



Department of Geology

Overview

The Department of Geology constitutes a varied menu of disciplines that includes specialities such as Geology, Geochemistry, Environmental Geology and Geochemistry as well as Mineral Resource Throughput Management. The Department of Geology is proud to serve the South African and African Mining Communities.

The year 2012 was once again an active year for the Department of Geology. An important strategy was to reduce student numbers to align the intake with the teaching and research capacity of the Department. Student numbers of the first-year intake dropped as a result of the selection process while the number of second-year students also decreased. The third-year number remains high and an increase in honours' students resulted from the high third-year numbers of the 2011 class. The honours' intake increased to

more than thirty, despite efforts to keep the intake at twenty-five.

Three senior staff members (Prof. W.A. van der Westhuizen, Dr. H. Praekelt and Prof. M. Tredoux) are nearing the end of their careers and a new appointee, Dr. Johann Claassen, joined the Department on the 1st of January 2012. Dr. Claassen will concentrate on Mineral Resource Throughput Management (MRTM) and will also add value to a number of existing courses, especially in the field of geo-metallurgy.

Activities

The well-known MINQUIZ competition for schools (Free State Province) was hosted by the Department of Geology. The Department took the task over from the Department of Chemistry that hosted the competition in the past.



Students at Namaqua Sands where heavy mineral deposit where ilmenite and other heavy minerals are mined.

Staff Members Visiting Abroad

Mrs. H.C.F. Pretorius conducted mineralogical research at the Massachusetts Institute of Technology (MIT) in Boston for three months during the latter half of 2012. She also visited the Laurentian University in Sudbury in Canada where she investigated a technique to concentrate unique minerals from samples (Bon Accord) from Barberton. This research forms part of a project under the auspices of Prof. Marianne Tredoux. Preliminary research indicates a possibility for the discovery of one or more unknown minerals. She also attended the 34th International Geological Congress in Brisbane, Australia, where she presented a paper entitled "Behaviour of Natural Radionuclides in Groundwater hosted in the Uranium-rich Granitic Basement of Vaalputs, Namaqualand, South Africa".

Dr. J. Claassen visited Brisbane during February 2012 to discuss the MRTM course with role players in Australia. Meetings were also scheduled with a number of mining companies where the aims and principles of the course were explained.

Dr. Lutz Hecht and Prof. W.-U. Reimold invited Prof. C. Gauert to visit the Natural History Museum in Berlin, Germany, where Prof. Gauert presented a public talk on "The Bushveld and Uitkomst Complexes – similarities and differences". Prof. Gauert also attended the 9th Annual Inkaba ye Africa workshop at GFZ, the German Research Centre for Geosciences, Potsdam, where he presented two research papers on topics related to the eastern Bushveld Complex.

Students, Miss E. Kotze, Miss J.J. Beukes and Mr. H.Giebel were co-authors.

Prof. Gauert attended the First European Mineralogical Conference in Frankfurt, Germany, where he was a co-author on three research papers. Prof. Gauert also attended the International LASI V Conference – Karoo 2012, in Port Elizabeth in October where he was a co-author on two papers. At the beginning of October he participated in the GeoHannover Conference in Germany where he and Mr. C. Guenther presented a paper on the mapping of deuteritic alteration and mineralisation critical for the geo-metallurgy of the Uitkomst Complex in the Mpumalanga Province.

Dr. F. Roelofse attended the 9th Annual Inkaba ye Africa workshop at GFZ, the German Research Centre for Geosciences, Potsdam, where he presented a paper on his Bushveld Igneous Complex research. Dr. Roelofse was also co-author on a paper with an Honours' student, Mr. A. Bentile, and Prof. M. Tredoux.

Prof. M. Tredoux conducted a few short overseas visits. The visits included the Bonn University, Germany, 12 – 15 November, where she had discussions with Prof. Chris Ballhaus about collaborative work which forms part of the Ph.D. work of Ms. Megan Purchase, who accompanied her on the visit. This was followed by a visit to Leoben University in Austria, 16 – 24 November, where she used the electron microprobe and Raman spectrometer with collaborators, Dr. Federica Zaccarini and Dr. Ronald Bakker. Prof. Tredoux also attended



Honours' students visit Namdeb on the Orange River where diamonds are mined.

the 9th Annual Inkaba ye Africa workshop at GFZ, the German Research Centre for Geosciences, Potsdam, Germany, from 25 – 30 November 2012. She was a co-author of five presentations with her students: Mr. A. Bentile (Hons.), Miss R. Makhadi (Hons.), Miss J. Markram (Hons), Mr. K. Milanzi (M.Sc.), and Miss M. Purchase (M.Sc.). Prof. Tredoux also presented a talk entitled “International programmes as vehicles for capacity building: An overview of Inkaba Phase 2”.

Student Matters

Miss R. Makhadi won the second prize for Best Presentation at the 9th Annual Inkaba ye Africa workshop at GFZ, the German Research Centre for Geosciences, Potsdam, Germany.

Miss J. Markram, a Magister student, visited Potsdam in Germany during November 2012 to attend the 9th Annual Inkaba ye Africa workshop where she presented a talk entitled “Mineralogical and geochemical interpretations on the pegmatoidal and non-pegmatoidal Merensky Reef, Western Bushveld Complex”. Her co-authors were Prof. M. Tredoux and Dr. F. Roelofse.

Other Magister students attending the 9th Annual Inkaba ye Africa workshop included Mr. H. Giebel, Miss M. Kotze, and Miss J.J.Beukes. All these students presented scientific talks and posters at the conference. Profs. M. Tredoux and C. Gauert put in much time and effort to manage the Inkaba ye Africa project at the UFS.

Mr. J. Clark (M.Sc.) attended the 9th International Symposium on Environmental Geochemistry (ISEG)

at Aveiro, Portugal, 15 – 22 July. He presented a paper co-authored by Profs. M. Tredoux and C. Van Huysteen. The title of the paper was “The environmental geochemistry of mercury in Bloemfontein, South Africa”.

Miss B. Kennedy, another M.Sc. student supervised by Prof. Tredoux, attended a congress on “Ophiolites” (2012) in Trabzon, Turkey, 16 – 22 May 2012, where she was presented with the prize for the best presentation. Her presentation was entitled “A novel mechanism to explain the highly enriched PGE ores in cumulus phases of ophiolite complexes”. (Co-authors were Tredoux, M. and Steyl, G.).

The postgraduate Mineral Resource Management programme is still popular with 19 students registered for 2012 (15 students enrolled for 2011). Workshops were conducted at the University of Pretoria and at the Council for Geoscience in Pretoria. The following Geology degrees were conferred in 2012: 49 B.Sc., 16 B.Sc. (Honours), five M.Sc. and seven MRM degrees, two MRM diplomas and one Ph.D. Graduates from this institution continue to be preferred by employers in the mining industry.

It is expected that student numbers will continue to decrease for the next two years after which the numbers should remain constant. First-year student numbers declined from 194 students (GLG114) in 2011 to 118 in 2012. Second-year student numbers were 85 for GLG214 (98 in 2011) while third-year numbers for GLG324 were 79 (64 in 2011). Honours' students totalled 30 (29 in 2011).



Learners enjoy a volcano experiment during SciFest Africa held in Grahamstown.



Schools in the Gold category during the oral competition of the annual Minquiz Provincial Competition.

Visitors to the Department

Prof. Lew Ashwal from the University of the Witwatersrand paid a visit to Dr. F. Roelofse in February to discuss research matters.

Mr. Dennis Hoffman from Lonmin visited the Department on 19 April 2012 and had discussions with the lecturing staff. He acted in his capacity as a member of the Minerals Education Trust Fund, an organisation representing the South African Mining Industry on the tertiary education front.

The President of the Geological Society of South Africa, Mrs. Marcia van Aswegen, visited the Department on 20 April 2012. After discussions with staff members she gave a presentation on Sable Software, a package that is applicable to the mining environment.

Mr. R. da Silva from GW Base Metals visited the Department in August 2012. GW Base metals provided a bursary to a student for an honours' project. The bursary was awarded to Mr. K.C. Mahlahlane.

The prestigious biannual Alex du Toit Lecture was hosted by the Geology Department in August 2012 where the world-renowned komatiite expert, Prof. Nick Arndt, presented a lecture covering aspects of komatiite volcanology and geochemistry.

Dr. D. Harney (Anglo-American Base Metals) also visited the Department in December 2012 to discuss matters relating to the Minerals Education Trust Fund, as well as to present a donation from Anglo-Gold Ashanti for the erection of a core store.

Mr. Deon Nel from Anglo American (Kumba Iron Ore), who conducted geological exploration around the Kolomela Mine north of Postmasburg, visited the Department of Geology in September 2012. He presented a lecture on geological exploration for iron ore and also had a contact session with the students studying geology.

Mineral Resource Throughput Management (MRTM)

The Department of Geology hosted its first winter school for students in the MRTM programme from 30 July to 1 August 2012. Thirty-five students and delegates from the industry attended the school, which included practical workshops and a mini-symposium. Case studies on mining optimisation and the application of throughput accounting and change management in the mining environment were some of the topics covered during the symposium. Students were also advised regarding aspects of the compilation of reports and mini-dissertations. It is envisaged that this winter school will become an annual event.

Geological Excursions

Mrs. H. Pretorius and Dr. J. Claassen accompanied the sixteen Mineralogy honours students to Johannesburg in March 2012. The group visited Gold One's gold plant in Springs, Mintek's research facilities and attended two seminars on analytical techniques and geometallurgy at Mintek and the University of Johannesburg (UJ), respectively.

Prof. M. Tredoux and Dr. F. Roelofse conducted their annual geochemistry/metamorphic geology excursion to the Vredefort Impact Structure during September 2012. Sixty students were introduced to phenomena relating to the impact of a large meteorite, as well as the geochemistry and metamorphic petrology of the area.

During July 2012, Prof. Gauert accompanied twenty-two honours' students on their annual economic geology visit to mines and ore deposits to investigate their nature, genesis and age relationships. This excursion lasted eight days and nine mines were visited; including Kuruman, Sishen (iron ore), Kolomela (iron ore), Aggeneys (lead and zinc), Namaqua Sands (heavy minerals) and Copperton (copper, not in production) in the Northern Cape as



Honours students collecting samples at Rosh Pinah, southern Namibia. Sphalerite is a zinc sulphide that occurs at the Rosh Pinah mine.

well as Namdeb (diamonds) and Rosh Pinah (Namibia, zinc) and Scorpion (Namibia, zinc) on the lower Orange River.

Prof. Gauert also conducted economic geology excursions to the Free State Gold Fields that constituted three groups of honours' students visiting the Tsepong, Masimong and Phakisa shafts of Harmony Gold Mines during September 2012.

Prof. Gauert also accompanied 75 third-year students for one-day visits to the New Generations group of companies' dolerite quarry (aggregates supplier to Ready Mix Concrete) in Bloemfontein-East and to the dolerite quarry on the Kimberley road for open-pit mapping.

Prof. W.P. Colliston undertook an excursion to the Free State Goldfields during March 2012 where the students were enlightened regarding the complexities of underground mapping in a deep gold mine. The Masimong Shaft of Harmony Gold Mines was used for the mapping exercise that lasted for five days. Afterwards, the students had to submit the plans that resulted from their mapping exercise.

Dr. H. Praekelt and Prof. W. Colliston took the second-year students on a number of excursions to the Austin's Post area south of Bloemfontein where they were taught the skills of geological field work, mapping and the draughting of geological sections.

Mr. A. Odendaal entertained the first-year students on a number of excursions around the Bloemfontein area to introduce them to the local geology and for them to appreciate the wonders of the Karoo Supergroup with all its geological splendour. Included in their wanderings were plant and reptile fossils, intrusive geological relationships, as well as a variety of sedimentary rocks and structures.

Dr. H. Praekelt and Mr. A. Odendaal conducted the second-year students' excursion to Barkly East and the students were exposed to the upper part of the Karoo succession consisting of mudstone, sandstone and lava. Interesting volcanological and sedimentological characteristics were studied and discussed. An ancient volcanic neck occurs in the area and this usually gives rise to intense discussions and speculation.

Degrees Conferred

Ph.D. graduate during 2012:

- **Nel, L.** The geology of the Springbok Flats. (Supervisor: Prof. W.A. van der Westhuizen).

The following M.Sc. students graduated during 2012:

- **Globig, J.** Phase relationships of Iherzolites from the Rovic mine, South Africa: a pilot study of extensive and intensive parameters using mineralogical; phase equilibria.



- **Joubert, A.** Structural-stratigraphic controls on carbon in the Witwatersrand Basin.
- **Ngaruye, J.** A petrographic and geochemical investigation of Sn-W-Nb-Ta-rich pegmatites and mineralised quartz veins in southeastern Rwanda.
- **Pretorius, H.C.F.** The content and behaviour of natural radionuclides in basement-hosted groundwater from Vaalputs, Namaqualand, South Africa.
- **Wildau, A.** An investigation of microscopic phases in the Bon Accord oxide body, Barberton region, South Africa.

Magister in Mineral Resource Management (MRM):

- Claassen, J.O.
- Henderson, D.
- Mmebe, S.G.T.
- Moller, W.R.
- Van den Heever, M.
- Van den Heever, M.B.
- Van Heerden, C.N.

Postgraduate diploma in Mineral Resource Management:

- Mogwera, K.G.
- Sheppard, D.A.

Community Service

Although Inkaba no longer supports the EarthWISE outreach project, Inkaba students acted as facilitators for the EarthWISE participation in SciFest 2012, TecnoX 2012 and the 2012 MinQuiz competition, and helped with an enrichment weekend for science teachers and learners in the Northern Cape. EarthWISE activities for 2012 included the following:

Geology boxes

Ten Geology boxes were made for the Department of Education. Only different rocks were requested. Three different sedimentary rocks, two igneous rocks and four metamorphic rocks were included in the boxes.

Science Unlimited, Bethlehem (8 & 9 March)

EarthWISE participated in the Science Unlimited Meeting in Bethlehem. The coordinator had a presentation entitled: "Whoa! My continent is moving!" The sessions were sold out and were presented eight times each of the two days with the classroom filled to the brim. The presentations entertained grade 8 – 10 learners from different schools.

SciFest Africa, Grahamstown (14 – 20 March)

EarthWISE assisted the science exhibition of the Faculty of Natural and Agricultural Sciences, UFS, at the annual SciFest in Grahamstown. The theme of the festival was "Science Rocks" and the Faculty's theme was "Journey to the centre of the Earth".

Second Science & Technology Train and Space Geodesy Observatory Workshop, Matjiesfontein (15 April – 21 April)

EarthWISE attended the above-mentioned workshop and delivered a presentation entitled: "Vehicle Science Centre from the S&T train".

Kovsie Open Day, University of the Free State, Bloemfontein (1 May)

EarthWISE organised an interactive exhibition for the Department of Geology to encourage learners to study geology.

Minquiz Provincial Competition, UFS, Bloemfontein (10 May)

The EarthWISE coordinator was responsible for organizing the annual Minquiz Provincial Competition in conjunction with Mintek and the Department of Geology. Thirty-nine Free State schools participated in the competition where the top three schools in the Platinum and Gold category walked away with prize money. The two highest scoring learners in the written test were invited to take part in the National Minquiz Competition in Randburg.

Astronomy Fair, UFS, Bloemfontein (19 July – 21 July)

The University of the Free State presented an Astronomy Fair and invited EarthWISE to attend. The first two days of the fair was for UFS101 students only, but it was open to the public on the last day. An exhibition was set up with meteorites, rock samples from the Vredefort Dome and posters explaining the different types of meteorites, and the difference between the different space objects and craters.

National Science Week, Boyden Observatory, Bloemfontein

The National Science Week was held from 30 July to 3 August 2012 and Boyden Observatory invited EarthWISE to form part of the activities at their site. Interactive presentations and experiment sessions were held for eight schools throughout the week. It was entitled "Meteorites, Impacts & Mass Extinction" and learners were shown rock samples of impact sites and real meteorites. Learners conducted their own experiments where they made moon craters.

Science Day, De Aar (24 & 25 October)

EarthWISE again presented the Science Day at De Aar High School. Six science presenters and a marketing manager participate in this day and they presented lectures to around 300 learners.

Interaction with Industry

Samancor Chrome, Eastern Chrome Mine, African Rainbow Minerals / Nkomati Mine, Norilsk Nickel, Dt. Rohstoff AG, Harmony Gold Mines, Two Rivers Platinum (ARM-Impala), Exxaro, and AngloGold Ashanti.





Research Outputs

Department of Geology

Research Articles

Colliston, W.P., Schoch, A.E. & Praekelt, H.E. 2012. Stratigraphy of the Mesoproterozoic Aggeneys Terrane, Western Namaqua Mobile Belt, South Africa. *South African Journal of Geology* 115(4): 449-464.

Roelofse, F. & Ashwal, L.D. 2012. The lower Main Zone in the Northern Limb of the Bushveld Complex - A >1.3 km thick sequence of intruded and variably contaminated crystal mushes. *Journal of Petrology* 53(7): 1449-1476.

Zintwana, M.P., Cawthorn, R.G., Ashwal, L.D., Roelofse, F. & Cronwright, H. 2012. Mercury in the Bushveld Complex, South Africa and the Skaergaard intrusion, Greenland. *Chemical Geology* 320-321: 147-155.

Chapter in Book

Tredoux, M. 2012. The mixed blessing of large mineral resources. In: *Terra*, edited by A. Lamprecht and I. Powel. Cape Town: SoSo Press. pp. 96-109.

Book

Roelofse, F. 2012. *Mineralogical, geochemical and isotopic constraints on the evolution of the lower Main Zone and Platreef on the Northern Limb of the Bushveld Complex: Bulletin 141*. Pretoria: Council for Geoscience.

Staff

Professor: Prof. W. Van der Westhuizen.

Associate-professors: Profs. W. Colliston, C. Gauert, and M. Tredoux.

Senior Lecturers: Drs. H. Praekelt, F. Roelofse and J. Claassen.

Junior Lecturers: Ms. H. Pretorius and Mr. A. Odendaal.

Part-Time Lecturers: Drs. J. Loock and L. Nel.

EarthWise-officer: Ms. M. du Plessis.

Affiliated Lecturers: Messrs. A. Dunne, J. Grobler, I. Hunt, P.G. Laurens, R. Vrijens, Dr. P. Viljoen, and Dr. H.B. Prinsloo.

Senior Officer: Ms. R. Immelman.

Secretary: Ms. P. Swart.

Technician: Mr. A. Felix.

Officer: Professional Services: Mr. P. Roodt.

Assistant Officer: Mr. J. Choane.

Technical Officer: Mr. D. Radikgomo.



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