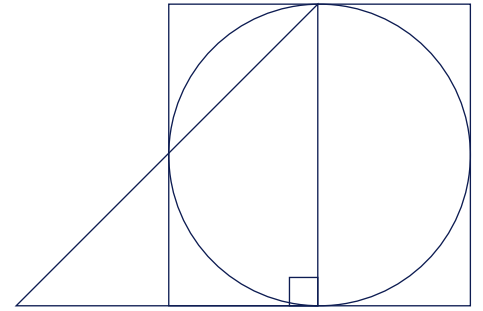


# Report

05/06



## Faculty of Natural and Agricultural Sciences



# Faculty of Natural and Agricultural Sciences

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Lacea Loader  
Leonie Bolleurs

*Language revision*  
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*Layout and cover design*  
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## Contact details

### *Dean*

Prof. Herman van Schalkwyk  
+27 51 401 2535  
[hvs.sci@ufs.ac.za](mailto:hvs.sci@ufs.ac.za)

### *Vice-Dean*

Prof. Neil Heideman  
+27 51 401 3855  
[heidemannj.sci@ufs.ac.za](mailto:heidemannj.sci@ufs.ac.za)

### *Office of the Dean*

Ms Lorinda Rust  
+27 51 401 2322  
[rustl.sci@ufs.ac.za](mailto:rustl.sci@ufs.ac.za)

### *Faculty Manager*

Ms Corné Havemann  
+27 51 401 2490  
[havemach.sci@ufs.ac.za](mailto:havemach.sci@ufs.ac.za)

### *Liaison*

Mr Nelis Maeder  
+27 51 401 2531  
[maedecj.stg@ufs.ac.za](mailto:maedecj.stg@ufs.ac.za)

### *Physical address of the office of the Dean*

Room 9A, Biology Building, Main  
Campus, Bloemfontein

### *Postal address*

University of the Free State  
PO Box 339  
Bloemfontein  
South Africa  
9300

### *Fax*

+27 51 401 3728

### *Faculty website*

[www.ufs.ac.za](http://www.ufs.ac.za)

# From the Dean's office



*Prof. Herman van Schalkwyk.*

The Faculty of Natural and Agricultural Sciences at the University of the Free State (UFS) leads the way in the practising of natural and agricultural sciences in South Africa and the highest levels of quality and credibility are reflected.

Our commitment, however, reaches far beyond just this. It reaches beyond the borders of the country and across continents; its multi-disciplinary and practical approach is vested in all the disciplines presented by the faculty.

In 2005/06 the Faculty experienced significant growth in measurable outputs. A contributing factor was the comprehensive apparatus strategy and plan which was implemented in 2005. With this strategy, university funds were used to leverage other funds in order to obtain huge discounts from suppliers of apparatus. In this way the faculty managed to obtain almost R50 million worth of apparatus in 2005.

The strategy was continued in 2006 when an agreement to the value of R7 542 531 was reached with Shimadzu, according to which apparatus was supplied to the faculty at discount prices. The agreement, which is valid for three years, entails the free replacement of apparatus which is purchased during this period with upgraded versions.

The new apparatus forms part of the UFS vision to compete internationally with quality research outputs in certain niche areas, to provide leadership in advanced training to students from the African continent and to establish the university as a leader among South African universities.

Two researchers with a B rating from the National Research Foundation (NRF) were also appointed. Both of these initiatives bore fruit and in 2006 the faculty increased its total research outputs by

about 13%. As an example, the Department of Chemistry's outputs increased by 100%.

The faculty has been bursting at the seams over the past couple of years. Student figures rose from 3 935 undergraduate, postgraduate and occasional students in 2005, to 4 224 in 2006. There is also strong representivity of students from other African countries and in 2005/06 almost 600 students studied at the faculty.

An extended B.Sc. programme has been presented to students since 2005. The programme aims at providing students who do not comply with all the requirements for the B.Sc. programme with the necessary sub-structure to complete the B.Sc. degree successfully. A preliminary evaluation of the results indicates that the programme is delivering the desired results.

The alignment of the Qwaqwa Campus, which was incorporated into the UFS in January 2003, remains a challenge. Regular discussions are held with staff on the campus in order to make the faculty's programmes more sustainable and to align it with the broader strategic plan of the UFS.

On a national level, the faculty is in the process of making its mark in terms of teaching and community service. In 2005 the faculty again actively began utilising its

experimental farms. A three-way agreement between the UFS, the National Farmers Union (NAFU) and the Mangaung Local Municipality led to the establishment of the Lengau Agricultural Development Centre on the Sydenham Experimental Farm. The centre provides training and mentorship to small-scale upcoming farmers.

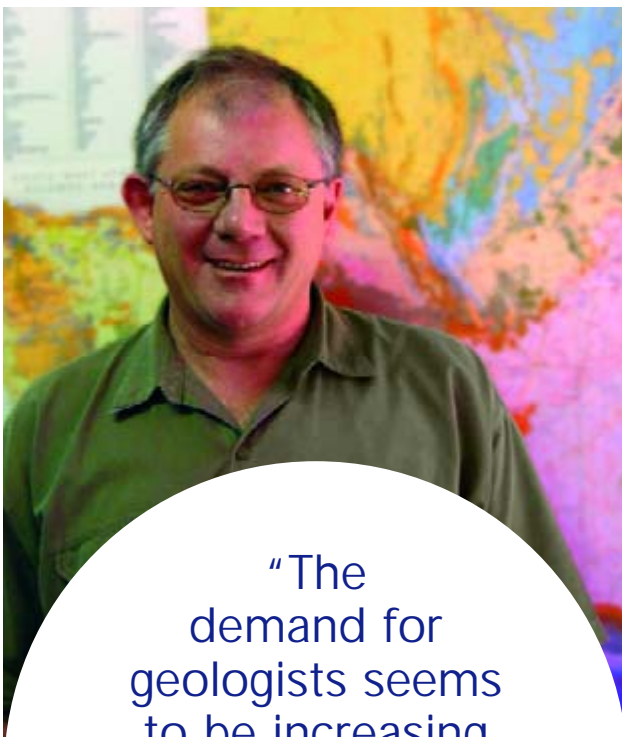
To be dynamic and progressive requires innovative thinking. It requires commitment and a desire to deliver excellent teaching and learning opportunities to students. It requires a willingness to form partnerships, and a multi-disciplinary and practical approach to the tertiary education environment in South Africa.

This report covers the faculty's activities in 2005/06. It is a reflection of two years' commitment on the part of a team of skilled and motivated academics and support staff.



**Prof. Herman van Schalkwyk**

Dean: Faculty of Natural and Agricultural Sciences  
University of the Free State



“The demand for geologists seems to be increasing with exploration programmes on a global scale.”

Prof. Willem van der Westhuizen.

## Overview

The vision of the Department of Geology is to play a prominent role in a global geological context by means of innovative and entrepreneurial paradigms and actions.

In 2005 the department boasted with 19 honours students. This trend continued with 2006 following the same pattern with an increase in activities and student numbers. Honours student numbers rose to 23, the highest number in the history of the department. This growth is linked to the economy and the increase in commodity prices, with the demand for geologists increasing as a result of exploration programmes on a global scale.

In both 2005/06 honours students have completed or are in the process of completing a number of research projects on gold mines amongst others, and research has been conducted into the geological effects of blasting in the Phalaborwa Mine.

The continued rise in student numbers, as well as the demand for graduates in geology in South Africa, has continued unabated. The gold and platinum industries especially, are employing many of our graduates. Students with honours degrees were employed by uranium, gold and platinum mining and exploration companies.

During 2005 two Ph.D. students, Dr Gerard Letlatsa and Dr Leon Jacobson, completed their studies. The titles of their theses are respectively: *Geological conditions and environmental impact of the Mohale Dam, Lesotho Highlands Water Project* and *The application of compositional analysis to provenance studies of archaeological pottery in Southern Africa: A geochemical perspective using XRF spectrometry.*

Two more Ph.D. projects were initiated, both of which are related to the Uranium Research Project. These are entitled: *A subsurface basin analysis of the Karoo Supergroup in the Springbok Flats area, north of Pretoria* and *Environmental toxicity and exploration techniques in the Karoo Uranium Province.*

In 2006 one Ph.D. project was initiated which is jointly supervised by Proff. Marian Tredoux from the Department of Geology and Peter



“Students with honours degrees were employed by uranium, gold, platinum mining and exploration companies.”

Holmes from the Department of Geography. It is entitled: *A new perspective on the geohydrological and surface processes controlling the depositional environment at the Florisbad archaeozoological site.*

In 2005 nine M.Sc. students researched various aspects of geology including gold and

platinum research, coal geology, base metals, meteorites, sedimentology, and Mineral Resource Management (mineralogy/metallurgy).

During 2006 one M.Sc. student completed his studies. The title of his thesis is: *The relationship between geological structures and shortwall mining at Matla Collieries, Mpumalanga.*

In 2005 six degrees and one postgraduate diploma in Mineral Resource Management (MRM) were awarded, while 2006 saw the awarding of two MRM degrees and two postgraduate diplomas to students who completed their studies. Workshops for the MRM courses were conducted in Midrand and in Pretoria.

Prof. Tredoux, Dr Christoph Gauert, Ms Annegret Lombard and two students travelled to Mozambique to attend the 21st Colloquium of African Geology, where a number of research papers were read. Dr Gauert and Prof. Herman van Schalkwyk, Dean: Faculty of Natural and Agricultural Sciences also travelled to Germany to attend the 5th Annual Meeting of the *Inkaba Ye Africa* project, a collaboration project between German and South African scientists. Prof. Tredoux visited the Environmental Inorganic Geochemistry

Group laboratory (EIGG) at Curtin University of Technology in Perth, Australia as well as the Department of Geology at the University of South Australia in Adelaide to discuss collaboration. She also attended the 16th Annual VM Goldschmidt Conference in Melbourne where she and co-authors read two papers.

Prof. Tredoux recorded eight radio sessions on *Radio Sonder Grense* and *Radio Rosestad*. In addition to her postgraduate students at the UFS, she is also co-supervisor of two M.Sc. students at the University of Cape Town.

Ms Lombard attended the 3rd Conference of the Association of African Women Geoscientists in El Jadida, Morocco where she presented some of her research on meteorites. She also organised the prestigious Alex du Toit Memorial Lecture that was presented by Prof. Uwe Reimold.

Equipment is an integral part of the department. The department gratefully acknowledges support of the faculty in the purchase of a new AXIOS XRF spectrometer for analysing rocks and minerals. This state-of-the-art piece of equipment will add value to research in the department and will also be of use to other departments in the Faculty of Natural and Agricultural Sciences.



Chromite layers at the Dwarsrivier National Monument site in Mpumalanga.



Other equipment in the department includes:

- **Electron microprobe:** This piece of equipment has been operational since 1984. It contributed to research and publications until 2005.
- **X-ray diffraction:** The diffractometer is 16 years old and is still functioning effectively. X-ray diffraction also finds application in other departments in the faculty.
- **Fluid inclusion laboratory:** This laboratory has also contributed data for research over the past two decades. In 2006 fluid inclusion research was applied in the field of semi-precious stones (tanzanite).
- **Research Microscope:** During 2006 the department purchased ten Olympus research microscopes for teaching purposes. These microscopes will enhance research, especially in the fields of mineralogy and petrology.

The department has worked in collaboration with a number of institutions both locally and internationally:

#### Local

- Department of Geology, University of Natal, Durban
- Department of Geology, University of Pretoria
- Department of Geology, University of the Witwatersrand
- Department of Geology, University of Cape Town
- Kumba Resources
- BHP Billiton plc.
- Harmony Mining Company Ltd.
- Eysizwe Coal
- Council for Geosciences, Pretoria
- South African Committee for Stratigraphy
- XStrata SA (Pty) Ltd.
- Metorex (Pty) Ltd.
- African Rainbow Minerals (Pty) Ltd.
- Exxaro Resources Ltd.

#### International

- Department of Geology, Imperial College, London, UK
- Royal School of Mines, Department of Geology, UK
- Department of Geology, Martin Luther University of Halle-Wittenberg, Germany
- GKSS Research Centre Geesthacht, Germany
- Federal Institute for Geosciences and Natural Resources (BGR) in Hannover, Germany
- French National Centre for Scientific Research (CNRS), Nancy, France
- Global Mineral Resources Assessment Project Central to Southern Africa (*US Geological Survey*)
- Department of Geology, University of Modena e Reggio Emilia, Italy

For 2005/06 the department received funding to the value of R2 158 664 from a number of institutions.

Staff members in the department are currently conducting research on uranium. A sharp rise in the price of uranium created an urgent need for such research. The price of the metal has, since January 2003, increased from US\$9 to over US\$36 per pound in January 2006 and to US\$ 75 in January 2007. This increase in the price led to an escalating interest in uranium ores, especially as a result of declining fossil fuel reserves and increasing oil prices. Work on uranium and molybdenum mineralisation commenced early in 2005 on a contractual basis between the department and an international mining and exploration company. This company approached the department to conduct research, and a contract for R1,4 million over three years has been negotiated.

The research continued during 2006 and included the nature and genesis of uranium deposits as well as the geology and stratigraphy of the central Karoo region, mineralogy of U-mineralisation, geochemistry of the ore deposits, geo-botanical aspects, radon occurrences, exploration techniques, analytical methods, fluid movement through different formations and factors controlling pathways and areas of mineralisation. Other departments in the faculty also participate in a variety of projects. As these projects progress, a number of students will be working towards higher degrees in these fields. As the project progresses, a number of students will be working towards higher degrees in these fields. An M.Sc. student, Mr Peter Saffy, started a research project and has completed field work in the Aberdeen and Beaufort West area. This research could be extended to a number of other countries in Africa and elsewhere.

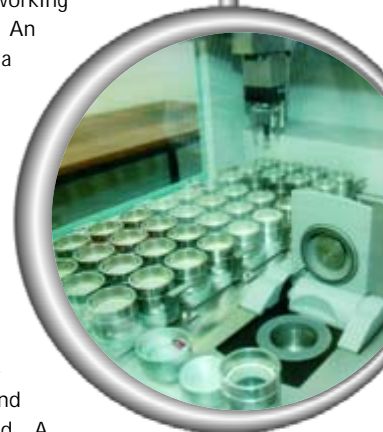
Another topic researched by the department is that of the Witwatersrand gold deposits. This topic forms part of the department's traditional research domain. Interesting research on both the Free State goldfields and the West Rand goldfields is presently being conducted. A study on the pre-B Reef topography in the Free State goldfields is assisting with the prediction of the continuation of mineralised areas. Mineralogical studies and structural interaction in the Carletonville area are revealing new insights into the origin of the Witwatersrand gold mineralising event.

Another traditional area of research in the department is the Namaqua Metamorphic Complex. Publications from earlier research are still forthcoming, and researchers from this department are probably the most knowledgeable in South Africa in this field. Some research is still being conducted on selected aspects of this field.

The Ventersdorp Supergroup has formed an important component of the research in the department for many years. Although recently scaled down, this research will receive renewed attention in the years to come.

Researchers are also conducting research in the field of African geology. A new thrust will be directed towards Tanzania where many opportunities exist. A number of students have already been identified for postgraduate studies in Tanzania. Staff members and students will be involved in research covering the petrology of mafic complexes as well as the genesis and distribution of semi-precious stones such as gem-quality zoisite ("tanzanite").

In 2006 one student, Ms Palesa Langa, was doing mineralogical and geochemical as well as fluid inclusion research under the supervision of Prof. Reyno Scheepers and Dr Gauert. More stu-



dents will enrol for magister projects during 2007.

Sedimentological research on various aspects such as alluvial diamond occurrences and comparative studies relating to similarities between the deposition of modern analogues with ancient examples from the Witwatersrand deposits are also being investigated.

Research on rare minerals is also on-going and the possibility of acquiring new equipment such as a mineral analyser will open up new avenues of research.

Economic geology research on ore genesis is being investigated by Dr Gauert and students. Dr Gauert and M.Sc. student, Mr Lourens Joubert, are researching the ore genesis and geochemistry of the Nkomati Ni-Cu-PGE mine (XStrata), Uitkomst Complex near Badplaas. Dr Gauert and honours students also completed research on the Vergevoeg Fluorite-Hematite Deposit near Rust de Winter (Metorex (Pty) Ltd.).

Platinum geochemistry is being researched by Prof. Tredoux and Dr Gauert with their postgraduate students.

Research into meteorites also forms part of this department's activities. This is done by Ms Lombard under the supervision of Prof. Tredoux.

Structural and stratigraphical aspects of the rocks of the Kango Group are being researched by Dr Hermann Praekelt and students.

### Academic staff

**Professor Researcher:** Prof. Willem van der Westhuizen

**Associate Professors:** Proff. Wayne Colliston, Marian Tredoux

**Senior Lecturers:** Drs Christoph Gauert, Hermann Praekelt (Programme Director)

**Junior Lecturers:** Mr Nicolaas Scholtz, Ms Annegret Lombard

**Part-time Professors:** Proff. Aylva Schoch, Reyno Scheepers

**Part-time Lecturer:** Mr Leon Nel (resigned at the end of 2006)

**Affiliated Lecturers:** Prof. Gerhard Beukes, Messrs Johan Loock, Petrus Laurens, Petrus Grobler, Andre Dunne, Derek Hall, Ms Vanessa Lickfold, Judith Diedericks

### Contact details

Prof. Willem van der Westhuizen  
Department of Geology  
University of the Free State  
PO Box 339  
Bloemfontein  
South Africa  
9300

Telephone: +27 51 401 2515  
Fax: +27 51 401 3815  
E-mail: [vdwestwa.sci@ufs.ac.za](mailto:vdwestwa.sci@ufs.ac.za)  
Website: [www.ufs.ac.za](http://www.ufs.ac.za)



Honours students from the department visited the Sheba Mine (gold mine) in Barberton during the annual student tour in September 2006. They used this opportunity to investigate one of the new stops.

# Research outputs

## Publications

Coetzee, M.S., Beukes, G.J., De Bruijn, H. & Bisschoff, A.A. 2006. Geochemistry and petrogenesis of tholeiitic intrusions of possible Bushveld-age in the Vredefort Dome, South Africa. *Journal of African Earth Sciences* 45: 213-235.

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## Chapters in books

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# Statistical data of the faculty





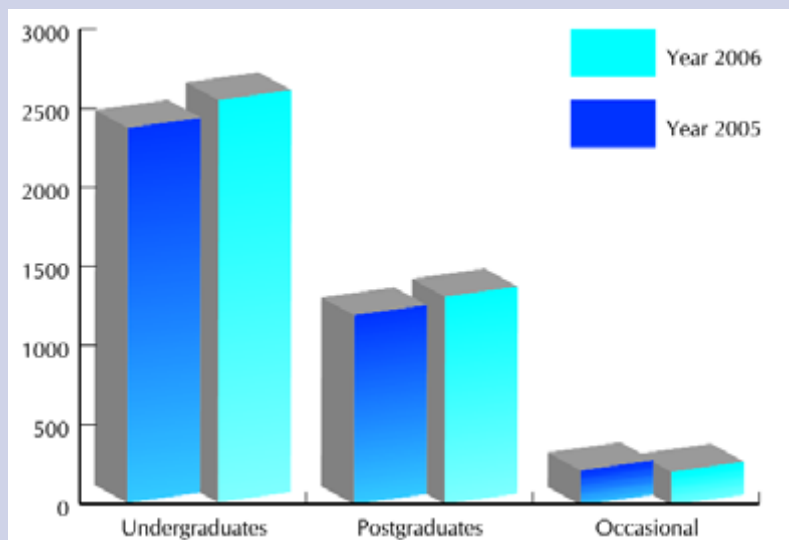
# Student figures

Faculty of Natural and Agricultural Sciences, 2005/06

Male					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	676	31	26	724	1457
Postgraduate	351	22	15	400	788
Occasional	84	3	4	17	108
<b>Total 2005</b>	<b>1111</b>	<b>56</b>	<b>45</b>	<b>1141</b>	<b>2353</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	729	28	21	768	1546
Postgraduate	385	21	16	431	853
Occasional	68	2	2	23	95
<b>Total 2006</b>	<b>1182</b>	<b>51</b>	<b>39</b>	<b>1222</b>	<b>2494</b>

Female					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	563	41	11	394	1009
Postgraduate	206	16	11	221	454
Occasional	101	5	2	11	119
<b>Total 2005</b>	<b>870</b>	<b>62</b>	<b>24</b>	<b>626</b>	<b>1582</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	641	39	17	401	1098
Postgraduate	243	15	17	234	509
Occasional	103	2	2	16	123
<b>Total 2006</b>	<b>987</b>	<b>56</b>	<b>36</b>	<b>651</b>	<b>1730</b>

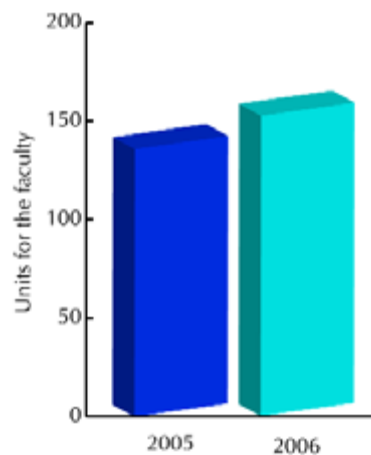
Total					
2005					
Description	African	Coloured	Indian	White	Total
Undergraduate	1239	72	37	1118	2466
Postgraduate	557	38	26	621	1242
Occasional	185	8	6	28	227
<b>Total 2005</b>	<b>1981</b>	<b>118</b>	<b>69</b>	<b>1767</b>	<b>3935</b>
2006					
Description	African	Coloured	Indian	White	Total
Undergraduate	1370	67	38	1169	2644
Postgraduate	628	36	33	665	1362
Occasional	171	4	4	39	218
<b>Total 2006</b>	<b>2169</b>	<b>107</b>	<b>75</b>	<b>1873</b>	<b>4224</b>



Student figures

Student nationality		
Nationality	2005	2006
Angola	1	
Asian countries	21	18
Botswana	20	20
European countries	6	6
Lesotho	142	142
Malawi	2	1
Mauritius		2
Mozambique	8	7
Namibia	40	42
No information	1	
North America	4	4
Other Africa	45	48
South Africa	3610	3893
South America		1
Swaziland	13	13
Zambia	4	6
Zimbabwe	18	21
<b>Total</b>	<b>3935</b>	<b>4224</b>

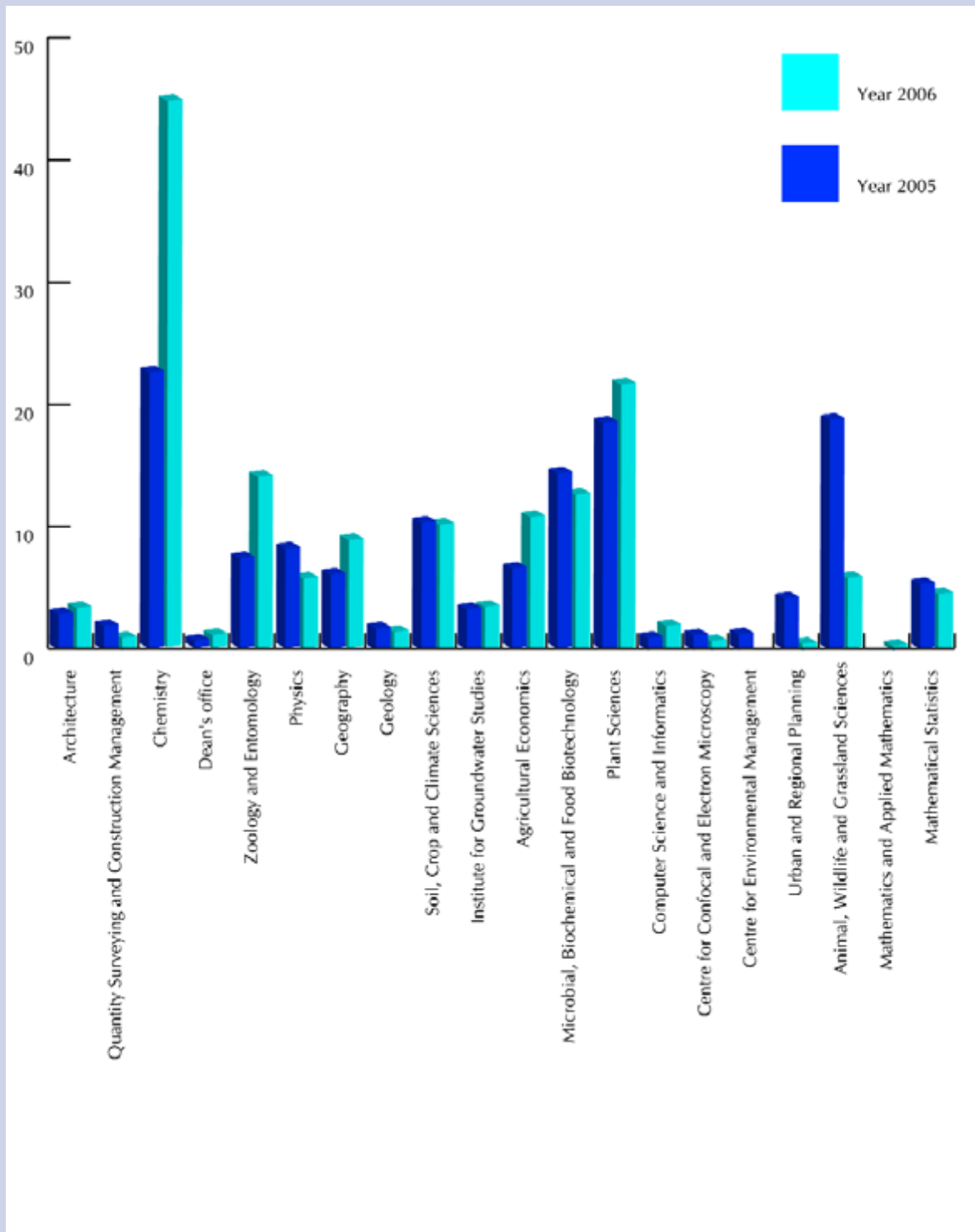
## Research outputs for the Faculty of Natural and Agricultural Sciences



Articles published in accredited approved research journals.

## Departmental research outputs

Articles published in accredited approved research journals, 2005/06



# Glossary



# Glossary

## A

ACIAR	Australian Centre for International Agricultural Research
AEASA	Agricultural Economics Association of South Africa
ALPRU	African Large Predator Research Unit
ARC	Agricultural Research Council
ARMSCOR	Armaments Corporation of South Africa
ARS	Agri Risk Specialists
ASAQS	Association of South African Quantity Surveyors
ASSA	Anatomical Society of South Africa
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AVS	American Vacuum Society

## C

CANSA	Cancer Association of South Africa
CATSA	Catalysis Society of South Africa
CBD	Convention of Biological Diversity
CCEM	Centre for Confocal and Electron Microscopy
CePHMa	Centre for Plant Health Management
CfPB	Centre for People and Buildings
CIAT	International Centre for Tropical Agriculture
CIDB	Construction Industry Development Board
CIMMYT	International Maize and Wheat Improvement Centre
CIOB	Chartered Institute of Building
CIOB-SA	Chartered Institute of Building - South Africa
CSACEE	Central South African Council on Economic Education
CSIC-INTA	Centro de Astrobiología
CSIR	Council for Scientific and Industrial Research
CSIRO	Commonwealth Scientific and Industrial Research Organisation

## D

DEAT	Department of Environmental Affairs and Tourism
DiMTEC	Disaster Management Training and Education Centre for Africa
DMISA	Disaster Management Institute of South Africa
DST	Department of Science and Technology

## E

EAAP	European Association for Animal Production
EASA	Education Association of South Africa
ECA	European Crystallographic Association
EIGG	Environmental Inorganic Geochemistry Group
EPWP	Expanded Public Works Programme
ESBES	European Symposium on Biochemical Engineering Science
ESREL	European Safety and Reliability
ESRP	Economic and Social Rehabilitation Programme

## F

FAO	Food and Agriculture Organisation
FEMS	Federation of European Microbiological Societies
FMP	Facilities Management Programme
FOTIM	Foundation of Tertiary Institutions of the Northern Metropolis

## FSRPO

Free State Red Meat Producers Organisation

## G

GIS	Geographical Information Systems
Glen ADI	Glen Agricultural Development Institute
GM	Genetically Modified
GMBA	Gauteng Master Builders' Association
GMO	Genetically Modified Organisms
GWK	Griekwaland-Wes Koöperasie

## H

HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
HPLC	High Performance Liquid Chromatography
HSPCM	Health and Safety Programme for Construction Managers

## I

IAGOD	International Association on the Genesis of Ore Deposits
IAH	International Association of Hydrogeologists
ICCC	International Conference on Coordination Chemistry
ICEC	International Cost Engineering Council
ICID	International Commission on Irrigation and Drainage
ICP	Inductively Coupled Plasma
ICRBM	International Conference on Rodent Biology and Management
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDC	Industrial Development Corporation
IGS	Institute for Groundwater Studies
IITA	International Institute of Tropical Agriculture
INCRoP	Insects on New Crops Programme
INTSORMIL	International Sorghum and Millet Research Support Programme

## IPMA

International Project Management Association

## IPMP

Intensive Project Management Programme

## IRDP

Institutional Research and Development Programme

## IRWH

In-field Rainwater Harvesting

## IUCr

International Union of Crystallography

## IUMS

International Union of Microbial Societies

## IUPAP

International Union of Pure and Applied Physics

## J

JFM	Journal of Facilities Management
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## L

LExEn Life in Extreme Environments

## M

MIRCHEN	Microbiological Resources Centre
MIT	Massachusetts Institute of Technology
MRM	Mineral Resource Management
MSA	Master's Degree in Sustainable Agriculture
MSSA	Microscopy Society of Southern Africa
MUCPP	Mangaung University Community Partnership Programme
MURP	Master's Degree in Urban and Regional Planning

## N

NaCOF	National Climate Outlook Forum
NAFU	National African Farmers Union
NAMC	National Agricultural Marketing Council
NASA	National Aeronautics and Space Administration
NASSP	National Astrophysics and Space Science Programme
NCEE	National Council for Economic Education
NDA	National Department of Agriculture
NECSA	National Energy Commission of South Africa
NELSAM	Natural Earthquake Laboratory in South African Mines
NERPO	National Emergent Red Meat Producers' Organisation
NGO	Non-Governmental Organisation
NML	National Metrological Laboratory
NMMU	Nelson Mandela Metropolitan University
NMR	Nuclear Magnetic Resonance
NRF	National Research Foundation
NUFU	Norwegian Council of Universities Committee for Development, Research and Education
NWGA	National Wool Growers' Association

## O

OABS	Optimal Agricultural Business Solutions
OECD	Organisation for Economic Co-operation and Development

## P

PARSA	Parasitological Association of Southern Africa
PDMIW	Processing and Disposal of Mineral Industry Wastes
POT	Peaks over Threshold
PPP	Public Private Partnership
PRT	Protein Research Trust

## R

RICS	Royal Institute of Chartered Surveyors
RIEP	Research Institute of Education Planning
RNA	Research Niche Area
RPO	Red Meat Producers' Organisation

## S

SA	South Africa
SAACE	South African Association of Consulting Engineers
SAB	The South African Breweries Limited
SACI	South African Chemical Institute
SACPCMP	South African Council for the Project and Construction Management Profession
SACPVP	South African Council for the Property Valuation Profession
SACQSP	South African Council for the Quantity Surveying Profession
SADC	Southern African Development Community
SAFMA	South African Facilities Management Association
SAFOI	South African Fryer Oil Initiative
SAIP	South African Institute of Physics
SAISC	Southern African Institute of Steel Construction
SAMSI	Statistical and Applied Mathematical Sciences Institute

SANCIAHS	South African National Committee for the International Association of Hydrological Sciences	SEDA	Small Enterprise Development Agency	UNEP	United Nations Environment Programme
SANCU	South African National Consumer Union	SMME	Small, Medium and Micro Enterprises	UNESCO	United Nations Educational, Scientific and Cultural Organisation
SANPAD	South Africa-Netherlands Research Programme on Alternatives in Development	SRC	Student Representative Council	USA	United States of America
SAPOA	South African Property Owners' Association	SRL	Sustainable Rural Livelihood	USAID	United States Agency for International Development
SAPS	South African Police Services	SSAG	Society of South African Geographers	UTCHEM	University of Texas Chemical Compositional Simulator
SAQA	South African Qualifications Authority	<b>T</b>		UWC	University of the Western Cape
SASAS	South African Society for Animal Science	THRIP	South African National Research Foundation Thrust for Industry-Related Projects	<b>W</b>	
SASQUA	Southern African Society for Quaternary Research	TUE	Technical University Eindhoven	WARFSA	Water Research Fund of Southern Africa
SAVAH	South African Association of Visual Arts Historians	<b>U</b>		WATOC	World Association of Theoretically Orientated Chemists
SBE	Sustainable Built Environments	UCT	University of Cape Town	WFP	World Food Programme
		UFS	University of the Free State	WITS	University of the Witwatersrand
		UJ	University of Johannesburg	WRC	Water Research Commission
		UK	United Kingdom	WUA	Water Users' Association
		UN	United Nations		