



UNIVERSITY OF CAMBRIDGE

Department of Earth Sciences

Earth Sciences

Laboratory Facilities

Downing Site

October 2010

Safe Use of Department Facilities

To comply with Health and Safety legislation and University and Departmental requirements, the following instructions must be followed:

1. Before using a facility, the academic Staff member in charge (Head of Section) must be consulted, and all necessary health and safety documentation must be in place.
2. The observance of safe practice is a condition of use of any departmental facility, and it is the responsibility of all members of the Department to ensure that before using any facility they are properly acquainted with the operation of the equipment and with the emergency and safety procedures to be followed in its use.
3. The Head of Section will arrange for you to have any training necessary. This should be recorded on your Personal Training Record (See Safety Handbook).
4. You must ensure that you are completely familiar with the Code of Safe Practice for the laboratory, and you must follow it at all times. The Codes of Safe Practice are available on the Safety pages of the Departmental website and are displayed in the laboratories.
5. Specific safety procedures apply to work involving hydrofluoric acid, cryogenic liquefied gases, radioactive substances, x-ray work, and ultraviolet light. Any member of Department whose work involves any of these must ensure they have a thorough knowledge of the current procedures and appendices involved.
6. A safe working procedure must be agreed with Head of Section or Local Safety Officer before you begin work. Risk Assessments and, if necessary, Chemical Hazard Risk Assessments must be in place for all experimental procedures. For standard activities, the Risk Assessment and Safe Working Procedure for the area will be sufficient, in which case, you must familiarise yourself with these.
7. Risk Assessments and Chemical Hazard Risk Assessments are to be updated annually, or when any part of the procedure changes, or after the occurrence of any incident or accident.
8. Copies of all new or revised Risk Assessments and Chemical Hazard Risk Assessments must be lodged with the Principal Assistant/Safety Administrator (S032), and the originals kept in the green Safety Box File in the laboratory where the activity is to be carried out. You should keep a third copy as your personal reference.

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CATHODOLUMINESCENCE EQUIPMENT

Academic Staff Member: Dr. J.A.D. Dickson

Location:

North Wing – 3rd floor - Room N331

Equipment

Cathodoluminescence equipment - - low magnification, “cold cathode” type.

The CL equipment may be used only after instruction has been given by Dr. Dickson. The instrument has a H.T. supply and its electron gun is a source of ionising radiation. Full protection from these hazards is incorporated into the instrument’s design.

The instrument is fitted on a Nikon Optiphot microscope and is connected via a c-mount to an Optronics Magnafire peltier-cooled digital camera.

All malfunctioning of the equipment must be reported to Dr. Dickson as soon as possible. On no account may attempts be made to rectify faults.

Additional information may be obtained from Dr. J.A.D. Dickson.

Special Precautions: please refer to the safety procedures before use

The utmost care must be taken in using the equipment in view of the radiation hazard. Safety precautions are listed under sedimentary lab. Guidance on work with sealed sources and x-ray equipment, etc. is given in the document "*Working safely with sealed radioactive sources and radiation generators (University Safety Manual, Radiations Book 4)*" available at . <http://www.admin.cam.ac.uk/offices/safety/publications/> . Hard copy is available in the Library.

Revised 2007 JADD.

CHEMICAL LABORATORY

Academic Staff Member: Prof. M. J. Bickle

Location:

S. Wing – 4th floor - Room S415
Tel: 33468

Contact:

Dr Jason Day
Tel: 65282

Facilities:

Fume cupboards, oven, balances, furnace, desiccators, ultrasonic bath, ultrapure water system, glassware, various sample preparation devices and tools that may be lent out for short term use on their projects.

This laboratory provides facilities for standard chemical procedures. Use of the laboratory is authorised by Prof. Bickle who must be consulted in advance of any use of the laboratory.

All users of Chemistry facilities must sign a Use of Laboratories form and a risk assessment that includes all the chemicals to be used in the process performed.

Many chemicals are toxic or hazardous and advice on potential dangers and recommended operating procedures must be sought before work is commenced.

The laboratory must always be left clean and tidy as it is much used.

Special Precautions: please refer to the safety procedures before use

The utmost care must be taken when handling Hydrofluoric Acid. All work must be undertaken within the fume cupboard. See appendix 3 of the Protocols.

Revised J. Day 2007.

COMPUTING FACILITIES

Computer Officers Pete Hill, Aidan Foster or Jun Aizawa, can be contacted by emailing helpdesk@esc.cam.ac.uk. Alternatively call x33368. Their offices are in the north wing, N314/8 (both through N316).

	Library	PIB Lab (N217)	P11 Lab (S322)	Shell Computer Lab (N312)	Post-graduate Lab (N316)	Printer Room (S212)
HARDWARE						
Windows/Linux PCs	X	X	X	X	X	
B&W printer A4	X	X	X	X		X
Colour printer A4	X				X	X
Colour plotter (up to A0 poster size)					X	
Scanner	X			X	X	
Graphics Tablet					X	
CD-RW	X	X	X	X	X	
DVD-RW	X			X		
SOFTWARE (Windows)						
MS Office	X	X	X	X	X	
Adobe Photoshop				X	X	
End Note	X			X		
OCR software				X	X	
Arc GIS	X			X		
Matlab	X			X		
Origin	X	X	X	X	X	
Mathematica	X	X	X	X	X	
Igor	X	X		X	X	
Google Earth Pro	X	X	X	X	X	
GIMP (Image Manipulation)	X	X	X	X	X	
Inkscape (Drawing)	X	X	X	X	X	
Scribus (Poster Maker)	X	X	X	X	X	
OpenOffice (Office Suite)	X					
SOFTWARE (Linux)						
Standard Linux Applications (Including GIMP, OpenOffice)	X	X	X	X	X	
Matlab	X			X		
Mathematica	X	X	X	X	X	

DRAWING FACILITIES

Academic Staff Member: Dr. N. H. Woodcock

Contact:
Sharon Capon
Tel: 68322

The primary function of the drafting staff is to produce quality diagrams, drawings and maps for the academic staff for publication and teaching. The drafting staff will give advice to other members of the Department on drafting techniques (mainly use of CorelDraw). She will also assist with drafting for publication. All other drafting should be undertaken by individuals themselves.

ELASTICITY LABORATORY

Academic Staff Members: Prof M. Carpenter, Prof. S.A.T. Redfern

Location:

South Wing Second floor Room S208

Equipment:

Facility for Resonant Ultrasound Spectroscopy (Prof Carpenter)
Dynamic Mechanical Analyser, Torsion Pendulum (Prof Redfern)

All intending users must consult Professor Carpenter or Professor Redfern (as appropriate) to discuss the measurement strategy appropriate to their research, techniques of sample preparation and to arrange access to the laboratory.

Operating instructions for the equipment in the Elasticity Laboratory are clearly set out. Any instrumental fault should be reported immediately to the relevant member of academic staff.

Procedures involving the use of cryogenic liquids - liquid Nitrogen and liquid Helium – must be carried out only by trained users.

Special Precautions:

Under no circumstances may users attempt to rectify faults without first seeking advice.

Revised 2010 AB

ELECTRON MICROSCOPES

Academic Staff Member: Dr R. Harrison

Location:

S. E. Wing - Ground floor - Room S007
Tel: 33471

Technician:

Martin Walker
Tel: 33476
e-mail: mgw21@esc.cam.ac.uk

Equipment:

1 Scanning Electron Microscope incorporating an energy dispersive X-ray unit;
1 Transmission Electron Microscope.

The Laboratories are open to "AUTHORISED USERS" requiring Electron optical facilities and others under strict supervision. Authority to use the facilities must be obtained from the respective member of the academic staff listed above.

Appropriate training will be given and a person certified as an AUTHORISED USER after they have satisfied the technician that they are competent to operate the equipment on their own. Authorised users are required to sign the Safety Book to say that they have been instructed in the operation and emergency procedures for the equipment. The Personal Training Record should also be signed.

Manufacturers Operating Manuals are available to authorised users and appropriate reminder notices are on display in the laboratories.

THE FOLLOWING ACTIVITIES MAY BE PERFORMED ONLY WITHIN WORKING HOURS AND WITH ANOTHER PERSON WITHIN EARSHOT:

1. Microscope operator training.
2. Operations by unqualified, semi-trained personnel and visiting scientists.
3. Dismantling microscopes, service work and adaptation of equipment.

Please refer to the safety procedures before any use of this room.

Revised 2010 MW.

ELECTRON PROBE

Academic Staff Members: Dr M. Edmonds, Dr C. M. Petrone

Location:

East Wing - Ground floor Room N029
Tel: 39977

Contact:

Dr C. M. Petrone
Tel.: 33402 / 39977

Equipment:

Electron Probe Microanalyser.

The Electron Probe Microanalyser is available for use by members of the Department. It is a Cameca SX-100 instrument with 5 wavelength dispersive spectrometers, capable of automated quantitative analysis and elemental mapping of all elements from B to U (other than noble gases). An energy-dispersive spectrometer is used for qualitative characterisation of composition. Spatial resolution is up to 1 μ m.

All intending users must consult Dr. Petrone to discuss the measurement strategy appropriate to their research, techniques of sample preparation and to arrange access to the laboratory. Prospective users are strongly advised to speak with Dr Petrone about their research well in advance, in case any special analytical or sample preparation difficulties might exist.

Peak demand for the laboratory typically occurs from October to January. At other times of the year, the SX100 is usually over-subscribed and waiting times are typically 2-5 weeks. The booking schedule is displayed on the Departmental website (<http://www.esc.cam.ac.uk/cgi-bin/epma/mkbook.pl>) 4 weeks in advance. See this page also for information on permitted sample formats, how to get samples carbon coated, for advanced warning of scheduled down-time and other notices.

Users are trained and supervised by Dr Petrone. Provided that instructions are followed, no special hazards exist. Any instrumental fault should be reported immediately to Dr Petrone. For users specifically permitted to work out of normal working hours (having received permission and signed the relevant forms), faults should be dealt with according to the procedures documented in the laboratory. Almost no faults are amenable to user intervention, and hence in almost all cases of malfunction, the instrument should be shut down according to the instructions documented in the laboratory, details of the fault emailed to Dr Petrone (cpet07@esc.cam.ac.uk), and the session on the instrument terminated. Emergency contact telephone numbers are displayed in the laboratory.

Special Precautions:

Under no circumstances may users attempt to rectify faults without first seeking advice.

Revised 2010

FIELD EQUIPMENT

Academic Staff Member: Dr. N.Hovius

Location:

North Wing Room N222
Tel: 33458

Contact:

Glynis Caruana

Equipment:

Compass-clinometers
Tape measures
Limited camping gear
Helmets, goggles, and high-viz vests
Stereoscopes for viewing aerial photos
GPSs

A small stock of field equipment is available for the use of members of the Department, and to service undergraduate field courses. Please book equipment in good time, particularly for summer field work. All borrowings must be recorded in the loan book.

Helmets, goggles, hammers, hand lenses, and compass-clinometers are available for purchase at preferential rates in the Museum shop. Maps may also be ordered through the ACCOUNTS OFFICE at reduced rates, but please give at least 6 weeks notice.

When base maps are not available for a field area, and aerial photographs are needed, the Aerial Photography Unit in the University (Free School Lane) may be able to help for UK locations. The Department Administrator must be consulted before the Unit is approached and any order must be placed through the Department.

Mobile phones, walkie-talkies and first aid kits are available from the Principal Assistant's/Safety Administrator's office (S032).

FIELDWORK

WHEN UNDERTAKING FIELDWORK, A FIELD RISK ASSESSMENT COVERING INSURANCE, CONTACTS AND HAZARDS MUST BE COMPLETED – see Health & Safety page on the Departmental website.

A copy of the code of safe practice for fieldwork is given in the Safety Handbook. Before you depart for fieldwork, you must read and complete the relevant forms, including the name and address of the person to be contacted in the event of illness or accident in the field, details of your contact in the host country and your risk assessment.

Special precautions

Eye protection must always be worn when hammering in the field and helmets worn in areas of likely falling rock. Take care not to drop field equipment; it's usually more costly than it looks!

Revised 09.08

GODWIN LABORATORY FOR PALAEOCLIMATE RESEARCH

Academic Staff Member: Prof. David Hodell

Technical Officer: Mr Mike Hall

Senior Technician: Mr James Rolfe

Location: South Wing, 1st Floor, Rooms: S104, S105, S105A, S105B,
Tel: 64911/64914 S105C, S106, S108, S107, S111, & Oast House Store – Mill Lane

Equipment:

1 stable isotope mass spectrometer (VG-PRISM) + multi-carb preparation system.

1 stable isotope mass spectrometer (VG-SIRA) + multi-carb preparation system.

1 stable isotope mass spectrometer (Thermo- Finnegan MAT 253) + kiel device carbonate preparation system.

1 stable isotope mass spectrometer (Thermo- Finnegan MAT253) + gas bench.

1 stable isotope mass spectrometer (Thermo-Finnegan Delta V) + elemental analyser (Costech) + TC elemental analyser (Thermo Finnegan) + gas bench (Thermo-Finnegan).

1 Stable isotope mass spectrometer (Thermo-Finnegan Delta V) + elemental analyser (Thermo-Finnegan)

1 CO2 Coulometer (Coulometrics Inc)

1 Cavity Ringdown Spectrometer, Isotopic Liquid Water Analyser (Picarro)

The laboratory is equipped with state of the art high technology research equipment for the high precision stable isotopic analysis of:

18O/16O and 13C/12C from carbonates by acid digestion.

18O/16O in water through equilibration with CO2.

D/H in water through equilibration with H2/Pt.

13C/12C of dissolved inorganic carbon (DIC).

13C/12C of CO2 using 'tube cracker'.

13C/12C & 15N/14N in organic compounds.

D/H and 18O/16O in organic and some inorganic solid and liquid samples using pyrolysis.

% carbonate in sediment samples.

18O/16O and D/H in waters using isotopic liquid water analyser

Analysis of SO2 (34S)

Because of the complexity of the equipment and the cost of analysis the laboratory is operated solely by highly skilled technical staff. This ensures that the necessary precision and accuracy of data is maintained and samples are not lost. Assistance with

sample preparation and loading of samples is encouraged and a full account of the sample procedure and analytical techniques are provided.

Equipment used during sample preparation might include:

High precision micro balances.

Low power microscopes.

Wet and dry sieving techniques.

Chemical treatments.

Vacuum roasting.

Details regarding collection and storage of prospective samples and applications for analyses should be discussed with Mike Hall as early as possible in order to ensure that sufficient funding and appropriate 'machine time' will be available to complete a proposed research project.

Special precautions necessary.

Care must be taken during sample preparation using chemical techniques and vacuum equipment. High voltages present.

HIGH TEMPERATURE EXPERIMENTAL LABORATORY

Academic Staff Member: Prof. M.A. Carpenter

Location:

South Wing – 2nd Floor – Room S206
Tel: 33467

Technician:

Paul Taylor
Tel: 33467/68348

Equipment:

High-temperature furnaces, hydrothermal cold-seal pressure vessels and furnaces; controlled-atmosphere furnace.

Piston-cylinder apparatus is available in Room B1 and is under the strict control of Prof. M. Carpenter.

The Laboratory is open to “AUTHORISED USERS” doing experiments with equipment already operational and others under strict supervision. Authority to use the facilities must be obtained from Prof. M. A. Carpenter.

Appropriate training will be given and a person will be certified as an AUTHORISED USER when they have demonstrated satisfactorily to the technician that they are competent to operate the equipment on their own. Authorised users will be required to sign a Use of Laboratories agreement form to say they have been instructed in the operation and emergency procedures for the equipment

Instruction sheets and manuals will be available to authorised users for simple routine use. Such conventional experimental studies with equipment already operational and tested may be performed by authorised users during working hours.

Prototype experiments by authorised users may be performed only under the direct supervision of Prof. Carpenter.

THE FOLLOWING ACTIVITIES MAY BE PERFORMED ONLY WITHIN WORKING HOURS AND WITH THE TECHNICIAN ASSISTING

- (i) Substantial modification to experimental equipment.
- (ii) Experiments by trainees, semi-trained operators, visiting scientists and others who are not fully authorised users.
- (iii) Use of the cold seal high pressure system.

Special Precautions: please refer to the safety procedures section before use

Any use of high-pressure equipment requires great caution. Nobody may use such equipment without training.

Revised 09.08

INDUCTIVELY COUPLED PLASMA – MASS SPECTROMETER (ICP-MS)

Academic Staff Member: Dr S.A. Gibson

Location:

South Wing 3rd floor: Room S309
Telephone: 65282

Contact:

Dr J. Day
jday01@esc.cam.acu.uk

Website: www.esc.cam.ac.uk/resources/facilities/equipment-and-instruments/icp-ms.

Equipment:

The instrument is a Perkin Elmer Elan DRCII quadrupole-based mass spectrometer, capable of analyzing ~ 70 chemical elements in samples that can be put into aqueous solution. Detection limits and analytical precision may vary with analytical protocol, instrumental response, blank contamination, interferences, matrix composition, and isotopic abundance, but ranges from <1ppt (parts per trillion) to 100 ppm in aqueous solution. Analytical precision is typically 1-5% RSD at one standard deviation.

A New Wave Research UP213 laser is also available for Laser Ablation-ICP-MS analysis of solid samples.

To encourage collaboration both in the Department and University, we offer limited access to our ICP-MS instrument for scientific research purposes. This access must be authorised by Dr S. Gibson. Funding is necessary as fees will be requested to help cover lab costs.

Discuss sample preparation procedures with Jason Day in advance. Some established techniques are available. It is the user's responsibility to ensure sample preparation procedures are appropriate and effective, and that the analyzed solutions are compatible with the instrument.

A risk assessment may be required depending on the sample preparation that is chosen.

Special Precautions: please refer to the safety procedures section before use

Revised J. Day 2007.

INFRARED SPECTROSCOPY LABORATORY

Academic Staff Member: Prof. M. A. Carpenter

Location:

South Wing – 2nd Floor – Room S210

Tel: 68356

Contact:

Dr M Zhang

Tel: 33411

Equipment:

Infrared Spectrometer for infrared and visible extensions. High and low temperature sample holders. Preparation equipment. Thermogravimetric balance.

The laboratory is equipped with the most advanced infrared technology that is commercially available. The work requires extreme care both in running the instrument and in preparation of samples. Most of the samples are hygroscopic and must be kept in the heating compartment. The room is air-conditioned; the doors must be kept shut.

Use of the laboratory is authorised by Professor Salje or Professor Carpenter and is available to those who have well-formulated research projects which require the use of infrared spectroscopy. Training is normally provided by Professor Salje or Professor Carpenter. The theoretical background is taught in special courses and Part II Mineral Physics.

Special precautions

Any use of this equipment requires great caution. Nobody may use it without training.

ISOTOPE GEOCHEMISTRY LABORATORIES

Academic Staff members: Prof. M. J. Bickle / Dr. A Galy / Dr A. Piotrowski

Location:

South Wing
Ground Floor: Room S19/21 tel: 33445
4th Floor : Rooms S405 – 410 tel: 33445
 Room S417
 : Room S418a (shared)

Contact:

Dr Hazel Chapman
tel: 33405
hjc1000@esc.cam.ac.uk

Technician
Mrs Jo Clegg

Equipment:

GV 54 Sector solid-source mass-spectrometer
Nu ICP multi-collector mass-spectrometer
Dionex
Teflon vials and pressure vessels for rock dissolution
Quartz stills for preparation of ultra-pure acids
Cation, anion and reverse phase separation procedures

The laboratories are exceptionally well equipped for the isotopic analysis of Ca, Mg, Rb-Sr, Sm-Nd, Pa, Pb, Th, U, and many other elements at extremely low levels from rock, mineral and water samples. This type of analytical work requires enormous attention to detail in order to achieve low blanks and good results. A high level of manual dexterity is a positive advantage.

Isotope analyses and geochemical projects within the laboratories are authorised by Prof. Mike Bickle, who will liaise with Dr Albert Galy and Dr Alex Piotrowski. Use of the laboratories under supervision is available to those who have well-formulated research projects consistent with the isotope geochemistry laboratories' capabilities. Sampling is critical to any isotopic geochemical project, so it is essential to plan any project well in advance.

There are many opportunities, and indeed encouragement is given, for involvement in technical developments of micro-chemical methods and mass-spectrometer maintenance.

Training takes place through close interaction with other researchers so a minimum of 3-6 months is usually necessary to undertake a project and obtain a useful level of proficiency. Most of the procedures use toxic and hazardous materials so assistance and close supervision are necessary at some stages in the preparation techniques.

Special precautions: please refer to the safety procedures and risk assessments before use.

Utmost care must be taken when handling hydrofluoric acid and all acid work is undertaken in fume cupboards. PPE of clean Tyvek coveralls, overshoes or clean room shoes, gloves and safety spectacles must be worn at all time in labs S405-S410. Utmost care must be taken when using liquid nitrogen and the high voltage sources associated with the mass-spectrometer.

Revised 2010 HJC

LIBRARY

Academic Staff Member: Prof. M. J. Bickle

Location:

North Wing – 2nd Floor

Tel: 33429

Library Staff:

Sarah Humbert

Clare Pryke

N.B. No Library Material may be taken into the field, unless previously discussed with the Librarian. This prohibition covers books, maps and journals. Some maps for use in the field are available from the class assistants.

The major Department Library is on the Downing Site and covers all aspects of current research work, and a smaller Library, with largely complementary geophysics material, is sited at the Bullard Laboratories. We have large holdings of books, maps and journals, and members of the Department are encouraged to make full use of the stock and facilities available at both Libraries.

Electronic resources, in the form of e-journals, databases, and other subject-specific portals are available, with most of the important links available on the Library web page. Consult Library staff for access.

The Library has a computer suite with hardware and software comparable with the Shell Lab and postgraduate lab. It is heavily used by undergraduates in term time, but is available for department use at all other times.

A guide to the facilities offered by the Department Libraries is published separately. You should obtain a copy of this from the Library Staff **before** using the Library.

MICROSCOPES

Academic Staff Members: Dr M. Holness. Tel: 33434

Location – Special Microscopes

- a) Sed Lab microscope annex
- b) Room S036

Equipment:

Optical microscopes for routine thin section work are distributed by Dr M. Holness. Microscopes are issued on the understanding that they are not to be transferred to other workers and that they are to be returned to Dr Holness when the researcher leaves the Department.

Special Microscopes

- a) Sedimentary Laboratory

1 Nikon Optiphot microscope

Leitz microscope with Linkham fluid-inclusion stage giving a heating and freezing capability between + 250°C and – 180°C. The microscope is also fitted with photography equipment.

- b) Ground floor, East Wing, Room S036

Zeiss Axioplan Universal Microscope (For information on using this microscope, please consult Dr Sally Gibson/Dudley Simons).

Special precautions

**Microscopes are very sensitive and expensive pieces of equipment.
Please use them with great care.**

Revised 2010

MINERAL SEPARATION FACILITIES

Academic Staff Member: Prof. M. Bickle

Location:

North Wing
Ground Floor - Room N9 and N10
Tel: 33462

Contact:

Dr J. Day

Equipment:

This facility is shared with other lab users and any work done in this area must be compatible with what these users are working on. Special arrangements will sometimes be required so if you need to use the mineral separating facility, please give as much advance notice as possible.

The lab contains a Franz magnetic separator, LST, and other heavy liquid equipment. Some projects also require the rock saw or the rock crushing facility; please see safety information for the appropriate section if your samples need to be cut or crushed.

A risk assessment must be completed before beginning work in this lab. Some of the heavy liquids are highly toxic or produce toxic fumes.

Mineral separating facilities are controlled by Prof. Bickle who authorises use of the laboratory.

Special precautions please refer to the safety procedures section before use

Great care must be taken in handling heavy liquids. Please check that extraction equipment is fully working.

Revised J. Day 2007.

MUSEUM RESEARCH COLLECTIONS

SEDGWICK MUSEUM OF EARTH SCIENCES

General telephone number: 33456

Director	Dr David Norman	33426
Curator of Mineralogy and Petrology	Prof. Michael Carpenter	33483
Hon Curator of Palaeontology	Dr Liz Harper	33428
Hon Curator of Sedimentary Petrology	Dr Ken McNamara	33410
Conservator	Ms Sarah Finney	362522
Computer Officer	Ms Sandra Jackson	33456
Collections Manager	Mr Dan Pemberton	33373
Collections Assistant: Mineralogy and Petrology	Mr Steve Laurie	33931
Collections Assistant: Palaeontology	Mr Matthew Riley	33931
Education Officer	Ms Annette Shelford	66079
Documentation Assistant	Mr Rob Theodore	33456
Project Archivist	Ms Sandra Marsh	362522

The Sedgwick Museum houses major palaeontological, mineral, petrological and sedimentological collections of international importance. In terms of its sheer size, the museum is comparable to the geological collections of the National museums such as the Natural History Museum in London. The museum collections complement, to a high degree, the research expertise of the Departmental teaching staff and therefore constitute an integral element in the work of Earth Sciences within the University. In addition to research and teaching, the museum fulfils another important role, that of opening to the public and providing an insight into the workings of a University Department.

During 1990/91 the Sedgwick Museum was reviewed by the Universities Funding Council and designated a "centre of excellence" for the purposes of research and teaching. As a consequence, the museum and its collections have undergone considerable expansion and reorganisation (to accommodate collections from other universities). The Brighton Building, an environmentally-controlled high-density store, was built at Madingley Rise (adjacent to the Bullard Labs), and includes an archive and a conservation laboratory as well as research rooms. The original Sedgwick Museum on the Downing Site has undergone a major refurbishment, which presents the collections to the public in a modern arrangement which still retaining the museum's historical setting and ambience.

FOSSIL COLLECTIONS

Staff members:	Dr David Norman	Tel: 33426
	Dr E. Harper	Tel: 33428
	Mr D. Pemberton	Tel: 33373

The Sedgwick Museum houses a major palaeontological collection of international significance. In terms of its size, scope and extent of type, figured and cited specimens, the collection is second in importance only to that of the Natural History Museum in the UK. It is a comprehensive reference collection incorporating important British and

overseas materials ranging taxonomically from large vertebrate skeletons to forams and palynomorphs.

Much of the collection is fully documented on a computer-based cataloguing system, which is supervised by the systems manager. The system incorporates sophisticated information retrieval facilities through which specimens can be accessed on criteria such as bibliographic references, collector or donor, type or figured status, morphological keywords, locality, matrix lithology, preservation, chrono- and litho-stratigraphy and generic, specific or informal taxonomic names. Therefore, research material destined for the museum should not only have been acquired responsibly and be in good order but also must be accompanied by full catalogue information. Research students are expected to produce computer files of such information in a form suitable for incorporation into the Museum Catalogue and before submission of their Ph.D. dissertation, so that a printout of the catalogue entries can be bound in as an Appendix to the dissertation. Please contact the Museum staff for full instructions.

Examination or loan of Museum material for research can be arranged through the Museum staff. Material on loan must be kept in closed drawers and not left lying around in research students' rooms; **type and figures material must be LOCKED away when not in use**. Postgraduate students may view research material by prior arrangement with the relevant staff member, but loans of research material must be arranged through the student's supervisor.

THE HARKER PETROLOGICAL COLLECTIONS

Staff members:	Prof. M.A. Carpenter	Tel: 33483
	S. Laurie	Tel: 33931
Location:	Brighton Building (thin sections)	
	Rock Store (hand specimens)	

The Harker Collection of rock specimens and thin sections forms one of the finest existing petrological collections. Started by Alfred Harker in the 1880s, and expanded and catalogued by him for over 50 years, it now comprises some 157,000 catalogued samples with global coverage. Thin-sections and rock specimens are available for research and study. Most accessions since 1984 are in the computer catalogue. There is some coverage of older accessions. The thin section collection acts as a geographical index. All enquiries should be addressed to Prof. Carpenter.

The comprehensive excellence of the Harker Collection is largely due to a century of conscientious deposition of research material by workers in the Department, and to donation of interesting specimens by friends of the Department around the world. Visiting workers are urged to help maintain this edge of excellence by their own donations of significant material.

Research students with petrological topics are required to deposit representative samples of their research rocks in the Harker Collection. Such samples must include all specimens mentioned in the dissertation and in ancillary published papers. These must be catalogued before submission of the Ph.D. dissertation, and students must consult Prof. Carpenter in ample time before completion, so that the computer printout of the catalogue entries can be bound in as an Appendix to the dissertation.

THE MINERAL COLLECTION

Staff members:	Prof. M.A. Carpenter	Tel: 33483
	S. Laurie	Tel: 33931
Location:	Brighton Building	

The Mineral Collection has over 40,000 specimens, mostly still housed in the cabinets made in the 1860's for the Mineralogical Museum. Very little new material has been added in the last 25 years. The collection is very strong in 19th century material from classic localities in Britain and the European mainland.

Specimens are not normally loaned to students, but material can be made available for analysis. It is possible to look at the collection by arrangement with museum staff. Only 6000 specimens are in the database.

LEARNING COLLECTIONS

The Museum Education Officer administers a handling collection of several hundred fossil, rock and mineral specimens which are available for use for teaching and learning. The handling collection is used by a wide range of groups and individuals who visit the Sedgwick Museum, as well as by members of the Department of Earth Sciences for undergraduate supervisions and outreach activities.

- Loan boxes: Two boxes of rocks and rock-forming minerals, one box of fossils and one box of minerals which are available for loan for up to 28 days. The boxes can be used in the Museum or for teaching elsewhere.
- Handling drawers: Several trays of rock and fossil specimens for use in the Museum. Includes sets of Palaeozoic, Mesozoic and Cenozoic fossils, rocks, and fossil plants.
- Teaching sets: A selection of invertebrate fossils with multiple specimens.
- Individual specimens: A wide range of fossils, minerals and rock specimens can be used in the Museum or elsewhere. Loans are for up to 28 days.

Items and sets of items need to be booked in advance as they are in regular use in a wide range of teaching situations, including by schools. For more details about the collection and how to access or use the objects please contact the Education Officer Annette Shelford Tel.: 66079

A.G. BRIGHTON BUILDING

Academic Staff Members: Dr. D Norman & Prof. M.A. Carpenter

Location:

Madingley Rise, Madingley Road
(just beyond the Bullard Laboratories).

Contact:

Dr D Norman	Tel: 33426
Prof. M. A. Carpenter	Tel: 33483
Sarah Finney	Tel: 362522

This purpose-built, environmentally-controlled store incorporates dense (compactor) storage of a large proportion of the fossils and the mineral collection in three ground floor stores. In addition, there is a dedicated conservation laboratory, the first to be built in Europe purely for the conservation of geological materials. The laboratory, run by Sarah Finney, is rapidly becoming a centre of excellence in this increasingly important area of specimen management. The laboratory is well-equipped and provides a backup and permanent source of advice to students of palaeontology, mineralogy, petrology and sediments on matters of preparation (techniques and equipment), conservation, stability and long-term storage.

There is also an archive store of manuscripts, magnetic tapes, and illustrations and portraits from Cambridge's historical past, as well as thin-sections; there are also adjacent research rooms and small stores.

HIGH CROSS ROCK STORE

Staff members:

S. Laurie	Tel: 33931
Prof. M.A. Carpenter	Tel: 33483

Location:

High Cross, Madingley Road (adjacent to the British Antarctic Survey Building)

Tel: 33456 (Sedgwick Museum) or 01223-359098 (Rock Store phone)

Equipment: Mobile racking for dense storage of rocks and overflow fossils.

This store provides dense storage for the large, catalogued rock collections and sediments collections of the main museum. In addition, this store provides room for uncatalogued specimens which are simply too large to be accommodated in the Sedgwick Museum or Brighton Building.

Special precautions

Both these stores are protected by security alarms and access is permitted only under staff supervision. Mobile racking (compactors) must be operated only when a member of staff is present.

Revised 09.09

NUCLEAR MAGNETIC RESONANCE LABORATORY

Academic Staff Member: Dr Ian Farnan

Location:

3rd Floor South Wing Rooms S306/S307/S308

Equipment:

3 NMR spectrometers:

- A Varian Infinity Plus spectrometer equipped with a widebore 11.7 T superconducting magnet.
- A Chemagnetics Infinity spectrometer equipped with a widebore 9.4 T superconducting magnet.

Probes:

- 14-, 9-, 7.5-, 4-, 3.2- and 2.5-mm Varian/Chemagnetics MAS probes with possible spinning speeds up to 30 kHz.
- Varian probe for static NMR experiments with 5- and 10-mm radiofrequency coils.
- Home-built high temperature probe equipped with an electric furnace and water cooling system, able to reach temperatures in excess of 1200 °C.

Research undertaken involves the study of minerals, glasses and inorganic solids through the use of both one- and two-dimensional multinuclear (⁶Li, ²³Na, ²⁷Al, ²⁹Si, ³¹P) NMR techniques.

Contact: Dr Ian Farnan.

Special precautions

You must abide by warnings posted in the laboratory with respect to the special hazards created by the presence of the superconducting magnets. Pacemakers, magnetic media such as bank cards, watches, and ferromagnetic tools must all be kept away from the vicinity of the magnets. Only non-ferromagnetic tools may be used.

Revised 02.08.07_IF and AJC.

OCEAN BIOGEOCHEMISTRY LABORATORY

Academic Staff Member: Dr A Turchyn

Location:

South Wing – 3rd floor - Room S317 tel: 33461

Equipment:

Full recirculating Hood suitable for diluting acid and minimal chemical procedures, Spectrophotometer, Oven, Vortex Geni, MiEQ water supply, extraction workspace, vacuum pumps.

S317 is the wet chemistry preparation room for users of the Laboratory for Ocean Biogeochemistry. Use is strictly through permission of the head, Dr. Alexandra Turchyn. In this room we prepare sediment and pore fluid samples for subsequent light stable isotope analysis largely on the mass spectrometers in the Godwin Laboratory. Common procedures include carbonate dissolution, mineral separation, mineral precipitation and isolation (at present time largely barium sulfate), and vacuum filtration. We process close to 100 samples a month currently, largely for sulfur and sulfate-oxygen isotope analysis. Over the coming years this laboratory will obtain an anaerobic chamber and autoclave and will have the ability to grow bacteria in a strictly oxygen-free atmosphere to probe research questions involving the subsurface deep biosphere.

Current ongoing research projects in the laboratory include but are not limited to:

- Analysis of the viability of the carbonate-associated-sulfate proxy,
- Riverine variability in the oxygen and sulfur isotope composition of sulfate,
- Exploring sulfate-oxygen isotope variability in the modern surface ocean,
- Sample preparation of vein mineral samples from ophiolites for reconstructing hydrothermal vent fluid over time,
- Pore fluids in a variety of subsurface environments as a tracer for microbial processes.

OCEAN GEOCHEMISTRY AND PALAEOCHEMISTRY

Academic Staff Member: Prof. D. Hodell

Senior Research Associate: Dr Mervyn Greaves

Location:

S. Wing, 3rd & 4th floor

Rooms: S316

S416, S418, S418a (shared)

Tel: 68352

Tel: 33403

Contact:

Mrs Caroline Daunt

Mrs Salima Souanef-Ureta

Tel: 33405

Equipment:

Varian Vista ICP-OES

Thermo Element XR ICP-MS

As part of the Godwin Laboratory for Palaeoclimate Research, the laboratories are exceptionally well-equipped for trace metal ratio determinations in foraminifera and other marine samples. This type of analytical work requires enormous attention to detail in order to achieve good results, and a high level of manual dexterity is a positive advantage.

Use of the laboratories is authorised by Prof. Elderfield and they are available to those who have well-formulated research projects consistent with the laboratories' analytical capabilities. Success in this analytical area requires a high level of skill and dedication and, because routine assistance is not available and training takes place through close interaction with other researchers, a minimum of 6 to 12 months is usually necessary to undertake a sensible project and obtain a useful level of competence.

The procedures used involve toxic and hazardous materials, and therefore close assistance and supervision is necessary at some stages in the preparative techniques.

All users must sign a Use of Laboratories form. A risk assessment is required covering all the chemicals used and processes performed.

Special Precautions: please refer to the safety procedures before use

PALAEONTOLOGY PREPARATION LABORATORY

Academic Staff Member: Dr. N. Butterfield

Location:

North Wing – Room N322

Tel: 33379

Equipment:

The laboratory is primarily equipped for acid preparation of microfossils, including acetic, hydrofluoric and nitric acids. Acetic acid is used for digestion of carbonates (primarily Cambrian phosphatic microfossils), while hydrofluoric acid is employed mostly for palynological extraction and etching of siliceous material. In association with this latter technique are a variety of ancillary facilities that utilise nitric acid and other corrosive chemicals.

The acetic acid technique is relatively benign, but expert tuition in the use of hydrofluoric acid and other procedures is essential and should be recorded in the Personal Training Record. Great care must also be taken to avoid contamination of sieves and other equipment

Special precautions :

The utmost care must be taken when using Hydrofluoric Acid: all work must be conducted in fume cupboards. See safety procedure and appendix 3 of the Protocols.

Reviewed 13.08.07-NJB

PHOTOGRAPHY

Academic Staff Member: Prof. I. N. McCave

Location:

East Wing – Ground Floor
Rooms S035 & S036

Technician:

Dudley Simons, Room S035
Tel: 33407

Equipment:

The photographer's main duties are to undertake work for members of the academic staff. This will normally take precedence over work for research students and other members of the Department for whom the photographer will, in general, provide three kinds of service: -

- advise on photographic problems.
- undertake work which can be carried out only on the specialised equipment, or where a member has only very occasional photographic requirements.
- make and print particularly difficult plates for theses and other publications.

Photography and Illustration Services (PandIS)

PandIS is located across the road on the New Museums Site and provides a wide range of traditional and modern digital services. In addition to the provision of highly professional teaching resources, they also offer advice and support for teaching, research and publishing work. There are four main sections to the service: graphic design and illustration, photography, film processing and printing, and exhibition hire and production.

The prior approval of the department Accountant must be sought before expenditure is incurred at PandIS.

PRACTICAL CLASSES LABORATORIES

Chairman of Teaching Committee: Dr. N. H. Woodcock

Location:

North Wing IA (N225), IB GSA (N212),
Palæo Lab (N220)
Part III Study Base (N215) 2nd Floor

Class Assistant:

Mrs G. Caruana
Tel: 33473

South Wing IB GSB Lab (S213) 2nd Floor
Part II Lab (S322) 3rd Floor

Principal Assistant

Mr N Johnson
Tel: 68346/33470

Equipment:

Each teaching laboratory is equipped with microscopes and angle-poise lamps. Other equipment for practical classes is laid out by the technicians as required.

Members of the Department demonstrating in the laboratories are expected to check that microscopes and other equipment are working satisfactorily, and to be alive to any possible electrical faults, reporting them to the head of class immediately.

Considerable time is involved in preparing and assembling material for practical classes, e.g. thin sections and hand specimens, and care must be taken to ensure that these are not damaged.

There are also in several laboratories sample collections of thin sections which are available for use by students for revision purposes. This material should under no circumstances be removed from the laboratories. Sets of thin sections may be borrowed from the class assistants.

Sets of handouts and answer sheets for practical classes are available from the class assistants.

All persons working in the teaching laboratories are to abide by the Code of Safe Conduct and Good Practice.

Special precaution

Please report any faulty electrical equipment to the Head of Class immediately.

ROCK PROCESSING

Rock Crushing Facilities - Downing Site

Academic Staff Member: Prof. M.J. Bickle

Location:

Basement - North Wing - Room B3

Tel: 33460

Contact: Dr J. Day

Equipment:

Jaw Crusher, Roller Crusher, Ball Mill Grinder, Vacuum Cleaner, Compressed Air, Hammer and Anvil, Rock Splitter

No use of this facility without permission of Prof. Bickle who must be consulted before use.

No use of machines or heavy equipment out of departmental hours, and a buddy system is recommended.

The machinery is noisy and hearing protection is required. Hearing monitoring might also be required. Contact the Principal Assistant/Safety Administrator for advice (Room S032).

The facilities and the equipment must be left clean after use. A vacuum cleaner is provided for clearing up dust, etc.

Safety precautions

Do not remove safety covers on machinery.

Precaution must be taken to minimise dust, and appropriate breathing apparatus must be worn. COSHH regulations apply.

Revised 09.08

SEDIMENTARY LABORATORIES
(including Palaeoceanography Lab. N326)

Academic Staff Member: Prof David Hodell

Senior Technical Officer: Mike Hall

Location:

North Wing, 3rd Floor, Rooms N335 (Sed Lab),
N341-343, Palaeoceanography Lab N326
Tel: 33448

Technicians: Mr Simon Crowhurst

Miss Jeannie Booth
Tel: 33448

Equipment:

Micromeritics Sedigraph particle sizer, Beckmann Coulter counter multisizer 3, end-over-end and orbital shakers, drying ovens, sieves, photomicroscopes, Spectrophotometer, XRF core scanner, Magnetic susceptibility meter, glassware washing facilities, vacuum impregnation of samples in resin and cold setting of samples in resin for use with microprobes and CL.

The Sedimentary Laboratory contains a wide range of equipment. Training in the use of equipment is necessary and is authorised by those listed below or by Simon Crowhurst; specifically:

<u>Sedigraph and Coulter counter:</u>	Simon Crowhurst
<u>Wild picking microscopes:</u>	Simon Crowhurst
<u>Sieves, ovens and orbital shakers:</u>	Jeannie Booth
<u>Spectrophotometer and Magnetic susceptibility meter</u>	Simon Crowhurst
<u>Lancer glasswasher</u>	Simon Crowhurst or Jeannie Booth
<u>XRF core scanner, N343:</u>	Prof David Hodell

Special precautions please refer to the safety procedures for the labs before use
Great care must be taken in handling chemicals (in particular, impregnation plastics are carcinogenic). Work must be carried out in the fume cupboard using disposable gloves and apron.

Revised 2010

THERMAL ANALYSIS AND SPECTROSCOPY

Academic Staff Member: Prof. S.A.T. Redfern

Location:

Room S311: Micro-Raman, optical, and dielectric spectroscopy

Room S315: Thermal analysis

Contact:

Prof. S.A.T. Redfern, Dr R. Harrison.

Equipment:

We have a LabRam HeNe laser Raman spectrometer equipped with confocal microscope optics to allow spectroscopic analysis of small grains, single crystals, and (potentially) fluid inclusions. Linkham heating and cooling stages provide the means to collect spectra between -190 and 1200°C over the spectral range 180 to 4000 cm⁻¹.

An HP ac impedance analyser allows dielectric spectroscopy between room temperature and 800 °C in the frequency range 50 Hz to 13 MHz. The real and imaginary part of the dielectric permittivity may be determined across this regime.

A Nd-YAG laser is set up to allow measurements of optical frequency doubling in non-centric crystals.

A Perkin-Elmer "Diamond" DSC allows specific heat capacity measurements between 77K and 800K (contact Prof. Redfern).

Permission to use this equipment must be sought from Prof. Redfern who will arrange appropriate training and supervision.

Special Precautions: this equipment is for use by trained personnel only.

Updated SATR 03.08.07

THIN SECTION MAKING AND POLISHING

Academic Staff Member: Dr. M. Holness

Location:

South Wing-Rooms S023 and S024

Contact:

Mr M Walker
Tel.: 33476

Equipment:

Rock Saws and other preparation equipment. (Thin section making equipment, polishing and fine cutting equipment - Technicians only.)

Student/Researcher rock cutting will only be done after full training, and authorised by Mr M Walker.

Thin Sections

Those who require thin sections must consult the appropriate technician well in advance to book time to undertake preliminary sawing of rock chips ready to be made into thin sections by the technicians. Each batch of sawing will be limited to 24 sections and is carried out under the supervision of the technical staff. The rock cutting saws available cannot handle cuts deeper than 4 inches; so large specimens must be reduced in size by mechanical cracking or by cutting on the larger saw in the Basement (consult Technician).

Please note that requests for non-standard thin sections must be authorised by the student's supervisor in advance and, because of the considerably longer time needed for their preparation, are regarded as equivalent to a number of Standard Thin Sections, e.g. one 75x100mm section is equivalent to ten standard thin sections (Standard size 20x40mm).

Polishing

Thin sections which require polishing for work on the electron probe, ion probe or electron microscopes should be taken to the technician.

Friable rock which cannot be sectioned can be polished for reflected light microscopy, e.g. opaque minerals.

The polishing section also has equipment for cutting very thin slices of rock required for special purposes, e.g. where the specimen is very small and needs to be divided into several pieces for analysing by different technicians.

Special precautions please refer to the safety procedures before use

Care must be taken when using rock cutting saws and other rock preparation equipment. Goggles and ear protectors must be worn and safety guards used.

Revised Sept 09 MW

VEHICLES

Contacts: (Bullard) **Bob Cordiner** (for maintenance, repairs, faults)
Barbara Dyson (for bookings and the above in Bob's absence)
Gill Turner (if neither of the above is available)
(Downing) **Nigel Johnson** (who can liaise with Bob, Barbara and Gill)

Vehicles available - 1 car (Peugeot estate) and **Both vehicles are kept at the**
- 1 van (within Cambridge only) **Bullard.**

In order to drive any vehicle on University Business, drivers must be suitably qualified and show their full driver's licence (both ID photocard and paper counterpart) to Nigel Johnson (Downing Site) or Bob Cordiner (Bullard Labs) each year, complete the driver documentation, and agree to notify them of any changes, legal infringements or accidents, as this may bar them from university insurance cover. A copy of the driving licence will be retained on secure file. The Department requires all drivers to agree and sign a generic risk assessment, which covers them for regular journeys. Where extra hazards apply, such as driving alone ('lone working'), an individual risk assessment should also be completed. Driving on fieldtrips is covered by the field risk assessment. If you ever need to transport chemicals in the Department car strict guidelines must be followed: please contact Bob Cordiner for advice (rab4@cam.ac.uk or 37198). Further information on driving on University business is given in the Safety Handbook and in the Health and Safety section of the Departmental website.

Booking Vehicles

Department vehicles may be booked in the diary in Barbara Dyson's office where you also collect the keys; **you must log journey details when you return the vehicle**, entering outward and return mileage and specifying which grant is being used. Tell Bob or Barbara of any faults with the car and of any adjustments/repairs you made.

If you need to collect keys out of working hours or at a weekend, please make arrangements with Barbara/Bob or Nigel, otherwise you may not be able to get it. Allow time in your booking to clean the vehicle when you return it.

If you are involved in an accident, stop, give your name and address and say that the vehicle belongs to Cambridge University and is insured by the University for University business. **Never admit blame.** The insurance certificate is in the dashboard compartment. You must complete an insurance accident form that you can get from Nigel Johnson. Any accidents and claims on department vehicles may affect your own vehicle insurance. You are responsible for any fines imposed for any traffic or parking offences.

Returning Vehicles

For other than local journeys, before you return a vehicle – please

- **Put it through a car wash and clean out the interior**
- Leave the tank at least **half-full** - make a special journey if necessary.
- Remember to leave the **keys**. At weekends leave them on Barbara's desk.

Broken Windscreens (UK only): Royal & Sun Alliance has a special 24-hr arrangement for the repair of all windscreens with Autoglass Windshields, Unit 2, Elizabeth Way, Cambridge (tel 01223 461890). If the vehicle is outside the Cambridge area, telephone the Autoglass Helpline on 0800 363636 for details of the nearest repairer. A copy of the vehicle insurance certificate **must be produced** at the time of repair and the **policy excess of £250 or full cost of repair, which ever is the lower, paid immediately on completion of repair.** Autoglass will invoice Royal & Sun Alliance direct for the cost of repairs above the policy excess and you may claim back any expenses from the University.

WORKSHOPS

(a) Mechanical

Academic Staff Member: Dr. I. Farnan

Location:

South Wing - Ground Floor - Room S027
Tel: 33436

Principal Technician

Martin Walker

Technician:

P. Taylor (tel 68348)

Equipment:

A full range of workshop equipment, including numerically controlled milling machines.

The members of the workshop provide a wealth of expertise for the researcher to tap into; this section of the department can influence your approach to the way you may set out your research requirements.

Permission to use any equipment in the mechanical workshop must be obtained from the technicians.

Users will be considered to be inexperienced in the use of all machines until approved as competent by the technicians, and must not operate any machine unless a Workshop Technician is actually present in the workshop.

Users may then only operate equipment on which they have received instruction and for which they have signed the record book to indicate their familiarity with safety equipment and precautions.

The use of workshop facilities is restricted to normal working hours.

There is a fire exit through the workshop which must not be obstructed at any time. Free access to the main electricity board in the workshop must be maintained for access in the event of emergency.

Special Precautions

The workshop equipment is potentially lethal and must be used with the utmost care. Suitable PPE must be worn where necessary.

WORKSHOPS

(b) Woodwork/Building Maintenance

Academic Staff Member: Dr. I. Farnan

Location:

South Wing - Ground Floor - Room S029
Tel: 33465

Technicians in charge

C. Aldous
M. Walker

Carpenter: Charlie Aldous

Equipment:

Full range of woodworking equipment. To be used by technicians only.

Special Precautions please refer to the safety procedures section before use

The workshop equipment is potentially lethal and must be used with the utmost care. Guards must always be in place when using machines. Goggles and ear protectors must always be worn. Dust masks must be worn where appropriate, and LEV switched on.

Revised Sept 10

X-RAY LABORATORY

Academic Staff Member: Prof. S.A.T. Redfern

Location:

North Wing - Ground floor
Rooms N01, N03, and N06.
East Wing Room N029.

Technicians:

Tony Abraham

Radiation Protection Supervisors:

Prof. S.A.T. Redfern, Tony Abraham

Equipment:

The laboratory is equipped for the X-ray analysis of single crystals and powders. Some instruments are dedicated to the investigation of structural phase transitions. This type of work requires the utmost care in the alignment of the sample and control of the thermal conditions over long time periods. As several experiments may be performed using the same generator, any interference between different experimental equipment must be avoided.

In general, the technical staff will undertake work for academic staff and senior research workers, and other members with small projects. Members wishing to use the facilities themselves must obtain authorisation from Prof. Redfern. In order to fulfil safety regulations they must:

- (a) Attend an approved course on X-ray Diffraction Procedures, or satisfy the academic staff member that they have previously attended such a course and are fully familiar with the techniques they wish to use.
- (b) Understand the operating and emergency procedures for using the equipment and sign the book agreeing to abide by the code of practice.
- (c) Satisfy Professor Redfern and/or the Radiation Protection Supervisor that they are fully competent to use the equipment.
- (d) If working for a prolonged period in the X-ray laboratory, wear a radiation protection badge when working in the laboratory (Tony Abraham will arrange this).

Only designated staff may align a camera or diffractometer, or switch on an X-ray generator. Any malfunctioning of the equipment must be reported to Prof. Redfern or Tony Abraham as soon as possible; no attempt may be made to rectify the fault.

Any accident must be reported to Prof. Redfern as soon as possible.

Undergraduates may use the equipment only during working hours and when a technician or a demonstrator is present in the laboratory.

Special precautions

X-ray equipment is potentially hazardous, and the utmost care must be taken in its use. Guidance on work with x-ray equipment, etc. is given in the document "*Working safely with sealed radioactive sources and radiation generators (University Safety Manual, Radiations Book 4)*", and users must familiarise themselves with its contents.

Revised 2008