



Mineral resources



**SOUTH
AFRICA**
YEARBOOK
2011/12

South Africa's mining industry has been and remains the bedrock of Africa's economic powerhouse. The mining sector and its related industries are critical to the country's socio-economic development.

South Africa is well endowed with a considerable mineral resource base, estimated by Citibank at US\$2,5 trillion. The country's mining sector contributes about 8% to gross domestic product (GDP), which increases further to 18% when taking into account the indirect effect of mining on the economy. South Africa ranks among the top 10 countries in terms of the production of minerals such as manganese, iron ore, gold, chrome and ferrochrome.

The Mineral Policy and Promotion Branch of the Department of Mineral Resources is responsible for formulating and promoting mineral-related policies that will encourage investment in the mining and minerals industry, making South Africa attractive to investors while ensuring that environmental management forms an integral part of the ongoing exploitation of mineral resources.

The Mine Health and Safety Inspectorate (MHSI) is responsible for implementing mine-health and -safety legislation.

The Mineral Regulation Branch regulates the mining and minerals industry to achieve transformation and contribute to sustainable development.

Policy and initiatives

Mining and minerals policy is based on the principles of the Freedom Charter, according to which the mineral wealth beneath the soil will be transferred to the ownership of the people as a whole. The Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002), has opened doors for the substantial and meaningful participation of historically disadvantaged South Africans in the exploration and exploitation of mineral resources. The MPRDA, 2002 enshrines equal access to mineral resources, irrespective of race, gender or creed. Section 100 of the MPRDA, 2002 provides for the development of the Broad-Based Socio-Economic Empowerment Charter, which is popularly known as the Mining Charter.

The introduction of the Mining Charter in 2002 was aimed at transforming the mining industry to redress historical imbalances engendered by apartheid so that the industry is consistent with

the changes in South Africa's overall transformation of its social, political and economic landscape.

In 2010, the Department of Mineral Resources concluded an assessment of the progress of the industry's transformation against the Mining Charter objectives.

The racial ownership pattern of the country's mining assets had remained largely unchanged, with only 8,9% black ownership attained by 2009 against the target of 15%.

The reviewed Mining Charter, launched in September 2010, seeks to correct this, putting emphasis on 26% of South Africa's mining assets being Black Economic Empowerment (BEE)-compliant by 2014.

It also provides for the complete elimination of hostels on South Africa's mines by 2014, and introduces a sustainable element, premised on the understanding that the social licence to operate includes environment, health and safety performance.

Under the charter, companies found not complying could face penalties, which could include the revoking of a mining company's licence.

Working with the Mining Industry Growth, Development and Employment Task Team (Migdet), the Department of Mineral Resources identified industry constraints, including infrastructure, the lack of a beneficiation policy, skills shortages and regulatory issues.

A set of interventions was put in place to address these constraints, culminating in the signing of the Declaration on the Strategy for Sustainable Growth and Meaningful Transformation of the South African Mining Industry on 30 June 2010.

All stakeholders represented in Migdet signed the declaration document. The relevant transformation aspects of the declaration document were effectively migrated to constitute the bulk of the amendments of the Mining Charter.

A single window for processing mineral rights, associated environmental authorisation and water licences will ease administrative processes within government and mining companies. This is addressed by the following interventions:

- amending the MPRDA, 2002 to address ambiguities in interpretation of the law, mining of associated minerals, the consultation process, the partitioning of mineral rights, rehabilitation issues and alignment with the Beneficiation Strategy

In April 2011, the Ministry of Mineral Resources launched the online South African Mineral Resources Administration System for applying for prospecting rights, mining permits and mining rights. By February 2012, more than 3 000 applications had been lodged.

- discussions on the proposed amendments between the Department of Mineral Resources, Migdett, industry stakeholders, mine communities and various state departments
- streamlining administrative processes to shorten turnaround times for prospecting and mining rights
- auditing all rights since the implementation of the MPRDA, 2002
- developing an online licensing system.

The Geoscience Amendment Act, 2010 (Act 16 of 2010), expands the functions of the Council for Geoscience (CGS) by:

- mandating the CGS to be the custodian and curator of geotechnical information, to be a national mandatory advisory authority in respect of geohazards related to infrastructure development, to undertake exploration and prospecting research in the mineral and petroleum sectors and to add to the functions of the council
- putting mechanisms in place to address problems associated with infrastructure development on dolomitic land
- empowering the CGS to be the custodian of all geotechnical data to compile a complete geotechnical risk profile of the country
- enabling the CGS to become the custodian of technical information relating to exploration and mining.

The Beneficiation Strategy was approved by Cabinet in June 2011. Five value chains were prioritised from the selected commodities in the strategy, namely:

- iron and steel: beneficiating iron ore, chrome, manganese, nickel and vanadium
- energy commodities: focusing on coal and uranium
- autocatalytic converters and diesel particulate filters: beneficiating platinum group metals (PGMs)
- pigment and titanium metal production
- jewellery manufacturing: to increase beneficiation of PGM, diamonds and gold.

Mine environmental management

Mine environmental management forms an integral part of the management of mineral resources in South Africa. For the Department of Mineral Resources to manage effectively, it has to undertake research; develop mine environmental policies (legislation and strategies); and provide strategic guidance on mine environmental management, mine rehabilitation, water ingress, mine environmental legacies and sustainable development.

After more than a century, mining has left a scourge of derelict and ownerless mines, which cause serious environmental and health hazards, particularly for communities living nearby. The department has prioritised the rehabilitation of such mines.

The Minister of Mineral Resources, Ms Susan Shabangu, established the Rehabilitation Oversight Committee within the department to drive the implementation of a rehabilitation programme for all mines that were licensed prior to the passing of the Minerals Act, 1991 (Act 50 of 1991), and the MPRDA, 2002.

The Rehabilitation Strategy was signed off and the implementation plan and costs for the rehabilitation programme finalised. An amount of R52 million was set aside for the implementation of this programme in 2010/11.

The programme includes eliminating environmental damage by returning the affected land to a sustainable, usable condition. In 2010/11, five derelict and ownerless mines in the Northern Cape were rehabilitated:

- Jebolo
- Owendale
- Strelley
- Prieska
- Prieska Mill.

In 2011/12, the following mines were identified for rehabilitation:

- Osizweni in KwaZulu-Natal
- Lusikisiki in the Eastern Cape
- Penge in Limpopo
- Heuningvlei in the Northern Cape
- three more mines in Prieska in the Northern Cape
- Vergenoegd in Gauteng
- Ga-Motsamai in the Northern Cape
- Bestwell in the Northern Cape.

Comprehensive measures have also been put in place to compel companies to provide financially for post-mining rehabilitation.

Acid mine drainage (AMD)

Acid rock drainage occurs owing to reactions between sulphide minerals, oxygen and water, catalysed by bacteria. The mining of sulphide-rich materials exposes sulphide minerals to the elements, accelerating the natural process and forming AMD.

The sulphuric acid generated in these reactions can mobilise other components of materials, often resulting in high concentrations of toxic heavy metals in the rivers and streams that drain mining areas.

Key problem areas have been identified, including the Witwatersrand Gold Fields (the gold-mining areas of Gauteng and the Free State), various coalfields in Mpumalanga and the O’Kiep Copper District in the Northern Cape. Other areas are still being investigated.

In response to this threat, government constructed a number of canals in problem areas, including Grootvlei and the Klipspruit area between Florida Lake and the Fleurhof Dam. A task team led by the CGS drafted a report with recommendations that included pumping and treating the water in the Western, Central and Eastern basins, which was actioned by government.

By March 2012, the Trans-Caledon Tunnel Authority had reported progress in the implementation of the short-term solutions of the AMD Project as approved by Cabinet. The emergency or immediate solution as the first phase of the short-term solution was developed exclusively for the Western Basin to address the surface decant of acid mine water into the Tweelopie Spruit. National Treasury allocated R433 million for the implementation of the short-term solution. The emergency solution will increase the partial treatment of AMD (neutralisation of acid and removal of heavy metals) from 12 million litres (ML) per day to 30 ML per day.

It is envisaged that the short-term solutions will maintain underground mine water levels in the East Rand and Central Rand mining basins by protecting the environmental critical levels and also preventing surface decant of AMD in these basins. The water level in the Western Basin also needs to be drawn to the environmental critical level. The long-term feasibility study has begun.

African Mining Partnership (AMP)

The AMP was launched in 2004 to further the New Partnership for Africa’s Development objectives through mining and mineral initiatives in the quest for economic development on the continent.

Countries were assigned projects to spearhead and ensure that they contributed towards growing Africa’s economy through its mineral wealth.

In February 2010, the AMP merged with the African Union (AU). This improved its standing and helped to attract more countries to participate. The merger also gave the AMP access to the AU’s financial resources and is helping it achieve its vision of increasing the benefit of Africa’s mineral wealth for its own people.

African Diamond Producers’ Association (ADPA)

The Department of Mineral Resources received Cabinet approval to participate in the ADPA in 2009.

The ADPA has three organs, namely the Council of Ministers, Executive Secretariat and the Meeting of Experts. The Council of Ministers constitutes 18 African countries, 11 of which, including South Africa, are full members, while the remainder enjoy observer status.

The Executive Secretariat is the administrative organ and comprises a secretariat and two deputies. The Meeting of Experts consists of officials from the member countries and serves as the Working Group.

For South Africa, membership of this association presents an opportunity to position itself strategically among diamond-producing countries in Africa. It could add significant impetus to the diamond-beneficiation initiatives of South Africa. This will also boost the country’s aim of becoming the beneficiation hub and gateway to Africa.

Public entities and other agencies South African Diamond and Precious Metals Regulator (SADPMR)

The SADPMR was established in terms of the Diamonds Amendment Act, 2005 (Act 29 of 2005), and the Precious Metals Act, 2005 (Act 37 of 2005), which came into effect in July 2007. The Acts mandate the SADPMR to regulate the diamond, platinum and gold industries; and to accelerate beneficiation in the jewellery industry.

The regulator's objectives relating to precious metals are:

- ensuring that precious metal resources are exploited and developed in the best interests of all South Africans
- promoting equitable access to and local beneficiation of precious metals
- promoting the development of precious metal enterprises
- advancing broad-based socio-economic empowerment.

Council for Mineral Technology and Research

The mandate for the Council for Mineral Technology and Research, as set out in the Mineral Technology Act, 1989 (Act 30 of 1989), is to serve the national interest through research, development and technology transfer; to promote mineral technology; and to foster the establishment and expansion of industries in the field of minerals.

The council develops appropriate and innovative technology for transfer to the industry; and provides the industry with test work, consultancy, and analytical and mineralogical services.

Council for Geoscience

The CGS was established in terms of the Geoscience Act, 1993 (Act 100 of 1993). It is mandated to carry out systematic geological, geophysical, geochemical, marine geoscience, metallogenic and engineering geological mapping of South Africa. The council is also able to provide commercial geoscientific services.

State Diamond Trader

The State Diamond Trader was established in terms of Section 14 of the Diamonds Amendment Act, 2005. Its main purposes are to promote equitable access to diamonds and local beneficiation.

Mining industry

The discovery of world-class diamond and gold deposits in the latter half of the 19th century laid the foundation for the emergence of South Africa from an essentially agricultural to a modern industrial economy. The mining industry subsequently covered a wide-ranging spectrum of minerals, in which South Africa has an exceptional geological/mineral endowment.

Mining played a vital role as a foundation industry, which stimulated the development of key ser-

vices, manufacturing and side-stream industries. Mineral production has been a major contributor to foreign-exchange earnings and employment in South Africa. In the 1980s, the gold sector accounted predominantly for all mineral-related income.

However, gold has fallen from its eminent position as the main contributor to mineral sales, as a result of which employment in the mining industry has contracted significantly since 1986.

Employment in the mining sector decreased by 21,3% from an average of 553 542 jobs in 1997 to 435 628 in 2003. Employment figures started to grow after the promulgation of the MPRDA, 2002 in 2004, peaking at 492 219 in 2009 due to the impact of the world economic crisis, resulting in operations being downscaled and projects suspended owing to a decline in commodity demand and prices.

The PGM sector has become the largest employer and contributor to revenue earnings, contributing 37,4% of total mining employment, followed by the gold and coal sectors respectively. Although mining's contribution to GDP showed a marked decline from above 22% in 1980 to 9,7% in 2009, principally resultant from the introduction and faster growth of other sectors contributory to GDP, the mining sector grew significantly in real terms in the same period.

The relative percentage decline of mining's contribution to the national GDP from 1986 to 2007 should be understood in the context of the apparent economic diversification and faster growth pace of such sectors as manufacturing, financial and construction, to which the mining industry also contributes significantly.

With significant resources of gold, uranium, chrome, manganese, PGMs, titanium minerals, vanadium, coal, limestone, vermiculite and zirconium, South African mining real estate remains attractive for development.

Despite considerable diversification of the country's economy in the recent past, the mining sector remains a key variable in the economic growth equation. In 2009, the industry contributed 9,7% to gross value added, 10% to total fixed capital formation, more than 30% to the country's total export revenue, and it employed 2,9% of the country's economically active population, at just below half a million direct jobs and a further half a million indirect jobs.

The sector contributes 18% to the country's corporate tax receipts. The listed mining companies represent over 30% of the market capitalisation of the Johannesburg Stock Exchange Ltd. While mining activities consume 15% of national electricity, the mining industry directly contributes more than 95% towards the country's electricity generation.

According to the Chamber of Mines, total 2010 mining production grew by 5,4%, with PGM production up by 5,9% and coal production up by 1,6%. Iron ore production increased by 6,1%; manganese production grew by 56,6%; and diamond production improved 45,1%, albeit off a low base in 2009. Gold production fell by 4,5%, a much slower rate of decline versus the 7,1% in production recorded in 2009.

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 in the short to medium term. A large number of these known reserves were discovered using conventional exploration methodologies. For this reason, there still lies 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 in South Africa, while simultaneously contributing to socio-political improvement.

Mineworkers

According to the Chamber of Mines, in 2008 the South African mining sector employed 518 585 employees compared to 495 474 in 2007, representing an improvement of 4,7%. Mining accounted for 6,1% of total non-agricultural formal employment in the economy and 7,8% of total private-sector non-agricultural employment.

If the indirect and induced effects of mining are included, then another 500 000 jobs are estimated to exist in addition to direct mining jobs.

Mine health and safety

The MHSI of the Department of Mineral Resources, established in terms of the Mine Health and Safety Act (MHSA), 1996 (Act 29 of 1996), as amended, is responsible for protecting the health and safety of mineworkers and people affected by mining activities.

The activities of the MHSI focus on achieving a safer and healthier mining industry for all. The MHSI works closely with industry and labour unions to reduce the incidence of mine accidents, with stakeholders committing themselves to reducing fatalities continuously by at least 20% a year. The inspectorate is also pursuing a strategy to eliminate silicosis and noise-induced hearing loss (NIHL), also known as occupational deafness, by 2013.

The safety track record in the South African mining industry is a matter of great concern to the department, although the mining industry recorded a year-on-year reduction in fatalities from mine accidents from 2009 to 2010. In total, 127 mine employees died in 2010, compared to 168 fatalities in 2009. Fall-of-ground accidents remain the largest accident category and the predominant cause of fatalities, followed by transportation and machinery respectively.

To deal with the pressing occupational health and safety challenges facing the industry, the Department of Mineral Resources embarked on a number of interventions, including:

- implementing the amendments to the MHSA, 1996 to improve enforcement and prosecutions
- improving seismic network coverage and systems integration to assess actions taken by mines in dealing with high-risk areas, which are prone to seismic events
- establishing the Chief Directorate: Health to improve the health capacity of the inspectorate. Silicosis remains a major cause of premature retirement and death at South African mines owing to excessive dust exposure. Tuberculosis (TB), which is exacerbated by HIV and AIDS, is a serious challenge to the mining industry. NIHL is also a significant health hazard due to exposure to high levels of noise in working areas. Research conducted through the Mine Health and Safety Council (MHSC) is focused on ways of reducing excessive exposure to silica dust to prevent silicosis.

The amendment of the MHSA, 1996 is ongoing. The review of the MHSA, 1996 seeks to:

- strengthen enforcement provisions
- simplify the administrative system for the issuing of fines
- reinforce offences and penalties
- substitute, add and remove ambiguities in certain definitions and expressions

- effect certain amendments necessary to ensure consistency with other laws, particularly the MPRDA, 2002.

An amount of R145,8 million was allocated toward health and safety programmes in 2011/12.

The MHSC as an advisory body generates health and safety advice for the Minister on regulation, research, mine occupational health and safety information management and technical standard-setting. The MHSC continues to develop mechanisms that support the implementation of industry initiatives such as the Summit Action Plan, Mining Charter and HIV and AIDS Programme in the mining sector.

The Department of Mineral Resources continues to work with security forces to develop a strategy to combat illegal mining, which is one of the biggest threats to mineworkers' health and safety.

Mining Qualifications Authority (MQA)

The MQA was established as a sector education and training authority and aims to facilitate 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 monitoring the implementation of a sector skills plan
- registering skills-development facilitators at workplaces within the sector
- approving work-skills plans and annual training reports of companies in the sector
- developing unit standards and qualifications
- maintaining the quality of standards, qualifications and learning provision in the sector
- establishing, registering, administering and promoting learnerships
- administering existing apprenticeship systems
- administering and disbursing skills-development levies.

In 2011, the MQF placed 627 learners with 20 mining companies to gain work experience.

In 2010/11, the Department of Mineral Resources and the MQA entered into a partnership

where the MQA undertook to offer 60 bursaries to build the department's internal capacity. First-year students who were already enrolled and registered in the engineering fields at various tertiary institutions were recruited, owing to the urgency of the scheme. Other criteria were that the bursaries be awarded to students in great financial need.

Recruitment was done at the:

- University of the Witwatersrand
- University of Johannesburg
- University of KwaZulu-Natal
- Durban University of Technology
- University of the North West
- University of Limpopo
- Vaal University of Technology
- University of Venda
- Walter Sisulu University of Technology.

Of the 120 shortlisted students who were interviewed by the department, 60 met the criteria. They were equally divided among three branches, namely Mine Health and Safety; Mineral Regulation; and Mineral Policy and Promotion.

The agreement stipulated that the bursary scheme be implemented in the 2011 academic year for a period of four years, to be followed by a two-year internship programme. On completion, the students will be required to serve the department for the number of years for which they received financial assistance.

The MQA is developing training to support gemstone processing and jewellery manufacturing. Programmes include, among other things, developing management capacity within designated groups; workplace coaches and instructors; and an HIV, AIDS and TB prevention programme.

Chamber of Mines

The Chamber of Mines of South Africa is a prominent industry employers' organisation. Its purpose is to advance, promote and protect the collective interests of its members.

Its mandate includes monitoring, investigating, analysing and considering matters of collective interest to its members and providing recommendations on the position to be taken. Where appropriate, the Chamber of Mines represents its members and provides technical and expert assistance on matters affecting their collective interest.

A range of professional resources is maintained to support the chamber's policy review and advoco-

cacy functions; and to equip it to render advice to its members, including mining health and safety, education and training, communication, environmental management, economics and industrial relations.

For its members in the gold and coal sectors, the Chamber of Mines negotiates wages and conditions of employment with trade unions representing mining employees.

Members of the Chamber of Mines account for about 90% of South Africa's mining production by value and employ about the same percentage of the mining industry's labour force.

There are environmental issues that affect the integrity of the industry. To tackle these, the chamber has, among other things, engaged in:

- liaising with biodiversity stakeholders to develop the Biodiversity Guidelines that will be user-friendly for environmental managers within the mining industry
- facilitating the industry's involvement with government and other stakeholders to develop and implement the plan to manage AMD
- supporting the development of best practices for mine-water management through the Department of Water Affairs, such as the draft guidelines on water conservation and water demand management.

The chamber also represented the views and positions of South Africa's mining industry at the 19th United Nations (UN) Commission on Sustainable Development session, which focused on mining-waste management, transport, chemicals and the 10-Year Framework on Sustainable Consumption and Production. Moreover, the Chamber of Mines provided input in climate-change activities and participated in the UN Framework Convention on Climate Change's 17th Conference of the Parties held in November and December 2011 in Durban.

Small-scale mining in South Africa

The Department of Mineral Resources deems the role of small-scale mining in community upliftment, job creation and poverty alleviation critical. The department's Small-Scale Mining Strategy provides a framework for creating a sustainable sector that is characterised by growth and development, and contributes to rural development, job creation and poverty alleviation through community-linked small, medium and micro-enterprise projects.

Small-scale mining projects that fall within the Presidential poverty nodes will receive special

attention. The Department of Mineral Resources aims to identify and demarcate areas with mineral deposits and foster economies-of-scale by forming community clusters.

Small-scale mining projects and government-supported initiatives are also to be linked with financial institutions.

Mineral wealth

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 fluor-spar 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 Northern Cape Diamond Strategy is aimed at diversifying the province's economy from a primary-sector focus to secondary value-addition activities by establishing Kimberley as a centre of excellence within the Southern African Development Community.

The Kimberley International Diamond and Jewellery Academy is one of the six priority elements of the strategy. Its objectives include:

- responding to skill demands and development opportunities within the sector in a rapid and strategic manner, and engaging proactively with the sector to anticipate skills needs
- providing a mechanism for employers within the sector to formulate skills-development strategies that will increase competitiveness in regional, national and international markets
- providing accredited courses recognised by government and sought after by the industry, with eventual international accreditation
- promoting the empowerment of previously disadvantaged industry workers, including new entrants, through skills-development programmes
- becoming an integral part of the Diamond Centre for Excellence by promoting and developing skills as a critical component of competitiveness
- operating in a professional and business-like manner
- becoming financially and technically self-sustaining within five years of its establishment.

- 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.

The bulk of the known mineral resources and reserves were discovered using conventional exploration methods, but the country still has significant potential for additional discoveries of world-class deposits, using modern exploration technologies.

South Africa has the world's largest resources of PGMs (87,7% of world total), manganese (80%), chromium (72,4%), gold (29,7%) and alumino-silicates. South Africa also accounts for over 40% of global production of ferrochromium, PGMs and vanadium.

It is also the world's leading producer of chrome ore, vermiculite and alumino-silicates, and is among the top three producers of gold, manganese ore, titanium minerals and fluorspar.

The South African mining industry contributes 51,7% of world ferrochromium exports and 54%

of alumino-silicates, and is one of the world's largest exporters of PGMs, gold and vanadium, and a significant exporter of manganese ore. Other important export commodities include ferro-manganese and fluorspar.

Although South Africa is probably the largest exporter of vanadium, gold and PGMs, it is not possible to rank it because of the unavailability of export data from other producing countries.

The Directorate: Mineral Economics of the Department of Mineral Resources monitors and analyses the global supply and demand of minerals that affect the South African economy.

Gold

In 2009, total world gold demand increased by 8,4% to 4 264 t. This was the net effect of a 16,3% decrease to 2 417 t in demand for fabrication, a 51,6% fall in gold bar hoarding to 187 t, an increase of 33,3% in implied net investment to 1 429 t and a decrease of 27,8% to 254 t in producer dehedging.

Silver

South Africa does not have a primary silver mine and the metal is produced only as a by-product of other minerals. Silver was produced as a by-product from 13 gold operations, one uranium



Source: Statistics South Africa, January 2012

mine, two copper mines and two platinum mines in 2008. Despite the vagaries of the global economy, global production was estimated at 718,3 million ounces in 2009.

Coal

South Africa's saleable coal production declined by a marginal 0,8% to reach 250,6 Mt in 2009 compared to 2008. Local sales declined by 6,2% to 184,7 Mt while export sales declined by 0,2 % to 60,5 Mt. The value of local sales rose by 14,5% to R34,5 billion, while revenue from export sales fell by 30,8% to R30,9 billion.

Platinum-group metals

South Africa's PGM production decreased by 1,6% to 271,3 t in 2009 from 275,8 t in 2008. Production of platinum and palladium fell by 3,7% to 140,7 t and by 0,5% to 75,1 t respectively, while production of rhodium increased marginally to 20 t. However, despite a significant increase of 12,5% to 250,9 t in the export sales mass, revenue from such sales decreased by 31,3% to R53,5 billion, mainly due to low PGM prices in 2009 caused by the global economic crisis.

Non-ferrous minerals

Production of primary non-ferrous metals and minerals, excluding titanium and zirconium minerals, decreased slightly by 0,41% to 207,7 kt in 2009, compared to 2008, while total sales declined by 26,2% to R8,8 billion. Local sales volume decreased by 2,5% to 99,6 kt, while exports declined by 5,9% to 105,5 kt. Domestic sales revenue decreased by 27,9% to R4 billion, while export revenue decreased by 24,8% to R4,9 billion in 2009. Total sales of non-ferrous metals and minerals (primary and processed), excluding titanium minerals, zirconium minerals and aluminium, declined by 25,5% to R10,2 billion in 2009. During the same period, domestic sales decreased by 26,1% to R5,3 billion, while export sales declined by 24,9% to R4,9 billion.

Ferrous minerals

South Africa plays a significant role as a source of ferrous minerals. The country 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 ferroalloy smelters. Total sales

of ferrous minerals amounted to R61,8 billion in 2009, contributing 25,6% to South Africa's primary and processed mineral sales. Ferrous minerals export sales accounted for R53,4 billion, which is 30,4% of South Africa's export sales. At R36 billion, primary ferrous minerals contributed 14,5% to the revenue generated by the country's minerals industry.

Over the last decade, increasing portions of the production of chrome, manganese and vanadium ore have been processed to value added alloys in line with the drive for beneficiation, whereas the bulk of growth in iron ore production has been exported.

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. Sales of primary industrial minerals in South Africa grew steadily at an annualised compound growth rate of 15% from 2005 to 2009.

Industrial minerals contributed 4,6% of the total revenue from South African mineral sales during 2009, of which R10 billion was from local sales and R1 billion from exports.

From 2005 to 2009, sales of primary industrial minerals grew at an annualised compounded rate of 15%. However, total revenue decreased from R13,6 billion in 2008 to R11,1 billion in 2009, owing to the depressed economic conditions which resulted in weak demand for commodities in most sectors.

The 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.

In 2009, aggregate and sand, and limestone and dolomite accounted for more than 50% of industrial minerals' local sales value driven by demand from activities in the construction sector. The local sales value of industrial minerals decreased from R11,9 billion in 2008 to R10 billion in 2009.

Processed minerals

Total sales revenue of processed minerals decreased by 45,6% from R86,1 billion in 2008 to R46,8 billion in 2009, and export sales accounted

for 80% of total sales. The value of local sales of processed mineral products decreased by 53% from R17,4 billion in 2008 to R9,4 billion in 2009. The largest contributors to total sales were classified commodities at 48,7% as well as chromium alloys at 38,7%. Total production of processed minerals decreased by 18,5% to 6,6 Mt in 2009.

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 so much 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. Ten of the more significant geological formations in South Africa are discussed below.

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 renowned Barberton Greenstone Belt, the largest of its kind in South Africa, contains remnants of original crust, dated at around 3,5 billion years old.

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 "Ridge of White Waters" are world famous. Nearly half of all the gold ever mined has come from the extensive Witwatersrand conglomerate reefs that were discovered in 1886, not far from Johannesburg's city centre. The Witwatersrand is the greatest goldfield known to mankind. 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. These "gold reefs" were formed from gravels transported into the basin and reworked 2,75 billion years ago. The gold and uranium originated from a rich source in the hinterland.

Bushveld Complex and Great Escarpment

The Bushveld Complex extends over an area of 65 000 km² 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, PGMs and vanadium.

This mega-complex was emplaced in a molten state about 2 060 billion years ago into pre-existing sedimentary rocks, through several deep feeder zones.

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 potholes at Bourke's Luck, the Blyde River Canyon and the dolomite formation in which giant stromatolites bear witness to the 2,5-billion-year-old fossilised remains of vast oxygen-producing algae growth.

Drakensberg Escarpment and Golden Gate Highlands National Park

The main ramparts of the Drakensberg range, reaching 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 northern area of the Drakensberg 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 gold-fields.

Kimberlite originates as magma from very deep below the surface, and typically occurs as small volcanic pipes and craters at the surface. Included within solidified kimberlites are fragments of deep-seated rocks and minerals, including rare diamonds of various sizes.

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.

One such site is the Vredefort Dome, the oldest and largest visible impact structure known on Earth.

Declared a world heritage site in 2005, it lies some 110 km south-west of Johannesburg, in the vicinity of Parys and Vredefort in the Free State and North West.

This spectacular and complex geological feature, measuring 70 km across, was caused by the impact of a 10-km wide asteroid some two billion years ago. Only a partial ring of hills remains of the dome, created by the rebound of rock below the asteroid's impact site. The original crater – now eroded – is estimated to have been between 250 km and 300 km in diameter.

The Vredefort structure comprises a core zone of granitic rocks, surrounded by a ring-like collar zone of younger bedded formations. Only the north-western portion of the structure remains visible. The south-eastern half was flooded by sediments of the Karoo Supergroup, which cover the Free State.

About 40 km north of Pretoria is Tswaing, a small bowl-shaped 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 of 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, located some 120 km north-west of Johannesburg 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 material.

Table Mountain and the Cape Peninsula

Table Mountain is, arguably, 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 around 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.

Acknowledgements

Chamber of Mines
Council for Geoscience
Department of Mineral Resources
Eskom
Estimates of National Expenditure, 2011
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