University of Technology, Sydney

Department of Applied Geology

1989 Handbook

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ACADEMIC STAFF

Department of Applied Geology
Associate Professor and Head of Department

E.C. Leitch, MSc (Auck), PhD (UNE), FGS

Senior Lecturers

E. Frankel, BSc (Natal), PhD (Syd)
B.J. Franklin, BSc (Syd), MSc, PhD (NSW), MAIG, FGAA
B. Marshall, BSc (Lond), PhD (Brist), GradDipMgt (CIAE), ARCS, FGS, AMAIMM, MAIG
S.R. Sangameshwar, MSc (Mys), MSc, PhD (Sask), FGSI, AMAIMM, MAIG

Lecturer

C.G. Skilbeck, BSc, PhD (Syd)

Senior Tutor

J. Nicholson, MSc (NZ), AMAIMM

Tutor

J. Smith, BAppSc (NSWIT)

Honorary Associates

K.G. Mosher, ED, OBE, BSc (Syd), MAIMM
F.L. Sutherland, MSc (Tas), PhD (J Cook)

THE DEPARTMENT OF APPLIED GEOLOGY

The Department of Applied Geology is located principally on the third floor of Building 4, although there are also laboratories and preparation rooms on the lower ground floor. Most teaching and technical staff have offices on the third floor where all lectures and practical classes are held except for Geology 1 (full-time) which has lectures on the ground floor.

The Department has a number of specialist laboratories designated for particular teaching activities. Thus there is a coal laboratory set up for investigating economically important properties of coal, several laboratories devoted to transmitted and reflected light microscopy, a sedimentology laboratory, a laboratory for fluid inclusions, and one for carrying out engineering geology tests. A dark-room and specialist preparation rooms are available. A computer network is maintained by the Department for teaching, research and word-processing, and there are several stand-alone personal computers.

Additional facilities are available on a Faculty basis including laboratories for X-ray diffraction and fluorescence analysis, for differential thermal analysis, for crushing and grinding of rocks, and for mineral separation. Scanning electron microscope facilities and ICP equipment are also available within the Faculty.

STAFF RESPONSIBILITIES

As Head of Department **Associate Professor Evan Leitch** (Room 309) is responsible for the overall running of the Department of Applied Geology. He makes recommendations to the Head of School on student matters including withdrawal from subjects and other variations to programs, leave of absence, and special dispensations, and should be approached by students with problems relating to their course of study or other academic matters. His teaching is mainly in the field of tectonics, the large-scale structure and evolution of the Earth, and he is responsible for the Geodynamics and Tectonics subjects and also teaches in Geological Mapping and Geology 1. Professor Leitch's research interests are in

regional geology and tectonics, especially the geological evolution of eastern Australia.

Dr Edgar Frankel (room 315) is a sedimentologist concerned principally with the formation of shallow marine and non-marine deposits including coal. He is an experienced marine geologist and has researched extensively on the geology of the Great Barrier Reef. Dr Frankel teaches in the subjects Sedimentary Geology, Fossil Fuels, and Advanced Fossil Fuels. He also oversees Project Seminar and Field Project and teaches Environmental Geology.

Igneous geology is the main field of interest of **Dr Brenda Franklin** (Room 324B) but she also has interests and experience in metamorphic rocks and gemstones. Her teaching is mostly in Lithology, Mineralogy and Petrology and Advanced Petrology. She is responsible for the timetabling of subjects in the Department, is Sub-Dean and is Deputy Chair of the University Library Committee. Dr Franklin's research has concentrated on the origin and tectonic significance of mafic and ultramafic rocks, expecially those of the Tumut district in southern New South Wales.

Dr. Brian Marshall (room 324C) has expertise in structural geology and engineering geology and his teaching takes in the subjects Structural Geology, Advanced Structural Geology, and Advanced Engineering Geology. He is responsible for placing students on Industrial Training and is a Faculty representative on the Academic Board. Dr Marshall has research interests in structural geology, particularly in the application of structural studies to the understanding of the nature and origin of ore bodies.

The mineralogy, geochemistry and origin of metalliferous ore deposits in the special concern of **Dr Salem Sangameshwar** (room 301) who teaches subjects including Geochemistry, Economic Geology, Exploration Geochemistry, Exploration and Mining Geology and Mineral Deposits. His research is primarily concerned with the application of thermodynamics in the understanding of ore deposits and the extraction of metals. He will

pursue these interests while on study leave at Pennsylvania State University in Spring Semester 1989.

Dr Greg Skilbeck (room 316) is a petroleum geologist with interests in sedimentology, stratigraphy and the nature and origin of sedimentary basins. His teaching includes contributions to Fossil Fuels, Advanced Fossil Fuels and Engineering Geology, and he oversees Exploration Geophysics, Basin Analysis and Geological Mapping. Dr Skilbeck's current research concentrates on the petroleum geology of the Cooper Basin.

Mrs Jill Nicholson (room 314) is a widely experienced geologist with a major interest in scientific communication and the development and management of mining projects. She teaches the subjects Lithology, Technical Communication and Resource Management, gives part of the Geology 1 course, and is jointly responsible for placing students on Industrial Training. Mrs Nicholson's research is concerned with geological education and technical communication. She is on the Higher School Certificate Examination Committee for 3/4 Unit Science.

Mr John Smith (room 324D) is undertaking post-graduate studies in structural geology while teaching in the Department. He has responsibility for the classes in Engineering Geology given to students from the Faculty of Engineering, and for Geology 1 (part-time), and tutors in practical sessions in several other subjects. Mr Smith provides advice to students using the Department's computer systems.

Mr Alan Buttenshaw (room 318A) oversees the work of the Technical Staff. He is responsible for ensuring that specialist laboratories including the drafting room, the microscope rooms, and the computer room are satisfactorily maintained, and organises access to these facilities and the issuing of keys. Matters involving the security of the Department, safety, and damage to, a malfunction of, major equipment items in areas not under direct supervision by other staff should be drawn to his attention. Mr Buttenshaw issues permission letters for weekend work to senior students.

Mr David Colchester (room 333) has responsibility for the project room (room 332), the remote sensing laboratory (room 331) and the coal laboratory (room 330). He has undertaken research work in petrology and has much experience in sample preparation, staining and allied matters, and X-ray analysis.

Mr Alan Giles (room LG4B) is responsible for the Department's facilities on the lower ground floor, including thin (LG6E) and polished section (LG6D) preparation rooms, the engineering geology laboratories (rooms LG6 etc) and the rock storage area. He is a trained geologist who has specialist knowledge in the study of fluid inclusions and the preparation of materials for microscope study.

Mrs Leighonie Green (room 311) is the technical officer in charge of the area of the Department including the petrology laboratory (room 319), the economic mineralogy laboratory (room 326), and the microscope laboratories (rooms 324A and 325). She services the microscopes and provides advice on drafting. Mrs Green is a qualified geologist who specialised in engineering geology.

Mrs Jan Pearson (room 320) works part-time in the Department, sharing responsibility for the Geology 1 and Structural Geology laboratories (rooms 323 and 322). The map library (room 312) is also her responsibility and she and Mrs Taylor-Perkins issue laboratory material and manuals for the Geology 1 and Geology for Engineers classes. Mrs Pearson is completing a degree in Earth Sciences specialising the field of geomorphology.

Mrs Vicki Taylor-Perkins (room 320) is a part-time member of the Department who shares responsibility for the Geology 1 and Structural Geology laboratories (rooms 323 and 322) with Mrs Pearson. She organises the Departmental Library (room 327) and prepares many of the displays in the Department. Mrs Taylor-Perkins is on leave until the end of July 1989.

COURSE INFORMATION

APPLIED GEOLOGY DEGREE COURSE

The course is designed for students seeking careers as professional geologists. The basic award for successful completion of the course is Bachelor of Applied Science; students who have performed meritoriously in formal course work and have submitted a project report of high standard are awarded the degree with Honours.

The course program comprises six stages of formal study plus at least one year of full-time (or its equivalent) industrial training. Industrial training is an essential part of the degree program, and is normally completed before the final stage of formal instruction. The Department of Applied Geology maintains close liaison with potential employers, and assists students to obtain appropriate positions.

The common course patterns are:
- four years of full-time enrolment including two six-month periods of industrial training;

- six years of part-time* attendance while concurrently employed full-time in a geologically relevant field;

- alternating periods of full study with similar periods of full-time relevant employment.

Full-time attendance involves 24 hours per week at the University; this enables a full Stage of the course to be completed in a semester.

Part-time attendance involves 12 hours per week at the University; with this form of attendance the equivalent of a full Stage may be completed in one year. It is normal practice for employers to release part-time students for at least one half-day per week for attendance at classes. Students

commonly attend the University for one half-day and three evenings per week, or for two half-days and two evenings per week.

* Industrial training can be achieved by being concurrently in suitable employment. The matter should be discussed with the Head, Department of Applied Geology.

FULL-TIME PROGRAM

In these programs, each Stage corresponds to one semester spent in full-time attendance at the University.

STAGE 1

Autumn Semester	***Hours/Week***
62311 Geology 1F/T	6
62411 Chemistry 1 F/T	6
33160 Science Mathematics 1 F/T	6
63211 Physics 1 F/T	6

STAGE 2

Spring Semester	
62322 Geological Mapping	4
62325 Lithology	2
62421 Chemistry 2 F/T	6
33163 Science Mathematics	3
33141 Statistics 1	3
63221 Physics 2 F/T	6

STAGE 3

Autumn Semester	
62396 Industrial Training	6
Spring Semester	
62330 Mineralogy and Petrology	8
62332 Geodynamics	3

62335 Sedimentary Geology 6
62336 Geochemistry 3
31799 Computing 1 4

STAGE 4

Autumn Semester

62341 Technical Communication 4
62342 Structural Geology 6
62343 Economic Geology 4
62348 Resources Management 3
62355 Basin Analysis 3
62375 Exploration Geophysics 4

Spring Semester

62397 Industrial Training 2 6

STAGE 5*

Autumn Semester

62350 Engineering and Environmental Geology 6
62352 Advanced Petrology 4
62353 Fossil Fuels 4
62356 Exploration Geochemistry 3
62359 Project Seminar 3
62372 Advanced Structural Geology 4

STAGE 6*

Spring Semester

62351 Exploration and Mining Geology 4
62360 Field Project 9
62364 Tectonics 3
62367 Remote Sensing 4

one of:

62371 Advanced Fossil Fuels 4
62374 Mineral Deposits 4
62377 Advanced Engineering Geology 4

PART-TIME PROGRAM

STAGE 1

Academic Requirements

Autumn Semester	***Hours/Week***
62312 Geology 1 P/T (2sem)	3
62412 Chemistry 1 P/T (2sem)	3
33159 Science Mathematics 1 P/T (2sem)	3
63211 Physics 1 P/T (2sem)	3
Spring Semester	
62312 Geology 1 P/T (2sem)	3
62412 Chemistry 1 P/T (2sem)	3
33159 Science Mathematics 1 P/T (2sem)	3
63211 Physics 1 P/T (2sem)	3

STAGE 2

Academic Requirements

Autumn Semester	
33141 Statistics	3
62422 Chemistry 2 P/T (2sem)	2
33163 Science Mathematics 2	3
63221 Physics 2 P/T (2sem)	3
Spring Semester	
62322 Geological Mapping	4
62325	
Lithology	2
62422 Chemistry 2 P/T (2sem)	3
63221 Physics 2 P/T (2sem)	3

STAGE 3

Academic Requirements

Autumn Semester	
31799 Computing 1	4
62336 Geochemistry	3
62332 Geodynamics	3

Spring Semester

62330 Mineralogy & Petrology 8
62335 Sedimentary Geology 6
Industrial Requirements
62398 Industrial Training P/T 3

STAGE 4
Academic Requirements
Autumn Semester
62342 Structural Geology 6
62355 Basin Analysis 3
62375 Exploration Geophysics 4
Spring Semester
62341 Technical Communication 4
62343 Economic Geology 4
62348 Resource Management 3
Industrial Requirements
62398 Industrial Training P/T 3

STAGE 5*
Academic Requirements
Autumn Semester
62352 Advanced Petrology 4
62353 Fossil Fuels 4
62372 Advanced Structural Geology 4
Spring Semester
62350 Engineering and Environmental Geology 6
62356 Exploration Geochemistry 3
62359 Project Seminar 3
Industrial Requirements
62398 Industrial Training P/T 3

STAGE 6*

Academic Requirements

Autumn Semester

62351 Exploration and Mining Geology 4
62367 Remote Sensing 4
one of:
62371 Advanced Fossil Fuels 4
62374 Mineral Deposits 4
62377 Advanced Engineering Geology 4

Spring Semester

62360 Field Project 9
62364 Tectonics 3

Industrial Requirements

62398 Industrial Training P/T 3

* With permission of the Head of Department, other subjects may be substituted for particular subjects in Stage 5 or Stage 6, where this is appropriate.

GEOLOGY PRIZES & SCHOLARSHIPS

1. Francis E. Feledy Prize

Awarded to the part-time Physical Science student about to enter the final year of his/her course who has the best performance so far in the course. Cash award of $100.

2. BP Coal Australia Prize

Awarded competitively to a student completing Stage 4 or Stage 5 who undertakes a final year project in an area directly related to the coal industry. Cash award of $500.

3. St. Joe Mineral Deposits Prize
Awarded to the student who obtains the highest weighted average mark in the subject Mineral Deposits. Cash award of $50.

4. Western Mining Corporation Prize
Awarded to the student completing the Field Project who has the highest weighted average mark. Cash award of $200.

5. CRAE Mapping Prize
Awarded for the best performance by a project student whose project involves a significant field mapping component. Cash award of $250.

6. Prospector's Supplies Prize
For the best performance in first-year geology subjects by a student continuing in Geology. (A brunton compass).

7. Geology Staff Prize
Awarded for the best performance in Stage 1 by a student continuing in Geology. (Equipment to the value of $50).

FIELD EXCURSIONS

Fieldwork is a very important aspect of geological training and field excursions of varying duration form part of the course at all stages. The excursions are an integral part of subjects and satisfactory fieldwork assessments are required in order to pass. The timing of excursions is determined at the beginning of each semester and all students must attend. Geology 1 and Engineering Geology for Engineers both involve two 1-day excursions, normally held on Saturdays during the semester. Other excursions commonly involve several days and those for subjects in the same stage are commonly run together to minimise travel time and costs.

In 1989 amongst the major excursions that will run are the following:

a) Excursions associated with Advanced Structural Geology, Advanced Petrology, and Stage 6 electives.

b) Structural Geology and Economic Geology (combined). Second break, first semester.

c) Sedimentary Petrology and Petrology (combined). First break, second semester.

d) Geological Mapping. Second break, second semester.

Precise dates will be available early in the appropriate semester.

Shorter excursions may be run with other subjects and the above list is not exhaustive.

The Department usually arranges accommodation, mostly involving camping or the use of on-site caravans, but students need to provide their own equipment (tent, sleeping bag,etc) and are responsible for the costs incurred, and the provision of food, etc. Transport is commonly organised by the Department.

Field excursions are much enjoyed by most participants. Although they demand hard work (both mental and occasionally physical) they provide opportunities for getting to know fellow students and staff in a relaxed atmosphere, and involve travel to new and commonly little-visited parts of the State.

STAFF-STUDENT COUNCIL

Twice a semester the staff meets with representatives of the various stages, service subjects, post-graduate students, and the president of GUTS, to discuss any matters of concern regarding subjects, excursions, departmental arrangements, rules etc. Representatives are elected early in Autumn semester and meeting times are advertised on Department notice boards.

CAREER PROSPECTS FOR GEOLOGISTS

Employment opportunities in Geology for graduates vary widely, being much controlled by the demand for metals and fuels. At present there is a shortage of geologists, principally because of the very great activity in gold exploration and mine development, and high salaries are available although continuity of employment is not quaranteed. Even in time of low exploration activity graduates of the Department of Applied Geology have found employment more readily than most others. This is due to two factors: the vocationally oriented nature of the course, and the experience and contacts gained by students during Industrial Training, a unique aspect of our course!

Graduate geologists are employed by metalliferous exploration and mining companies, by companies exploring for coal and oil and gas, by firms of geological consultants, by companies quarrying non-metallic materials including sand, clay, limestone and concrete aggregate, and by firms providing geotechnical advice to civil engineers and those carrying out environmental impact and pollution control studies. Investment firms, major broking houses and the corporate financing section of large banks have geologists on their staffs. The Department of Mines (including the NSW Geological Survey), the Department of Main Roads, the Bureau of Mineral Resources, the Industries Assistance Commission and CSIRO all employ geologists as do Elcom, the Soil Conservation Service and the Water Resources Commission.

There is a shortage of teachers trained in geology, and geologists have jobs in town planning, personnel management, professional employment agencies, libraries and museums. As the need for quality water supplies grows and the problem of soil pollution, especially by salt, increases there should be further opportunities for graduates.

A four-year degree, as awarded by the University of Technology, Sydney, is the standard minimum qualification for professional employment as a geologist.

STUDENT GEOLOGICAL SOCIETY (GUTS)

There is a very active student geological society that arranges a variety of social gatherings, field trips, career nights, mineral sales etc. The society fields teams in inter-department sporting events and takes part in other intramural activities. It was awarded 'student society of the year' in both 1987 and 1988.

The social peak of activities occurs towards the end of Spring semester when the annual dinner is held, which culminates in the distribution of various awards to the staff by the students and vice-versa.

SUBJECT OUTLINES

62311 GEOLOGY 1 F/T
Six semester hours (2s/hrs lectures, 4 s/hrs practical)
The dynamic Earth; Earth structure and the evolution of the continents and oceans. Modern and ancient environments. Geological history. Geological structure of Australia. Resource and environmental geology.

62312 GEOLOGY 1 P/T
Three semester hours for two semesters
Equivalent to 62311.

62322 GEOLOGICAL MAPPING
Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)
Prerequisite: 62311 or 62312 Geology 1
Maps and aerial photographs; contours; stratigraphic principles and correlation; folds and faults; interpretation of geological maps; surveying and mapping techniques. Geological framework of New South Wales. Six-day field camp.

62324 CLAY MINERALOGY
Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)
Geology and mineralogy of non-metallic mineral deposits; quality parameters and testing procedures for industrial use; special techniques for clay evaluation.

62325 LITHOLOGY
Two semester hours (1 s/hr lecture, 1 s/hr practical)
Prerequisite: 62311 or 62312 Geology 1

Crystal symmetry and habit. Crystal growth types. Chemical classification of minerals; Physical properties of minerals. Field classification and hand specimen description of igneous, sedimentary, metamorphic and volcanic rocks. Practical mainly hand specimen examination of common rock-forming and ore minerals, and rocks.

62330 MINERALOGY AND PETROLOGY

Eight semester hours (3 s/hrs lecture, 5 s/hrs practical)

Prerequisite: 62325 Lithology

Crystal symmetry and Miller Indices. Optical theory. Use of the polarizing microscope. Optical properties, chemistry and paragenesis of rock-forming minerals.

Crystallisation paths of igneous minerals; occurrence, mineralogy and texture of igneous rocks; nature of magma and its cooling behaviour; magmatic differentiation; sources of magma - nature of crust and upper mantle; igneous rocks associations. Types of metamorphism and textures of metamorphic rocks; chemical equilibria and metamorphic mineral reactions; concept of metamorphic zones and facies; metamorphic rock associations. Microscopic and megascopic description of rock types. Five-day field camp with 62335 Sedimentary Geology.

62335 SEDIMENTARY GEOLOGY

Six semester hours (3s/hrs lectures, 3 s/hrs practical)

Pre or Corequisites: 62330 Mineralogy & Petrology

Nature and origin of sedimentary materials and stratigraphic sequences including processes of weathering, transportation, deposition and diagenesis. Sedimentology of principal depositional environments; petrographic and textural analysis of sediments; nature and identification of clay minerals; introductions to palaeontological techniques. Field work.

62336 GEOCHEMISTRY

Three semester hours ($1\frac{1}{2}$ s/hrs lectures, $1\frac{1}{2}$ s/hrs practical)

Corequisite: 62330 Mineralogy & Petrology

Abundance and distribution of elements and their geochemical classification. Crystallochemical concepts structure and classification of common minerals. Fundamentals of chemical thermodynamics and application of thermodynamics to geological systems. Isotopy. Aqueous geochemistry and its significance in chemical weathering, chemical sedimentation, diagenesis and metamorphism.

62341 TECHNICAL COMMUNICATION

Four semester hours (2 s/hrs lectures, 2 s/hrs tutorial)

Prerequisites: 62330 Mineralogy & Petrology, 62335 Sedimentary Geology

The nature of technical communication, geological report writing and presentation. Visual communication; charts, graphs, line drawings, maps, statistics. Legal problems of technical communication; contracts, copyright. House style, standard abbreviations and terminology. Editing, preparation and submission of technical manuscripts for publication and/or printing.

Oral presentation of technical reports, participation in symposia. Journal and library research.

62342 STRUCTURAL GEOLOGY

Six semester hours ($2\frac{1}{2}$ s/hrs lectures, $3\frac{1}{2}$ s/hrs practical)

Prerequisites: 62330 Mineralogy & Petrology, 62335 Sedimentary Geology

Stress, strain, rheological concepts, and problems pertaining to rock deformation; classification, recognition and formation of fracture systems in brittle and transitional environments; classification, recognition and formation of structures in ductile environments; collection and analysis of structural data in mine, field and laboratory; data presentation; mineralisation in the structural environment. Field work.

62343 ECONOMIC GEOLOGY

Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Prerequisites: 62330 Mineralogy & Petrology, 62335 Sedimentary Geology

Introduction to the nature of ore bodies; genesis, classification and laboratory methods of investigating such deposits. Field guides to mineralisation. Field investigation of mineralisation.

62348 RESOURCE MANAGEMENT

Three semester hours (1 s/hrs lecture, 2 s/hrs practical)

Prerequisite: 62325 Lithology

Determination of reserves and resources on a global scale. Definition of reserve categories in use in Australia. The structure and financing of mining companies including financial evaluation techniques using discounted

cash flows. Stock exchange operation. Metal marketing and cartels. The New South Wales Mining Law; comparison with law in other States. Government policies with respect to the mining industry and the effects of political decisions on mining operations. Ethics in the mining industry and the geological profession.

62350 ENGINEERING AND ENVIRONMENTAL GEOLOGY

Six semester hours (2 s/hrs lectures, 4 s/hrs practical plus four day field excursion)

Pre or Corequisites: 62342 Structural Geology, 62375 Exploration Geophysics, 62348 Resource Management

Environmental ethics. Fundamental concepts in environmental planning. Geologic hazard recognition and planning. Australian environmental legislation. Environmental impact statement preparation. Environmental aspects of geological resource utilisation. Mine rehabilitation. Soil classification. Rheological properties of rocks and soils. Soils compaction for engineering. Rock mass concepts and classification.

Engineering testing of rock and soil materials. Groundwater geology, hydrology, exploration and development. Soil and rock slope stability. Engineering geology in dam, reservoir, road and railway planning and design.

62351 EXPLORATION AND MINING GEOLOGY

Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Prerequisites: 62342 Structural Geology, 62343 Economic Geology

Principles of project initiation and continuation: functions of the controlling on- site geologist; exploration programs and budgeting; critical path analysis. Prospect analysis using discounted cash flow methods. Relation of exploration programs to geological models. Prospecting methods and follow-up techniques. Drilling: commonly used methods; logging of drill-products; interpretation of results. Drill-sections, level plans, grade and recovery predictions, reserves estimations. Mineral processing.

62352 ADVANCED PETROLOGY

Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Corequisite: 62372 Advanced Structural Geology

Mineral stability fields in the crust, Constitution of the crust and upper mantle. Origin of basaltic magmas. Partial melting and fractional crystallisation hypotheses. The "pyrolite" model. Orogenic igneous rock associations. Petrological evolution of the crust and upper mantle. Experimental metamorphic reactions. Metamorphic facies. Mineral parageneses in metamorphic rocks. Eclogites. Metamorphic belts. Metamorphism and crustal evolution. Field work.

62353 FOSSIL FUELS

Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Pre or Corequisites: 62335 Sedimentary Geology, 62355 Basin Analysis

World energy market. Geology of fossil fuel deposits including coal and associated strata, petroleum, natural gas and synfuels derived from oil shale, tar sands and other petroliferous sediments. Introduction to methods of resources size estimation. Field excursion.

62355 BASIN ANALYSIS

Three semester hours($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Pre or Corequisites: 62342 Structural Geology, 62375 Exploration Geophysics

Techniques of stratigraphic dating and correlation; interpretation of modern and ancient depositional environments; palaeocurrent analysis; provenance, dispersal.

Basin types; relations between basin structure, tectonism and sedimentation.

62356 EXPLORATION GEOCHEMISTRY

Three semester hours (1 s/hrs lecture, 2 s/hrs practical)

Pre or Corequisites: 62342 Structural Geology, 62343 Economic Geology

Introduction to geochemical exploration. Stream, soil rock, plant sampling. Testing methods. Sampling theory. Sample security. Geochemical maps.

62359 PROJECT SEMINAR
Three semester hours
In preparation for the Field Project (62360), students are assigned seminar topics which include a literature search on an area of interest, background reading on relevant theoretical topics, and practical or field exercises designed to develop skills applicable to the particular Field Project proposed.

62360 FIELD PROJECT
Nine semester hours
This is an assignment to be carried out under supervision of a specified member of staff. The assignment combines a literature search, field mapping and/or sampling, and a short laboratory investigation. Assessment is based on a formal typed and bound report submitted to the supervisor before the last week of the semester.

62364 TECTONICS
Three semester hours (1 1/2 s/hrs lectures, 1 1/2 s/hrs practical)
Prerequisites: 62322 Geodynamics, 62352 Advanced Petrology
Origin and evolution of the Earth's continental crust. Change in tectonic regime with time. Large-scale geologic cycles, major Precambrian-Cambrian boundary divisions. Archean geology and tectonics. Granite/greenstone and high-grade metamorphic terrains. Proterozoic crustal associations, special characteristics and tectonics. Reactivated basement models. Plate tectonics and crustal evolution, orogeny, the Wilson cycle, and tectonostratigraphic terranes. Tectonics of present day plate boundaries. Tectonic evolution of Australia.

62367 REMOTE SENSING
Four semester hours (1 1/2 s/hrs lectures, 2 1/2 s/hrs practical)
Pre or Corequisites: 62342 Structural Geology, 62343 Economic Geology
Utilisation of differing parts of the electromagnetic spectrum in remote sensing. Distant and near remote sensing; radar and infrared imagery; traditional black and white, and colour air-photography; multispectral photography and scanning; satellite imagery. Emphasis will be on

geological applications of remote sensing in reconnaissance mapping, geotectonics, and mineral exploration. Practical work will predominantly involve principles of air-photo interpretation.

62371 ADVANCED FOSSIL FUELS

Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Prerequisite: 62353 Fossil Fuels

Exploration and production techniques for coal and petroleum deposits. Reservoir engineering and development of petroleum fields. Assessment of coal and petroleum reserves. Geological factors in coal mine development and operation. Economic assessment and risk analysis.

62372 ADVANCED STRUCTURAL GEOLOGY

Four semester hours

Prerequisite: 62343 Economic Geology

Corequisite: 62352 Advanced Petrology

Elastic, plastic and viscous behaviour in relation to the deformation of mono- and poly-minerallic aggregates; microfabric studies - grain boundary relationships, preferred orientation and the application of the U-stage; theoretical advances in the formation of folds, foliations and lineations; metamorphism and deformation in space and time-progressive deformation relationships in hand-specimen, mine and regional scales; metamorphism, deformation and remobilisation of ore deposits; tectonics and ore distribution; the evolution with geologic time of structure, tectonics and ore deposits. Field work.

62374 MINERAL DEPOSITS

Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)

Prerequisites: 62342 Structural Geology, 62343 Economic Geology

Case studies of classical metallic and non-metallic mineral deposits; their genesis in the light of current theories of ore formation; evidence adduced from field and laboratory studies. Classification of mineral deposits relative to environment and methods of formation.

62375 EXPLORATION GEOPHYSICS
Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)
Prerequisites: 63223 Geodynamics, 31799 Computing 1
Introduction to common methods of air and ground geophysics: theory, technique and equipment; interpretation principles; limitations, particularly in differing parts of Australia. Applications of selected techniques in regional exploration, ground follow-up and target-detailing. Down-hole methods of geophysics; geophysical logging.

62377 ADVANCED ENGINEERING GEOLOGY
Four semester hours ($1\frac{1}{2}$ s/hrs lectures, $2\frac{1}{2}$ s/hrs practical)
Prerequisite: 62350 Engineering & Environmental Geology
Quantification of geologic data for engineering purposes; stress and deformation in soil and rock masses, especially near surface excavations and underground openings; special techniques for field and laboratory investigations; evaluation and development of groundwater resources, probabilistic analysis of soil and rock slope stability.

62378 MINERAL SCIENCE PROJECT
Five semester hours
This project involves a field and/or laboratory study on a topic selected by the Head of Department. It should include literature review pertinent to the topic, a review of appropriate methods of scientific investigations and where, possible should relate to the facilities available to the individual student.

62379 MINERAL SCIENCE PROJECT
Report and Seminar
Two semester hours
A report and seminar prepared by the student on the mineral science project.

62381 ENGINEERING GEOLOGY
(for engineers)
Two semester hours
Nature of minerals; origin and classification of igneous, sedimentary and metamorphic rocks; rock weathering processes; river landscapes, marine landscapes; rockslope stability; uses of rock in construction; structural features of rocks; geological mapping techniques; introduction to rock mechanics.

62390 THESIS
(Applied Geology) F/T

62391 THESIS
(Applied Geology) P/T & EXT

62396 INDUSTRIAL TRAINING 1
(Applied Geology)
Prerequisite: 62322 Geological Mapping, 62325 Lithology
The first period of at least six months full-time relevant industrial employment is necessary to satisfy this subject. The employment must have the approval of the Head, Department of Applied Geology.

62397 INDUSTRIAL TRAINING 2
(Applied Geology)
Prerequisite: stage 4, Applied Geology Course.

62398 INDUSTRIAL TRAINING P/T
(Applied Geology)

NON GEOLOGICAL SUBJECTS INCLUDED IN THE APPLIED GEOLOGY DEGREE COURSE

Subjects from the Department of Applied Chemistry

62411 Chemistry 1 F/T
62412 Chemistry 1 P/T
Six semester hours (2 s/hrs lectures, 1 s/hr tutorial, 3 s/hrs practical). (62412 extends over 2 semesters at 3 s/hrs per week).
Pre-requisite : HSC Science (any course) or Equivalent
Revision of basic concepts. Atomic structure. Periodic table. Bonding. Stoichiometry. Heat changes in chemical reactions. Structure of matter. Changes of state. Redox reactions.

62414 Chemistry 1M F/T (alternate to 62411 or 62412)
Six semester hours
Assumed knowledge: Core of HSC Chemistry 2U course or equivalent
Preparation for practical work, atomic structure, periodic table, chemical bonding, Redox reactions, chemical energetics, properties of matter.

62421 Chemistry 2 F/T
62422 Chemistry 2 P/T
Six semester hours (2 s/hrs lectures, 1 s/hr tutorial, 3 s/hrs practical). (62422 extends over 2 semesters at 3 s/hrs per week).
Pre-requisite: Chemistry 1 or Chemistry Certificate (Sydney Technical College)
Chemical equilibrium. Acid-base theory. Reaction kinetics. Electrochemistry. Manufacture of chemicals. Introduction to organic chemistry.

62424 Chemistry 2M F/T (alternate to 62421 or 62422)
Six semester hours
Pre-requisite: Chemistry 1M F/T or Equivalent
Chemical kinetics, chemical equilibrium, enthalpy and entropy, acid-base theory, complex ions, electrochemistry, manufacture of chemicals.

Subjects from the Department of Applied Physics

63211 Physics 1
Six semester hours (3 1/2 s/hrs lectures, 1 s/hr tutorial, 2 1/2 s/hrs practical)
Co-requisite: Science Mathematics 1
Introduction to the fundamental laws of mechanics, thermal physics, wave motion and optics.

63221 Physics 2
Six semester hours (2 1/2 s/hrs lectures, 1 s/hr tutorial, 2 1/2 s/hrs practical)
Pre-requisite: Physics 1
Introduction to electrostatics, electromagnetism and circuit analysis, properties of matter and optics.
For Chemistry and Geology students: atomic & nuclear physics instead of gravitation and additional optics.

Subjects from the Faculty of Mathematical and Computing Sciences

31799 Computing 1
(for science students only)
Four semester hours (2 s/hrs lectures, 2 s/hrs practical)
Pre-requisite: Science Mathematics 2 or equivalent
The aim of this subject is to introduce science students to computers and their use. Programming skills will be developed using Fortran 77 language on the University's Amdahl Unit & system.
The emphasis is on structured programing techniques and the subject contains a significant element of practical programming work.

33141 Statistics 1
Three semester hours
Pre-requisite: Science Mathematics 1
Descriptive statistics. Basic probability theory. Binomial and normal distribution. Standard tests of significance. Correlation and regression. Distribution-free tests.

33160 Science Mathematics 1 F/T
33159 Science Mathematics 1 P/T
Six semester hours (3 s/hrs lectures, 3 s/hrs tutorial). (33159 extends over 2 semesters at 3 s/hrs per week).
Pre-requisite: HSC 2U Mathematics or equivalent
Introduction to the derivative, local and global extreme values; instantaneous rates of change; non-time rates; continuity; introduction to the integral; area-predicting formulas; volumes of geometric solids; calculation of work; improper integrals; first and second derivative test; mean value principle; composite functions and the chain rule; related rates; l 'hospitals' rule; differentials and implicit differentiations; change of variables technique in integration; the indefinite integral; integration by parts.

33163 Science Mathematics 2
Three semester hours (1 1/2 s/hrs lectures, 1 1/2 s/hrs tutorial)
Pre-requisite: Science Mathematics 1
More antiderivatives; logarithmic laws and their applications; integrations using the natural logarithmic function; the number e; the concepts of inverse functions; the exponential function and its properties; arc length; surface area; method of partial fractions; introduction to differential equations; separation of variables technique.

APPLIED GEOLOGY DEPARTMENT

List of subjects to Run in 1989

(Actual timetable details will be posted on noticeboards next to Faculty Office at enrolment time)

Autumn Semester

STAGE 1
62311 & 12 Geology 1 F/T and P/T

STAGE 2
NOT TO OPERATE

STAGE 3
62332 Geodynamics (provisional)
62336 Geochemistry (provisional)
(One or both may run depending on numbers)

STAGE 4
62341 Technical Communication
62342 Structural Geology
62343 Economic Geology
62348 Resource Management
62355 Basin Analysis
62375 Exploration Geophysics

STAGE 5
62352 Advanced Petrology
62353 Fossil Fuels
62356 Exploration Geochemistry
62359 Project Seminar
62372 Advanced Structural Geology

STAGE 6
62351 Exploration & Mining Geology
62360 Field Project
Elective
62371 Advanced Fossil Fuels and/or
62377 Advanced Engineering Geology

Spring Semester
STAGE 1
62312 Geology 1 P/T

STAGE 2
62322 Geological Mapping
62323 Lithology

STAGE 3
62330 Mineralogy & Petrology
62332 Geodynamics
62335 Sedimentary Geology
62336 Geochemistry

STAGE 4
NOT TO OPERATE
(Possible one or two subjects may run, depending on numbers)

STAGE 5
62350 Engineering & Environmental Geology
62359 Project Seminar

STAGE 6
62360 Field Project
62364 Tectonics
62367 Remote Sensing
Elective
62374 Mineral Deposits

PRINCIPAL DATES FOR 1989

AUTUMN SEMESTER

February 3	Enrolment of new students
February 10	Re-enrolment of continuing students
February 13 (week 1)	Stage 2-6 classes commence
February 13	Orientation Day for new students
February 20	Stage 1 classes commence
March 10	Last day for addition of subjects to approved program
March 20	Tutorial Week commences
March 23	Last day to pay HECS tax
March 24-27	EASTER
March 30	Last day for withdrawal from subjects or course without penalty
April 25	ANZAC DAY
April 26	Physical Sciences Graduation and Prize Giving Ceremonies
May 1	Tutorial Week commences
June 12	QUEEN'S BIRTHDAY HOLIDAY
June 13	Formal Examinations commence
June 23	Formal Examinations end for Physical Sciences

SPRING SEMESTER

July 21	Re-enrolment of continuing students
July 24 (Week 1)	Classes commence
August 3	New students commence
August 11	Last day for addition of subjects to approved program
August 23	Last day to pay HECS tax
August 28	Tutorial Week commences
August 30	Last day for withdrawal from subjects without penalty.
October 2	EIGHT-HOUR DAY HOLIDAY
October 9	Tutorial Week commences
November 20	Formal examinations commence
December 1	Formal examinations end for Physical Sciences

GENERAL INFORMATION

Administrative Matters

The Students Administrative Unit is responsible for administrating the Rules & Regulations which relate specifically to the students body.

Enquiries regarding administrative matters should be made at the **STUDENT INFORMATION OFFICE** which is located on level 4 of the Tower building. Information and assistance are available on courses,admission requirements, enrolment,examinations, variation of course/program and withdrawal from course.

Student Identification Card

An identification (ID) card will be issued to students during enrolment. This card should be carried at all times as such identification is required for the use of computer and library facilities and for admission to formal examinations.

Notification of Changes

It is the students responsibility to ensure that any changes, such as address and name changes be provided to the University. Forms are available at the Student Information Office. The University does not accept responsibility if official mail does not reach students due to a failure to notify a change of address.

Subject Exemptions/Admission with Advanced Standing

Students who have previously completed appropriate subjects of courses at recognised tertiary institutions may be granted subject exemptions. Students wishing to apply should fill in an Exemption Application Form available from the Student Information Office.

YOUR ENROLMENT AND THE HIGHER EDUCATION CONTRIBUTORY SCHEME (HECS)

Effect on Variation of Course Program/Addition or Withdrawal from Subjects.

With the introduction of the HECS (graduate tax) next year it is important that you are aware of the following:

1. You must pay this tax by 23rd March in Autumn Semester and 23rd August in Spring semester
OR
provide or apply for a taxation file number on enrolment.

If this is not done your enrolment is automatically terminated.

2. The last day you can add a subject is: 10th March in Autumn semester, 11th August in Spring semester.

3. The last day you can lodge an application to **drop a subject** or **withdrawal entirely** from a course, or apply to the Registrar for Leave of Absence **without incurring the HECS penalty is:**
- 30th March in Autumn semester,
- 30th August in Spring semester.

4. **NOTE:** If academic approval is subsequently gained to withdraw from a subject/course/or leave of absence you will **still be liable** to the Australian Taxation Office for HECS charges.

5. If you have been sick, had an accident or some other misfortune that has forced you to reduce your studies during the semester then you may appeal to the Commonwealth Government to seek a refund or have your liability reduced.

Forms for adding/dropping subjects and change of course are available from the Student Information Office or the Faculty Office (Building 4, Room 308).

The Student Information Office can be contacted by telephone. The number is 218-9145/9262.

Student Services

The student services unit is also located on level 3A of the Tower building and can be contacted by telephone on 218-9145/9147/9262. This unit is to assist students to perform to the best of their abilities and to gain the most from their education. It provides such services as

Student Counselling - Problems of a personal nature, study difficulties or anything else likely to affect a student's progress may be discussed with complete confidentiality.

Student Health Service - This service is staffed by a Medical Practitioner and nursing sister and provides a free service to all students.

Student Welfare Service - This service covers such things as accommodation, Austudy, help with appeals, disadvantaged and disabled students, students loan fund.

Library Facilities

The University's main library is located at the Markets Campus on the corner of Hay Street and Ultimo Road. Hours of opening are posted at the library and on notice boards at the Faculty Office students may borrow from the library on presentation of their University ID card. No limits are placed on the number of books which may be borrowed, but overdue items must be returned before further loans are made. There are audio-visuals in the library, including a wide variety of videotaped material. Photocopying facilities and computer terminals are available.

Students are encouraged to ask the librarians on duty at the information desk for any help they need in using the library. Library orientation tours are held early in each semester. Leaflets on the literature of various subjects are available.

Computing Services

The Computer Centre provides a comprehensive range of facilities and services to meet the major computing requirements of the University.The central computer installation is located on level 9 of the Tower. Collections of terminals are located at various positions. Tower Building, level 10, room 1013, Building 4, rooms 438 & 440.

Intending users of Computing Centre facilities must first register and production of ID card is required for collection of jobs and use of terminals.

For detailed information about the various administration, academic and social aspects of UTS get a copy of the UTS Brochure - Undergraduate Studies, 1989 from the Student Information Office or the Faculty of Physical Sciences Office.

The Calendar, the official information quide to courses, rules and regulations may be purchased from the Union Shop in the Tower. Copies of the Calendar are available for perusal at the Library and at the Student Information Office.

Academic Progression

ACADEMIC PROGRAM - Your academic program is selected and approved at the time of enrolment. As far as possible it should conform with the course patterns published in this handout. Obviously, when failures occur or timetable difficulties arise, this is not always possible. Careful attention should then be given to selecting subjects for which all the necessary pre-requisites have been completed. Combinations of subjects must not span more than three stages of the course. It is essential

that you seek advice at this stage and that your program is officially approved by a member of the academic staff.

Listings of current subject enrolments are produced in Weeks 5, 10 and 15 of each semester. These are displayed on the third floor of Building 4 in the case of Applied Chemistry, Applied Geology and Material Science students and on the tenth floor of Building 1 for Applied Physics students. You should check these listings to ensure that you are enrolled in the correct subjects and that any variations have been recorded.

EXAMINATION TIMETABLES - Provisional and final examination timetables are displayed on the notice boards. It is the students' responsibility to notify the Registrar if a clash of times occurs in their examination program.

ASSESSMENT - The measurement of performance in individual subjects may take into account work completed in the laboratory and in class tests and/or assignments given throughout each semester as well as results obtained at formal examinations.

The formal assessment periods for the courses within the School are as follows -

ATTENDANCE PATTERN	**ASSESSMENT PERIOD**
Full-time or sandwich	One semester
Part-time	Two semesters

This means that full-time or sandwich students will be formally assessed at the end of each semester. Part-time students will be formally assessed at the end of the Spring Semester, although results may be obtained at the Autumn Semester for subjects taken in that semester.

Formal assessment means that a student's overall performance in the assessment period will be expressed as a Weighted Average Mark (W.A.M.) and an appropriate progression category awarded.

The WAM measures the performance of a student in a particular assessment period and is calculated from the results of all subjects completed within that assessment period.

$$\text{WAM} = \frac{\text{Sum of (W.F. x mark)}}{\text{Sum of WF}}$$

Where WF = subject weighting factor (semester hours) and mark = subject assessment (%).

CONCEDED PASSES - In the event of failing one subject within an assessment period a student may be granted a conceded pass in that subject on the following conditions -

i a mark of 45 to 49 in that subject;
ii a WAM of at least 55% for that assessment period;
iii no previous failure in that subject.

PROGRESSION AND PROBATION - Students whose scholastic performance is satisfactory in a given assessment period will continue to proceed normally through the course (Progression Category A).

In the case of students whose scholastic performance is unsatisfactory, a system of academic probation applies. This system is not intended as a penalty, but is meant to assist students to remedy the deficiencies in their performance. However it should be recognised that failures, particularly failures sufficient to lead to probation, can give rise to consistent difficulties in selecting a program once you are 'out of phase' in a given course.

All students on probation or continuing probation are assigned an academic adviser whose assistance should be regularly sought in order to speed up a return to normal progression.

Students may be placed on probation (Progression Category P) at the end of an assessment period for any of the following reasons -

i a WAM less than 45%;
ii failure in all subjects taken in that period;
iii failure in a subject for a second time;
iv generally unsatisfactory performance.

A student on probation will continue on probation (Progression Category R) if his/her WAM at the end of the next assessment period is less than 50%.

EXCLUSION - A student may be excluded from the course in which he/she is enrolled for any of the following reasons -

i obtaining a WAM < 40% while on probation;
ii obtaining a WAM < 50% while on continued probation;
iii failure in a subject for the third time, regardless of Progression Category (A, P or R);
iv consistently unsatisfactory performance.

APPEALS AND RE-ADMISSION - Students may appeal against exclusion only on the grounds of clearly relevant accredited evidence. Readmission to a course after a period of exclusion is possible but not automatic.

FACULTY INFORMATION

THE FACULTY OF PHYSICAL SCIENCES

The Faculty of Physical Sciences consists of one School, the School of Physical Sciences. The principal academic and administration officers of the Faculty and School are:

Dean of Physical Sciences, Head of School and Professor of Chemical Technology
RJ Breakspeare, Ph D (Exeter), FRSC, CChem, ARACI,

Sub Dean
BJ Franklin BSc (Syd), MSc PhD (NSW), MAIG, FGAA

Deputy Head of School
RW Jones, BSc, Dip Ed (Melb), PhD (Cantab), C Chem, ARACI

NSWIT Reader
GB Smith, BSc (UNE), PhD (Monash), MAIP

Administrative Officer
BJ Kitto, BA (Macq)

The School is divided into four separate Departments, each of which offer a full degree program on a sandwich or part-time basis extending over four to six years. The Departments are:

Applied Chemistry
Applied Geology
Applied Physics
Materials Science

The degree courses all include a requirement of a minimum of one year's appropriate industrial experience which must be undertaken prior to, or concurrent with the final stage of the course.

(a) A high standard of achievement in the formal course work associated with the degree program.

(b) Presentation of an acceptable report on project work undertaken in conjunction with an industrial concern and/or within the University.

(c) Satisfactory completion of any advanced reading assignments, seminars, and such additional work as may be approved by the Head of Department.

(d) The completion of a program of study and industrial experience extending over a minimum of four years full-time. The program may be completed by an equivalent part-time pattern.

FACULTY OFFICE

To help students in the Faculty of Physical Sciences with any advice they need or difficulties they may experience a Faculty Information Office has been set up in Building 4, Room 308, directly opposite the Harris Street lifts. This office is open five days a week from 8-30 am to 1-00 pm & from 1-30 pm to 5-00 pm and students requiring information will be directed to the relevant academic and/or technical person.
In addition course & subject variation forms,examination timetables, etc are available from this office.

The Faculty Office can be contacted by telephone. The number is 218-9951.

The semester timetables, listing of current enrolments and examination results will be posted as they become available on notice boards adjacent to this office for students from all Departments, excepting

Applied Physics whose enrolment details and timetables will be available from the 10th floor, Tower Building. You should check these listings to ensure you are correctly enrolled and that any variations have been recorded.

STUDENT ADVICE

Because of the possible consequences you are to work hard to avoid probation, or if on probation to work even harder, and to avail yourself of as such assistance as possible, both in determining a suitable program and in carrying out the studies involved. This should mean regular communication with all your lecturers, and with your Head of Department or Head of School if particular difficulties arise.

Students seeking any advice should see the following:

(a) for **Applied Physics** subjects

Associate Professor A R Moon
Room 1/1230 (Tower building)
Tel. 218-9468

Dr P Logan
Room 1/1122A (Tower building)
Tel. 218-9525

(b) for **Applied Geology** subjects

Associate Professor E Leitch
Room 4/318B
Tel. 218-9457

Dr B Franklin
Room 4/324B
Tel. 218-9570

(c) for **Applied Chemistry** subjects

Associate Professor W Stern
Room 4/217
Tel. 218-9402

Dr G Norton
Room 4/430
Tel. 218-9462

(d) for **Materials Science** subjects

Associate Professor R McMillan
Room 4/427
Tel. 218-9460