

DEPARTMENT OF GEOLOGY

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OVERVIEW OF 2020

The Department of Geology is responsible for teaching and research in the geological sciences in the University of the Free State (UFS). The Department offers six undergraduate, three honours, and four MSc programmes (Geology, Geochemistry, Environmental Geology, and Mineral Resource Management [MRM]), as well as the PhD by research.

In 2020 the Department awarded a total of 77 degrees – 37 BSc, 25 BSc Hons and 15 MSc. The Department enrolled 131 undergraduate, 25 honours and 52 master's students (34 in MRM, and 18 in Geology, Geochemistry and Environmental Geology), and 7 PhD candidates.

Ms Rinae Makhadi's promotion to lecturer and the successful completion and submission of the doctoral thesis by Adriaan Odendaal are highlights in the Department's staff development drive.

The Department published 16 journal articles, a chapter in a book, three articles in conference proceedings and delivered one conference paper.

A panel of three external academics conducted the departmental five-year audit review from 4 to 7 August 2020. Due to the prevailing COVID-19 situation, it was not possible for the panel to visit UFS and all the interviews and discussions took place using Microsoft Teams. The Directorate for Institutional Research and Academic Planning (DIRAP) set up the terms of reference and arranged all interviews and engagements of the review panel with the staff and Head of Department, and the Dean. The Department submitted its self-evaluation report to the panel for the review. The emphasis of the academic review process was on continuous improvement and development of the Department, with the view to enrich further the quality of the work that it does. The review provided an opportunity for the Department, together

with the panel, to reflect critically on the work it has done over the last few years, its current state and future direction. In its feedback, the review panel provided a list of commendations and recommendations to assist in the improvement plan of the Department.

ACHIEVEMENTS

Staff Achievements

Dr Martin Clark and Dr Mathew Huber won the Excellence in Learning and Teaching Award, in the category 'Technology Enhanced Learning', from the Faculty of Natural and Agricultural Sciences. The award was for their presentation titled 'Bringing together the old and the new: Combining traditional field exercises, gamification, and 4IR components for efficient and effective holistic learning of Geology students' presented at the 2020 Excellence in UFS Learning and Teaching conference, held in September 2020.



Dr Martin Clark and Dr Mathew Huber utilising aerial photography and 3D models in field studies

Student Achievements

The Department of Geology annually recognises the best-performing students by awarding various prizes and financial incentives. Mr Madaka was the best first-year Geology student and the winner of the Impala Platinum prize and the Wiley book prize. Marizanne van Ede was the winner of the financial prize supported by the Professional Provident Society (PPS) for the best second-year Geology student, and Thapelo Lepolesa received the Exxaro Resources Ltd book prize and financial prize from the Department as the best third-year Geology student.

The Bridge the Gap (BTG) programme was launched by the students of the UFS Geology Department in collaboration with the students from the University of the Witwatersrand (Wits) and the University of Johannesburg (UJ). The initiative was featured in the Geological Society of South Africa (GSSA) *Geobulletin* in September 2020.

TEACHING AND LEARNING

The Department offered six undergraduate programmes for the BSc, majoring in Geology, Environmental Geology, Geochemistry, Geology and Geography, Geology and Chemistry, and Geology and Physics. Seventeen (17) undergraduate and 13 honours modules were offered, including a new module introduced in 2019, on 'Skills development and ethics for geoscience professionals' to equip graduates with an industry-relevant practical edge.

The modules presented by the Department attempt to integrate theory, laboratory and geological field investigations, and most include visits to mines and mineral processing plants, geoscientific laboratories or research centres. At the undergraduate level, the first-, second- and third-year students visited various geological sites to study the different geological aspects pertinent to the respective modules.

COVID-19 made 2020 a very difficult year for teaching and learning, providing many challenges. This was particularly true for Geology because geological teaching and learning is heavily dependent on field excursions, and visits to mineral exploration sites, geoscience laboratories, national geoscientific institutions and mines. As soon as the lockdown started, the Department introduced a number of innovative techniques, such as videos and online lectures, to cover the theoretical components of the teaching and learning project. However, the Department realised early in the first semester that the teaching and learning of geological sciences would be incomplete without the practical and laboratory components of the geological modules, which require instruction and close supervision by the academic staff. It was necessary to intervene with some form of face-to-face engagements, such as boot camps and limited outcrop investigations.

The designing of boot camps aimed at including face-to-face, intense and continuous practical sessions for the students over short periods, to replace the normal semester-long practical and laboratory sessions. Students were prepared for the boot camp sessions through online videos and lectures to ease the workload for each module. The boot camps were held from 7 September to 7 October, and involved three practical modules (GLGY 2652, 2632, and GLGY 2662) and laboratory-based modules

such as GLGY 2612 (Mineralogy) and GLGY1614 (Introduction to Geology and Planet Earth). A week was assigned to each module and students handed in assignments during the week and wrote a semester test at the end of each module session.

There was strict control and observance of COVID-19 guidelines such as social distancing, use of masks and gloves, and application of sanitiser during the boot camps. No infections or other COVID-related issues were reported.



Second-year students in practical classes on geological structures and map preparation skills in a boot camp under strict COVID-19 guidelines

The boot camp was very successful, and enabled the Department to complete the teaching and learning project successfully with minimal negative impact. The success can be attributed to the collective effort of all staff, particularly the support and teaching staff as well as the programme director, who were directly involved in the logistics and implementation of the boot camp and in the limited outcrop visits. Although both students and lecturers were under tremendous pressure, the boot camp sessions covered the practical aspects of all the first- and second-year modules with significant practical and laboratory components.



Students sketching and mapping out a rock face on top of Musgrave Koppies



Students observing a road-cutting close to Thaba Nchu Mountain

as part of the afore-mentioned collaboration. Dr Robert Hansen leads the CMBG.

A project under the CMBG has resulted in a feasibility study to build an up-scale acid mine drainage (AMD) treatment plant at the South32 Union Coal Mine in Mpumalanga. Engineers from Zutari have been appointed to conduct the feasibility study, with technical input from the CMBG team and DRDGOLD Limited.

Dr Hansen and his team also commenced with a Welkom wetlands impact study in 2020. The project has a broad scope and the long-term aim is to understand the biogeochemistry of the Welkom wetlands and determine the processes controlling the fate of pollutants in this wetland system. A reconnaissance study has been conducted and two honours students and one master's student are working on this project.

A compost-soil nutrient augmentation project was initiated as part of a collaboration between the UFS and ZZ2, a farming conglomerate in the Mooketsi area of the Limpopo Province. The project is focused on addressing how much of the compost material is immediately available for plant uptake, the chemical composition of these nutrients, and the rate at which the nutrients are released.

The Department continued to collaborate with the DSI-NRF Centre of Excellence for Integrated Mineral and Energy Resource Analysis (CIMERA), jointly hosted by the Department of Geology at UJ and the School of Earth Sciences at Wits. In 2020, Prof Bisrat Yibas secured additional research funding from the DSI-NRF CIMERA, increasing to three the number of MSc projects in the Department funded by the Centre of Excellence.

Dr Hendrik Minnaar continued his research on the crust formation processes in the Paleoproterozoic Richtersveld Magmatic Arc. He also secured funding from the Research, Education and Investment (REI) Fund of the GSSA in support of his research in the Northern Cape to determine the age of the Vuurdoed Subsuite in the Vioolsdrif Suite.

Justine Magson received research funding from the Central Research Fund (CRF) for Sr isotopic variations in bifurcating chromitite layers of the UG1 at the Impala Platinum Mine, Rustenburg. The study aims to contribute to the understanding of chromitite bifurcations and their formation. Isotopic signatures analysis and mineral chemistry, as well as detailed petrographic studies of the bifurcating chromitites of the UG1 at No 11 Shaft of Impala Platinum, will be used to achieve the objective of the research.

Ms Magson continued her PhD research on a project titled 'Probing magma dynamics and mineralization in the Bushveld Complex using high-resolution, multi-isotope (Fe-Cu-Zn and Sr-Nd-Hf-Pb) analysis across major compositional and mineralogical discontinuities'. In October 2020, she visited Rhodes University to collect mineral chemistry data from her samples using the Electron Probe Micro Analyzer (EMPA - Jeol JXA 8230 Superprobe).

RESEARCH AND INNOVATION

The Bushveld Complex research project, funded by the International Continental Scientific Drilling Program (ICDP) since 2019, made slow progress in 2020 due to the restrictions resulting from the COVID-19 pandemic. In December, Prof Frederick Roelofse and Ms Justine Magson participated in a virtual training session, organised by the Operational Support Group (OSG) of the ICDP, on ICDP's drilling information management system (mDIS) that will be used to store the data generated over the course of the project.

A very significant funding agreement has concluded in 2020 between the UFS and the Hans Merensky Foundation (HMF) to launch a five-year project titled 'Merensky Group for Airborne Geological Image Classification (MAGIC)', under the leadership of Dr Martin Clark, the principal investigator. The overarching aim of the MAGIC project is to perform focused research on the development of remote sensing technologies using unmanned aerial vehicles (UAV) and satellites for application in the mining and groundwater exploration industries in South Africa and beyond. Specific focus areas include mineral exploration, extraction and remediation, as well as regional groundwater exploration and management. The proposed research targets two areas – the Barberton Greenstone Belt (Mpumalanga) and the Karoo. Remote sensing technologies will aim to better characterise the structural architecture and history of the rocks in Mpumalanga and the Karoo in order to manage better near-surface groundwater resources.

Significant progress on water treatment technologies has been made over a number of years on a collaborative project with the former SAENSE (a biochemistry platform funded by the Technology Innovation Agency [TIA] and located at UFS). With the phasing out of the SAENSE platform, the Centre for Mineral Biogeochemistry (CMBG) in the Department of Geology, which forms part of the recently-formed Biogeochemical Research Infrastructure Platform (BIOGRIP – operated from the University of Cape Town), absorbed the staff and projects that were ongoing



The Jeol JXA 8230 Superprobe at Rhodes University used by Justine Magson

Adriaan Odendaal completed his PhD research on the fluvial-lacustrine Beaufort Group of the Karoo Supergroup, and investigated the Ecce-Beaufort contact, west of Bloemfontein, and the occurrence of large-scale mass movements in the Thaba Nchu area.

Ms Jarlen Keet continued with her research for her PhD on deciphering the lateral and vertical variation of strontium, neodymium and sulphur isotopes of the Flatreef, to understand the implications for the formation of the reef and its comparison to the Merensky Reef in the western and eastern Bushveld Complex. Her research aims at understanding the implications of the isotope variations in the Flatreef and its comparison with the Merensky Reef in the western and Eastern Bushveld Complex.

As part of his PhD studies, Mr Ernest Moitsi continued working on the mineralogical and metallurgical (process mineralogical assessment) of various UG2-ore types from Hossy, Rowland and Safy Shafts of the Sibanye-Stillwater Marikana Operations, in the Bushveld Complex in the North West Province. The study includes an evaluation of different ore mineralogy and texture types to flotation response, the identification of critical characteristics that have an influence on flotation performances and platinum-group elements (PGE) recovery. This will enable Mr Moitsi to gain the insight into factors that influence milling behaviour and flotation performances as well as platinum group metals recovery of the UG2 Chromitite layer at the above-mentioned three shafts.

As part of her PhD study, Ms Megan Welman-Purchase continued researching the stability of Prussian blue and Turnbull's blue with implications for Witwatersrand sulfidic Au-tailings environment and on the behaviour of cyanide in Au-mine tailings. Her research includes a chemical experiment study in order to distinguish Prussian from Turnbull's blue, forming the basis for bioremediation research.

Ms Thendo Mapholi and Mr Justin Nel worked on the final versions of their MSc dissertations on Nkombwa Phosphate Mineralogy and on the structural geology of the Namaqualand Mobile Belt, respectively, and are set to graduate in 2021.

As part of the continuous drive to develop the research and its teaching infrastructure of the Department, Justine Magson secured several core stands as a donation from Kumba Iron Ore Ltd to alleviate the shortage of core stands in the Department's core shed. Dr Hendrik Minnaar and Justine Magson transported the core stands to UFS and set them up in the Core Shed, and are ready for use.



The core stands donated by Kumba Iron Ore being transported to the Geology Department Core shed



The acquired core stands in the core shed ready for use

ENGAGED SCHOLARSHIP

Prof Frederick Roelofse continued to serve as chair of the Palaeoproterozoic Task Group of the South African Committee for Stratigraphy (SACS) and was involved in the review of four lithostratigraphic descriptions for publication in the *South African Journal of Geology*. Lithostratigraphic descriptions for the Verena Granite (Lebowa Granite Suite, Bushveld Complex) and the Hekpoort Formation (Pretoria Group, Transvaal Supergroup) were finalised and published under his leadership.

Mr Ernest Moitsi continued to serve as the co-opted Committee Member of Mineralogical Association of South Africa (MINSA).

NATIONAL AND INTERNATIONAL COLLABORATION

The Department has excellent collaborative relationships with the industry, as illustrated by the Minerals Education Trust Fund (METF) subventions to all our full-time academic staff members to date, and increasing levels of collaboration. The feedback the Department received from mining companies on the quality of our graduates has been very encouraging. As a result, student bursaries, research support in the form of access to mine facilities and research materials such as drill cores and samples, are improving. The mining industry supports by way of providing access to their facilities and materials such as samples for a number of honours, master's and doctoral research projects. Staff research and interaction with the industry have also improved significantly.

The collaboration agreement with De Beers, which commenced in 2018, continued into 2020, resulting in three additional projects for honours students. The research collaboration expands the understanding of mantle xenoliths from kimberlite pipes and generating significant number of mineral chemistry data sets using the electron microprobe analyser (EMPA) and LA-ICP-MS in De Beers Laboratory.

As reported above, the collaboration with the GeoForschungsZentrum (GFZ) German Research Centre for Geosciences, the University of the Witwatersrand and the Friedrich-Alexander University, led to the grant from the ICDP, continued into 2020, as did the collaboration with DSI-NRF CIMERA.

The staff of the Geology Department maintained active collaboration with researchers from the following institutions:

- University of Cape Town
- University of Johannesburg
- University of Pretoria
- Rhodes University
- University of the Witwatersrand
- Central University of Technology
- Council for Geoscience
- Sibanye-Stillwater Company
- McGregor Museum
- Louisiana State University, USA
- Université De Lille, France
- University of Exeter, UK
- University of Leoben, Austria

- Natural History Museum, London, UK
- Universität Hamburg, Germany
- University of Vienna, Austria
- Natural History Museum Vienna, Austria
- University of Gothenburg, Sweden
- University of Oslo, Norway
- Friedrich-Alexander University, Germany
- German Research Centre for Geosciences – GFZ Potsdam, Germany
- Museum of Natural History, Sweden
- Polish Academy of Sciences, Poland
- Zavaritsky Institute of Geology and Geochemistry, Russia

Ms Jarlen Keet participated in the University of Western Australia's Centre for Exploration Targeting (CET) online short course series, titled the 'Magmatic Mineral Systems', from 7 to 20 November. These courses provide the opportunity for geoscientists from both industry and academia to gain better insights on the latest advances in Ni-Cu-PGE sulfide targeting, from terrain to deposit scale. It is anticipated that collaborative projects could emanate from these interactions.

POSTGRADUATE STUDENTS

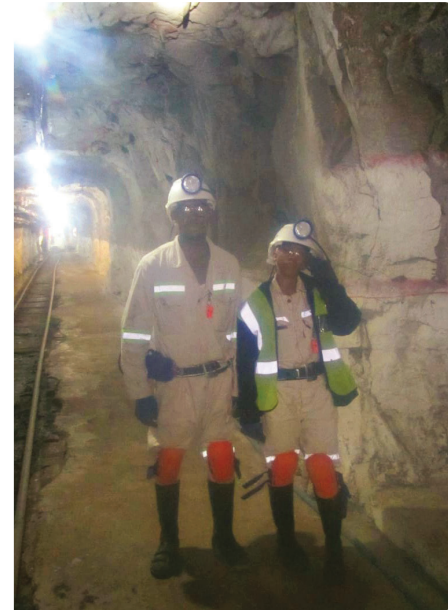
The Department of Geology offers a variety of postgraduate programmes, including honours (with specialisation in Geology, Geochemistry and Mineralogy, and Environmental Geology), four different MSc programmes (Geology, Geochemistry, Environmental Geology, and Mineral Resource Management), and the PhD degree by research. In 2020, the Department enrolled 84 postgraduate students – 25 BSc Hons, 52 MSc and 7 PhD candidates.

Forty postgraduate students (25 BSc Hons and 15 MSc) obtained their degrees in 2020. Seven of the MSc awardees who have completed their MSc research successfully in 2020 are:

- Danita Hohne (Geochemistry)
- Marcelle Ferreira (Geology)
- Francois Byleveld (Geology)
- Dakalo Nempumbada (Geochemistry)
- Mariska Nicholson (Geology)
- Ryan Nel (Geology)
- Monique Maree (Geology)

The other eight MSc awardees have successfully completed the two-year intensive modules and mini-dissertations required for the fulfillment of MRM qualification and obtained their degrees in 2020. These graduates are Pieter van der Merwe, Cindi Henderson, Marelize du Toit, Zandile Mjoli, Franco Burger, Gilbert Malose Thobejane, Tlou Piet Sebola, and Lawrence Ngalela.

The normally intensive field schedule, which forms part of the extensive honours programme, could not be implemented due to COVID-19 travel restrictions. However, under strict adherence to COVID-19 guidelines, Ernest Moitsi and honours student, Tshepang Moseki, conducted sampling at underground workings of Khuseleka Shaft of the Sibanye-Stillwater Rustenburg Platinum Operations in North West Province.



Ernest Moitsi and Tshepang Moseki conducting sampling at Khuseleka Shaft, Sibanye-Stillwater Rustenburg Platinum Operations

POSTDOCTORAL RESEARCH FELLOWS

Dr Emmylou Kotzé, from South Africa, was appointed as a postdoctoral fellow at the end of 2020. She is working in the Bushveld Research Group under the guidance of Prof Roelofse.

Our other postdoctoral research fellow, Dr Martin Clark (from Canada), will be principal investigator of the MAGIC project.

STAFF MATTERS

Mrs Petro Swart retired at the end of 2020 after serving the Department for nearly three decades.

In October 2020, the Department welcomed Ms Ruvey Zaal as senior administrative and financial officer. Ms Zaal had previously worked in the UFS Department of History.

The Department congratulated Ms Rinae Makhadi on her promotion to Lecturer. Adriaan Odendaal completed and submitted his doctoral thesis in 2020. The accomplishments of Rinae and Adriaan are important highlights in the career development strategy of the Department.

Dr Elizaveta Kovaleva resigned in December 2020 after just over a year of tenure in the Department.

RESEARCH OUTPUTS

Research Articles

Darrocha, A.F.S., Cribba, A.T., Buatois, L.A., Germs, G.J.B., Kenchington, C.G., Smith, E.F., Mocke, H., Gretchen, R.O.'N, Schiffbauer, J.D., Maloney, K.M., Racicota, R.A., Katherine A.T., Gibson, B.M., Almond, J., Koesterer, B., Boag, T.H., Tweedt, S.M. & Lafamme, M. 2020. The trace fossil record of the Nama Group, Namibia: Exploring the terminal Ediacaran roots of the Cambrian explosion. *Earth-Sciences Reviews* 212: 103435. DOI: 10.1016/j.earscirev.2020.103435.

Goderis, S., Soens, B., Huber, M.S., McKibbin, S., Van Ginneken M., Van Maldeghem F., Debaille V., Greenwood, R.C., Franchi, I. A., Cnudde V., Van Malderen, S., Vanhaecke F., Koerber, C., Topa, D. & Claeys, P. 2020. Cosmic spherules from Widerøefjellet, Sor Rondane Mountains (East Antarctica). *Geochim Cosmochim Acta* 270: 112-143.

Hansen, R.N. 2020. Process network modelling of the geochemical reactions responsible for acid mine drainage emanating from the Witwatersrand tailings facilities. *South African Journal of Geology* 123(3): 357-368. DOI: 10.25131/sajg.123.0024.

Huber, M.S. & Kovaleva, E. 2020. Identifying Gaps in the Investigation of the Vredefort Granophyre Dikes: A Systematic Literature Review. *Geosciences* 10: 306. DOI: 10.3390/geosciences10080306.

Huber, M.S., Kovaleva E. & Riller, U. 2020. Modeling the geochemical evolution of impact melts in terrestrial impact basins: Vredefort granophyre dikes and Sudbury offset dikes. *Meteoritics & Planetary Science* 55:2320-2337. DOI: 10.1111/maps.13582.

Klemm, R., Beinlich, A., Kern, M., Junge, M., Martin, L., Regelous M. & Schouwstra, R. 2020. Magmatic PGE Sulphide Mineralization in Clinopyroxenite from the Platreef, Bushveld Complex, South Africa. *Minerals* 10: 570. DOI: 10.3390/min10060570.

Knoll, A. H., Germs, G.J.B., Tankard, A. & Welsink, H. 2020. Tonian microfossils from subsurface shales in Botswana. *Precambrian Research* 345:105779. DOI: 10.1016/j.precamres.2020.105779.

Kotzé, E. & Gauer, C. 2020. PGE distribution in the chromitite layers at Eastern Chrome Mine, Eastern Bushveld Complex, South Africa: A descriptive study with comparison of EPMA and LA-ICP-MS methods for detection of trace PGE in base metal sulphides. *South African Journal of Geology* 123(4): 551-572. DOI: 10.25131/sajg.123.0033.

Kovaleva, E. 2020. Textural identification of polycrystalline Magmatic, tectonically - deformed, and shock- related zircon aggregates. *Minerals* 10(5): 469.

Kovaleva, E. & Dixon, R. 2020. Properties of Impact-Related Pseudotachylite and Associated Shocked Zircon and Monazite in the Upper Levels of a Large Impact Basin: A Case Study from the Vredefort Impact Structure. *Minerals* 10(12): 1053. DOI: 10.3390/min10121053.

Kovaleva, E., Huber, M.S. & Dixon, R. 2020. Material mixing in shock-induced pseudotachylites, Vredefort impact structure, South Africa. *Lithos* 370–371: 105621. DOI: 10.1016/j.lithos.105621.

Makhadi, R., Oke, S.A. & Olojade, O.O. 2020. The Influence of Non-Engineered Municipal Landfills on Groundwater Chemistry and Quality in Bloemfontein, South Africa. *Molecules* 25(23): 1-16. DOI: 10.3390/molecules25235599.

Roelofse, F., De Bruijn, H., Cornell, D. & Kristofferson, M. 2020. Lithostratigraphy of the Palaeoproterozoic Verena Granite. *South African Journal of Geology* 123(1): 117-128. DOI:10.25131/sajg.123.0007.

Stephens, J., Killick, D., Wilmsen, E., Denbow, J. & Miller, D. 2020. Lead isotopes link copper artefacts from northwestern Botswana to the Copperbelt of Katanga Province, Congo. *Journal of Archaeological Science* 117: 105124. DOI: 10.1016/j.jas.2020.105124.

Walter, B.F, Steele-MacInnis, M., Giebel, R.J., Marks, M.A.W. & Markl, G. 2020. Complex carbonate-sulfate brines in fluid inclusions from carbonatites: Estimating compositions in the system H₂O-Na-K-CO₃-SO₄-Cl. *Geochim Cosmochim Acta* 277: 224-242. DOI: 10.1016/j.gca.2020.03.30.

Chapters in Books

Yibas, B. 2020. Oxidation Processes and Formation of Acid Mine Drainage from Gold Mine Tailings, a South African Perspective. In: *Recovery of Byproducts from Acid Mine Drainage Treatment*. E. Fosso-Kankeu, C. Wolkersdorfer & J.vBurgess, J. (Eds). Wiley: Scrivener Publishing LLC. Chapter 4: pp 73–96. DOI:10.1002/9781119620204.ch4.

Conference Contributions

Conference Papers/Posters

Clark, M.D. & Huber, M.S. 2020. *Bringing together the old and the new: Combining traditional field exercises, gamification, and 4IR components for efficient and effective holistic learning of Geology students*. Paper presented at the 2020 Excellence in UFS Learning and Teaching Conference, Bloemfontein, South Africa. 22 September 2020.

Huber, M.S., Kovaleva, E., Clark, M.D. & Fourie, F. 2020. *Evaluating the Emplacement Mechanisms of Vredefort Impact Melt Dikes*. Paper delivered at the 11th Planetary Crater Consortium (Virtual meeting). 5-7 August 2020.

Webb, S.J., Trumbull, R.B., Ashwal, L.D., Roelofse, F., Khoza, D. & Hayes, B. 2020. *The Bushveld Complex Drilling Project: an ICDP project on the origins, emplacement and consequences of the world's largest known igneous intrusion*. Paper delivered at the American Geophysical Union (AGU) Fall Meeting (Global virtual meeting 1-17 December 2020).

Conference Proceedings

Lourens, P., Erasmus, M., Hansen, R.N. & Allwright, A. 2020. Groundwater Nitrate Bioremediation of a Fractured Rock Aquifer System in South Africa. In: *Proceedings of IMWA 2020 'Mine Water Solutions'*. Christchurch, New Zealand, 9-13 November 2020. J. Pope, Ch. Wolkersdorfer, A. Weber, L. Sartz & K. Wolkersdorfer, K. (Eds). pp. 140-145.

Welman-Purchase, M. 2020. A Model of the Behaviour of Cyanide in Witwatersrand Sulfidic Au-tailings Environment. In: *Proceedings of IMWA 2020 'Mine Water Solutions'*. Christchurch, New Zealand, 9-13 November 2020. J. Pope, Ch. Wolkersdorfer, A. Weber, L. Sartz & K. Wolkersdorfer (Eds). pp. 100-105.

STAFF (2020)

Head of Department: Prof B Yibas

Professor: Prof B Yibas

Associate Professor: Prof F Roelofse

Senior Lecturers: Dr R Hansen, Dr M Huber, Dr E Kovaleva and Dr H Minnaar

Lecturers: Ms JJ Keet, Ms J Magson, Ms R Makhadi, Mr ME Moitsi and Mr A Odendaal, Ms Michelle Dimmick-Touw (contract)

Junior Lecturers: Ms T Mapholi and Mr J Nel

Research Fellows: Prof WP Colliston, Dr PG Meintjes, Dr L Nel, Dr HE Praekelt and Prof WA van der Westhuizen

Affiliated Professors: Prof DE Miller, Prof R Schemers and

Prof A Scooch

Affiliated Associate Professors: Prof CD Geert, Prof GJB Germs, Prof L Jacobson and Prof RP Schouwstra

Affiliated Lecturers: Mr E Bergh, Prof C Dohm, Mr A van Niekerk, Dr H Prinsloo, Mr T Diale, Mr P Viljoen, Prof K Visser and Mr A Venter

Affiliated Researchers: Dr RJ Giebel, Ms HCF Pretorius and Dr MJ van der Merwe

Research Associate: Dr Johan Loock

Programme Director: Ms J Magson

Programme Director (Mineral Resources Management [MSc]): Ms M Dimmick-Touw

Senior Assistant Officers: Mr A Felix, Ms P Swart, Ms C van der Vyver and Ms R Zaal.

Technical Officers: Mr P Lehloeny, Ms M Purchase and Mr D Radikgomo