RHODES UNIVERSITY
Where leaders learn

RHODES GEOLOGY

DEPARTMENT OF GEOLOGY

Recumbent folds in Silurian quartzites in Meiringspoort

GEOLOGY STUDENT HANDBOOK 2018

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WEB SITE: http://www.ru.ac.za/geology

An **electronic version of this handbook** can be found on the Geology website.

◆INTRODUCTION◆

🕮 WHAT IS GEOLOGY?

Geology is the scientific study of Earth, a complex, dynamic planet whose interior and surface are subject to continuous modification by a variety of processes. Geology aims at documenting and understanding these processes and how they have changed through time. This is achieved through studying rocks - their composition and properties, the sequence in which they occur, the minerals and fossils they might contain, their age and relationships to one another. Every rock contains a record of its history and the process by which it formed. Geology aims to read that record through scientific investigation, and using the information to reconstruct Earth history and processes, and to locate mineral deposits for use in developing and developed countries.

Our planet is dynamic. Earth has a molten nickel-iron core that is responsible for the Earth's magnetic field. Energy escaping from the core is expended at the surface of the Earth by the moving of the large lithospheric plates and by volcanism. Plate movements are responsible for creating many of the surface features of the planet including large fold mountain belts such as the Andes and Himalayas, and are also responsible for the formation of basins in which sediment eroded from these mountains is finally deposited. Earth has, with time, evolved into a chemically differentiated planet, as geological processes have resulted in the formation of the iron core, silicate outer solid Earth, the oceans and atmosphere. The origin and evolution of life on Earth is intimately related to the geological evolution of the planet.

The evidence for the complex evolution of Earth and the interaction of its different parts lies in rocks formed throughout Earth history. In Geology one learns to search for this evidence and to decipher the message in the rocks. In this regard Geology is largely a descriptive, interpretive and historical science. This is not to say that Geology is not a true science or is non-quantitative. Much of the "description" in modern geological studies involves obtaining a wealth of quantitative data and the "interpretation" requires rigorous analysis of such data. It is well to remember that the Earth is a complex chemical system subject to a variety of physical forces. Sound knowledge of the laws of chemistry and physics is a powerful tool for a geologist. Another important factor in geology is time. The Earth is about 4600 million years old, an intangible quantity in human experience. The magnitude of the time periods within which geological evolution operates sets Geology apart from other sciences (except Astronomy).

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🕮 WHAT SHOULD I STUDY WITH GEOLOGY?

Geology is an extremely broad science, and experience in almost any other science course can support and benefit a geologist. If one views Geology as a study of the physics and chemistry of the Earth then it is clear that a solid grounding in physics and chemistry is important in the education of a geologist. It is no small wonder that two of the largest subdisciplines of Geology are **geophysics** and **geochemistry**. Those with a particular interest in the evolution of life (**palaeontology**) should seek to combine their Geology studies with appropriate courses in life sciences.

One should not underestimate the interaction between Geology and our modern human society, whether it concerns the exploitation and utilization of **mineral resources**, the mitigation of natural disasters covered by **tsunami**, **volcano**, **flood**, **landslide** and **earthquake** activity, the conservation and effective use of soil and water resources, or the planning and construction of roads, bridges, tunnels, dams and new urban areas. There is currently widespread interest in **climate** change, particularly global warming. Geology is crucial to climate change research, first because the record of climate change is preserved in rocks and ice and a knowledge of this record is vital for predicting future changes; and secondly, because geological processes may also result in climate modification. Investigating all these **environmental**

problems requires significant from the geologist and those with interest in these areas should combine Geology with studies in geography, environmental science, engineering and economics. Students wishing to major in Geology should choose courses which, together with Geology semester credits, build as strong a science degree as possible.

Another factor to bear in mind is that geologists study the whole Earth and there are world-wide employment opportunities for geologists. Although a sound knowledge of English is essential for a career as a scientist, a working ability with other European languages considerably enhances the capacity of geologists, particularly those employed in mineral exploration, to function in the field. Students might seriously consider taking a course in French or Spanish in their degree curriculum.

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🕮 WHAT IS EXPECTED OF ME, THE STUDENT?

As an undergraduate student, you are expected to be responsible for a 40-hour work week, divided amongst your required major courses, consisting of contact (lecture) time, assigned practicals, and any additional assigned work, lecture preparation, reading, etc. Therefore, for the 1st year Earthscience/Geology course, you should expect not less than 10 hours of work per week (3 hours of lectures, a three hour practical, and up to 4 additional hours of work); for a 2nd year course, you can expect about 13 hours per course in a week (3.75 hours of lectures, 3-4 hours of practicals, and another 5-6 hours of work), and for a 3rd year course, 20 hours per week (same load as second year, with more extra work and independent preparation and study expected). You are increasingly expected to demonstrate self-motivated use of the library, for reference books and the internet, to supplement your lecture material, and before you go to your lecturer for extra help. This can be applied to all of your undergraduate courses. In addition, in the Geology Department (among others), you will find that practical tests and exams often use Saturday mornings, and that compulsory field courses use some of your vacation times. All of this means that you are being prepared for a culture of life-long learning, where your career is not just a job, it's a way of thinking about the world.

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🕮 GOING FURTHER - POSTGRADUATE COURSES

In the time that elapsed since your lecturers were undergraduate students, the amount of scientific knowledge has increased significantly and may have doubled. This exponential growth in scientific knowledge, has, sadly, eroded the value of the B.Sc. degree and employers generally find it insufficient qualification for employment and advancement as a professional in one's chosen field. The B.Sc. Honours (Hons) degree has for many years been the required minimum to be employed as a professional geologist. Students should bear this in mind when planning their University careers. In Geology, as with many other science departments, entry into B.Sc. (Hons) programmes is NOT automatic - dependent only on a simple pass mark for 3rd level courses. Instead we prefer to allow up to 12 students into Honours who have achieved at least a 60-65% aggregate for their senior geology courses. This rule is flexible to some extent. Students with poorer pass marks but who go out and gain relevant work experience before re-applying may get accepted into Honours depending on performance and availability of space in the programme.

The reason for requiring something extra for Honours students comes from the nature of the Honours course. It is very different from undergraduate courses in that students are expected to do much of the work on their own, through reading, writing essays, presenting seminars, etc. Knowledge is not gained merely by listening to the lecturer; rather it is acquired by interaction with the published literature, peers, and other staff members. In addition, students undertake a small research project. The whole thrust of Honours is to broaden the student's knowledge of Geology and to develop critical faculties and

investigate skills in the students.

Beyond B.Sc. (Hons) lie the M.Sc. and Ph.D. degrees. These are usually research degrees completed by undertaking a programme of research and presenting the results in the form of a written thesis. Research is usually conducted in collaboration with a member of the academic staff who will supervise the research project and hopefully also provide funding for the research activities. The role of the supervisor is to guide and advise, but it is the student who is expected to do the work and the thinking. Creative persons with a deep interest in their subject and who enjoy an intellectual challenge thrive in M.Sc. and Ph.D. programmes. Those individuals who wish to be employed in the research environment or to pursue a career in academia should aim at obtaining at least an M.Sc., but preferably a Ph.D.

The Department also offers M.Sc. degrees in Exploration Geology (by coursework and dissertation) and Economic Geology (some coursework and thesis). The M.Sc. (Expl. Geol.) is geared for professional geologists who have worked in industry prior to registering for the M.Sc., whereas the M.Sc. (Econ. Geol.) does not require previous work experience and is more research oriented. Details of the Masters programme in Exploration and Economic Geology can be obtained from the Geology Department's website.

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◆WHO'S WHO ....? ◆

🕮 THE DEPARTMENT OF GEOLOGY

The Department of Geology is one of the oldest departments at Rhodes University, having been established shortly after the University was founded as a University Challenge in 1904. The department is housed in a modern building in Artillery Road on the T-junction with Lower University Road.

The Geology Department teaches six undergraduate semester credit courses, which are required to obtain a B.Sc. degree with a major in Geology. For students who already have a B.Sc. degree with a major in Geology, we offer a B.Sc. (Hons) degree in Geology. Further postgraduate degrees in Geology at the M.Sc. and Ph.D. level are obtained by thesis-based research. For the professional geologist following a career in the minerals industry, the department offers two postgraduate degrees obtainable through course work and dissertation: the M.Sc. (Exploration Geology) and M.Sc. (Economic Geology).

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🕮 STAFF

The Head of Department position is currently vacant. The HOD's office is on the top floor of the Geology building next to the office of the departmental secretary, **Ms Vuyokazi Nkayi.** The departmental secretary will normally be able to answer your queries about the functioning of the Department.

Mrs Ashley Goddard is the Administrative Officer for the Exploration and Economic Geology M.Sc. programs and she has many years of experience in the handling of all administrative work related to these programs.

Prof. Robin "Jock" Harmer (Professor) is the Director of the Exploration M.Sc. programme, joining the department in 2015. He holds a Ph.D. from the University of Cape Town, and held research and teaching positions at the CSIR, University of Pretoria and the Council for Geoscience before joining the minerals industry in 2002 where he was involved in managing exploration programmes for PGE, base metals and the REE in Africa, India and Greenland. His principal research focus is on the understanding of the petrogenesis, evolution and mineralisation of carbonatites and alkaline rocks.

Prof. Steve Prevec (Associate Professor), completed his Ph.D. at the University of Alberta, and conducted post-doctoral research work and teaching in central Canada and in South Africa. He teaches in the fields of geochemistry, petrology, and magmatic ore deposits. His research interests are in isotope geochemistry, emplacement of mafic magmas and their ores, and impact cratering.

Prof. Steffen Büttner (Associate Professor) has a Ph.D. from Universität Frankfurt-am-Main, Germany. He is the department's structural geologist, and has post-doctoral and teaching experience from other European universities. He teaches introductory geology at first year level, and structural geology at all levels, and geophysics at third year level. He also runs the Honours field school and teaches in the Science Faculty's Extended Studies Program. His research interests are the evolution of high-grade metamorphic crust at all scales and the relationships between deformation and mineral chemistry and, more recently, fluid inclusion studies.

Prof. Hari Tsikos (Associate Professor) followed his undergraduate degree from the University of Athens with M.Sc. and Ph.D. degrees from Rhodes University. This was followed by several years of postdoctoral research at RAU (now UJ) and the universities of Oxford and Aberdeen in the United Kingdom. His research and teaching interests lie in the broad fields of economic geology and low-temperature geochemistry, with special interest in the Kalahari Manganese Field.

Dr Eugene Grosch (Lecturer) has a Ph.D. degree from the University of Cape Town, with teaching and

research credentials from UWC, UKZN, and the University of Bergen (Norway). His expertise includes, but is not limited to, metamorphic terranes from high grade to low grade and from ancient cratons to young collisional belts. He teaches mineralogy, petrography, and metamorphic petrology.

Dr Afsoon Kazerouni (Lecturer) earned her Ph.D from Aarhus University (Denmark) in Geology and has post -doctoral teaching and research experience at Aarhus, GEUS (Geological Survey of Denmark and Greenland), Ton Duc Thang University (Vietnam) and Texas Tech University, USA. Her research interests include provenance and diagenesis studies on sediments using accessory mineral geochemistry and will be responsible for teaching courses in sedimentology hydrogeology in the Department.

Dr Deon van Niekerk (Senior Instrument Scientist) has a Ph.D from University of Hawaii at Manoa (USA) and currently is responsible for managing and developing the NRF- and Rhodes University-sponsored Electron Probe Micro-analyzer Laboratory. His research interests include using X-ray micro-analysis and other in situ techniques to study the petrology of extra-terrestrial rocks from asteroids and planets in the solar system; to address problems ranging from igneous and impact processes to the understanding of mineral assemblages possibly dating back to the origin of the Solar System.

Research Associates and Postdocs

Prof Goonie Marsh (Professor Emeritus) studied at the University of Cape Town before taking up a lectureship at Rhodes University in 1974. He retired at the end of 2012, and manages the department's XRF facility. His main research interests comprise the chemistry of basaltic lavas and related intrusions, particularly those of the Karoo Igneous Province.

Dr Rob Gess (Research Associate) joined the department formally in 2013 as a post-doctoral fellow. He is a Devonian palaeontology specialist, and teaches in the palaeontology courses.

Dr Nicola McLoughlin (Research Associate and/or Post-doctoral Fellow) joined the department late in 2015, and is a specialist in the biogeochemistry of early life, with particular interest in the Barberton greenstone belt.

Mr Mike Skinner (Research Associate) is a consultant to the diamond exploration industry, and a kimberlite petrology specialist, formerly with De Beers. He teaches kimberlite petrogenesis at postgraduate level.

Dr Baojin Zhao (Research Associate) is a specialist in exploration geology, mining-related environmental studies, and ore deposits and has taught at postgraduate level in the M.Sc. Exploration course in the past.

Other departmental Research Associates who are not routinely involved in teaching include **Dr Roger Scoon** (Bushveld Complex) and **Dr Andy Moore** (placer deposits and palaeogeography).

Technical and support staff

In support of departmental teaching and research activities is **Ms Andrea King** (Principal Technical Officer) who is in charge of the thin section laboratory, workshops, vehicles, field equipment, departmental maintenance, and thin section preparation. She is assisted by **Andile** (**Chris) Pikoli** and **Mr Thulani Royi** (Workshop Assistants), whose principal functions lie in thin-section preparation.

For more detailed information about the staff, and our contact details, please see the staff pages on the departmental website.

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◆UNDERGRADUATE COURSES◆

Undergraduate courses in Geology consist of a first level course (EAR101 and GLG102), which serve as a broad introduction to Earth Science with particular focus on the solid Earth, and the complementary second and third level courses which systematically cover the main fields of Geology. The first level courses assume no previous knowledge of Geology, and they effectively prepare students for the more comprehensive courses of subsequent years.

Some Important Dates

8 February	Honours Lectures begin
15 February	Undergraduate lectures begin
25-28 March	Easter vacation (undergraduate years)
27 May	Undergraduate lectures (1st semester) end)
18 July	2nd semester lectures begin
~27 August- 4 Sept	GLG2 and GLG3 Field Courses*
21 October	Undergraduate lectures End
21 October	Deadline for Honours theses

Important: Please note that the number and dates of your **class tests** will be set by your lecturers, who should advise you of test dates and mark weightings at the beginning of each course section. You should expect a theory test approximately every 2 weeks (if not more frequently), and usually one or more practical tests in each course.

There will be a Theory and Practical Exam set for each subject (1 of each in GLG102, and 2 of each for each semester of GLG2 and GLG3 courses), scheduled normally during the formal university Exam Periods.

*Field course dates are subject to confirmation.

🕮 FIRST YEAR COURSE: GEOLOGY 1

Geology 1 is made up of two semester credits: Introduction to Earth Science (EAR) 101 and Geology (GLG) 102. The EAR101 course may be taken on its own and it is also a prerequisite for GLG102, GOG 102 (Geography), and Environmental Science.

INTRODUCTION TO EARTH SCIENCE 101: 1st semester (February - June)

This is a stand-alone semester credit offered jointly by the Departments of Geology and Geography. The course consists of lectures, tutorials, practicals, essays and a field trip and offers a broad introduction to Earth Science. Details of the EAR101 course are in a separate handbook. Please refer to it.

Students wishing to proceed to the second year of Geology (and/or Geography) must have passed both Earth Science 101 and Geology 102 (Geography 102). An aggregate pass in Geology 1 may be awarded provided that all subminima in both credits have been obtained. **NB:** Earth Science 101 can be aggregated with either Geology 102 or Geography 102 to obtain credit in Geology 1 or Geography 1, but not both. Please refer to the separate Earth Science 101 booklet for details of the course and for lecture venues.

For students in EAR101 who intend continuing to GLG102, the recommended textbook is "Earth: Portrait of a Planet" by Stephen Marshak, which may be purchased at Van Schaik's bookshop in High Street. It is STRONGLY recommended that you purchase your own copy. However, a few copies of this book are also available from Short Loan in the Main University Library.

GEOLOGY 102: 2nd semester (July - October)

This course gives a more in-depth introduction to solid Earth Science, building on the material covered in EAR101. The course examines, in more detail, the building blocks of the Earth – rocks, their classification, and the processes responsible for their formation. The course looks at how these materials deform and change when subjected to stresses within the Earth. The course also examines the concepts of geological time and stratigraphy and the formation of mineral deposits, particularly with reference to southern Africa.

Content and teaching goals

After studying GLG102 you should understand and be able to identify, describe and explain:

- Processes that have created past and present-day Earth systems, both on smaller and larger scales;
- The common types of sedimentary, igneous and metamorphic rocks and the processes that formed them;
- The deformation of rocks in both brittle and ductile environments, and the geotectonics of major plates;
- The stratigraphy of the various rock sequences in southern Africa, the evidence for evolution of past-life, and the occurrence and formation of economic mineral deposits.

You should also be able to:

- Use available resources such as the library to obtain information and evaluate its validity, and communicate effectively through the written word;
- Understand and interpret simple geological and structural maps and construct geological cross-sections;
- Record and interpret geological features in the field, using measurements, notes and sketches.

The knowledge and skills gained are assessed by means of written practical assignments, field reports, and theory and practical tests and examinations.

Classes There are 4 formal lectures per week. The fifth lecture period each week will be used for class tests and presentation of supplementary material such as videos and slides. There is also one practical period of 3 hours each week. Lectures will be given in Room C11 and practicals in Rooms C43 and C12, Geology building, in the Geology 1 timetable slot.

Field Courses In addition to field work carried out during certain practical classes, a compulsory field course will be run, outside Grahamstown, during this semester. This will require students to complete certain field exercises and write reports on the work done. The field course counts towards the Class Record in GLG102.

Textbook The recommended textbooks for Geology I are "Earth: Portrait of a Planet" by Marshak, and "The Story of Earth and Life", by McCarthy & Rubidge, both of which are stocked by University Booksellers, High Street.

Library Most of the books and journals pertaining to Geology are housed on the top floor of the Main University Library. Apart from the stacks, housing books and journals, there is ample study space. Students are encouraged to make full use of the library. Apart from the recommended textbook for this course, there are numerous other 1st year level texts on Geology, and students are strongly encouraged to supplement their lecture notes with their own notes from the numerous books and periodicals available.

Class Record Theory and practical tests, essays, and practical exercises for which marks are awarded will be combined into the Class Record. The Class Record mark contributes a maximum of 30% of the final mark for GLG102.

Important*: Please note that the number and dates of your **class tests** will be set by your lecturers, who should advise you of test dates and mark weightings at the beginning of each course section. You should expect a theory test approximately every 2 weeks, and one practical test in each subject. There will be one Theory and one Practical Exam set for GLG102 during the Exam Period.

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🕮 SECOND YEAR COURSES: GEOLOGY 201 AND 202

The second year is devoted to developing the formal undergraduate education in the fields of mineralogy, geochemistry, igneous petrology, sedimentology, structural geology and metamorphic petrology, with geophysics and hydrogeology.

Outcomes

By the end of the year you should be able to demonstrate a thorough understanding of the theory, principles and practice in the main fields of geoscience. You should be able to describe, identify, and interpret minerals and sedimentary, metamorphic and igneous rocks using microscopic and field techniques and explain genetic processes that led to their formation. You also should be familiar with the nature, appearance and formation of the most common deformation structures. You should be able to demonstrate, both on your own and in teams, that you can map and interpret geological features in the field.

You also should be able to process data, use all available library and information sources to analyse and evaluate a wide range of information, and present the results in logical verbal and written forms in seminars, essays and reports. Knowledge and skills will be assessed by means of written theory and practical assignments, seminars, field reports, tests and examinations.

GEOLOGY 201: 1st semester (February - June)

Geophysics: A three-week course that covers an introduction to the principles and limitations of important geophysical methods: gravity surveying, electrical methods, magnetic surveying, seismic reflection and refraction surveying, and, time permitting, radiometry.

Igneous Petrology: This course covers the composition and classification of igneous rocks, the petrology of mantle and crust, and the processes by which magmas are generated and differentiated.

Optical Mineralogy: Optical mineralogy is an essential tool in geosciences, required for the examination of rocks and minerals using the polarising microscope. A two-week module covers the behaviour of light in crystalline solids, the optical properties of rock-forming minerals (colour, refractive index, birefringence, optic sign, etc.), and their identification under the microscope. The main emphasis is on the practical aspects of mineral identification.

Mineralogy: This is essentially a tools-course that follows the introduction to Optical Mineralogy and covers a wide spread of topics fundamental to many aspects of geology. The lectures cover the systematic mineralogy (structure and chemistry) of rock-forming silicate minerals, basic geochemistry (why do particular minerals attract particular chemical elements?), and an introduction to phase diagrams. The accompanying practicals deal with the identification of common minerals using the transmitted-light polarising microscope. The lectures may be supplemented with a series of problems to be solved in the student's own time.

Petrography: This course builds on the mineralogy course, and provides an introduction to the diagnostic mineralogy, textures, and classification of igneous, sedimentary and metamorphic rocks.

GEOLOGY 202: 2nd semester (July - October)

Structural Geology: This course introduces the principal processes of rock deformation in the brittle and plastic field, including the relationship of stress and strain and the response of rocks to the application of differential stress under various physical conditions. It introduces the basic tools used in structural geology for the assessment of structures and for the understanding of their formation (stress-strain diagrams, the Mohr stress diagram, conjugation of faults, some important mechanisms of plastic deformation; folding and folding mechanisms). Practical assignments introduce the basic tools for structural analysis (stereonets and interpretation of stereonet data, structural maps and cross-sections).

Hydrogeology: In this two-week course, you will be exposed to the study of source, occurrence and movement of groundwater. The course will have a special focus on the evaluation of groundwater resources in southern Africa where management on this fresh water source is increasingly important. This short course will present the factors influencing the dynamics of groundwater flow, water table fluctuations and the evolution of drainage basins from geological point of view.

Sedimentology: This three week course will present an introduction to fundamental sedimentary settings and their characteristic textures and bedforms.

Metamorphic Petrology: The course introduces the basic concepts of metamorphism, the different types, grades and facies, dependence on bulk rock composition and chemistry, and the principal reaction mechanisms that control metamorphism. Weekly practical assignments involve metamorphic mineral identification, description and interpretation.

Classes	For both semester credits there are 5 formal lectures and one extended practical per week. Some of the classes may be used for tests, tutorials and presentations of videos and slides.
Textbooks	Essential and recommended textbooks for both semesters are detailed in the BOOKLIST.
Library	Now that you are 2nd year students, it is vital that you use the books in the library!! Supplementing the lecture and practical material with additional information is an essential part of university education and is expected of you.
Field Course	In 2nd-Year Geology there is one <u>compulsory</u> field course held over the September vacation (for GLG202). The course will take place run in the Eastern Cape ± Free State, focussing on aspects of the stratigraphy, sedimentology, palaeontology and hydrogeology of the Karoo Basin. Reports on the work done during the field trip must be handed in shortly after your return from the field. The mark will count towards the Class Record.
Class Record	Theory and practical tests, essays, seminars, and practical exercises for which marks are awarded will contribute to the Class Record component of the final mark.

Important*: Please note that the number and dates of your **class tests** will be set by your lecturers, who should advise you of test dates and mark weightings at the beginning of each course section. You should expect a theory test about every 2 weeks (if not more frequently), and one practical test in each course. There will be a Theory and Practical Exam set for each subject (2 of each for GLG201 and for GLG202) during the Exam Period.

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🕮 THIRD YEAR COURSES: GEOLOGY 301 AND 302

These are third level semester credits in Geology. Entry into GLG301 normally requires credits in Chemistry 101 and 102 and credit in at least one of GLG201 and GLG202, and adequate performance in the other.

Content and teaching goals

By the end of the year you should be able to demonstrate a thorough understanding of the theory, principles and practice of all of the fundamental subdisciplines in Geology offered in the Rhodes Geology degree programme. You should be able to describe, identify and interpret igneous, metamorphic and sedimentary rocks and minerals, deformed rocks, ore deposits and economic minerals, and show competence in working with geological and structural maps, and aerial photographs and satellite images. It is important too that you recognise and understand the interrelationship among the various fields of geoscience.

You should be able to work independently and in teams in field work and to demonstrate basic research-, creative problem-solving- and critical thinking-skills. At this level you should show well-developed communication skills and be able to structure logical arguments in both verbal and written forms in seminars, essays and reports.

Knowledge and skills will be assessed by means of written theory and practical assignments, field reports, tests and examinations.

GEOLOGY 301: 1st semester (February – June)

Igneous Petrology: This course builds on the principles developed in GLG2 and deals with the emplacement of melts into the crust, and includes an introduction to radiogenic isotopic tracers as fundamental geochemical tools in igneous petrology.

Structural Geology and Tectonics: This course builds on the contents of the 2nd year level course on Structural Geology and aims to deepen the understanding of rheological variations in the lithosphere, and their effect on structural evolution and plate tectonics. In this regard, the scope is increased to larger scale tectonic processes and the structural evolution in various tectonic settings. Practicals include work using the Mohr stress diagram (revising some 2nd year material), analytical techniques using the stereonet, and a field exercise.

Sedimentology: This course develops the basic concepts of stratigraphy and bedform analysis into the larger scheme of basin analysis, using case studies of modern and ancient sedimentary basins with particular emphasis on South African examples.

Palaeontology: Palaeontology is the study of life, in its many varied forms throughout geological history. This course complements the study of sedimentary rocks and emphasises how fossils can be used as tools to solve geological problems and understand ancient depositional environments. An introduction to the evolution of life from the earliest of time is presented and followed in more detail by a review of the fossil record from 600 million years to present. Topics covered include basic taphonomy, and the study of invertebrates, vertebrates, plants, and trace fossils.

GEOLOGY 302: 2nd semester (July - October)

Low-Temperature Geochemistry: This is a three-week course presenting an introduction to the main principles and applications of light stable isotope and trace element geochemistry in (near-)surface environments. The main emphasis of the course is on the use of such geochemical "proxies" towards understanding low-temperature ore-forming processes and the evolution of palaeoenvironments.

Metamorphic Petrology: This course covers the application to metamorphic petrology to geological setting; the determination of metamorphic temperatures and pressures, and the relationships between petrography, metamorphic conditions, and tectonic settings of metamorphism. Weekly practicals involve metamorphic mineral interpretation using the petrographic microscope.

Economic Geology: This course deals with the processes and environments of formation of mineral deposits, and covers the following topics: introduction and geochemical classification of the elements; classification, stabilities and textures of the ore minerals; classification of mineral deposits; mineral deposits related to various rock types, processes and environments including: mafic-ultramafic igneous rocks, felsic intrusions, subaerial volcanism, submarine volcanism, volcanism and sedimentation, clastic sedimentation, weathering, regional metamorphism and solution-remobilisation. Southern African examples are emphasised.

Classes	In both semesters there will be 5 formal lectures and 1 extended practical period per week as given in the University Calendar.
Textbooks	See the BOOKLIST for essential and recommended textbooks for GLG301 and GLG302.
Library	Apart from the prescribed textbooks, students are required to supplement their lecture and practical material by referring to the many books and journals in the Main Library.
Field Course	There is a one-week compulsory field course held in the September vacation, organised and run by Hari Tsikos. The field course focuses on Economic Geology, specifically the ore deposits in the western part of the Kaapvaal Craton. A field report on work done during the field trip must be handed in within about two weeks of your return (specific date and time to be announced), and the marks will count towards the Class Record. The best field report is awarded the Edgar D Mountain Award.
Essays	Students are expected to write an essay in each semester. The essay topic will be chosen from a list provided by the lecturers, who will also provide details about presentation of the typescript.
Class Record	Theory and practical tests, essays, and practical exercises for which marks are awarded will contribute to the Class Record component of the final mark.

Important*: Please note that the number and dates of your **class tests** will be set by your lecturers, who should advise you of test dates and mark weightings at the beginning of each course section. You should expect a theory test about every 2 weeks (if not more frequently), and one or more practical tests in each course. There will be a Theory and Practical Exam set for each subject during the Exam Period.

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🕮 UNDERGRADUATE FIELD COURSES

Field courses are essential components of the curricula at all undergraduate levels and at Honours level. Attendance is compulsory and marks are awarded for field exercises. These marks count towards the Class Record. Because of timetabling constraints field courses are held on weekends and during University vacations.

Field studies are an essential complement to what is learned in the classroom. All successful geologists have developed acute observational skills of natural phenomena. Such skills come more naturally to some than to others but can be acquired by all with experience. Closely allied to observational skills is the ability to record observations accurately. Despite the advent of dictaphones, video cameras, etc., the most widely used recording device remains the field notebook and the geological map.

The field courses are designed to develop the most basic skills in geological observation, field measurement, and recording. To this end, students must possess a suitable (small, hardcover) field notebook, a geological hammer, and a hand lens. More sophisticated field equipment is supplied by the department. In the field courses the emphasis is on students' input and staff guidance. It is important to appreciate that observational skills lie very much in the realm of personal development; the teachers' contribution to developing the skills is important but limited. Students approaching the field courses with a positive attitude towards learning will find their efforts richly rewarded.

During field courses students are exposed to risks, but with due care most accidents can be avoided by acting responsibly and with forethought. Potentially hazardous situations result from:

- visits to quarries or steeply inclined slopes;
- road cuts, and traffic movement;
- animals and reptiles;
- collection of rock samples.

It is the student's responsibility to be as careful as possible and to be considerate of other people in the vicinity. Further details on safety in field work will be discussed with you and will be presented in various field guides at appropriate times. Students also should arrange their own insurance cover as the University does not provide it. Students will be required to sign indemnity forms before embarking on field trips.

GLG 102 Weekend optional field course(s) early in October
Two one-day excursions, usually on consecutive weekends, comprising an introduction to basic geological processes in the Grahamstown – Port Alfred area.

GLG202 Field Course
Field course through Karoo sedimentary and igneous rock succession. The course emphasises sedimentary rocks, structures, sequences, and environments, and the fossil record therein (both plants and animals).

GLG302 Field Course
To be determined.

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🕮 REGULATIONS FOR UNDERGRADUATE COURSES

Full regulations governing your academic progress to getting a degree can be found in the Science Faculty handbook or the University Calendar. In this section we summarise, for convenience, the more important aspects. Please note that in the event of any dispute, the Calendar entry will be considered binding.

Please note that in order to be eligible for Professional Registration, which is presently required for all practicing scientists (under SACNASP legislation), you should ensure that in addition to your geology courses, your degree program should consist of at least 50% Natural Science courses, and your Year I curriculum should include at least 2 of the following subjects: chemistry, physics, mathematics, or a biological science subject.

FIRST LEVEL COURSES

There are two first level courses in geology. EAR101 is offered in the first semester and GLG102 is offered in the second semester. Credit may be obtained in either course separately and in addition an aggregate mark of 50% will be deemed equivalent to the course GLG1 provided the subminimum is achieved in each component. For the purposes of aggregation the subminimum for EAR101 and GLG102 is 40%. For the purposes of supplementary examinations, the subminima are 35% in EAR101 and 45% in GLG102.

EAR101 and GLG102, or both, can be used as credits towards a degree in which Geology is not a major.

SECOND LEVEL COURSES

There are two independent second level courses in Geology. GLG201 is normally held in the first semester and GLG202 is normally held in the second semester. Credit may be obtained in either course separately or in the two-credit course GLG2 by obtaining an aggregate mark of 50%. For the purposes of aggregation, a subminimum of 40% applies to both GLG201 and GLG202. Supplementary exams are not offered in GLG201 or GLG202.

A candidate may not register for GLG201 before first obtaining credit in GLG102 or GLG1 and attending CHE 101 and 102 (Chemistry). A candidate may not register for GLG202 without having attended GLG201.

THIRD LEVEL COURSES

There are two third level courses in Geology. GLG301 is normally held in the first semester and GLG302 is normally held in the second semester. Credit may be obtained in either course separately or in the two-credit course GLG3 by obtaining an aggregate mark of 50%. For the purposes of aggregation, a subminimum of 40% applies to both GLG301 and GLG302. Supplementary exams are not offered in GLG301 or GLG302.

A candidate may not register for GLG301 before (a) first obtaining credit in at least one second level Geology course and having adequately performed in the other; (b) first obtaining credit in CHE1 and (c) attending EAR101. A candidate may not register for GLG302 before first having attended GLG301.

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🕮 DULY PERFORMED (D.P.) CERTIFICATES

Students are expected to attend all meetings of the class and to complete all work assigned to them. Failure to do so may result in a student being refused a D.P. Certificate by the Head of Department.

In order to earn a D.P. Certificate, the **minimum** requirements are:-

1. Lectures: Although attendance at lectures possibly may not be monitored, satisfactory attendance is required and students may be called upon to justify persistent absence from lectures.
2. Practicals: Attendance of at least 80% of all meetings is required. Practical assignments must be handed in for marking on due dates. Attendance registers will be kept.
3. Class Record: A mark is assigned to each student, based on all tests, essays and practical assignments handed in. Work not handed in is awarded a mark of zero. Late submissions may be penalized (typical penalties are 5% off per day late). The average mark is consulted at the end of the year when the award of D.P. Certificates is considered.

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🕮 EXAMINATIONS

FIRST YEAR COURSES

EAR101 Please refer to the separate EAR101 booklet for details of the examinations.

GLG102 (November period)
1 Theory paper of 3 hours
1 Practical paper of 3 hours

Final marks in this semester credit are compiled as follows:

Theory paper	40%
Practical paper	30%
Class record	30%

Obtaining credit: A semester credit will be awarded for each of EAR101 and GLG102 provided a student obtains a final mark of ≥50% in each of these courses. In addition, if a student fails one of these courses, the student may still obtain credit for the course GLG1 if the aggregated mark for EAR101 and GLG102 is 50% or higher, provided that the final mark for the failed course is not lower than 40% and the subminima have been achieved in the theory and practical components of both courses. EAR101 may **not** be aggregated with **both** GLG102 **and** GOG102 in order to obtain credit for both GLG1 and GOG1 (i.e., the student must choose one or the other). Note that students who fail to achieve exam subminima in EAR101 will not be permitted to register for GLG102 in that year.

Note: In order to proceed to a 2nd level course in Geology a student must meet the following minimum requirements:

- < credits for EAR101 and GLG102 or a credit for GLG1
- < adequate performance in CHE1

SECOND LEVEL COURSES

GLG201	2 Theory papers of 3 hours each
(June period)	2 Practical papers of 3 hours each
GLG202	2 Theory papers of 3 hours each
(November period)	2 Practical papers of 3 hours each

The final examination mark for each semester will be made up as follows:

Theory paper	40%
Practical paper	30%
Class record	30%

Subminima: Students are reminded that, although they may achieve an overall aggregate of 50% or more for the semester final examination mark, they may be awarded a fail symbol for the semester if the following subminimum marks are not achieved:

Theory:	40%
Practical:	40%

Obtaining credit: A semester credit will be awarded for each of GLG201 and GLG202 provided a student obtains a final mark □50% in each of the courses or in the two-credit course GLG2 by obtaining an aggregate mark of 50%. For the purposes of aggregation, a subminimum of 40% applies to both GLG201 and GLG202. There are no supplementary examinations for these semester courses. In order to proceed to a 3rd level course in Geology, a student must meet the following minimum requirements:

Credits in EAR101, GLG102 and GLG201 or GLG202 (with an above subminimum mark in the other 2nd level semester).

THIRD LEVEL COURSES

GLG301	2 Theory papers of 3 hours each
(June period)	2 Practical papers of 3 hours each
GLG302	2 Theory papers of 3 hours each
(November period)	2 Practical papers of 3 hours each

The final mark in each semester credit is compiled as follows:

Theory paper	40%
Practical paper	30%
Class record	30%

Obtaining credit: A semester credit will be awarded for each of GLG301 and GLG302 provided a student obtains a final mark 50% in each of these courses or in the two-credit course GLG3 by obtaining an aggregate mark of 50%. For the purposes of aggregation, a subminimum of 40% in theory and in practical exams applies to both GLG301 and GLG302. There are no supplementary examinations.

◆HONOURS◆

A full Honours degree in Geology requires the following:

1. Attendance of the lecture courses on offer and completion of practical assignments.
2. Attendance of the **Field SCHOOL in the second term** and writing a report on work completed in the course.
3. Completion of a **Research Project** and the writing of a **Research Project Report**.

LEARNING OUTCOMES

By the end of the year, you should be able to demonstrate a detailed knowledge and understanding of the information, concepts and principles of Geology.

You should be able to:

- Identify problems and formulate questions;
- Collect, analyse and critically evaluate data to answer questions;
- Work effectively in teams;
- Work effectively on your own, and organise and manage your workload and your time;
- Communicate results effectively and succinctly, both verbally and in written form, using appropriate technology;
- Demonstrate the origin of your ideas by appropriate application of required referencing styles
- Appreciate the evolution of science, the need for new questions, research and answers;
- Apply your acquired knowledge in novel situations by being creative and innovative;
- Adopt (both academically and socially) to new situations in a high speed, modern society driven by technological, political and cultural changes.

🕮 THEMATIC COURSES

The Honours program consists of seven mandatory modules, one field school, and ~12 weeks allocated for work on a research project. Most modules consist of two weeks teaching and are examined in the form assignments and a 2h theory exam for each module. In 2015 we offer courses on Hydrothermal ore deposits, Metamorphic Petrology, Sedimentology, Magmatic ores, Exploration Techniques, and an extended Field School module. Additional courses may be offered in a given year. The scheduling of the modules can be obtained from the teaching plan that is uploaded on the Geology Department's website.

Each course topic will comprise lectures, seminars, assignments, practical work, and reading. At Honours level, students are expected to take greater responsibility for their own knowledge and intellectual development, and the emphasis is placed on reading and self-learning. Students are expected to complete all essential work pertaining to each course within the scheduled timetable**.** Late submissions will attract a penalty (typical penalties are 5% off per day late). Furthermore, absolutely no course material will be accepted for marking once the next course has begun! Honours students will also be developing group work and responsibility skills (and earning money) through assisting with undergraduate teaching, by working as teaching assistants throughout the year.

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🕮 FIELD COURSE AND REPORT

The Field School is a module of 5-6 weeks in total. It is run in the second term in April and May and is run and is supervised by Steffen Büttner. The module consists of two weeks of preparation, focusing on principal mapping and field work routines and on the geology of the geological terrains that will be visited during the two weeks field trip. After the field trip two weeks are available for thin section petrography of rocks encountered and mapped in the field and for the preparation of a report on selected aspects of the field course. The field module will be assessed in the form of tests, practical assignments, mapping exercises and a field report. Further information can be obtained from the Field School website at http://www.ru.ac.za/geology/staff/buttner/honoursfieldschool/ . Please refer also to the section headed "Field Courses" in this handbook. A field guide with detailed information and instructions will be supplied closer to the time of the field course.

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🕮 RESEARCH PROJECT

The Honours Project is an important component of the Honours course. It involves about ~12 weeks of formal research work time, to which additional time should be found as necessary for literature work and sample and/or data processing. It contributes nearly 30% of the final mark, and therefore requires considerable effort and thought. The project is intended to demonstrate a student's ability to carry out a geological investigation and report on it in written and oral form. It gives the student an opportunity to:

- perform some original research work independently;
- evaluate and interpret data obtained during the course of field and laboratory work;
- read the relevant literature around the subject of the project;
- write up the results in an acceptable form (Refer to the section on "Writing a Scientific Report" in this booklet);
- present the results of the investigation before an audience.

The subject selected for investigation should be of interest to the student and, as far as possible, be in line with the research interests of a member of staff in the Department so that there can be close cooperation and adequate supervision. Staff members may provide suitable research topics.

Students employed by mining/exploration companies may find it possible to utilize their work for the Honours project. They should consult with their employers about this possibility. However, projects based on (vacation) employment frequently prove unsatisfactory, usually because there is insufficient supervision at the field-work stage, and the student must reconcile the perceived requirements of their corporate employer, and the requirements of the department.

In all cases, the project must be discussed with the staff of the Department and cleared before it is embarked upon. A supervisor will be appointed to advise and guide the student in the research direction chosen. Each student should communicate with his/her supervisor at the earliest opportunity and keep in regular contact with him/her during the investigation. Remember that it is up to you, the student, to ensure that you get the assistance you require; this is your project.

The project should entail fieldwork (normally geological mapping or careful sampling), laboratory investigation, and writing. Mapping investigations normally are well suited to the project. Detailed maps of a small area, or a structural analysis of a folded terrane, or measurement and interpretation of stratigraphic sections, are also well-suited.

In special cases, however, a laboratory project may be undertaken instead of a field project. This might involve a mineralogical or geochemical study of a suite of samples from a mine or borehole (samples

should be collected by the student), or an application of the computer program to a geological problem, etc. Nevertheless, as a general rule, the project should include some fieldwork and a map showing the geology of the area and sample localities.

The field investigations usually will be followed by a period of laboratory work. The student should bring back sufficient sample material suitable for the laboratory investigations (clean, fresh, correctly labelled rock, etc.). The supervisor will help in liaising with the Department's service facilities. The sample collection and preparation and analytical stages of your work should be conducted by the end of the Easter break. There is considerable demand for the various facilities by research students and staff, and delays can be expected.

Students should consult with their supervisors prior to embarking on the laboratory work in order to plan the work and determine the number of thin sections and chemical analyses required. A limit will be placed on the number of samples to be processed. Arrangements for thin sectioning should be made first through your supervisor and then with Andrea King. Those students intending to carry out chemical analyses should contact Prof. Marsh (XRF) and Dr Costin (EMPA, EDS, XRD) at an **early stage** in order to fit into the analytical programme. Remember to leave sufficient time for interpretation of the analytical results prior to submission of the final draft.

The completed project is to be handed in to the departmental secretary not later than **17h00 on 21 October 2015.** An initial penalty of 2% followed by 1% per day will be imposed for late submission. Some guidelines on how to prepare your Honours project are given in the next chapter.

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🕮 MARK BREAKDOWN AND CURRICULUM DATES

The final mark for the Honours course is calculated according to the following key:

5 Exams (80x5)	400
Class marks from 4 course modules (40 each),	160
Field course and report	140
Research project	270
Presentation of the research project	30
TOTAL:	1000 marks

Please note that thesis work intervals where you are not in formal classes are NOT designed as opportunities for you to squeeze in some work for your bursary sponsors / employers, or for vacations, etc. This does not mean that these are forbidden, but ultimately it is only you who will suffer if your thesis progress is interfered with. Trust us, <u>you will need this time</u> for your thesis work.

(The external examiner's visit will occur in latest November, depending on his availability. **Do not plan your trip home until you have confirmation of these dates!**).

◆GUIDELINES FOR COMMUNICATING GEOLOGY◆

🕮 WRITING A SCIENTIFIC REPORT

The execution and interpretation of the research work are useless without the findings being presented in a lucid way. "It is not necessary for a plumber to write about his pipes, but the research scientist, perhaps uniquely among the trades and professions must provide a written document showing what he did, why he did it, how he did it, and what he learnt from it." (Day, 1979: How to write and publish a scientific paper, p. iv). Compilation of the draft of the project is most important, and can also be a time-consuming process. The instructions below relate particularly, but not only, to the Honours Research Project.

In writing a scientific report the student must be fully aware that the University considers plagiarism, copying and collusion in a serious light, and substantial penalties are imposed where such are found. In recent years some institutions and departments have experienced a substantial increase in these unacceptable practices. Further details can be found in the section headed "Departmental Policy on Plagiarism" in this booklet.

Π Format

The text must be typewritten on A4-sized paper, with 1½ or double line spacing, and should follow the format specified in the "Instructions to Authors" of papers to be published in the S.A. Journal of Geology. The submitted manuscript should have a 30 mm margin on the left hand side and 25 mm margin on the right, top and bottom. Any hand-drawn diagrams should be drawn in ink, neatly labelled, and have concise, appropriate captions. Photographs can be valuable additions to the text; these should preferably be taken by the student, and they should be scaled and suitably captioned. Diagrams and photographs should be referred to, and consecutively numbered, as Fig. 1, Fig. 2, etc. Tables also should be numbered consecutively. Please note that original photographs are generally preferable to those scanned and computer printed, which may be of inferior quality.

The text of the project should, in general, take the form of a paper published in a scientific publication; see any recent issue of the South African Journal of Geology (SAJG), for example, i.e.:

Abstract

- This should be a brief statement of the aims and subject of the project, including the main findings and their implications
- It should not be longer than 1 side of an A4 sheet

Introduction, usually consisting of the following:

- Brief summary of why the topic of the report is important/interesting
- Review of work in the area by others
- Statement of the specific aim(s) of the work

Main body divided into chapters/sections, including:

- Presentation of results (new data only)
- Discussion of results
- Summary/conclusion
- Acknowledgements

List of references

- Careful attention should be paid to correct referencing. The references in the text appear as Smith (1988), Jones et al. (1987), etc. In the reference list the style should conform to that of the SAJG. "Instructions to Authors" are to be found as the last page of recent issues or on the website of the journal. Appropriate abbreviations are listed in the "Guide

to preparation of papers for publication by the Geological Society of South Africa", kept in the Secretary's office.

Appendices

- This can include maps, sample localities, logs, analytical data and methodology

The length of the text of the project should be determined through discussion with your supervisor. The length of project reports should be between 10 000 and 25 000 words, depending upon the nature of the topic (Introduction to end of list of References). Part of the exercise is to ensure that the text is kept concise and to the point.

Needless to say, the text should be **very** carefully edited prior to submission. Students must ensure that enough time is set aside for proofreading and correction before the handing-in date. It cannot be emphasized sufficiently how important it is to produce a properly edited, error-free project report. This is one area that students neglect and which draws comment from the external examiner year after year. The quality of your work will be judged by the quality of your project report and many students are awarded disappointing marks purely on poor editing of the final draft. Generally, not enough attention is given to presentation of an immaculate and impeccable piece of text. Aspects such as clarity, organization and presentation are worth almost as much as "scientific content", and deserve due attention. The completed project should be bound (at your expense, using the Department's spiral binding equipment) prior to submission. The project will be marked by at least two staff members and an External Examiner, and should be corrected or amended as necessary and lodged permanently within the Departmental library.

(SELF-)EVALUATION OF WRITTEN REPORTS

The following list gives some idea of the criteria which may be used in evaluating written scientific reports, such as essays, field course reports and research projects. You might expect that about half the mark is allocated to organisation and presentation, and half to the scientific content i.e. how well you have thought out and executed your arguments.

1 Content

1.1 Delimitation and hypothesis

- Does the introduction introduce the subject in a relevant and reasonably concise way (i.e., after 1-2 pages, I expect to know what is being done, why, and how, very broadly)?
- Is a reasonable context established for the subsequent body of the report? (for example, in terms of the existing literature in the relevant field)
- Is the purpose of the study clearly stated, or do you have to figure it out yourself?
- Does it make sense, in light of what was subsequently undertaken to investigate it?

1.2 Methodology

- Is there a section summarising the more "technical" approach to the study, including logistics of data collection; what was collected and how?
- Is this section reasonably complete, in light of the work reported on?

1.3 Organisation

- Does the project include all of the required elements, in the "correct" order (this can be somewhat flexible, but there should be some logic to it)?
- Are the contents of the various sections appropriate to their titles? i.e., general context provided in the introductory part, new data (and no interpretations) in the results section, and interpretations and conclusions afterwards, etc. Is there material more suited to appendices than to the body of the text, or *vice versa*?

2 Presentation

2.1 Style and grammar

- Quality: Is the use of language (spelling, grammar, use of capitalisation) consistent (and ideally, correct)?
- Is the presentation style consistent (use of blank lines or indents to demarcate new paragraphs, no big empty spaces, captions without figures or *vice versa*)?

2.2 References

- Is the number of references reasonable?
- Are appropriate references used? (some breadth of references dates, not too dependent on individual references, no overuse of textbooks, particularly course-prescribed references and texts)?
- Are the references properly listed in the text, and properly (consistently, in alphabetical order) listed in the Reference Section?

2.3 Figures

- Are the figures (photos, "plates", data plots, maps) clear and legible?
- Are they properly embellished with labels, arrows, scales, etc. as appropriate?
- Are they properly captioned?
- Are they appropriate and necessary to the text (and are they specifically referenced in the text)?

3 Interpretations and assessments (relevant to Discussion and Conclusions, and indirectly to the Abstract)

- Is the discussion free from the introduction of new original data (i.e., stuff that should be in "Results")?
- Is there a coherent, logical argument or presentation style?
- Is there appropriate use of illustrations/plots/figures to clarify or develop arguments/points?
- Is there good use of references to support or debate the arguments?
- Do the Conclusions (and Abstract) represent accurate and concise summaries of the key points of the project?
- Quality of Science; are the conclusions and interpretations correct, and are they appropriate for Honours (rather than undergraduate) level?

◆DEPARTMENTAL POLICY ON PLAGIARISM◆

This is defined as "Taking and using ideas, writings, works or inventions of another as if they were one's own". Reference should be made to the Rhodes University website and to the Calendar for a detailed statement on the Rhodes University policy on plagiarism.

🕮 ACKNOWLEDGING THE SOURCE OF MATERIAL

When you write an essay or report in an academic setting, it is normal to draw on material written by other people. However, when you do this it is important that you acknowledge the fact that you have drawn on other people's work. There are standard procedures for doing this - for example by citing a reference and providing details of the source in a reference list at the end of the assignment. You are expected to do this even where you do not quote directly from your source but merely express in your own words ideas or arguments which you have taken from that source. In addition, where you quote verbatim from a published source, you must put inverted commas round the quoted material and provide a page number. The only situation in which these rules do not apply strictly is in examinations written without access to books and other reference materials.

🕮 WHAT IS PLAGIARISM?

Plagiarism refers to the practice of presenting as your own work material which has been written by someone else. Any use of material that is derived from the work of another person constitutes plagiarism, **unless the source is clearly acknowledged in the manner described above**. You will be guilty of plagiarism if, for example, you hand in an assignment under your own name which, either in part or as a whole,

- Π is copied from an essay or practical report written by another student;
- Π is copied from a document downloaded from a website;
- Π is copied from a published article or book chapter;
- Π has been written for you by someone else.

The following comments come from the handbook of the Department of Geology, University of Durham:

> Plagiarism therefore applies to verbatim copying and close paraphrasing by simply changing a few words or the order of sentences, or quotation of phrases from someone else's work or concepts without appropriate acknowledgement. The student must ensure that someone else's work is not presented as the student's own.
>
> With regard to collusion, note that students also should avoid unauthorised, deliberate collaboration with one or more other students in producing assignments which are identical or very similar. Such collusion is not acceptable.
>
> The key words in avoiding all the difficulties referred to above are "appropriate acknowledgement".
>
> If you are unclear as to what comprises plagiarism, you may also wish to consult http://www.ru.ac.za/media/rhodesuniversity/content/documents/law/10-students/plagiarism_policy.pdf , or ask a staff member for assistance.

🕮 WARNING!

As a University student you are being trained to understand and observe the highest standards of ethics, integrity and professional practice in the writing of essays and reports. The Department of Geology therefore expects these high standards to be observed as a matter of course. Please be careful. Many students think that there is no harm in copying sentences from books and articles when composing essays and practical reports. However, in terms of the policy stated above, the use of even one sentence without acknowledgement constitutes plagiarism and is not acceptable.

Plagiarism, being cheating and dishonest, is a direct assault on the core values of a university, which are truth and intellectual honesty. This is why universities view plagiarism so seriously. It is most important to realise that there is nothing to gain from cheating. First, the cheaters place their whole university career and future at risk. Second, one can never gain intellectually from cheating. One cannot learn from an assignment without doing the required work. third, the mark one obtains for an assignment allows one to judge your own progress in mastering the required work. A mark for plagiarised work is fiction and cannot be used by the cheater to indicate whether they are coping sufficiently with the work to obtain pass marks in tests and examinations. So ultimately the cheaters cheat only themselves.

🕮 SENATE POLICY ON PLAGIARISM

The Senate of the University has adopted an overall policy towards the handling of plagiarism. In terms of this policy:

- Departments are encouraged to address the matter in their teaching and to train students in the correct procedures for acknowledging the sources of material used for assignments;
- Higher standards are expected as students progress through the University. The highest standards are expected of all post-graduates;
- Cases of plagiarism must be addressed by disciplinary procedures within the Department and at University level.

🕮 DISCIPLINARY ACTION IN RESPONSE TO PLAGIARISM

In terms of this policy, the Geology Department has a Disciplinary Committee which deals with such cases. Where staff members have evidence that students have plagiarised work, the matter will normally be referred to this Disciplinary Committee. Where the Committee concludes that plagiarism has occurred, it will make a ruling as to what disciplinary steps are appropriate. In terms of the Senate guidelines, these are classified as follows:

Class	Violation	Consequences
A	first-time offenders, "minor infringements" at 1st Yr level	Hearing by lecturer, which may lead to: verbal warning + mark penalty (typically, 0% for any work which includes plagiarized material), and offense reported to Dept and recorded on Dept. database.
B	minor infringements beyond 1st Yr, repeat offenders, more serious infringements	'Informal' Dept hearing which may lead to: mark penalty, offense recorded on Protea (university student record); loss of student's D.P. in extreme cases. Student will receive a written report.
C	major, extremely serious infringements	Referred by Dept. to Chair of the Senate Standing Committee on Plagiarism for a formal hearing, and may lead to: any combination of the above penalties, suspension, or exclusion from the University.

At each level there are formal appeal procedures which can be followed if a student believes they are the victim of an injustice. For more information, see http://scifac.ru.ac.za/plag2008.doc.

<u>ALL</u> departmental assignments (practical reports, essays, field reports, etc.) which are handed in for assessment must be accompanied by a signed copy of the "Plagiarism Declaration", which is available from the Departmental Secretary and the Departmental website.

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◆SERVICES◆

🕮 LIBRARY

Books and journals are kept in the Main University Library (top floor). Certain books belonging to the Department may be kept on Reserve in the departmental secretary's office. They must be signed out from the Departmental Secretary before 16h30 and returned by 08h30 the following morning at the latest. Other reference material will be kept on short loan in the Main University Library. Theses and Project Reports are kept in the lockable cupboards in the Staff and Senior Student Tearoom. Please see the departmental secretary to obtain the keys to the cupboards.

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🕮 COMPUTER LABORATORY

The Department has a limited number of PCs available for the use of postgraduate students (Honours, MSc, PhD). Gabi Costin is in charge of the Computer Laboratory. Users are strongly advised to keep updating backup files for all their documents on their own media. The software library includes relatively up-to-date desktop software (Microsoft Word, Excel, PowerPoint, and the Adobe suite including Acrobat professional, Illustrator, and Photoshop). These PCs also have some specialized software for thermodynamic modeling installed. Full Internet services are available (e-mail and Web) but for checking e-mails and web surfing students are requested to use their private laptops or public computer labs elsewhere on campus.

🕮 PRINTING AND PHOTOCOPYING

The Departmental Printer and Photocopier are for use on Geology Departmental business only, and require electronic cards for use. Paper for the photocopier and the printer may be obtained from the departmental secretary, Vuyokazi Nkaiy. Please note that printing charges are significantly more expensive than photocopying, and that the printer can become very slow during busy times, or when PDF files are being downloaded for printing. Note that the University Library also provides access to photocopying services.

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🕮 MAP LIBRARY

The Department has a large and valuable map library which is housed room 44A. It comprises a collection of geological and topographic maps organised as a function of topic, geographical region and scales. The maps are kept in clearly labelled drawers. As the cost of replacing damaged maps becomes increasingly expensive, the user is asked to handle the maps with care. No cutting or drawing on the maps is allowed. Undergraduate students are not allowed to remove maps from the map room. However, they may ask staff members for permission to access the map room and to study the maps *in situ*. Postgraduate students may borrow maps only after consulting with the HoD and signing for them in a specifically designed notebook housed in the map room, providing that the maps are not taken out into the field. In other words, the map library should be treated as a reference collection. Explanations of geological maps published by the Council for Geoscience are kept in a locked cupboard in Room 44A.

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🕮 SAMPLE PREP LABS

The Department has facilities for a variety of sample preparation techniques, including rock crushing, thin section preparation, preparation of powder pellets and fused glass beads (for XRF), and rock dissolution. These are all located in the basement, and must only be used under supervision by staff and/or after training by qualified (trained) personnel. Your first point access is Ms Andrea King, the department's CTO.

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🕮 ACCESS TO DEPARTMENT AND LABORATORIES AFTER HOURS

All staff and postgraduate students are issued with keys which allow them to gain access to the department and appropriate laboratories or offices after hours. Keys are issued against a deposit and it should be stressed that for students the possession of keys is a privilege and subject to certain conditions. **The keys must under no circumstances be lent or given to any person who is not entitled to such, nor may they be used to give unauthorised individuals access to the department, laboratories or offices.**

It is official University policy not to allow undergraduate students access to the department after hours. However, from time to time undergraduate students are required to be in the department outside normal hours. In such cases they may be given access with the permission of the Head of Department or appropriate academic member of staff and by arrangement with the departmental secretary. In this event, the keys must be signed out before **16h30** and returned by **08h30** at the latest, the following morning.

◆BOOK LIST FOR 2016◆

Notes:
The cost of books has risen to such a level that the following list has been trimmed to an irreducible minimum. Those marked *Essential* will be needed by each student; those in the *Recommended* category represent desirable supplementary reading material but it is possible to manage without them where the student is financially restricted. These books are stocked by Van Schaik's Bookstore (129 High Street). Pre-owned copies of some books may be available from Fables Bookshop (119 High St.).

(*) indicates that these books should be possessed by all students proposing to continue to the Honours degree.
(#) indicates that these books will be used in Geology II and Geology III.
(@) indicates books which are interchangeable.

GEOLOGY 1

Essential

Marshak (2012)	Earth: portrait of a planet (WW Norton & Co, N.Y.) (4th edition)
McCarthy & Rubidge (2005)	The story of Earth & Life (Struik, C.T.)

GEOLOGY 2

Essential

	Benton & Harper (1997) :	Basic Palaeontology (Longman)
(*)	**Boggs (2006)** :	Principles of sedimentology and stratigraphy (Prentice Hall)
(#)(*)	**Deer, Howie & Zussman (1992)**	Introduction to the rock-forming minerals (2nd Edn, Longman Scientific & Technical)
(#)	**Saggerson: (1986)**	Handbook of minerals under the microscope (Univ. of KwaZulu-Natal Press)
(#)(*)	**Winter (2001)**	An introduction to Igneous and Metamorphic Petrology (Prentice Hall)
(*)(@)	**Davis & Reynolds (2012)**	Structural geology of rocks and regions (3rd Edn, John Wiley & Sons)
	OR	
(*)(@)	**v.d. Pluijm & Marshak (2004)**	Earth Structure: an introduction to structural geology and tectonics (WW Norton & Co., N.Y.) (2004)

Recommended

Doyle (1996)	Understanding fossils (John Wiley & Sons)
Rubidge & Brink (1986)	Life through the ages (National Museum, Bloemfontein) **(available from Dr Rose Prevec, Albany Museum)**

GEOLOGY 3

Essential

(*)(@)	**Davis & Reynolds (2012)**	Structural geology of rocks and regions (3rd Edn, John Wiley & Sons)
	OR	
(*)(@)	**v.d. Pluijm & Marshak (2004)**	Earth Structure: an introduction to structural geology and tectonics (WW Norton & Co., N.Y.) (2004)
	Robb (2005) :	Introduction to ore-forming processes (Blackwell Science Ltd., Oxford)
(#)(*)	**Winter (2001)**	An introduction to Igneous and Metamorphic Petrology (Prentice Hall)

Recommended

(*)	**Wilson & Anhaeusser (Eds)**:	The Mineral Resources of South Africa (6th Edn, Council for Geoscience, Handbook 16) (1998)
	Johnson, Anhaeusser, Thomas (eds):	The Geology of Southern Africa (Council for Geoscience) (2006)

GEOLOGY HONOURS

Essential

(*)(@)	**Davis & Reynolds (2012)**	Structural geology of rocks and regions (3rd Edn, John Wiley & Sons)
	OR	
(*)(@)	**v.d. Pluijm & Marshak (2004)**	Earth Structure: an introduction to structural geology and tectonics (WW Norton & Co., N.Y.) (2004)

Recommended

	Passchier & Trouw (2008/12)	Microtectonics (Springer Verlag)

Magmatic breccia in mafic granulites of the Mesoproterozoic Bysteek Formation, central Namaqua Belt

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