



South Africa **Yearbook** 2018/19

# Mineral Resources

South Africa is a leading producer and supplier of a range of minerals, with over 1 800 mines and quarries across the country. Mining contributes about 7.3% directly to South Africa's Gross Domestic Product (GDP) and over 454 000 direct jobs, with an estimated US\$2.5 trillion to US\$3 trillion non-energy mineral resource base.

The Department of Mineral Resources (DMR) assumes the custodianship of all mineral resources in South Africa on behalf of its citizens.

To this end, the DMR promotes and regulates the minerals and mining sector for transformation, growth and development as well as ensures that all South Africans derive sustainable benefit from the country's mineral wealth.

Various specialised divisions of the DMR and associated institutions are responsible for the administration of the mining legislation and regulations and for promoting the development of the industry. The DMR's strategic goals are to:

- promote and facilitate an increase in mining activity and in value added to mineral resources extracted in South Africa
- implement transformation policies that redress past imbalances through broader participation in the mineral sector
- provide a framework for managing health and safety risks, enforce compliance and promote best practice in the mineral sector
- promote sustainable resource management, contribute to skills development and the creation of sustainable jobs in the mining sector
- contribute to a reduction in the adverse impacts of mining on the environment
- attract, develop and retain appropriate skills and ensure the optimal utilisation of resources
- implement risk-management strategies and promote corporate governance.

Mining is regulated by three branches: the Mineral Policy and Promotion Branch, the Mineral Regulation Branch and the Mine Health and Safety Inspectorate.

## Mineral Policy and Promotion Branch

The Mineral Policy and Promotion Branch was created in April 2005, resulting from the split of the Mineral Development Branch. The strategic plan behind this restructuring was based on the fact that the functions performed by the former Mineral Development Branch could broadly be divided into three main streams: regulation, promotion and policy formulation.

The branch is responsible for formulating mining and petroleum industries' policies and promotes investment and development of these industries.

## Mineral Regulation Branch

The Mineral Regulation Branch consists of four chief directorates. Their functions are to:

- administer the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) and other applicable legislation to ensure the granting of prospecting and mining rights in terms of the Act
- promote mineral development including urban renewal, rural development and black economic empowerment
- address past legacies with regard to derelict and ownerless mines and enforce legislation regarding mine rehabilitation by means of regulated environmental management plans
- coordinate and liaise with national, provincial and local government structures for efficient governance.

## Budget and funding

The department has a total allocation of R6.2 billion over the medium term, 52.2% (R3.2 billion) of which is for transfers to its entities, which carry out a significant portion of its functions. Due to the labour-intensive nature of the department's work, which requires inspections to be conducted to ensure that mining companies comply with legislative requirements, expenditure on compensation of employees accounts for an estimated 34.2% (R2.1 billion) of the department's total budget over the Medium Term Strategic Framework (MTEF) period. This allocation will enable the department to conduct an estimated 30 099 mandatory inspections over the period ahead to monitor and enforce compliance.

## Role players

### Minerals Council of South Africa (MCSA)

The Chamber of Mines South Africa was formally renamed the Minerals Council South Africa (Minerals Council) in 2018, which coincided with the ongoing corporate restructuring of the South African mining industry. The organization has undergone numerous changes since it was founded in 1889, and the latest name change was spurred on by the changing times in the mining landscape. The Minerals Council is an association of mining companies and mines operating in the gold, coal, diamond, platinum and other mineral commodity sectors and acts as the principal advocate of the major policy positions endorsed by mining employers.

The organization also represents the formalised views of its membership to various organs and spheres of government, and to other relevant policy-making and opinion-forming entities, both within and outside the country.

The Minerals Council is a mining industry employers' organisation that supports and promotes the South African mining industry. It serves its members and promotes their interests by providing strategic support and advisory input.

A key role of the organisation is to facilitate interaction among mining employers to examine policy issues and other matters of mutual concern to crystallise and define desirable industry standpoints. A variety of initiatives are in place to promote collaboration between members. Consultation and collaboration are voluntary and never encroach on the autonomy of members.

The Minerals Council also acts as a principal advocate to government, communicating about major policies endorsed by its members. A further vital function of the organisation is to represent some sectors in collective bargaining with organised labour.

The Minerals Council's vision is to reposition the South African mining sector as South Africa's foremost industrial sector. The Minerals Council seeks to create, in partnership with key stakeholders, a conducive policy, legislative and operating environment that facilitates doubling real investment in mining by 2030.

Achieving this vision will be a game changer for the country and its ability to achieve the National Development Plan

(NDP) objectives to improve South Africa's economic growth, developmental and transformation vision as outlined in the NDP.

### South African Mining Development Association (SAMDA)

SAMDA, which was formed in 2000 as a junior mining initiative by a group of people associated with various South African junior and Black Economic Empowerment mining companies, aims to create an enabling environment for raising finance, developing technical and other skills, practising responsible environmental management and sustainable development as well as the maintenance of standards of good practice in the junior mining sector.

### Mining Qualifications Authority (MQA)

Government's influence within the mineral industry is not only confined to orderly regulation and the promotion of equal opportunity for all its citizens and investors, but government also participates in mining operations through state-owned companies such as Alexkor, the African Exploration Mining and Finance Corporation (Pty) Ltd and the Industrial Development Corporation.

All stakeholders in the industry need to intensify skills-development efforts to ensure that the mining industry operates in a sustainable and competitive environment.

The future of mining in the country largely depends on the successful implementation of skills development initiatives.

Particular focus is placed on artisans and artisan aid as well as other technical skills. Capacity-building within the department and associated institutions has also been prioritised in respect of identified critical areas of skills shortage; necessary interventions have been introduced, which include learnership programmes and bursary schemes.

The MQA was established as a sector education and training authority and facilitates the development of appropriate knowledge and skills in the mining, minerals and jewellery sectors to:

- enable the development and transformation of the sector
- contribute to the health, safety and competitiveness of the sector
- improve access to quality education and training for all

- redress past inequalities in education and training. The MQA is responsible for:
  - developing and implementing a sector skills plan
  - developing unit standards and qualifications for the sector
  - establishing, registering, administering and promoting learnerships and apprenticeships
  - maintaining the quality of standards, qualifications and learning
  - disbursing grants from the skills-development levy.

### Voluntary associations

- The Southern African Institute of Mining and Metallurgy was founded in 1894. This is a professional institute with local and international links aimed at helping members to source news and views about technological developments in the mining, metallurgical and related sectors as well as embracing a professional code of ethics.
- The South African Colliery Managers Association represents eight mining houses and some smaller operators with 43 mine operations in four provinces. Current SACMA membership totals 434 coal mining. The association's operations have an annual turnover of over R35 billion with a labour bill contribution of over R6 billion to the South African workforce comprising 47 000 direct employees.
- The Association of Mine Managers South Africa provides a platform for mining industry professionals to discuss, evaluate and debate mining and minerals policy, technical innovations, safety and health challenges and advancements in mining in South Africa. Current membership stands at 825 in seven categories – candidate (student), junior associate, ordinary, associate, honorary life, honorary associate and retired members.
- Geological Society of South Africa was established in 1895 and is one of the oldest scientific societies in South Africa. It is a society that exists for geologists and earth scientists with an interest in southern Africa and has over 2 500 members and student members.
- The Engineering Council of South Africa is a statutory body established in terms of the Engineering Profession Act, 2000 (Act 46 of 2000). Its primary role is the regulation of the

engineering profession in terms of this Act. Its core functions are the accreditation of engineering programmes, registration of persons as professionals in specified categories, and the regulation of the practice of registered persons.

- The South African Council for Natural Scientific Professions is a legislated regulatory body for natural science practitioners in South Africa. The natural sciences encompass a wide range of scientific fields covering basic sciences and many of their applied derivatives.

### South African Diamond and Precious Metals Regulator

The SADPMR is mandated to regulate control over the possession, purchase, sale, processing and export of diamonds, and the regulation of precious metals. The regulator's total budget for 2019/20 is R118.7 million.

### Council for Mineral Technology and Research

Mintek helps the minerals industry to operate more effectively by developing and making available the most appropriate and cost-effective mineral recovery and mineral beneficiation technologies.

It is engaged in the full spectrum of minerals research: from the mineralogical examination of ores to the development of processing, extraction and refining technologies, as well as conducting research into the production of added value products and feasibility and economic studies. Much of this work is carried out in close liaison with the local and international minerals and metallurgical industries.

Mintek is involved in research into the use of nanotechnology for medical applications of gold as well as giving effect to the Hydrogen Strategy.

This is intended to create future demand for gold and platinum in keeping with the national objective of achieving 20% global market share of platinum catalysis by 2020.

### Mine Health and Safety Council

The MHSC is mandated to advise the Minister of Mineral Resources on occupational health and safety at mines, develop legislation, conduct research, and liaise with other statutory bodies on matters relating to occupational health and safety at mines.

### **Council for Geoscience**

The CGS's principal mandate is to develop and publish world-class geoscience knowledge products, and provide geoscience-related services to the South African public and industry.

### **State Diamond Trader**

The SDT is mandated to buy and sell rough diamonds to promote equitable access to diamonds and the local beneficiation of diamond resources. It generates revenue by selling rough diamonds to clients, mainly diamond polishers and cutters.

### **Petroleum Agency South Africa (PASA)**

PASA promotes exploration for onshore and offshore oil and gas resources, as well as their optimal development on behalf of government, as designated in terms of the Mineral and Petroleum Resources Development Act of 2002. The agency regulates exploration and production activities, and acts as the custodian of the national petroleum exploration and production database.

Government has taken a decision to separate the oil and gas sector from mining in terms of legislation that governs these industries. The development of Petroleum Resources Bill has commenced in early in 2019 and is expected to be finalized in the near future.

### **African Mining Partnership (AMP)**

The AMP, whose main function is to drive the New Partnership for Africa's Development mining initiatives, was established during the African Mining Minister's meeting in Cape Town in February 2004. South Africa, as a major role player in this body, has played an important role as the Secretariat, in hosting as well as coordinating the affairs of the AMP. The AMP merged with the African Union Conference of Ministers Responsible for Mineral Resources Development.

### **African Diamond Producers Association (ADPA)**

ADPA is an association of diamond-producing African countries, 11 of which have full membership while seven only enjoy observer status. The association is chaired on a rotational basis.

The main focus of the ADPA revolves around the

implementation of aligned policies and strategies intended to maximise the benefits derived from revenue of diamonds across the African continent. In doing so, the ADPA explores the development of a best practice document that will promote the realisation of harmonised policies across Africa with a goal to increase foreign investment in the diamond sector for the benefit of all member states.

### **The Kimberley Process**

South Africa is one of the founding members of the Kimberley Process, which brought into existence the KPCS or Kimberley Process Certification Scheme.

The Kimberley Process was established when diamond producing countries convened in Kimberley, South Africa, in May 2000, to discuss ways to stem the trade in "conflict diamonds" and ensure that the diamond trade was not fuelling armed conflicts.

In December 2000, the United Nations General Assembly adopted the landmark Resolution 55/56 of 2000, which supported the establishment of an international certification scheme for rough diamonds.

By November 2002, negotiations between governments, the international diamond industry and civil society organisations resulted in the creation of the KPCS, which was launched in Kimberley, South Africa, in 2003. As one of the founding members of the KPCS, South Africa played a pivotal role in the establishment of the KPCS as well as the harmonisation of the regulatory framework relating to the sale and export of diamonds. The KPCS has had 55 participants representing 82 countries that counts for 99.8% of the global production of rough diamonds. The KPCS core document (statutes) governs the global production of rough diamonds and stipulates the objectives, definitions, internal controls and, with which most importantly, minimum requirements that each participant must comply.

The Kimberley process consists of six various working groups which assist the scheme with its mandate. These working groups are committee on Participation and Chairmanship, Committee on Rules and Procedures, Working Group on Monitoring, Working group on Statistics, Working group on

Artisanal and Alluvial Production and the working group of Diamond Experts. South Africa is currently serving as the Chair of the working group on monitoring from 2017 and the term will end in 2019. India was appointed as the KPCS Chairpersonship during a plenary meeting held in Brussels in 2018 for a period of one year.

### **Projects and initiatives**

With significant resources of gold, uranium, chrome, manganese, Platinum Group Metals (PGM), titanium minerals, vanadium, coal, limestone, vermiculite and zirconium, South African mining real estate remains attractive for development.

South Africa has significant known reserves and resources of mineral commodities, with almost 60 minerals being actively mined and prospects for exploitation of an additional two new minerals over the short to medium term. A large number of these known reserves was discovered using conventional exploration methodologies. For this reason, there is still considerable residual potential for discovery of world-class deposits using modern exploration technology.

This is further supported by existing mining infrastructure, which enables investors to leverage maximum value from their investment while simultaneously contributing to socio-political improvement.

### **Shale-gas exploration**

The potential of shale-gas exploration and exploitation provides an opportunity for South Africa to begin exploring the production of its own fuel and marks the beginning of the reindustrialisation of the economy.

The regulations on petroleum exploration and exploitation prescribe good international petroleum industry practices and standards, which enhance safe exploration and production of all petroleum and will further ensure that petroleum exploration is conducted in a socially and environmentally balanced manner.

South Africa's potential shale gas resources have been estimated to be at 370 trillion Cubic Feet. There has been no exploration activities as environmental impact assessment are still to be done to confirm this resources size. The DMR and the Council for Geoscience are undertaking a five-year geo-scientific

research project called the Karoo Deep Drilling Programme which is expected to end in 2020. The aim of the programme is to understand the potential impact of geo-resource exploration activities in the Karoo Basin. The project site was selected in the municipal area east of Beaufort West which holds the highest gas recovery from Carbonaceous Whitehall Formation.

### Transforming the mining sector

Accelerating transformation in the mining sector remains a key priority. The department will facilitate this process by monitoring and enforcing compliance with the mining charter, and issuing a targeted 450 mining licences over the medium term to historically disadvantaged South Africans, with special focus on empowering women in the sector. This is set to result in spending of R245.7 million over the MTEF period in the Mineral Regulation programme, which is allocated 22.5% (R1.4 billion) of the department's total budget over the same period. To provide financial and technical support to 200 new and established small, medium and micro enterprises (SMMEs), particularly those in small-scale mining, an estimated R98.7 million over the medium term is allocated in the Mineral Policy and Promotion programme.

The department aims to adopt a more proactive approach to engaging the mining industry, communities and stakeholders about the quality, sustainability and transformation of the industry. In this regard, the department intends to conduct 450 stakeholder engagements and consultations with the sector over the medium term at a projected cost of R90.1 million in the Mineral Regulation programme.

These are engagements and consultations envisaged to facilitate communication between stakeholders and communities living in mining areas, and address mining charter objectives such as the provision of housing.

Further expenditure of R62 million over the MTEF period in the same programme will facilitate a targeted 636 inspections to ensure that mining companies comply with their social labour plans. These plans commit companies to invest in the upgrading of human settlements and skills development for mineworkers and the surrounding communities, in line with regulation 46 of the Mineral and Petroleum Resources Development Act of 2002.

### Investment in the mining sector

The finalisation of the Mining Charter is expected to improve investor confidence in the sector despite general slowdown in global demand for mining commodities and low mining production. To leverage this improved confidence and increase the mining sector's contribution to GDP to ensure real mining investment in South Africa, more attention will be devoted to attracting domestic and foreign investment into the sector.

With this imperative in mind, the department plans to conduct 105 mining promotional events and workshops both locally and internationally through an allocation of R245.7 million over the MTEF in the Mineral Promotion and International Coordination subprogramme in the Mineral Policy and Promotion programme. An additional R92.4 million over the medium term has been reprioritised from the programme to the Petroleum Agency South Africa to promote the exploration and optimal development of onshore and offshore oil and gas resources.

### Rehabilitating derelict mines and protecting the environment

Through the department's activities to rehabilitate old mines and minimise the impact of mining on the environment, it aims to improve the wellbeing of nearby communities by creating environmentally habitable areas, and reducing human and animal exposure to asbestos fibres. These efforts also contribute to a reduction in occupational health incidents, as the department enforces compliance with mine health and safety legislation, and prosecutes mines that do not comply. To conduct a targeted 25 188 occupational health and safety inspections and mine audits over the MTEF period, the Mine Health and Safety programme is set to receive an allocation of R699 million.

The department expects to conduct 3 825 environmental verification management inspections over the medium term to ensure compliance with the National Environmental Management Act, 1998 (Act 107 of 1998) at an estimated cost of R723 million; and rehabilitate 129 dangerous derelict and ownerless mine sites, including asbestos sites, at an estimated cost of R445 million. This spending is in the Mineral Regulation and Administration subprogramme in the Mineral Regulation

programme. An additional R8.3 million through the expanded public works programme is earmarked for Mintek for the rehabilitation of the derelict and ownerless mines.

### Other Developments

More than R150 billion has been committed to commodity sectors such as precious metals, ferrous and non-ferrous metals, energy commodities and industrial minerals in various provinces. Once completed, the projects are expected to employ more than 10 000 people.

### Stability in the mining sector

Mining production decreased by a higher than expected 4.8% in December 2018, probably due to strikes at some gold operations, after a 5.6% contraction in November 2018. Seasonally adjusted mining production fell by 1% in the fourth quarter compared with the previous quarter. For 2018 as a whole, production fell by 1.6% compared with 2017, down from the 3.9% rise in 2017. Gold, copper and iron ore were the biggest contributors to production loss.

Gold continued its long-term decline with a 14.5% drop in production in 2018, the biggest annual slump since 2008 when production tumbled by 16.2%. Strike action during the year contributed to the fall in activity in 2018. The metal's production has steadily declined over the last few decades. In the last 20 years, gold producers have only seen two years of positive annual growth (in 2002 and 2013), with the country producing 83% less gold in 2018 than it did in 1980.

Copper production fell by 28.5% in 2018. This is the biggest annual fall on record since 1981, while iron ore was the third largest contributor to mining's slump in 2018, falling by 2.3%. Production of diamonds, chromium, manganese, and platinum group metals (PGMs) all increased in 2018, with diamond production rising by 7.7%, the fourth consecutive year of positive growth.

The value of mineral sales increased by 5% year-on-year in 2018. Positive contributors to the increase included manganese at 37.5%, coal at 11.8%, PGMs at 8.1% and iron ore at 2.3%.

Stability within the mining industry remains imperative to ensure its sustainable growth and competitiveness. The

importance of healthy relations between mining companies, communities and local government cannot be overstated. For mining to be sustainable, mutual respect and cooperation are critical. Right-holders must also engage continuously with the relevant communities, for the duration of their right, to preemptively address issues as they arise.

The DMR continues to engage various community structures, where discontent between mining companies and some host communities – often characterised by violence and destruction to property – has become more pronounced.

While employment of people living close to the mines remains important, South Africa belongs to all who live in it, and opportunities from mining cannot only be limited to those residing nearer mining operations. Mineral resources must be used to benefit the country as a whole.

### Illegal mining

Illegal mining is on the rise in South Africa and presents multi-dimensional challenges that need to be addressed from a range of perspectives with a collective multi-disciplinary approach.

Illegal mining activities take place on the surface and underground, and manifest at closed off mines, abandoned mines and in many cases even at operating mines.

Illegal miners frequently risk their own health and safety, as well as that of others, by entering mostly abandoned shafts and sometimes operating shafts, travelling as far as 4km underground, where they live for several days at a time.

Illegal artisanal mining is often organised and conducted by crime syndicates. Illegal miners, known as *zama zamas*, are often heavily armed and, when trespassing on operating mines, set ambushes and booby traps for employees, security and rival groups of illegal artisanal miners.

Illegal miners openly flout personal health and safety to open cement-plugged shafts with explosives on abandoned mines or live underground for extended periods of time, without necessary protective gear, once they have gained access to operating mines. The *zama zamas* then pose severe risks to legitimate mine employees, safety protocols, shaft infrastructure and stability, equipment, and ultimately the business.

Primarily, as a result of their illegal mining activities feeding

into the illicit trade of precious metals and diamonds, coupled with the lucrative high financial returns, compared to routine lawful employment, these *zama zamas* continue risking their lives, and the lives of others, even though the real economic value of their efforts is not realised.

The Minerals Council has recognised that the only way to deal with the problem is to focus on the supply and demand side of illegal mining – all five levels of the syndicates need to be addressed.

While local police and mine security deal with the first two tiers, the Minerals Council, assisted by the Standing Committee on Security, the South African Police Service, the National Co-ordinating Strategic Management Team and the DMR, is working to identify and deal with the next three levels that constitute the buyer market nationally and internationally. This work is undertaken hand-in-hand with international agencies such as the United Nations Interregional Crime and Justice Research Institute, European police, Interpol and international embassies.

### Policy and legislative framework

Government took a decision to create policy and regulatory certainty in the mining and upstream petroleum industry.

In this regard, the Broad Based Socio-Economic Empowerment Charter for the South African Mining and Minerals Industry (Mining Charter, 2018) was gazetted for implementation on 27 September 2018. The gazettement of the Mining Charter followed an elaborate consultation process with industry stakeholders including mining communities on achieving growth, competitiveness and transformation of the mining industry.

The Mining Charter implementation guidelines were also gazetted for implementation in December 2018 to assist with compliance with the Mining Charter requirements. The guidelines outline processes, procedures, forms and templates to be used by mining right holders in the implementation of the Mining Charter of 2018.

The government's decision to separate mining and oil and gas legislation is being implemented. A draft Upstream Petroleum (Oil and Gas) Bill has been developed and is due to be subjected to public participation, Cabinet and Parliamentary

processes. This Bill, once finalised, will provide certainty to the upstream petroleum industry and stimulate growth and development in this sector.

In respect of mining, the Mineral and Petroleum Resources Development Act of 2002 (the Principal Act) continues to apply. The department has also gazetted the Draft Housing and Living Conditions Standards, 2019. The Draft Standards are intended to improve the housing and living conditions of mine employees as required by section 100(1) of the MPRDA.

### Rehabilitation of mines

The mine rehabilitation programme has had a positive effect on communities where the projects include economic growth owing to sourcing labour and material locally. The programme also results in improved health and well-being of communities. The rehabilitation programme reduces the risk of humans and animals being exposed to asbestos fibres originating from sites where asbestos used to be mined.

Job creation is one of the key requirements of the rehabilitation project. This contributes to some of the priorities of the National Development Plan.

The DMR also develops reports on mine closures as well as derelict and ownerless mines. The strategy for managing and rehabilitating derelict and ownerless mines aims to guide the management of the environmental legacies of mining.

It proposes a prudent course of action for the state to discharge its responsibility regarding constitutional rights as contemplated in Section 24 of the Constitution.

The implementation of the strategy will continue with annual updates, completed by actuarial scientists commissioned by the department, estimating the State's liability for the rehabilitation of derelict or ownerless mines.

The DMR plans to rehabilitate 45 derelict and ownerless mines and dangerous holing sites in 2019/20, to date a total of 267 derelict and ownerless sites have been rehabilitated.

### Acid mine drainage (AMD)

The DMR has successfully implemented two ingress controls namely Florida Canal and Modderbree. There are plans to implement two ingress controls by 2020.

## Resources

South Africa's mineral wealth is typically found in the following well-known geological formations and settings:

- the Witwatersrand Basin yields some 93% of South Africa's gold output and contains considerable uranium, silver, pyrite and osmiridium resources
- the Bushveld Complex is known for PGMs (with associated copper, nickel and cobalt mineralisation), chromium and vanadium-bearing titanium-iron ore formations as well as large deposits of industrial minerals, including fluorspar and andalusite
- the Transvaal Supergroup contains enormous resources of manganese and iron ore
- the Karoo Basin extends through Mpumalanga, KwaZulu-Natal, the Free State as well as Limpopo, hosting considerable bituminous coal and anthracite resources
- the Phalaborwa Igneous Complex hosts extensive deposits of copper, phosphate, titanium, vermiculite, feldspar and zirconium ores
- kimberlite pipes host diamonds that also occur in alluvial, fluvial and marine settings
- heavy mineral sands contain ilmenite, rutile and zircon
- significant deposits of lead-zinc ores associated with copper and silver are found in the Northern Cape near Aggeneys.

## Coal

The Coal sector remains the largest sector, by value, within South Africa's mining industry, contributing about 25% of the total mining GDP (R335 billion). The top five major producers starting with the top producer include Anglo American, Exxaro, Sasol Mining, South32 and Glencore.

## Gold

South Africa dominated global gold production in the 20th century, but due to resource depletion and high operational costs the country's dominance in world gold sector has since decreased from the 1st rank in 1970s to the 8th rank in 2018.

## Platinum group metals (PGMs)

South Africa is a host to 85% of global PGM reserves – with

platinum, palladium and rhodium being the most of economic importance in the country's context. PGM sector is second largest contributor to total mining GDP (R335 billion), which is about 20% of that value add. In terms of employment, PGM sector is the largest employer with over 172 000 workers which represents about 38% of the total mining employment in South Africa.

## Platinum

South Africa accounts for 96% of known global reserves of the PGMs.

The Merensky Reef, stretching from southern Zimbabwe through to the Rustenburg and Pretoria regions, is the centre of platinum mining in South Africa, playing host to companies such as Rustenburg Platinum Mines and Bafokeng Rasimone Platinum Mines.

Amplats is the industry leader in the mining, marketing, and distribution of platinum. Amplats produces 40% of the world's total PGMs.

Other key platinum mining companies in South Africa include BHP Billiton and Impala Platinum.

Platinum mining in South Africa is growing. The establishment of projects such as the R7,1 billion Twickenham Expansion Project, 100 km south-east of Polokwane, will see the production of 250 000 t/m pure platinum.

The Impala Platinum No. 20 Shaft Project is geared to produce 185 000 ounces of platinum a year on the Bushveld Complex.

Many platinum mines are implementing mechanisation with about 30% of the country's current underground platinum production coming from mechanised mining. Mechanisation is difficult for the gold-mining industry because orebodies are steeper than those of platinum mines.

## Palladium

South Africa is the world's second-largest palladium producer. All of South Africa's production is sourced from the Bushveld Igneous Complex, which hosts the world's largest resource of PGMs.

Palladium and platinum are more abundant than any of the other PGMs.

## Ferrous minerals

South Africa is the largest producer of chromium and vanadium ores and a leading supplier of their alloys. It is also a significant producer of iron and manganese ores, and a minor producer of ferrosilicon and silicon metal.

Ferrous minerals are produced from some 32 mines and 23 ferroalloys smelters.

## Copper

Palabora, a large copper mine, smelter and refinery complex managed by the Palabora Mining Company at the town of Phalaborwa in Limpopo, is South Africa's only producer of refined copper. Producing about 80 000 t per year, it supplies most of South Africa's copper needs and exports the balance.

Useful byproduct metals and minerals include zirconium chemicals, magnetite and nickel sulphate as well as small quantities of gold, silver and platinum. Palabora's large block cave copper mine and smelter complex employs approximately 2 200 people. Palabora also owns a nearby vermiculite deposit, which is mined and processed for sale worldwide. Vermiculite is a versatile industrial mineral.

## Chrome

South Africa accounts for 74% of chrome reserves globally.

## Manganese

South Africa accounts for 26% of manganese reserves, but exploitation of the mineral has not reflected its development potential.

## Non-Ferrous Minerals

South Africa has significant resources and reserves of non-ferrous minerals, which include nickel; copper; zinc; lead; titanium; zircon; antimony; and cobalt. This sector contribute about R30 billion to the mining GDP and comprises about 17 000 employees.

## Diamonds

South Africa, the site of the biggest diamond discovery, plans to process a greater proportion of its gems locally to keep more profit in the country.

Government wants to cut and refine 70% of the diamonds mined in South Africa by 2023. Only 4% is processed locally.

### Industrial minerals

There are some 680 producers of industrial minerals in South Africa, of which almost half are in the sand and aggregate sector.

There are some 153 producers of clays (brick-making and special), 40 limestone and dolomite, 79 dimension stone, 28 salt and 20 silica producers. Bulk consumption of industrial minerals is realised in the domestic market, as most are low-priced commodities and sold in bulk, making their economic exploitation highly dependent on transport costs and distance to markets.

### Mineral Regulation

The purpose of the Mineral Regulation Programme is to regulate the minerals and mining sector to promote economic development and employment and also ensure transformation and environmental compliance.

There was a 5% increase in the budget allocation for Mineral Regulation.

Expenditure in the Management Mineral Regulation sub-programme is planned to almost double to R40 million. This sub-programme provides overall management of the programme.

Expenditure is planned to increase because of responsibilities transferred from the Department of Environmental Affairs.

### Geology

South Africa has a long and complex geological history dating back more than 3 700 billion years. Significant fragments of this geology have been preserved and, along with them, mineral deposits.

The preservation of Archaean geology, dating back more than 2 500 million years, has resulted in the Archaean Witwatersrand Basin, as well as several greenstone belts, being preserved.

### Barberton mountain land

This beautiful and rugged tract of country with some of the oldest rocks on Earth is found south of Nelspruit, Mpumalanga.

The greenstone formations represent the remains of some of

the earliest clearly decipherable geological events on the Earth's surface.

Silica-rich layers within the greenstone have revealed traces of a very early life form – minute blue-green algae.

Granites surround the formations and gneisses that are more than 3 000 million years old. Gold, iron ore, magnesite, talc, barite and verdite are mined in the area.

### Witwatersrand

The geology and gold mines of the Witwatersrand (Ridge of White Waters) are world famous.

More than 50 055 t of gold have been produced from seven major goldfields distributed in a crescent-like shape along the 350-km long basin, from Welkom in the Free State in the south-west, to Evander in the east.

The geology of the region can be seen at many outcrops in the suburbs of Johannesburg. The sequence is divided into a lower shale-rich group and an upper sandstone-rich group. The latter contains the important gold-bearing quartz-pebble conglomerates.

### Bushveld Complex and escarpment

The Bushveld Complex extends over an area of 65 000 km<sup>2</sup> and reaches up to 8 km in thickness. It is by far the largest known layered igneous intrusion in the world and contains most of the world's resources of chromium, PMGs and vanadium.

The impressive igneous geology of the Bushveld Complex can best be viewed in Mpumalanga, in the mountainous terrain around the Steelpoort Valley. The imposing Dwars River chromitite layers, platinum-bearing dunite pipes, the discovery site of the platinum-rich Merensky Reef, and extensive magnetite-ilmenite layers and pipes near Magnet Heights and Kennedy's Vale are in this area.

The Great Escarpment of Mpumalanga is one of South Africa's most scenic landscapes. This area features the Bourke's Luck Potholes, which have become a major tourist attraction.

### Drakensberg Escarpment and Golden Gate Highlands National Park

The main ramparts of the Drakensberg range, which reach

heights of more than 3 000 m, lie in KwaZulu-Natal and on the Lesotho border. These precipitous mountains are the highest in southern Africa and provide the most dramatic scenery.

They were formed by the partial erosion of a high plateau of basaltic lava, which is more than 1 500 m thick, and covers the Clarens sandstones.

Prior to its erosion, the continental basalt field covered significantly more of the continent.

The uKhahlamba-Drakensberg Park, which covers 243 000 ha, has been declared a world heritage site. More than 40% of all known San cave paintings in southern Africa are found here.

The scenic Golden Gate Highlands National Park in the Free State features spectacular sandstone bluffs and cliffs. The sandstone reflects a sandy desert environment that existed around 200 million years ago. Dinosaur fossils are still found in the area.

### Karoo

Rocks of the Karoo Supergroup cover about two-thirds of South Africa and reach a thickness of several thousand metres. The sedimentary portion of this rock sequence reveals an almost continuous record of deposition and life, from the end of the Carboniferous into the mid-Jurassic periods, between 300 million and 180 million years ago.

Karoo rocks are internationally renowned for their wealth of continental fossils, and particularly for the fossils of mammal-like reptiles that show the transition from reptiles to early mammals, and for their early dinosaur evolution. During this long period of the Earth's history, southern Africa was a lowland area in the centre of the Gondwana supercontinent.

Initially, the prehistoric Karoo was a place of vast glaciation. It then became a shallow inland sea, before this was replaced by huge rivers, with lush flood plains and swampy deltas, which dried out to form a sandy desert. Finally, vast outpourings of continental basaltic lava accompanied by the break-up of Gondwana occurred.

### Diamond fields

Kimberlite is the primary host-rock of diamonds and was first mined as weathered "yellow ground" from the Kimberley mines,

starting in 1871 at Colesberg koppie, now the site of the Big Hole of Kimberley. At increasing depths, less-weathered “blue ground” that continued to yield diamonds was encountered.

The discovery of kimberlite-hosted diamonds was a key event in South Africa’s economic and social development, and paved the way for the later development of the Witwatersrand goldfields.

The Orange and Vaal rivers’ alluvial diamond fields and the rich West Coast marine diamond deposits all originated by erosion from primary kimberlite pipes.

### **Meteorite impact sites**

Impacts by large meteoritic projectiles played a major role in shaping the surface of the Earth. The Vredefort Dome is the oldest and largest visible impact structure known on Earth and is a World Heritage Site. It lies some 110 km south-west of Johannesburg, in the vicinity of Parys and Vredefort in the Free State and North West.

About 40 km north of Pretoria is the small bowl-shaped Tswaing meteorite-impact crater. Just one kilometre in diameter, this is one of the best-preserved and accessible impact craters of its kind on Earth. It was created about 220 000 years ago when a meteorite, about 50 m, wide slammed into the Earth, and is one of the few impact craters containing a crater lake.

### **Pilanesberg**

The Pilanesberg Complex and National Park in North West is a major scientific attraction which includes a number of unique geological sites.

The complex consists of an almost perfectly circular, dissected mountain massif some 25 km in diameter, making it the third-largest alkaline ring complex in the world. The geology reflects the roots of an ancient volcano that erupted some 1,5 billion years ago. The remains of ancient lava flows and volcanic breccias can be seen.

The dominant feature of the complex is the concentric cone sheets formed by resurgent magma that intruded ring fractures created during the collapse of the volcano. There are old mining sites for fluorite and dimension stone, and a non-diamond-bearing kimberlite pipe in the region.

### **Cradle of Humankind**

This World Heritage Site extends from the Witwatersrand in the south to the Magaliesberg in the north, and is considered to be of universal value because of the outstanding richness of its fossil hominid cave sites.

The Sterkfontein area near Krugersdorp is the most prolific and accessible fossil hominid site on Earth. It comprises several scientifically important cave locations, including Sterkfontein, Swartkrans, Drimolen, Kromdraai, Gladysvale and Plover’s Lake, all of which have produced a wealth of material crucial to palaeoanthropological research.

### **Table Mountain and the Cape Peninsula**

Table Mountain is South Africa’s best known and most spectacular geological feature, comprising a number of major rock formations.

The earliest of these are the deformed slates of the Malmesbury Group, which formed between 560 million and 700 million years ago.

Coarse-grained Cape granite intruded about 540 million years ago. The Table Mountain Group, which started forming about 450 million years ago, consists of basalt, reddish mudstone and sandstone that is well exposed along Chapman’s Peak.

Overlying this is the light-coloured sandstone that makes up the higher mountains and major cliff faces of the Cape Peninsula, as far south as Cape Point.

Much younger sandy formations make up the Cape Flats and other low-lying areas adjacent to Table Mountain. The Table Mountain Group continues further inland across False Bay in the strongly deformed Cape Fold Belt.