

# CORPORATE PROFILE



**Botswana  
Geoscience  
Institute**

Excellence in Geoscience





## Botswana Geoscience Institute

Botswana Geoscience Institute (BGI) is a parastatal constituted under the Botswana Geoscience Institute Act, 2014 and is wholly owned by the Government of Botswana. In 2014, the Government of Botswana made a decision to create Botswana Geoscience Institute (BGI) restructured from the Department of Geological Survey (DGS).

### The beginning

Botswana Geoscience Institute (BGI) is a parastatal constituted under the Botswana Geoscience Institute Act, 2014 and is wholly owned by the Government of Botswana. In 2014, the Government of Botswana made a decision to create Botswana Geoscience Institute (BGI) restructured from the Department of Geological Survey (DGS).

The decision was largely prompted by the need to improve efficiencies in carrying out geoscience research, in line with the best practices expected of a geological survey organization (GSO). The decision was also based on the high desire of achieving Botswana Government's primary imperative of successfully implementing programmes and projects within time and costs that transform the lives of Botswana's citizens for the better, as required in the National Development Plan 10 and the subsequent NDPs. BGI now has a significant task to position itself as a significant creator of wealth and improving the quality of life of Botswana's citizens.

Through this restructuring, there would be a clear, modern and scientific strategy designed to meet the national economic and developmental needs. It is a known fact that, the roles of national geoscience institutions have, throughout the world played a key role in the development of nations and states. This

was premised on the need to assess the geological setting to aid mineral exploitation. This is still an important objective of many resource-rich countries such as Botswana and certainly with the global demand for mineral resources this is no better seen than on the African continent.

BGI would also provide geoscience information to stimulate mineral exploration in an increasingly competitive environment and will also address quality of life issues. In carrying this out, the organisation will be highly responsive to stakeholder demands and adaptable to meet emerging economic status needs.

A key outcome of this restructuring was the formulation of an organisation that is demand driven and underpinned by an ability to adapt and change so that it can maintain its relevancy to Botswana. To realize this ambition, the Government of Botswana enacted Botswana Geoscience Institute Act in 2014 to correctly mark the creation of the anticipated geoscience organization.

The legislation was followed by a rigorous programme of the formative imperatives of the organization, such as setting up of key systems, processes, resources and capacity building essential for delivery of the Institute's mandate. The Institute is now in a functional state and aims to serve the nation as anticipated.



## Brand Promise

Excellence in Geoscience

## Vision

To be a Renowned Geoscience Centre

## Mission

We Create Economic Value through Advancing, Promoting and Disseminating Geoscientific knowledge for the benefit of Botswana and our Global Partners.

## Values

Botswana Geoscience Institute has defined its core values that represent the attitudes, behaviours, and characters that will create an enabling environment, guide the Institute and shape the high-performance culture for the successful implementation of its Mandate and Corporate Strategy.

- **Reliable:** We are reliable custodians of Geoscience information.
- **Innovative:** We promote market-oriented and innovative products and services.
- **Professional:** We espouse professionalism.
- **Integrity:** We create a conducive environment that promotes absolute integrity.
- **Teamwork:** Kgetsi ya tsie e kgonwa ke go tshwaraganelwa. We stand together.





## BGI Corporate Structure



## Corporate Governance

BGI is governed by a Board of Directors consisting of eight (8) Non-Executive Directors. The Chief Executive Officer is an Ex-Officio Member of the Board. BGI is committed to the highest standards of corporate governance and business integrity, ethical values and professionalism in all of its activities. As an essential part of this commitment, the Board of Directors support a high standard of corporate governance and the Board is accountable to the shareholder in this regard.

The Board is responsible for the general control of the performance and management of the undertakings and affairs of the Institute. According to Botswana Geoscience Institute Act, 2014, the selection and appointment of members of BGI Board of Directors, lies with the Minister of Mineral Resources, Green Technology and Energy Security. As per best practice, board appointments are based on prescribed skills and experience, as such the appointed members of the board have diverse skills and experience in various disciplines which accordingly assists in ensuring BGI discharges its mandate within the stipulated provisions of the Botswana Geoscience Institute.

Such disciplines include: Geological Engineering, Sciences, Law, Market Regulation, Finance and Accounting, Management and Business Administration/ or any other relevant discipline as may be determined by the Minister.

## Our business

Botswana Geoscience Institute was established to undertake research in the field of geosciences, provide specialised geoscientific services and advice in all matters of geohazards. The Institute is also responsible for promoting the search for, and exploration of any mineral in Botswana. The Institute is a custodian of all geoscience data/information which include non-confidential prospecting reports.

### We are active in:

- Advancing the geoscientific knowledge of Botswana
- Promoting public understanding of geoscience
- Undertaking geoscientific research, related technological development and disseminating geoscientific research findings
- Long term monitoring, effective data management and high quality applied research
- Geoscience information updates including digitization and delivery of web enabled data
- Rapid map revisions to geological mapping
- Seismicity risk reduction assessment and geohazards related to extra-terrestrial events risk reduction assessment
- Systematic geochemical survey for mineral exploration and environmental baseline purposes
- National resource assessment and estimate of mineral resource, petroleum and gas potential
- Strategic aquifer mapping and groundwater modelling
- Thematic mapping
- National geotechnical indicators in response to expanding towns and villages
- Regional impacts of mining, including water extraction or kimberlitic dewatering
- Compiling and developing a comprehensive and integrated collection of knowledge and information of geology, geochemistry, geophysics, engineering geology, economic geology, geochronology, geotechnical investigations, seismology, geohazards, environmental geology and other related disciplines
- Act as an advisory body in respect of geohazards related to infrastructure and development
- Conduct geotechnical surveys

## Operations and Services

### Geological Mapping

This function is responsible for advancing geological knowledge of Botswana through research and geological mapping at different scales.

It comprises three (3) geoscience disciplines being Regional Geology, Geophysics and Geochemistry. Under this responsibility, BGI carries out field geological, geophysical, geochemical surveys and utilises other geoscience data such as drill hole (e.g. core, chips, and geophysical logs;) and satellite imagery to map and update the geological maps and reports of Botswana. Geological maps and reports are the basis of mineral exploration and sustainable land use management as they spatially show information on geological environments (rocks) and their economic potential or value to the socio-economic development of this country.

The key products and services are geological maps and bulletins, reports, publications, geoscience data and geological advice.

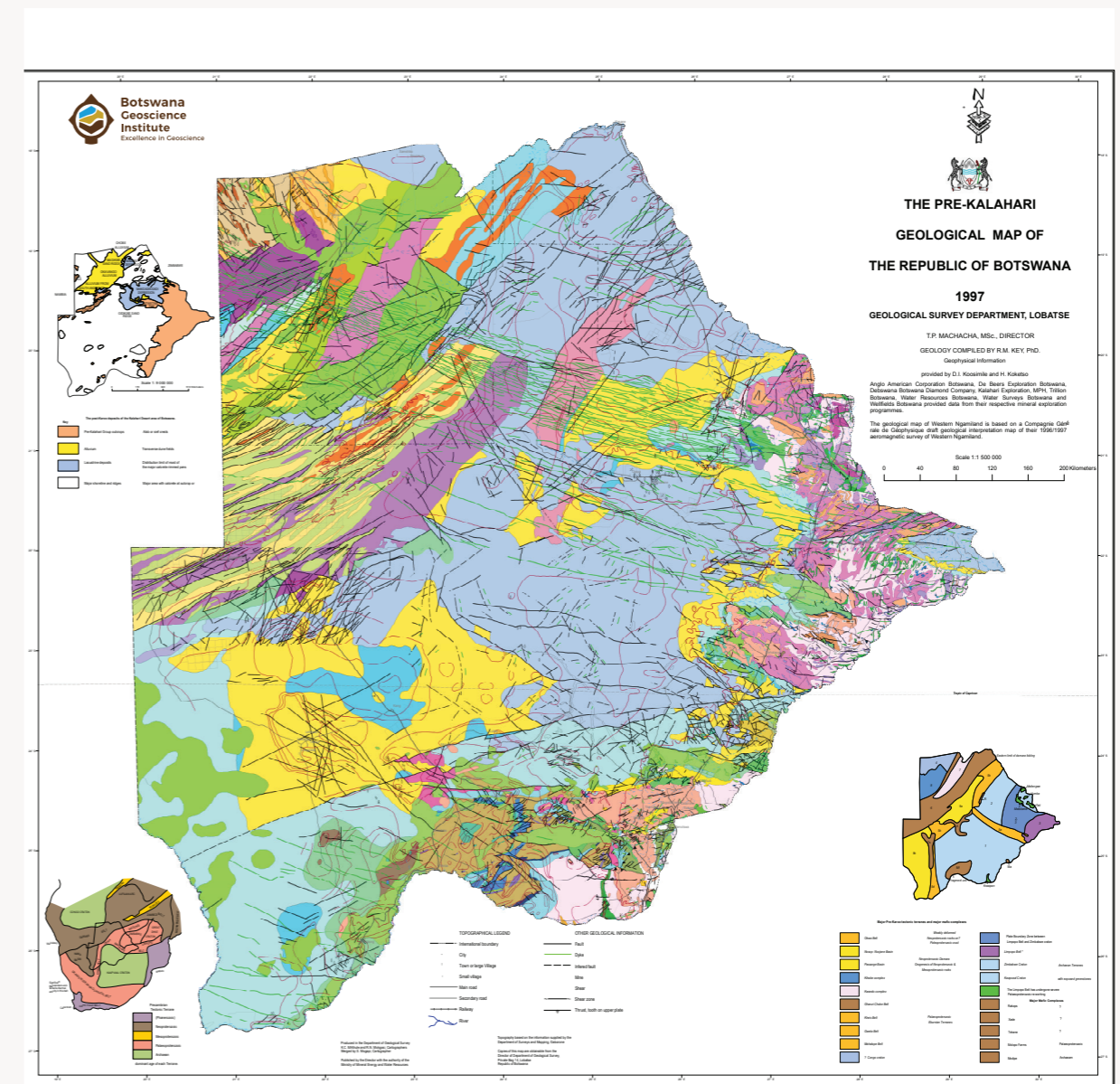


Figure 1: The Pre-Kalahari geological map of Botswana 1997



This function comprises geoscience disciplines of Economic Geology, Geochemistry and Mineral Accounting. It is responsible for evaluating Surveys products mainly the geological maps/information for economic purposes. This evaluation establishes whether economic value can be derived from the identified (mapped) rocks.

**Mineral Resources and Hydrocarbons**

This function comprises geoscience disciplines of Economic Geology, Geochemistry and Mineral Accounting. It is responsible for evaluating Surveys products mainly the geological maps/information for economic purposes. This evaluation establishes whether economic value can be derived from the identified (mapped) rocks. Mineral Resources advances the economic mineral potential of the country to foster mineral exploration, discovery and exploitation through targeted research and systematic evaluation processes in conjunction with Surveys function and Laboratory services. The function is responsible for national mineral accounting and therefore render advice to macroeconomic planners and the nation at large.

Botswana is an implementing partner of the Wealth Accounting and Valuation of Ecosystem Services (WAVES) - a global partnership led by the World Bank that aims to promote sustainable development by mainstreaming natural capital in development planning and national economic accounting systems, based on the System of Environmental-Economic Accounting (SEEA).

The WAVES global partnership brings together a broad coalition of governments, UN agencies, non-government organizations and academics for this purpose.

BGI undertakes National Mineral Accounting under this global partnership, carried out by the Government of Botswana (GoB) and the World Bank. Mineral Accounts provides information on five commodities being diamonds, coal, copper-nickel, soda ash and gold.

Information from the mineral accounts is of critical importance to Botswana's economy and the national balance sheet. Mining in Botswana, continues to be the largest contributor to gross domestic product (GDP), generating the majority of export earnings, and making major contribution to government fiscal revenues.

**Seismicity Monitoring and assessment**

The Botswana Geoscience Institute operates a network of 21 seismic monitoring stations located

throughout Botswana at an approximate spacing of 200 km.

These stations record any earth tremors and are telemetered to relay the information at close to real-time to BGI data centre in Lobatse for processing. Products from this work include seismicity maps used by the public to determine the earthquake vulnerability of different areas before putting up structures and buildings. Seismology is a scientific discipline that is concerned the study of earthquakes and the propagation of seismic waves within the earth. It provides information about the composition and state of the planet's interior.

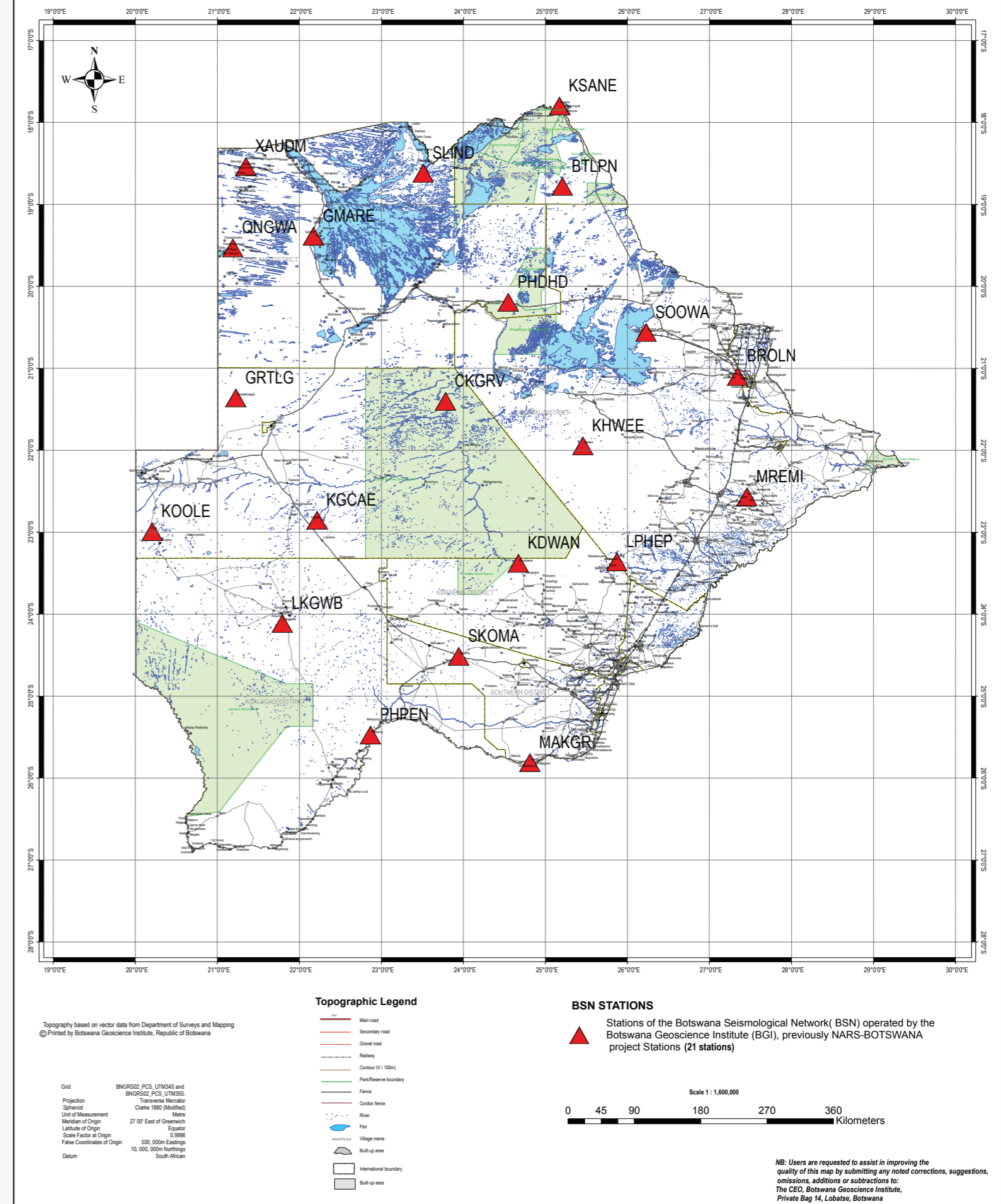
Botswana experienced its largest earthquake of the magnitude 6.5 in April 3, 2017 and its impact was felt across the country.

Whilst there is generally, a low probability that another big seismic event will occur in Botswana in the near future it is important to recognize the potential for such catastrophic impacts in urban centers and major villages across the country, and to apply appropriate mitigation measures.

Earthquakes in urban areas are more dangerous because of the density of the infrastructure. The rapid growth in the number of people living in cities, towns and urbanized village landscapes is increasing in Botswana, and this is paralleled by a corresponding proportional increase of susceptibility to natural disasters such as earthquakes.

Therefore, rapid urbanization of Botswana necessitates the need for detailed seismic microzonation to predict the nature of impacts should a seismic event occur. The initiative will also go a long way in establishing seismic building codes and increase building integrity in order to ensure the future safety of communities. Seismic codes are intended to protect people inside buildings by preventing collapse and allowing safe evacuation. Structures built according to such local codes should resist minor earthquakes undamaged, resist moderate earthquakes without significant structural damage, and resist severe earthquakes without collapse.

**BOTSWANA SEISMOLOGICAL NETWORK ( BSN) STATIONS**



*NB: Users are requested to assist in improving the quality of this map by submitting any noted corrections, suggestions, omissions, additions or subtractions to: The CEO, Botswana Geoscience Institute, Private Bag 14, Lobatse, Botswana*



## Geohazards

The Botswana Geoscience Institute has the capacity to respond to national geohazard issues in particular those that affect the geo-environment. Notably, the BGI is a key stakeholder in issues of National Disaster Management in respect of hydrogeological and geotechnical matters, such as land subsidence and aquifer systems pollution.



## Drilling Services

BGI offers drilling Services to a number of customers depending on their needs. The main focus areas are mineral exploration core drilling, stratigraphic drilling, water borehole drilling and drilling for geotechnical studies. This service is carried out to support BGI's research initiatives, as well as attending to external clients' needs on a cost recovery basis.

BGI is well-positioned to carry out stratigraphic, mineral exploration, geotechnical, and hydrogeological drilling, including provision of specialised drilling services (undisturbed sampling with high sample recoveries), for both research purposes and as a response to external customers' needs. BGI found it prudent to adopt this model to avoid high cost of outsourced drilling, and also

to ensure flexibility and cost effectiveness in the delivery of strategic and collaboration projects.

Approximately 25% of Botswana, has surface exposed rocks and/or geological formations. Rocks generally outcrop in the narrow eastern corridor and in the Ghanzi ridge. Exploration in these areas was relatively friendly enabling the discovery of mineral deposits in the areas, consequently leading to the opening of mines. The remaining 75% of Botswana is concealed by the Kalahari sands. Minimal exploration has indicated that underlying the Kalahari sands are rocks that are potential metallogenic provinces that still remain untapped for mineral potential. Discovery of new deposits in these areas could go a long way in diversifying the mineral industry from the current diamond-dominated mining sector.

In order to map the unexposed pre-Kalahari geology covered by the Kalahari Sands, Botswana Government has since independence, embarked on aggressive nationwide geophysical mapping resulting in 90% of the land area covered in high resolution aeromagnetic and relatively high-resolution gravity survey in the northern part, central and Molopo Farms areas.

In order to further identify and confirm rocks mapped using geophysical surveys, BGI is capacitated with drilling capability to support aggressive mapping projects. When the second edition of the national 1997 map and 1994 bulletin went into print, less than 20% of the country area was covered by 1:125 000 (~15%) and 1:250 000 scale geological maps (~5%). By 2011, with a combination of field geological mapping, geophysical interpretation and drilling (by DGS, 45% of the country had been covered by (37% of 1:125 000 scale and 8% of 1:250 000 scale) geological maps.



## Laboratory Services

BGI Laboratory Testing Services consists of the Physical and Chemical testing on geological raw materials such as soil, rocks, ores and water. The laboratory is adequately equipped with a wide range of modern instrumentation and competent personnel that enables it to produce quality and timely analytical results.

The Physical Testing Laboratory prepares geochemical samples through drying, crushing, milling and sieving. Primary treatment is also possible for removal of organic matter, calcium carbonate and chlorides. Separation of heavy minerals from the light ones through density liquids is also applicable. Loss on ignition by heat treatment, determination of limits on clays for soil engineering properties and full brick-earth and pottery are also available.

Mineralogical determination is another service done through the X-ray Powder Diffraction, petrography, hardness, thermal conductivity, alpha spectrometer.

The Chemical Testing Laboratories receives pulverized geochemical samples from the physical testing laboratory and carry out chemical analysis as per customer requests (see table 1). The laboratory does a wide range of analysis in geochemical samples such as major, minor, trace and ultra-trace

elements and many others. This laboratory also conducts borehole water analysis to determine its quality. The laboratory gives technical advice on water quality test reports basing on BOS 32:2009 for human drinking water specification and BOS 365:2010 drinking water for livestock and poultry specification.

The laboratory is implementing ISO/IEC 17025 standard, which is a general requirement for the competence of testing and calibration laboratories in order to accredit its test methods and earn international recognition. The laboratories have implemented Laboratory Information Management System (LIMS) to monitor its technical and management processes.

The system is the key driver in enforcing the laboratory's Quality Control (QC) and Quality Assurance (QA) procedures, the functionality needed to satisfy accreditation requirements as per ISO 17025. To ensuring the validity and reliability of results, the laboratories participate in the Proficiency Testing schemes such as, South African Bureau of Standards Water Proficiency Testing Scheme (Regional), SADC MET Water Proficiency Testing Scheme (Regional) and International Geochemistry Proficiency Testing Scheme -U.K (international). These schemes monitor, assure quality of the results as well as checking competence of personnel.



Table 1: Equipment used and parameters tested at our chemistry lab

EQUIPMENT/TECHNIQUE	TYPE OF SAMPLE	PARAMETERS/ANALYTES TESTED
Microwave Digestion System	Sample preparation for Soil, Rocks, ores, vegetation, Water	Major and trace elements
The Ox Advanced Fusion instrument	Sample preparation for oxides, cement, geological samples.	Major and trace elements
ICP-OES 7300 DV	Soil, Rocks, Precious Metals and Water	Al, Au, Be, Cd, Co, Cr, Cu, Fe, Mn, Pb, Zn etc. Rare Earth Elements.
ICP-MS	Soil, Rocks, Precious Metals and Water	Trace and Ultra trace elements, Rare Earth Elements etc
Zetium X-Ray	Soil, Rocks, ores,	Al <sub>2</sub> O <sub>3</sub> , SiO <sub>2</sub> , Fe <sub>2</sub> O <sub>3</sub> , MgO, CaO, MnO, Na <sub>2</sub> O, K <sub>2</sub> O, P <sub>2</sub> O <sub>5</sub> and TiO <sub>2</sub> , Single elements
Fluorescence		
Ion Chromatography (ICS 3000)	Water	F <sup>-</sup> , Br <sup>-</sup> , Cl <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , SO <sub>4</sub> <sup>2-</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup> , Na <sup>+</sup> , K <sup>+</sup> , pH & EC
Auto-Titrator	Water	pH, Conductivity, Alkalinity, Chloride, Temp, TDS
X-Ray Powder Diffraction	Rock & Soil	Mineral identification
Laser Diffraction	Soil	Grain size distribution
Alpha Diamond Analyser	Rock	Diamonds identification and classification
Sieving	Soil & aggregates	Grain size distribution
Presidium Diamond Tester	Rock	Minerals identification
Polarising Microscope	Thin sections	Minerals properties
Reflectance Microscope	Minerals	Minerals properties
Hardness Tester	Minerals	Mineral hardness
Compression machine	Rock & solids	Strength
Aggregate Impact Tester	Rock & solids	Strength
Jaw crusher	Rock	Sample preparation
Aggregate Crushing Value	Rock	Strength
Mill Barrels	Rock & soil	Powdered samples
Discoplan Ts & RotaPol	Rock	Thin section
Brick-earth properties	Clay	Atterberg limits, shrinkage, water absorption, loss on ignition, strength, efflorescence, firing temperature
Pottery	Clay	Atterberg limits, shrinkage, firing temperature, strength
Loss Angeles Abrasion	Rock	Abrasion resistance
Water Absorption	Rock	% water absorption
Methylene blue	Rock	% clay content
Specific gravity	Rock / soil	Specific gravity
Bulk Density	Rock	Density



### Geoscience Data and Information Management

BGI collects and preserves Geoscience data and makes it accessible for public use and research.

1)BGI has an established Geoscience Information Centre for the collection and preservation of Geoscience data and information. The centre is accessible for public use and research.

This operation is primarily about dissemination and promotion of Geoscience information and data to the public and encourage further mineral exploration. The information is in the form of geological maps at various scales, including non-confidential prospecting license reports, chip and core samples and geographic information system (GIS) and Remote Sensing. There is a comprehensive collection of earth sciences literature in print and electronic formats, including books, bulletins, journals, maps and reports used in the search for resources across the country.

### Online Data and Information Packages

As a custodian of Geoscience Data and Information, Botswana Geoscience Institute through the process of systems automations and digitisation has developed the following data bases online to enable access to information remotely to customers and guide prospective investors in the mining industry in Botswana.

**Botswana Geoscience Portal (GDP) - <https://www.geos.bgi.org.bw>**

This platform integrates all BGI data to promote BGI's visibility to the global village. It is a GIS based and interactive platform which can overlay different datasets from Geology, Geophysics, Geochemistry, Drill holes, Seismic data, and Publications.

**LIBWIN Library Systems - <http://www.library.bgi.org.bw>**

This is a platform for managing Geoscience research Collections and Publications among others. It aggregates data for research or business intelligence purposes and ensures library operations are synergised with various standards and regulations of libraries around the world in a library environment.

The portal is a repository for Consultants, Geoscientific, Prospecting licenses and Mineral Resources reports, Annotated Bibliographies, Bulletins, District Memoirs, Records of the Geological Survey, Seismological Bulletin Series, Multimedia, Books, Journals, etc.

**Borehole Information System (BIS) BOREHIVE <http://www.bh.bgi.org.bw/>** presents all Borehole information which has been acquired from various sources including reports and records from prospecting and mining companies, farmers, Department of Water and Sanitation as well as Botswana Geoscience Institute.





### Groundwater Monitoring

Water is a precious resource without which, life as we know it would not exist. Generally, Botswana's climate is characterized by low rainfall and high evapotranspiration rates, making reliance on surface water difficult, for that reason, the importance of our groundwater resources cannot be overemphasized as they are a reliable natural resource.

Groundwater is abstracted for use in supplying both rural and urban centres, industries including mines, energy sectors such as power plants and the agriculture sector in which most Botswana are dependent on.

Botswana Geoscience Institute, with expertise in geoscientific research and advisors with respect to geohazards, promotes sustainable development and management of Botswana's precious groundwater resources by carrying out research to encourage aquifer protection and safe disposal of hazardous water waste. The carries out various groundwater monitoring projects to monitor contamination from source and implement mitigation measures to prevent pollution. It also informs on geohazards that may cause contamination of groundwater such as floods and earthquakes. The Institute also monitors hazards caused by groundwater interacting with infrastructure such as rising damp and seepage problems.

Being the custodian of all geoscience data, BGI is better placed to give advice with regard to groundwater

potential and groundwater vulnerability of aquifer units in Botswana, thereby making the institute a one-stop centre for all groundwater-related matters.

### Geotechnical Assessments

BGI undertakes assessments of mechanical properties of soil and rocks to determine their behaviours under different conditions. This will inform the stability and integrity of infrastructure, dams, road construction and mines.

Geohazard events such as sinkholes, ground fissures, ground settlement caused by geological processes and human activities bring severe threats to human lives, infrastructure and natural environment.

Although there are no incidents of catastrophic nature to date in Botswana, there are indications that Botswana is at risk of geohazardous events. Ground fissures have been observed along roads such as Lethakeng, Morwamosu, Hatsalatladi and Boatle -Mankgodi. Fissures have also been observed on virgin, uninhabited areas in Kgwakgwe near Kanye and Moshaneng areas. The town of Lobatse is also inundated with such geological features because of its soils and structural and geological setting. This is because the town is located in a carbonaceous or karstic environment that is prone to the formation of caves as well as expansive soils. There is therefore need for BGI being the custodian of geo-information and an advisory body with respect to geohazards to conduct a countrywide investigation and mapping of geohazards particularly land subsidence throughout Botswana.







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