share of the global exploration budget, estimated to be over US$4.5 billion, in 1997.

Recent statistics indicate that around 375 exclusive prospecting licences are currently valid. Of these, some 32% are for base metals, 26% for precious metals and 34% for diamonds (of these 80% are for offshore exploration), with the remainder for rare metals, semi-precious stones, industrial minerals and dimension stone.

Compared to global averages of 60% for precious metals, 30% for base metals, and 10% for others, including diamonds, Namibian exploration is strongly biased towards diamonds and, to a lesser extent, towards base metals. This is a reflection of the historical perception of Namibia's mining sector which undoubtedly has excellent diamond and base metal potential. However, its considerable opportunities for gold and other mineralisation are not currently receiving their due attention.

Over 60 companies are now exploring in Namibia, and there has been a noticeable increase in international interest. Before independence, South African firms dominated the scene, but since 1990 an increasing number of international companies have recognised the country's potential.

Several major international companies, including MIM and BHP, as well as South African firms whose interests are now international (such as Avmin), now hold exploration licences. Junior companies such as Caledonia, Great Fitzroy Mines and Kalahari Gold and Copper are also actively involved in exploration, adding their efforts to those of established Namibian companies like Gold Fields Namibia, Erongo Mining and Exploration, Tsumeb Corp., Namdeb and Namco.



Above: Sea-walls give access to offshore diamond-bearing gravels

Left: Amongst its equipment fleet, CDM uses two bucket-wheel excavators for overburden removal

Some diamonds were concentrated in the terraces of the proto-Orange, while others were transported together with gravel into the submarine delta of the Orange River, forming an intermediate depository. These sediments were re-worked during several Cainozoic marine transgressions and regressions before finally being preserved in raised diamondiferous beaches.

Additional reworking of the exposed beaches by wind action led to the formation of aeolian placer and deflation deposits. Diamonds have been found all along the Namibian coast, but the strip between Oranjemund and Lüderitz remains the main production area.

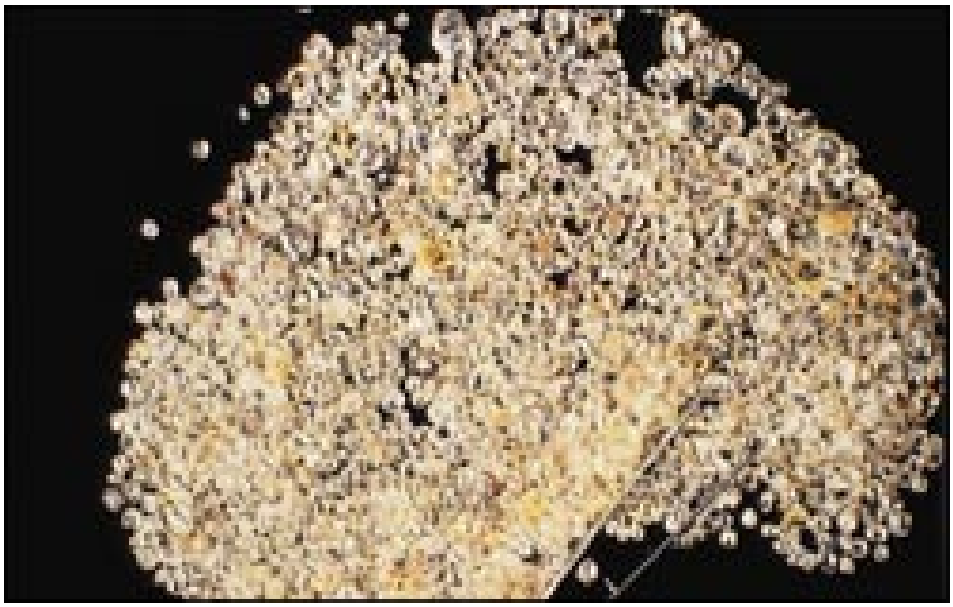
Mining of the beach deposits involves exposure of the diamondiferous gravel by overburden stripping using earth-moving machines, which include two large bucket-wheel excavators. The overburden sand is used to construct protective sea-walls, shifting the beach high-water mark up to 200 m seawards and exposing gravels up to 20 m below sea level. The ore is excavated by hydraulic excavators, and industrial vacuum machines are used for the final "clean-up" process. After treatment in the crushing plant, a concentrate is sent to the central recovery plant and sorthouse.

A deflation deposit is mined at Elizabeth Bay, south of Lüderitz. Mining is carried

at Auchas. The concentrates of both mines are forwarded to a central recovery plant for final treatment.

While near-shore shallow mining operations are under way, pioneering work is currently being carried out to recover diamonds from the seabed offshore Namibia. The offshore placer deposit is now known to extend into water depths that have hitherto prohibited mining operations.

Nevertheless, companies active in Namibian waters, spearheaded by De Beers Marine, have adopted a fresh approach, and today a fleet of purpose-built mining vessels recovers diamonds from the seabed in water depths of up to 200 m. These figures, both for the proportion of marine production and for water depths, are set to increase in the future.



Gem-quality stones make up the great majority of Namibia's diamond output

Namibian Mineral Production, 1996

Commodity	Unit	Quantity
Copper (blister 99%)	t	18,306
Lead (refined)	t	24,416
Zinc (concentrate)	t	35,873
Cadmium	t	9
Gold (dore and in blister)	kg	2,177
Silver (in blister)	kg	43
Pyrite (concentrate)	t	83,106
Diamonds	ct	1,486,457
Uranium (U3O8)	st	3,188
Salt	t	378,860
Fluorspar (acid grade)	t	32,285
Manganese ore	t	92,647
Arsenic trioxide (refined)	t	1,505
Lithium ores	t	1,981

out with mechanical excavators. Diamondiferous gravels of the proto-Orange River are recovered and treated

Base Metals

Base metal mining has a long tradition in Namibia and started on a large scale when copper was first mined at the Matchless mine, west of Windhoek, in 1855. To this day, copper remains an important commodity, followed by lead, zinc and manganese. In addition, there are known deposits of iron, tin, tantalite, tungsten and vanadium, some of which have been mined in the past.

Gold Fields Namibia, through its subsidiary Tsumeb Corporation (TCL), owns and operates several base metal mines and the smelter at Tsumeb. The Kombat mine, some 51 km from Tsumeb, produces around 400,000 t/y grading 3.13% copper, 0.93% lead and 22 g/t silver. A major surface and underground drilling programme is under way to prove additional ore reserves.

The Tsumeb-type Khusib Springs mine between Tsumeb and Grootfontein was opened by the company during 1996, while drilling at the nearby Tschudi prospect has reached an advanced stage and feasibility studies are under way. Besshi-type cupriferous pyrite bodies are mined by TCL at Otjihase, 20 km northeast of Windhoek. Current ore production is in the order of 500,000 t/y grading 2% copper, 16 g/t silver, 0.35 g/t gold and 16% sulphur as pyrite. Pyrite is shipped to Rössing Uranium for acid production.

Namibia's famous Tsumeb mine was also operated by TCL and, until its closure in 1996, was the major source of feed for the Tsumeb smelter. The polymetallic deposit, world-renowned for its variety of secondary minerals, opened in 1901 and in the 95 years of its lifetime produced over 29 Mt of ore, grading about 5% copper, 15% lead, 150 g/t silver and up to 2% zinc. Antimony, arsenic, cadmium and germanium were recovered as by-products.

The Rosh Pinah mine, located in the south of the country, some 20 km north of the Orange River, is a major lead and zinc producer operated by Imcor Tin. The ore grades 7% zinc and 2% lead, and some 70,000 t of zinc concentrate and approximately 28,000 t of lead concentrate are produced annually. The lead concentrate is toll-

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ESSENTIAL CONTACTS

smelted at Tsumeb by TCL, while the zinc concentrate is processed in South Africa.

Manganese is produced at a rate of around 90,000 t/y from the Otjosondumine, operated by Purity Manganese. The commission of a ferro-manganese plant to process ore from this mine is planned for the near future.

Uranium

Namibia is one of the world's principal uranium producers, and output of uranium from the Rössing mine currently accounts for an estimated US$115 million of Namibia's export earnings. Rössing is one of the world's largest open-pit uranium mines. Operated by Rössing Uranium Ltd, a subsidiary of Rio Tinto, it is located some 65 km inland from the coastal town of Swakopmund.

Irregular uranium mineralisation is hosted by alaskitic granites and requires selective mining. The mine production is assessed by a unique scanning system that monitors the ore grade in loaded mine trucks with sufficient accuracy to establish cut-off grades.

The mine is currently undergoing a major capital investment programme. Reserves at Rössing are substantial and long-term plans are in place for production until 2022. Mining is carried out at a rate of 43,000 t/d with an average grade of 0.035% uranium.

Gold

Namibia has a history of gold production and numerous gold deposits occur throughout the country. Nevertheless, today's gold production amounts to only some 2,000 kg/y, originating from the Navachab gold mine near Karibib.

The Navachab gold mine is a joint venture operation between Erongo Mining and Exploration, Inmet Corporation of Canada and Randgold and Exploration. The mine has sufficient identified reserves for production until 2004 and exploration drilling to identify additional reserves beneath the open-pit floor is ongoing.

Other Minerals

Namibian industrial min-eral production comprises a range of commodities including fluorite, lithium minerals, salt, wollastonite, carbonate fillers and dimension stone. Namibia is one of Africa's largest salt producers, with two solar evaporation pan complexes at Walvis Bay and Swakopmund. An acid-grade fluorite concentrate is produced at the Okorusu mine, located to the northeast of Otjiwarongo and recently acquired by Solvay. Annual production currently amounts to some 32,000 t, and the Government has recently approved a US$1.4 million loan for development to improve the waste stripping ratio and thereby production.

Cutting dimension stone at the Karibib processing plant. Namibia exports blocks of granite, marble, dolerite and sodalite

Namibia's dimension stone production comprises marble, granite, dolerite and sodalite. Sodalite is recovered in the far north of the country at Swaartbooisdrif, while the other materials are mainly derived from the central parts of Namibia. A cutting and polishing plant has been established at Karibib.

Semi-precious stone production takes place mainly on a small scale. The portfolio includes tourmaline, aquamarine, heliodore, morganite, mandarine garnet, topaz, rose quartz and blue lace agate.

Contact names and addresses

Namibia has one of the oldest mining industries in Africa, yet 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. Many incentives have recently been put in place to make Namibia one of the most attractive regions in Africa to carry out exploration and to develop new mines by a Government keen to diversify further the mining sector and to attract new investment.

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

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