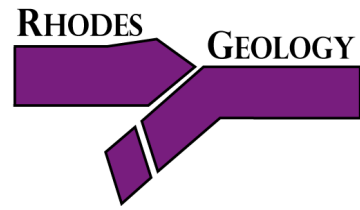




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DEPARTMENT OF GEOLOGY



Garnet and epidote alteration in metabasites from the Namaqua Belt

GEOLOGY STUDENT HANDBOOK 2024

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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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WHICH SUBJECTS COMBINE WELL 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 & Remote Sensing** 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 in other languages considerably enhances the capacity of geologists, particularly those employed in mineral exploration, to function in the field. Students might consider taking a course in French, Spanish or Chinese in their degree curriculum in order to improve their employability on the global job market.

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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, practical sessions, and any additional assigned work, lecture preparation, reading, etc. Therefore, for the 1st year Earthscience/Geology courses, you should expect not less than 10 hours of work per week (3 hours of lectures, a three hour practical session, 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 practical work, 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 field assignments often use weekends, and that compulsory field courses may be scheduled during 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 being and 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 BSc degree and employers generally find it insufficient qualification for employment and advancement as a professional in one's chosen field. The BSc 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 BSc (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 consistently achieved 65% or better in their undergraduate geology courses. This rule is flexible to some extent. Students with poorer pass marks but who go out and gain relevant and successful work experience before re-applying may get accepted into Honours depending on performance and availability of space in the programme.

The reason for requiring a solid undergraduate performance 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 up results from practical work, 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 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 understanding and investigate skills in the students.

Beyond BSc (Hons) lie the MSc and PhD 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 MSc and PhD 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 MSc, but preferably a PhD.

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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 Geology building in Artillery Road next to the main library.

The Geology Department teaches six undergraduate semester credit courses, which are required to obtain a BSc degree with a major in Geology. For students who already have a B.Sc. degree with a major in Geology, we offer a BSc (Hons) degree in Geology. Further postgraduate degrees in Geology at the MSc and PhD level are obtained by thesis-based research.

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STAFF

The Head of Department is Prof Steve Prevec. The HoD office is on the third floor of the department building.

Ms Nonkanyiso (Nkanyi) Maqanda is the Administrative Assistant of our department. She is with us only on a temporary and part-time basis (afternoons only). In addition to being the department's front desk person she has a wide range of administrative and financial management obligations. You will find her office on the third floor of the Geology building.

Prof. Steve Prevec (Professor), completed his PhD 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 PhD 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 the Science Extended Studies Program and structural geology and plate tectonics at 1st to 3rd year level. He also runs the Field School at Honours level. 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 and the evolution of kimberlite melt.

Dr Eugene Grosch (Senior Lecturer) has a PhD 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.

Mr Silindokuhle Mavuso joined us a lecturer in the nGAP programme in 2021. He is a sedimentologist and currently undertaking his PhD at Wits University, studying the Plio-/Pleistocene sedimentary environment of the Turkana Basin in East Africa in the context of early hominin evolution.

The positions of a **Hydrogeologist**, an **Economic Geologist** and the directorship of the **Exploration MSc Programme** are currently vacant.

Research Associates

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.

Prof. Robin "Jock" Harmer (Professor Emeritus) is the acting Director of the Exploration MSc programme. He holds a PhD 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.

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 (Senior Research Associate) joined the department late in 2015, and is a specialist in the biogeochemistry of early life, with particular interest in the Barberton greenstone belt. She also teaches undergraduate palaeontology courses.

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 the Principal Technical Officer who is in charge of the thin section laboratory, workshops, vehicles, field equipment, departmental maintenance, and thin section preparation. **This position is currently vacant.** The PTO 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.

IMPORTANT DATES (TERMS, EXAMS, ETC.) are indicated on the Teaching Plan that you can find on the department's website <https://www.ru.ac.za/geology/> in the section "Student Information"

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 1-2 weeks (if not more frequently), and usually one or more practical tests in each course.

There will be a theory exam set for each subject; some subjects may have an additional practical exam. Typically, each term will be examined via two 120 min exams.

*Field course dates are subject to confirmation and additional field outings may be scheduled.

NOTE: Due to the current vacancies the course schedule might change in 2024 depending on the availability of temporary teaching staff. Consult the teaching plan available on the Department website (<https://www.ru.ac.za/geology/>), for updates.

FIRST YEAR COURSE: GEOLOGY 1

Geology 1 consists 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, practical sessions, 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. The course coordinators are Prof Steve Prevec (Geology) and Prof Ian Meiklejohn (Geography).

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 with both. Please refer to the separate Earth Science 101 booklet for details of the course.

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. The course coordinator is Prof Steffen Büttner.

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 4-5 formal lectures per week. One lecture period each week may 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 GLG102 timetable slot.

Textbook

The prescribed textbooks for Geology 1 is “Earth: Portrait of a Planet” by Stephen Marshak. You should own your personal copy of this book.

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.

Entrance requirement	≥ 40% in EAR101.
DP requirements	Appropriate class attendance and submission of all assessed work (e.g. practical reports, tests). A class record of ≥40% in GLG102. Should you not achieve this minimum you will not be admitted to exams.
Assessment weighting	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 with 50% of the final mark for GLG102. The other 50% of the GLG102 semester mark are the average of the November examinations. There will be two theory exams (90 min each) set for GLG102 during the exam period.
Aggregation (ACR GLG 1)	The subminimum for aggregation in order to obtain an ACR in GLG1 is ≥40% in GLG 102 and in EAR 101, achieving an average mark of ≥50%.
Supplementary exams	Supplementary exams may be granted for students who cannot aggregate their GLG102 and EAR101 marks to obtain a GLG1 annual credit. Requirements for granting supplementary exams are: 1) a GLG102 class mark of ≥50%, 2) a semester mark of 40 to 49%; 3) no DP warning for the GLG102 course.

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 1-2 weeks, and one practical test in each course module.

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. The GLG2 course coordinator is Prof Steffen Büttner.

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.

Modules

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.

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

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 (stereonet and interpretation of stereonet data, structural maps and cross-sections).

Hydrogeology: In this three-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.

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 2 nd 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 2 nd -Year Geology there is a <u>compulsory</u> 4-5 field course usually held over long weekends during the first semester. The course will focus on aspects of the stratigraphy, sedimentology, and structural geology of the Karoo and Cape Supergroups. 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.
Entrance requirement	For GLG 201: GLG 1 credit and attendance of CHE101. For GLG 202: adequate performance (i.e., a valid DP certificate) in GLG 201 is required.
DP requirements	Appropriate class attendance and submission of all assessed work (e.g. practical reports, tests). A class mark of $\geq 40\%$.
Assessment weighting	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 with 50% of the final mark in each semester course. The remaining 50% are calculated from the average of the November examinations.
Aggregation (ACR GLG 2)	The subminimum for aggregation in order to obtain an ACR in GLG2 is $\geq 40\%$ in each semester course, achieving an average mark of $\geq 50\%$.
Supplementary exams	Supplementary exams may be granted for students who cannot aggregate their GLG2 semester courses. Supplementary exams may be granted for students who cannot aggregate their GLG201 and GLG202 marks to obtain a GLG2 annual credit. Requirements for granting supplementary exams are: 1) a semester class mark of $\geq 50\%$, 2) a semester mark of 40 to 49%; 3) no DP warning in either semester course.

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THIRD YEAR COURSES: GEOLOGY 301 AND 302

The GLG3 course coordinator is Dr Eugene Grosch.

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.

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. Practical sessions include work using the Mohr stress diagram (revising some 2nd year material), analytical techniques using the stereonet, and a field exercise.

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.

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.

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 <u>compulsory</u> field course held in the July vacation. The field course has been run recently in the Makhanda area and focuses the geology of the Karoo and or Cape Supergroups, but modifications will happen in the current year. 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.
Entrance requirement	A student may not register for GLG 301 before (a) first obtaining at least one second-year semester credit in Geology and having adequately performed in the other (i.e. a valid DP certificate); (b) first obtaining credit in the compulsory ancillary first year courses in Chemistry, Physics or Mathematics. For registration in GLG302, adequate performance in GLG301 is required (i.e., a valid DP certificate).
DP requirements	Appropriate class attendance and submission of all assessed work (e.g. practical reports, tests). A class mark of $\geq 40\%$.
Assessment weighting	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 with 50% of the final mark each semester course. The remaining 50% are calculated from the average of the November examinations.
Aggregation (ACR GLG3)	The subminimum for aggregation in order to obtain an ACR in GLG3 is $\geq 40\%$ in each semester course, achieving an average mark of $\geq 50\%$.
Supplementary exams	Supplementary exams may be granted for students who cannot aggregate their GLG3 semester courses. Supplementary exams may be granted for students who cannot aggregate their GLG301 and GLG302 marks to obtain a GLG3 annual credit. Requirements for granting supplementary exams are: 1) a semester class mark of $\geq 50\%$, 2) a semester mark of 40 to 49%; 3) no DP warning in either semester course.

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 audio-recording cell phones, video cameras, etc., the most widely used and most useful 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.

GLG2 Field Course

A 4-5 day field course through the Karoo and Cape Supergroup sedimentary rock succession. The course emphasises sedimentary rocks, structures, sequences, and environments, and the fossil record therein (both plants and animals). The field course may be merged with the modules on Sedimentology and Structural Geology.

GLG3 Field Course

A 5-7 day field course normally run in the August/September vacation.

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DULY PERFORMED (DP) CERTIFICATES

Students are expected to attend all class meetings and to complete all work assigned to them. Failure to do so may result in a warning or in being refused a DP Certificate by the Head of Department or course coordinator. In order to earn a DP Certificate, the **minimum** requirements are:-

1. Lectures: Although attendance at lectures may not always be monitored, satisfactory attendance is required and students may be called upon to justify persistent absence from lectures. Unsatisfactory lecture attendance may result in DP removal (DPR) or a DP warning (DPW). A DPR will bar the student from writing examinations in the subject in which the DP was removed. DPWs have implications for the granting of supplementary exams (see above).
2. Practicals: Attendance of all meetings is required. Practical assignments must be handed in for marking on due dates. Attendance registers will be kept. Missing prac sessions requires the presentation of a valid LOA.
3. Class Record: A class record mark is assigned to each student based on test, essay and practical assignment results. 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 computed at the end of the semester. Missing assignments and practical sessions without good reason (valid LOA certificates) may result in DPW or DPR. **Furthermore, a class record of at least 40%** is a DP requirement in all undergraduate semester courses.

◆ HONOURS ◆

A full Honours degree in Geology requires the following:

1. Attendance of the theory courses on offer and completion of related assignments.
2. Attendance of the Field School and writing a report on work completed in the course.
3. Completion of a **research project** and the writing of a **research project report (Honours thesis)**.

NOTE: The Honours curriculum does not have formal vacations between February and the end of November. Times not allocated to theory modules or to the Field School are dedicated to your research project. Based on individual progress in your research, your supervisor may grant you leave of absence during project time.

DP requirements	Attendance of all class meetings, submission of all assigned work, completion of the research project and the timely submission of the project report (thesis).
Supplementary exams	There are no supplementary exams at Honours level.

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.

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THEMATIC COURSES

The Honours program consists of five mandatory modules, one field school, and ~12-18 weeks allocated for work on a research project. Most modules consist of three weeks teaching and are examined in the form assignments and a 2h theory exam for each module. In 2024 we offer courses on Sedimentology, Metamorphic Petrology, Modern Mapping Techniques, Geotechnical Engineering, Structural Geology and Mineral Chemistry, Magmatic Ores, and a two-week Field School module. 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, 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.

FIELD SCHOOL

The Field School is a module of ~2 weeks in total. It is normally run in the middle of the year and is managed and supervised by Prof SA Prevec.

RESEARCH PROJECT

The Honours Project is an important component of the Honours course. It involves about ~12-18 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 fieldwork 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 the Technical Officer managing the thin section laboratory. Those students intending to carry out micro-chemical analyses should contact Dr van Niekerk (EMPA, EDS) 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 13 October**. An initial penalty of 5% followed by 3% per day will be imposed for late submission. Some guidelines on how to prepare your Honours project are given in the next chapter.

MARK BREAKDOWN AND CURRICULUM DATES

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

5 exams (80x4)	320
Class marks from 5 course modules (50 each)	250
Field course and report	130
Research project	300
TOTAL:	1000 marks

*This key might undergo review later in 2024 but is not likely to change significantly.

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 must discuss any time off with your supervisor, and all such breaks require his/her approval.

The external examiner's visit will occur in late 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.

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 20 000 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.

Further guidelines of appropriate scientific writing can be found on the Geology website under <https://www.ru.ac.za/geology/furtheronlineresources/>

(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,

- is copied from an essay or practical report written by another student;
- is copied from a document downloaded from a website;
- is copied from a published article or book chapter;
- 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 with the RU

policy on plagiarism available via a link from the Department's website under <https://www.ru.ac.za/geology/furtheronlineresources/> , 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 realize 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 plagiarized 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 plagiarized 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 1 st 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 1 st 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>.

ALL 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.

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 organized as a function of topic, geographical region and scales. The maps are kept in clearly labeled 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.

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 of call is the department's CTO.

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 unauthorized 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◆

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 McCarthy & Rubidge (2005)	Earth: Portrait of a Planet (WW Norton & Co, N.Y.) The story of Earth & Life (Struik, C.T.)
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GEOLOGY 2

Essential

Benton & Harper (1997) : (*) Boggs (2006) : (#)(*) Deer, Howie & Zussman (1992, 2013) (#)(*) Winter (2001) (*)(@) Davis & Reynolds (2012) OR (*)(@) v.d. Pluijm & Marshak (2004)	Basic Palaeontology (Longman) Principles of sedimentology and stratigraphy (Prentice Hall) Introduction to the rock-forming minerals (2 nd / 3 rd Edn, Longman Scientific & Technical) An introduction to Igneous and Metamorphic Petrology (Prentice Hall) Structural geology of rocks and regions (3 rd Edn, John Wiley & Sons) Earth Structure: an introduction to structural geology and tectonics (WW Norton & Co., N.Y.) (2004)
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Recommended

Doyle (1996)	Understanding Fossils (John Wiley & Sons)
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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

- Deer, Howie and Zussman (2013)** : Introduction to Rock Forming Minerals.



BScH students in the field

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