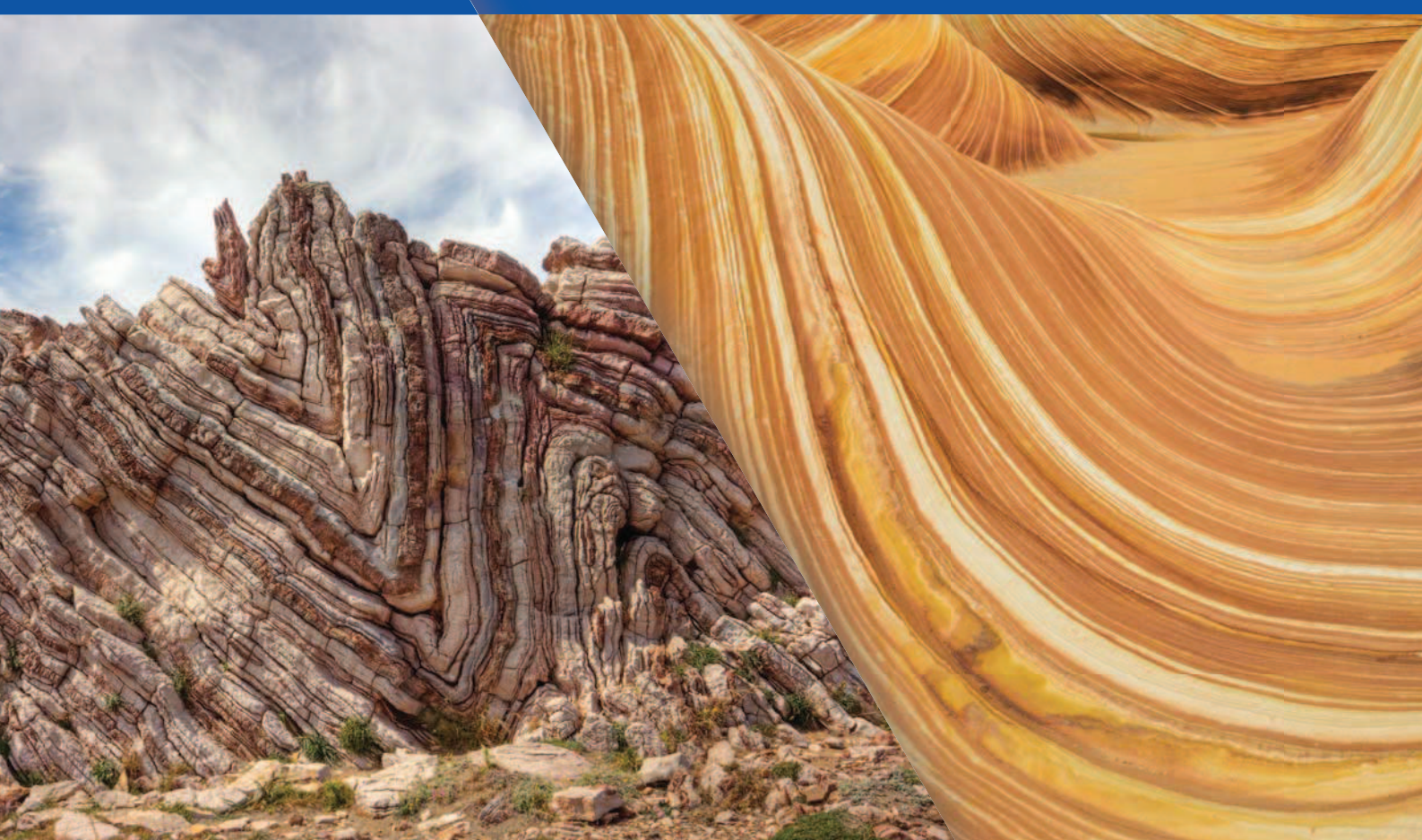


# Department of **Geology**

Faculty of Natural and Agricultural Sciences



## Contact Details



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# Overview of 2016

Seventy-four degrees were awarded by the Department of Geology over the course of the year; with 27 students receiving BSc degrees, 28 honours degrees, four MSc degrees, and 15 master's in Mineral Resource Management degrees. The department was responsible for the presentation of six undergraduate and three honours programmes, as well as the master's degree in Mineral Resource Management (that was reintroduced mid-2016 as the MSc Mineral Resource Management degree), and supervised the continued research of 33 students in the Mineral Resource Management programmes, 14 MSc candidates, and six PhD candidates over the course of the year.

Ms Susan Serfontein joined the department during the year as a National Research Foundation (NRF) intern under the joint supervision of Dr Freddie Roelofse and Mr Adriaan Odendaal. The department was saddened by the loss of Dr Johann Claassen and Prof Chris Gauert, who decided to pursue greener pastures, and excited by the appointment of Dr Robert Hansen as lecturer in Environmental Geochemistry. Both Dr Claassen and Prof Gauert were retained as affiliate researchers. Prof Marian Tredoux was retained on contract for the year. Dr Matthew Huber, postdoctoral research fellow under the joint supervision of Prof Tredoux and Dr Roelofse, was appointed as temporary part-time lecturer, as was Dr Gerhard Meintjes (affiliate researcher) for the presentation of undergraduate and postgraduate modules in economic and exploration geology due to the resignation of Prof Gauert.

## Achievements

Dr Elizaveta Kovaleva, postdoctoral researcher under the supervision of Dr Roelofse, won the prize for the best presentation by a PhD student at the annual Igneous and Metamorphic Studies Group (IMSG) meeting hosted by the University of Cape Town (UCT) with a talk titled "The geometric relationship of plastically-deformed zircon grains with the kinematic framework of a shear zone". Ms Justine Magson, a junior lecturer in the department, obtained her MSc degree at the summer graduation ceremony with a dissertation titled "Platinum-group elements within the Merensky Reef, Western Limb, Bushveld Complex: Results of a high resolution mineralogical and geochemical study". Prof Gauert and Dr Roelofse were informed that they had obtained C3 and Y2 NRF ratings respectively towards the end of the year. The visiting investigator appointment of Dr Roelofse at the

Department of Terrestrial Magnetism, Carnegie Institution for Science, was extended until the end of 2017.

## Activities

The year was characterised by numerous field trips across the country and with staff members travelling both locally and abroad. Staff members and students presented their work at several conferences, including the IMSG Meeting (UCT, January 2016), the 35<sup>th</sup> International Geological Congress (Cape Town, August to September 2016) and the 13<sup>th</sup> International Ni-Cu-PGE Symposium (Perth, Australia, September 2016). Undergraduate and honours students undertook field trips to the Big Hole Museum in Kimberley, the Vredefort Dome, the Vanderkloof area, and to various localities in and around Bloemfontein as part of their training. Unfortunately, several planned field trips had to be adapted or cancelled due to the spates of student unrest that characterised the year.





Staff and students at the 35<sup>th</sup> International Geological Congress.

The following Kovsky GeoTalks were presented over the course of the year:

- “Bending zircons and breaking ages: Effects of plastic deformation on microstructures, re-distribution of trace elements and retention of radiogenic isotopes in zircon”, presented by Dr Kovaleva, postdoctoral research fellow in the department.
- “Minerals exploration Greenland style: Lessons us Africans can learn”, presented by Prof Jock Harmer, Rhodes University.
- “New insights into the development of the Kakamas Terrane”, presented by Prof Jan van Bever Donker, University of the Western Cape.
- “30 years of earth sciences at Vaalputs, South Africa: Some proposed research guidelines for the disposal

of high-level radioactive waste in South Africa”, presented by Dr Marco Andreoli, University of the Witwatersrand.

Prof Harmer also presented a two-day short course on “Carbonatites – Markets, mineral exploration and rare-earth elements” to honours students. A drilling practice short course was again presented to honours students by Mr Colin Rice.

Mr Pelele Lehloeny, MSc student of Dr Roelofse, had the opportunity to spend three weeks at the Department of Terrestrial Magnetism, Carnegie Institution for Science in Washington, D.C., where he conducted *in situ* Sr-isotopic determinations on plagioclase from the Bushveld Complex.



Honours students at the Annual Plate Tectonics showcase organised by Prof Wayne Colliston as part of his “Plate Tectonics” honours module.





Second-year students sketching an outcrop containing sandstone, mudstone, and dolerite occurring in the vicinity of Thaba Nchu.



Honours students on their sedimentology field trip to Vanderkloof.



## Community Service

The department, in particular Ms Rinae Makhadi, again hosted the Free State leg of the Minquiz National Science Competition that was held on 19 May 2016. A total of 21 schools (mostly from the Free State), each represented by three learners, participated in the competition. The learners were also afforded the opportunity of visiting the departments of Chemistry, Physics, and Geology to see what these departments have on offer for prospective students.

A public lecture titled “Dust to planets: How the solar system was born” was presented by Dr Huber at the Naval Hill Planetarium in September.

## National and International Collaboration

Staff in the department actively collaborated with the following researchers at national and international institutions over the course of the year:

- Dr David Cornell, University of Gothenburg (Prof Willem van der Westhuizen)
- Profs F Zaccarini and G Garuti, University of Leoben (Prof Tredoux)
- Dr Iain McDonald, Cardiff University (Prof Tredoux)
- Prof Dr Chris Ballhaus, Steinmann Institute, Bonn University (Prof Tredoux)
- Drs Rick Carlson and Timothy Mock, Department of Terrestrial Magnetism, Carnegie Institution for Science (Dr Roelofse)
- Dr Bob Trumbull, Deutsches GeoForschungsZentrum (GFZ) (Dr Roelofse)
- Ms Shiona Moodley, National Museum (Bloemfontein) (Drs Huber and Kovaleva)
- Mr Stuart Bateman, Innov-X Africa (Drs Huber and Kovaleva)
- Mr Andrew Somers, SciAps Australia (Drs Huber and Kovaleva)

## Research Outputs

### Research Articles

Beukes, J.J., Gaurert, C.D.K. & Giebel, R.J. 2016. Cryptic mineral variation and PGE distribution in the Merensky Reef and its discontinuous melagabbro-norite hanging wall (“Brown Sugar Norite” – BSN) at Two Rivers Platinum Mine, Eastern Bushveld Complex, South Africa. *South African Journal of Geology* 119: 243–272.

Claassen, J.O. 2016. Application of manufacturing management and improvement methodologies in the southern African mining industry. *The Journal of the Southern African Institute of Mining and Metallurgy* 116: 139–148.

Claassen, J.O. 2016. Testing for heterogeneity in complex mining environments. *The Journal of the Southern African Institute of Mining and Metallurgy* 116: 181–188.

Claassen, J.O. & Laurens, P.G. 2016. Mineral resource management: Evaluating mineral resource throughput management. *South African Journal of Business Management* 47: 9–20.

Erasmus, E., Claassen, J.O. & Van der Westhuizen, W.A. 2016. Catalytic wet peroxide oxidation of formic acid in wastewater with naturally-occurring iron ore. *Water SA* 42: 442–448.

Gauert, C., Schannor, M., Hecht, L., Radtke, M. & Reinholz, U. 2016. A comparison of *in situ* analytical methods for trace element measurement in gold samples from various South African gold deposits. *Geostandards and Geoanalytical Research* 40: 267–289.

Killick, D., Miller, D., Thondhlana, T.P. & Martinon-Torres, M. 2016. Copper mining and smelting technology in the northern Lowveld, South Africa, ca. 1000 CE to ca. 1880 CE. *Journal of Archaeological Science* 75: 10–26.

Kovaleva, E., Klötzli, U. & Habler, G. 2016. On the geometric relationship between deformation microstructures in zircon and the kinematic framework of the shear zone. *Lithos* 262: 192–212.

Losiak, A., Golebiowska, I., Ferriere, L., Wojciechowski, J., Huber, M.S. & Koerber, C. 2016. WIP: A Web-based program for indexing planar features in quartz grains and its usage. *Meteoritics and Planetary Science* 51: 647–662.

Losiak, A., Wild, E.M., Geppert, W.D., Huber, M.S., Joeleht, A., Kriiska, A., Kulkov, A., Paavel, K., Pirkovic, I., Plado, J., Steier, P., Valja, R., Wilk, J., Wisniewski, T. & Zanetti, M. 2016. Dating a small impact crater: An age of Kaali crater (Estonia) based on charcoal emplaced within proximal ejecta. *Meteoritics and Planetary Science* 51: 681–695.

Mangwegape, M., Roelofse, F., Mock, T. & Carlson, R.W. 2016. The Sr-isotopic stratigraphy of the Northern Limb of the Bushveld Complex, South Africa. *Journal of African Earth Sciences* 113: 95–100.

Mielke, C., Muedi, T., Papenfuss, A., Boesche, N.K., Rogass, C., Gaurert, C.D.K., Altenberger, U. & De Wit, M.J. 2016. Multi- and hyperspectral spaceborne remote sensing of the Aggeneys base metal sulphide mineral deposit sites in the Lower Orange River region, South Africa. *South African Journal of Geology* 119: 63–76.

Rodler, A.S., Frei, R., Gaucher, C. & Germs, G.J.B. 2016. Chromium isotope, REE and redox-sensitive trace element chemostratigraphy across the late Neoproterozoic Ghaub glaciation, Otavi Group, Namibia. *Precambrian Research* 286: 234–249.

Tredoux, M., Zaccarini, F., Garuti, G. & Miller, D.E. 2016. Phases in the Ni-Sb-As system which occur in the Bon Accord oxide body, Barberton greenstone belt, South Africa. *Mineralogical Magazine* 80: 187–198.

### Conference Contributions

Beukes, J.J., Van Rensburg, D.J. & Gaurert, C. 2016. Sulphide and PGE distribution in the ‘Flatreef’ at Turfspruit, Northern Limb of the Bushveld Complex, South Africa. Poster presented at the 13<sup>th</sup> International Nickel-Copper-PGE Symposium 2016, Perth-Fremantle, Australia. 5–9 September.

Beukes, J.J., Van Rensburg, D.J. & Gaurert, C. 2016. Sulphide and PGE distribution in the ‘Flatreef’ at Turfspruit, Northern Limb of the Bushveld Complex, South Africa. Poster presented at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

Colliston, W.P., Schoch, A.E. & Mathee, H.L.M. 2016. Tectonic tribulations of Rodinian–Columbian vintage along the western margin of the Kaapvaal craton. Poster presented at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

Fourie, P.J. & Tredoux, M. 2016. Oxygen diffusion and geochemical speciation in abandoned gold mine tailings dams of the Witwatersrand. Paper

delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Giebel, R.J., Gauert, C.D.K., Marks, M.A.W. & Markl, G.** 2016. *Magmatic-hydrothermal processes forming the REE mineralisation in the Loolekop carbonatite of the Phalaborwa Complex, South Africa.* Poster presented at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Hansen, R.N. & Van Blerk, J.** 2016. *U and Th source term characterisation in selected Au tailings of the Witwatersrand, South Africa: A geochemical modelling and reaction network approach.* Poster presented at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Hohne, D., Hansen, R.N. & Esterhuysen, S.** 2016. *South Africa's current analytical capabilities for stable isotopes with reference to compliance monitoring for hydraulic fracturing and future legislative requirements.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Huber, M.S., Kovaleva, E., Roelofse, F. & Tredoux, M.** 2016. *Dynamics of Vredefort: Evidence for late emplacement of granophyre.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Huber, M.S., Kovaleva, E., Tredoux, M. & Roelofse, F.** 2016. *Revisiting Bon Accord: New field and petrographic data.* Paper delivered at the 8<sup>th</sup> Igneous and Metamorphic Studies Group (IMSG) Meeting, Cape Town, South Africa. 17–18 May.

**Kovaleva, E., Klötzli, U. & Habler, G.** 2016. *Planar deformation bands in zircon: A new evidence of seismicity.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Magson, J., Tredoux, M. & Roelofse, F.** 2016. *Results of a high resolution mineralogical and geochemical study within the Merensky Reef, Western Limb, Bushveld Complex.* Paper delivered at the 35<sup>th</sup> International

Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Mathee, H.L.M., Colliston, W.P. & Schoch, A.E.** 2016. *Structural analysis of the Riemvasmaak Mega Sheath Fold (RKMS) situated in the Grünau terrane of the Namaqua-mobile belt.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Mielke, C., Rogass, C., Boeschke, N.K., Segl, K., Gauert, C. & De Wit, M.** 2016. *GeoMap Base: A generic expert system mapper for imaging spectroscopy.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Netshitungulwana, R., Gauert, C., Vermeulen, D., Yibas, B. & Novhe, N.O.** 2016. *Geochemical baselines and metal deportment in the upper Olifants Primary Catchment by using stream sediment geochemistry, Witbank Coalfield, South Africa.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Ngaruye, J.-C. & Gauert, C.** 2016. *Chemistry of cassiterite, ferberite, and columbite-tantalite samples from Rwinkwavu, Bugarura-Kuluti and Musha-Ntunga mineral districts of the South-Eastern Rwanda.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Roelofse, F., Mangwegape, M. & Lehloeny, P.** 2016. *Trace element and Sr-isotopic variations in plagioclase of the Main and Upper zones, Northern and Western limbs, Bushveld Complex.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Schouwstra, R. & Dixon, R.** 2016. *Tracing the source of stolen PGM smelter products.* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

**Tredoux, M.** 2016. *Nano-entity formation prior to the crystallisation of platinum-group minerals: fundamental control by electron cloud interaction?* Paper delivered at the 35<sup>th</sup> International Geological Conference (IGC), Cape Town, South Africa. 27 August – 4 September.

## Staff

**Professor:** Prof WA van der Westhuizen.

**Associate Professors:** Profs WP Colliston, CDK Gauert, and M Tredoux.

**Senior Lecturers:** Drs JO Claassen, HE Praekelt, and F Roelofse.

**Lecturers:** Dr RN Hansen and Mr AI Odendaal.

**Junior Lecturers:** Mss J Magson, R Makhadi, and T Mapholi, and Mr R Rentel.

**Affiliated Academic/Research Staff:** Profs GJB Germs, DE Miller, R Scheepers, L Jacobson, RP Schouwstra, and AE

Schoch, Drs H Prinsloo, JC Looek, and PG Meintjes, Messrs AC Dunne, PJ Grobler, I Hunt, PG Laurens, PJ Viljoen, and MJAR Vrijens, and Ms HCF Pretorius.

**Postdoctoral Research Fellows:** Drs M Huber and E Kovaleva.

**Secretary:** Mrs PS Swart.

**Administrative Officers:** Mss R Immelman and C van der Vyver.

**Technical Support Staff:** Messrs J Choane, A Felix, and D Radikgomo, and Ms Megan Purchase.