



**Council for Geoscience**

**LABORATORY**

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# BACKGROUND

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The laboratory of the Council for Geoscience (CGS) offers analytical and consultation services in regard to primary solid sample preparation, mineralogy, petrology, geochemistry, coal, petrophysical characterisation, environmental research and analysis. The facility supports the organisational Geoscience Technical Programme (GTP) and offers commercial services to local and international clients.

Currently, the laboratory is working towards obtaining ISO17025 accreditation. Our data quality is greatly enhanced by our participation in a range of proficiency testing schemes and our rigorous quality management system.

The various components of the CGS laboratory are equipped with modern analytical instrumentation, along with specialised sample preparation and storage facilities. The analytical facilities of the laboratory support a range of geochemical surveys, environmental and water resource analyses, natural hazard investigations, mineral exploration, waste disposal and various processing and manufacturing industries.

## A. LABORATORY TECHNIQUES

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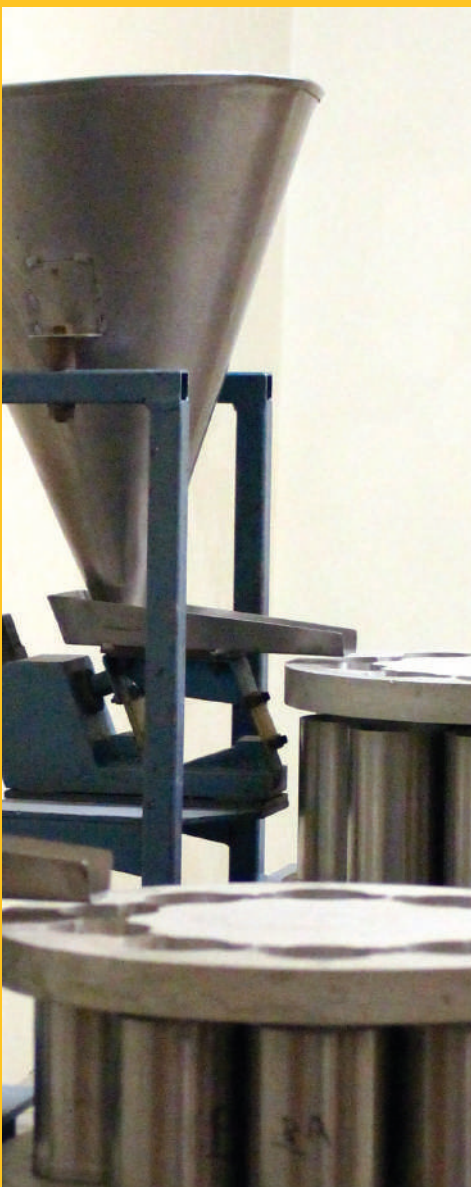
The CGS laboratory offers analytical and research techniques that employ recognised world-class methods designed to meet client needs and to support the CGS mandate. The products are of good quality and comply with recognised international standards. The availability of a wide range of instruments, equipment and techniques enables laboratory staff to employ multidisciplinary approaches to derive solutions and to assist clients in the evaluation of their data. The CGS laboratory currently offers the following specialities:

### 1. Rocks and soil sample preparation

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### 2. Chemistry

Chemical analyses are performed on soil, mineral, water, industrial and waste materials using modern instrumentation. A consultation service is offered to assist in data interpretation, sampling or analytical techniques and to develop new analytical methods. Samples are analysed to determine major and trace constituents by employing methods such as inductively coupled plasma mass spectrometry (ICP-MS) or inductively coupled plasma optical emission spectrometry (ICP-OES). Matrices such as coal or peat are analysed using ICP-MS. Solid samples are analysed for their mercury, carbon or sulphur contents using direct analysis instruments. A discreet analyser is used to analyse water samples for anionic constituents.





#### 4. Environmental

The facility undertakes investigations of natural and anthropogenic contamination. Services currently available are:

- Acid-base accounting (ABA)
- Paste pH and electrical conductivity
- Sequential extraction
- Inorganic toxicity characteristic leaching procedure (inorganic TCLP)
- Alkalinity and acidity tests
- Single and multistage batch leach
- Column leach
- Humidity cell leach testing.



#### 3. Coal

The coal section of the CGS laboratory has the capability to conduct coal, biomass, char, mine tailings, oil and shale quality assessments using modern analytical methods and instruments. Standard methods from various organisations such as the South African Bureau of Standards (SABS), the American Society for Testing Materials (ASTM) and the International Organisation for Standardisation (ISO) for secondary sample preparation and analysis are used.

The coal section participates in locally and internationally recognised inter-laboratory proficiency testing schemes such as Coal Concept and Coal Specifications. The following services are offered:

- Proximate analysis (ash, moisture, volatile matter, fixed carbon by difference)
- Ultimate analysis (carbon, hydrogen, nitrogen, total sulphur)
- HPVA (100 bar) capacity gas adsorption isotherms (coalbed methane gas adsorption measurements, CO<sub>2</sub> gas storage measurements for carbon capture, utilisation and storage (CCUS), shale gas adsorption measurements and surface area analysis)
- Coal petrography (maceral analysis, vitrinite reflectance analysis, dispersed organic matter by vitrinite, reflectance measurements, microlithotype analysis, carbon particle type analysis)
- Free swelling index
- Calorific value determinations.



# A. LABORATORY TECHNIQUES

(Continued)

## 5. Mineralogy

X-Ray diffraction (XRD) is a widely used investigative mineralogical technique used to estimate the qualitative and quantitative mineral composition of samples. Polytypes, in particular, can be identified and the crystallinity of mineral species can be assessed. XRD is an extremely powerful tool used for the examination of clay materials. The scanning electron microscope (SEM), with an attached microanalysis system (energy dispersive spectroscopy — EDS), is utilised to image the X-ray microanalysis of rocks, minerals and industrial materials.

SEM is widely utilised in applied mineralogy investigations and, increasingly, in environmental studies where the characterisation of microscopic particulate matter is required. In conjunction with other analytical techniques, SEM is a strong tool for solving various industrial problems associated with soil/water contamination, process control, product failure corrosion and product development. SEM provides the researcher with topographic imaging of the surface material with qualitative and quantitative compositional information of the matrix to assist in deriving scientific solutions and enhancing the quality of the scientific research product. Recently, the laboratory acquired a field emission gun SEM.

## 6. Petrography

Petrology explores the origin, history and structure of igneous, metamorphic and sedimentary rocks and soils. Petrographic techniques offered by the CGS laboratory include:

- Basic and detailed descriptions of rocks and modal and strain analyses
- Analyses for the alkali-aggregate reaction potential of rocks used in construction
- Petrographic sample preparation including the cutting of rock samples to make standard and large-format polished thin sections, the production of double-polished wafers and the polishing of rock specimens and stubs.



## 7. Rock physical properties

The section focuses on the measurement of physical rock properties directly related to geophysical methods and boasts a well-equipped section for the measurement of palaeomagnetic and physical properties. The section is able to perform measurements of the following properties:

- Magnetic susceptibility (mass and volume)
- Anisotropy of magnetic susceptibility (AMS)
- Normal remanent magnetisation (NRM) [direction and intensity]
- Thermomagnetic analysis
- Magnetic remanence and Königsberger ratio
- Bulk density (wet and dry)
- Electrical resistivity (time domain and frequency domain)
- Induced polarisation.

## 8. X-Ray fluorescence

A wide range of sample types are analysed in respect of major and trace elements. One of the state-of-the-art wavelength-energy dispersive XRF spectrometers in the CGS laboratory is equipped with simultaneous technology capabilities for the rapid analysis of large batches of samples (e.g. for geochemical exploration, mapping or large sampling projects).





## B. QUALITY POLICY STATEMENT

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The CGS Executive Management and staff in of the CGS Laboratory Services are committed to meeting and exceeding the expectations of the customers and stakeholders of the organisation by implementing, maintaining and continually improving the effectiveness of the Quality Management System to ensure continued compliance with the requirements of ISO 17025.

The CGS Executive Management aims to achieve a world-class laboratory Quality Management System through the following objectives:

- A high professional standard of laboratory practice in delivering good-quality geoscience products and services through the appropriate use of well-maintained facilities and calibrated equipment.
- Leveraging the Quality Management System as well as the laboratory processes to achieve the highest and consistent standard of service by adopting documented test methods and standard operating procedures.
- Impartiality, accuracy and timely delivery of all laboratory products and services through the implementation of performance monitoring, quality controls, proficiency testing and internal and external audits to ensure compliance with the Quality Management System and customer requirements.
- An enabling work environment that attracts, develops and retains competent staff.
- Effective communication of this policy statement and its Quality Management System documentation.

## FUTURE

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The CGS laboratory is planning to establish near future. Services envisaged to be offered by these facilities will contribute towards research solutions for geo-communities in rock dating research and geo-hazards and infrastructure development.



## CONTACT DETAILS

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