

ANU ELECTRON MICROSCOPY UNIT

2001 Annual Report

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EDITORIAL

Funding Common Access Facilities at the ANU

These are interesting times for ANU central facilities. The shift towards competitive external funding has thrown a bomb into a somewhat ossified system of resource allocation. While this gives cause to cheer, it also brings the need to justify the block grant and utilise it more effectively to preserve the identity of the ANU. The first priority has naturally been to help individual researchers adjust to the new funding mechanisms, but there is also an impact on various cross-campus research support facilities which until now have muddled through without a clear framework for policy or funding.

I believe that such facilities are an important element in many strengths of the ANU, including its capacity for multidisciplinary research, independent forward planning, and the ability of its researchers at all levels to change direction and follow new ideas quickly. Efficient provision of readily accessible shared infrastructure will often let relatively small ANU groups compete with larger, better funded laboratories overseas.

A strong case can be made for encouraging the development of common access facilities by recognising them as a group, particularly for the allocation of recurrent funds. Funding arrangements for administration, libraries and Information Technology have a very strong central component supplemented by peripheral resources and services as needed. What we don't share in such an organised way are the equipment and expertise forming the more immediate laboratory-based support for much research and some teaching. Allocation of funds to this collection of infrastructure providers is at first sight more difficult: the units are diverse; the relative importance of different techniques changes over time; and the most appropriate local managerial and funding arrangements differ from group to group because of intrinsic variations in the relative importance and cost of equipment, consumables, and staff expertise.

Distribution of central funds to different units should probably be linked to the level of services provided outside the host budget area. Centralised resources present well-known dangers. If they are under-resourced they cannot do the job, if they are too expensive people won't use them. If they are not sufficiently accountable they may forget who is feeding them, become less responsive to their users and follow their own agenda. So allocation of central funds should also be strongly linked to a mechanism for accountability.

I think we need to put together a structure which can:

- provide a common identity and voice for diverse, locally administered units providing common access facilities,
- act as a vehicle for the accountability of small units,
- allocate a centrally determined pool to supplement the recurrent funds of individual units
- balance support for the immediate needs of researchers with some of the proactive capability required for strategic planning.

These issues I hope will be addressed very soon. Those involved with the management of the ANUEMU are well aware that cuts stemming from the ARC levy have precipitated a crisis in recurrent funding – I suspect that some of the other central units would be seen to be in as bad a state if their budgets were as easily examined! In many ways the climate for change at the ANU is better than it has been for decades, but to take advantage of it an active debate and some action is needed.

Sally Stowe

2. THE ANUEMU AND ITS OBJECTIVES

The ANU Electron Microscopy Unit is a central facility housed in the Research School of Biological Sciences. Established in 1989, it provides access to electron microscopy and related techniques to staff and students from all areas of the ANU. It has seven electron microscopes (four scanning EMs and three transmission EMs), basic light microscopes and a range of ancillary equipment for specimen preparation and image handling. A newer 300kV TEM is housed in the Research School of Earth Sciences, and a 200kV TEM operates as an outstation within the Geology Dept. A full description of the operation of the facility can be found in a handout for users available from the unit, and through the web page <http://www.anu.edu.au/EMU>

Objectives of the Unit, as set out in its establishment paper (2498/1988):

The purpose of the unit is to provide an efficient service in scanning and transmission electron microscopy to the University community at large and to users external to the University, where appropriate. This service shall include provision for access to modern EM equipment, service for occasional users, training in EM methods for regular users and consultation on applications of EM. The Unit is encouraged to provide leadership in the development and implementation of new EM equipment and methodology. It is an objective of the University to maintain the standard of the facility at a level commensurate with the University's heavy commitment to research and to the major research objectives within the programs of the Schools and Faculties.

2. OVERVIEW OF THE YEAR

Overall the ANUEMU had an excellent year, with a record number of publications produced using its facilities. There was increased equipment use and several new instruments either installed or with the finance secured. Of these the major initiative is a dual Focused Ion Beam and SEM workstation, funded by the ANU and a successful ARC Linkage-Infrastructure Grant (with UNSW). The first generally accessible instrument of its type in Australia, and one of the first of this model in the world, the FIB/SEM will help give scientists in ANU and other Australian universities front-rank support for nanotechnology research in materials science, as well as opening up new areas of biological applications.

On the down side, for years the unit has been able to cater for increased demand on a constant budget by becoming extremely cost-effective. In recent years that process has gone well beyond reasonable limits, and has been exacerbated by the impact of the ARC levy and the need to earn external funds by activities not related to research and teaching. Although most performance indicators are still very good, the unit is already operating below the level of previous years in several respects (the level of instrument maintenance, the amount of service work performed, all but basic user support). It will not be able to continue in its present form much beyond 2002 unless a new funding mechanism is introduced that is consistent with the ANU's changed financial basis.

4. RESEARCH AND TEACHING ACHIEVEMENTS

A. LEVEL OF USE

More publications were produced from the ANUEMU during 2001 than ever before (83 notified to date). The Unit (RSBS site) was used by slightly fewer people than last year, but time on the electron microscopes increased by 8% to 7248 hours. Within this, scanning electron microscope (SEM) usage increased by 15% to 6124 hours, while transmission electron microscope (TEM) usage decreased by the same proportion to 1164 hours. Light microscope usage doubled, and ultramicrotome use increased by 30%. The CM300 TEM in RSES was used for 577 hours.

Distribution of use by School and Department is given in the appendices.

B. NEW EQUIPMENT

GLOW DISCHARGE UNIT. The primary use of this instrument is in biochemistry and structural biology, rendering carbon-coated grids hydrophilic for better and more consistently oriented absorption of proteins.

SCANNING TUNNELING MICROSCOPE A small budget EasyScan STM, suitable for teaching and work with uniform specimens.

WIDEFIELD CCD CAMERA on TEM. An SIS Megaview III digital camera funded from the EM Reserve in 2001 was installed on the 125kV Hitachi H7100 in January 2002. It fills the last major gap in the digital image production and handling capabilities of the unit, and makes routine TEM work much faster, more convenient, and less labour-intensive and expensive. In addition, the benefits when working with low contrast and beam-sensitive specimens extend the range of possible applications. This camera complements the higher-resolution but small field CCD cameras on the 300kV TEMs, and intensified video cameras on the lower kV microscopes

IATIA QPm PHASE TUBE and SPOT AINSIGHT® CCD CAMERA (delivered Jan 2002). IATIA is a new Australian high-tech company, formed to develop and market an image processing system developed at the University of Melbourne by Prof. Keith Nugent and his associates. The device uses a non-interferometric system of phase measurement and fast algorithms to generate images equivalent to a wide range of optically produced light microscope images. ANUEMU has bought the phase reconstruction system and a monochromatic CCD camera and is acting as a beta applications development site. There are several additional benefits - the CCD camera is suited for routine fluorescence work, and our original, heavily used colour CCD camera will need to be transferred less often between fewer microscopes. ANU researchers will have an early opportunity of using the new phase imaging device for light microscopy, and will also be able to experiment with the technique using transmission electron microscope images, where the potential applications are just beginning to be explored.

Funded: FOCUSED ION BEAM/SEM. A powerful new tool - the Swiss Army Knife of the nanotechnological world. This instrument was funded by an ARC Linkage Infrastructure grant (Principal Investigators Sally Stowe and Tim Senden, ANU, and Paul Munroe, UNSW). It consists of a fine (10 nm) beam of gallium ions which can carve away or deposit material so precisely that one of the major uses is in the preparation of ultrathin sections for transmission electron microscopy. The SEM column, focused at the same part of the specimen, allows real-time monitoring of the action of the ion beam and higher-resolution viewing of the result. Some of the immediate uses will be in the preparation of

customised tips and cantilevers for scanned probe microscopy, and stress-free sectioning of composites and polymers. The instrument will have a cold stage, available in few other places in the world, which will aid in working with beam-sensitive materials including organic polymers and biological samples. It should be commissioned in the last half of 2002.

C. REVIEW REPORT

The Unit was reviewed in 2000. The review report, released in 2001, led to the appointment of a new Microscopy Strategic Advisory Group to advise on campus microscopy, imaging and microanalysis, and recommended development along the lines of a Hub and Satellite model cross-campus. It commented favourably on the standard of operation of the unit within its current capacities and constraints and on the high degree of user satisfaction.

The review also recommended appointment of an administrative assistant. A part-time position funded largely from accumulated external earnings funded was trialed through 2001, but resources were not available to continue it.

D. STAFF PUBLICATIONS

Seven publications were produced by EMU staff in 2001 (NB for reporting purposes, these are already listed in School and Departmental reports):

More on the research interests of staff can be found on the ANUEMU web pages.

Brink FJ, Withers RL, Norén L (2001) Non-stoichiometric, rutile type, solid solutions in the $\text{Fe}^{\text{II}}\text{F}_2$ - $\text{Fe}^{\text{III}}\text{O}$ system. *Journal of Solid State Chemistry* 161: 31-37

Canny MJ, McCully ME, **Huang CX** (2001) Cryo-scanning electron microscopy observations of vessel content during transpiration in walnut petioles. Facts or artifacts? *Plant Physiology and Biochemistry*. 39: 555-563

Canny MJ, **Huang CX**, McCully ME (2001) The cohesion theory debate continues. *Trends in Plant Science*. 6(10): 454-455

Dowd A, **Llewellyn D**, Elliman RG, Luther-Davies B, Samoc M., Fitz Gerald JD (2001) Physical and optical characterisation of Ge-implanted silica. *Nuclear Instruments & Methods in Physics Research Section B - Beam Interactions with Materials & Atoms* 175: 637-640

Heady RD (2001) A history of the wood anatomy of *Callitris*. In *Perfumed Pineries: an environmental history of Australia's Callitris forests* ed. J Dargavel, D Hart, B Libbis. CRES/AFHS/Macquarie Univ. pp20-29.

Melcher PJ, Goldstein G, Meinzer FC, Yount DE, Jones T, Holbrook NM, **Huang CX**. (2001) Water relations of coastal and estuarine Rhizophora mangrove: xylem pressure potential and dynamics of embolism formation and repair. *Oecologia*. 126: 182-192

Sangster AG, Hodson, MJ **Huang CX** 2001. X-ray microanalytical studies of mineral composition in cell walls of needle tissues of American Larch [*Larix laricina* (Du Roi) K. Koch] and European Larch [*L. decidua* (L.) Mill.]. In "L'arbre 2000 The Tree" (ed. M. Labrecque) pp. 160-167. 4th International Symposium on the Tree, Montreal Botanic Garden. Isabelle Quentin Press, Montreal, Canada

In press:

Brink F, Withers RL, Friese K, Madariaga G, Norén L. An electron diffraction and XRPD study of superlattice ordering in the elpasolite-related oxyfluoride $K_3MoO_3F_3$. J Solid State Chemistry

E. TEACHING

Most teaching of postgraduate and honours students is on an individual basis, but ANUEMU also runs an annual workshop series, **AMicroscopy, Imaging and Microanalysis@**, for those who wish to acquire more background. Parts of this series may be incorporated into undergraduate courses. In 2001 the EMU staff were involved in more courses of various types than ever before.

The ANUEMU is used for undergraduate practicals and honours projects by the Division of Botany and Zoology, Faculty of Engineering and Information Technology (ENG 4517), Geology and Forestry Departments, with varying degrees of involvement by EMU staff.

Heady RH: lectured in the University of Canberra Conservation and Materials Analytical Chemistry Course.

Huang CX: with Prof. Margaret McCully, CSIRO Plant Industry, was involved with CSIRO PI /GRDC workshop in Root/soil biology in agriculture **B** towards a conceptual framework II.

Stowe S : organised and lectured (with Eldon Ball, RSBS) in the annual Microscopy, Imaging and Analysis workshops. In 2001 the workshop ran over 5 days.
Lectured in BIOL3162 (BamBi, ANU)

EMU also organised a number of workshops by external consultants or companies:

- with CSIRO Plant Industry, 4 workshops over 8 days by Steve Chapman (Protrain Ltd, UK) on the operation and maintenance of electron microscopes
- a one-day workshop on Image Processing by Oxford Instruments, Soft Imaging System, and Olympus
- a two-day workshop on light microscopy by Leica Instruments.

5. PUBLICATIONS using the ANUEMU facilities, 1989-2001

(Not including abstracts, theses or papers in press. **NB For statistical and reporting purposes items are not in addition to those listed in Departmental and School reports]**)

YEAR	RSBS	OTHER	TOTAL
1989	5	7	12
av 1990-1993	9.75	19.25	28.5
av. 1994 - 1997	10	50.5	60.5
1998	15	60	75
1999	7	68	75
2000	8	51	59
2001 to date	15	68	83

1999 not previously recorded

Compston P. Jar P-Y.B.(1999) The influence of fibre volume fraction on the mode I interlaminar fracture toughness of a glass-fibre/ vinyl ester composite. *Applied Composite Materials* 6(6) 353-368.

2000 not previously recorded:

Cook LG, Gullan PJ Stewart AC. (2000). First-instar morphology and sexual dimorphism in the gall-inducing scale insect *Apiomorpha Rübsaamen* (Hemiptera: Coccoidea: Eriococcidae). *Journal of Natural History* 34: 879-894

de Waal SA, Armstrong RA (2000) The age of the Marble Hall diorite, its relationship to the Uitkomst Complex, and evidence for a new magma type associated with the Bushveld igneous event. *S.A. Journ. Geol.* 103:128-140
Fischel DP, Pimentel MM, Fuck RA, Armstrong R (2000) U-Pb SHRIMP and Sm-Nd geochronology of the Sylvania volcanics and Jurubatuba granite: Paleoproterozoic juvenile magmatic rocks in the basement of the Brasília Belt, central Brazil. *Anais da Acad. Bras. Ciências*, **73(4)**, 390-399.

Glikson AY.(2000) Archaean impact fallout spherules and early terrestrial maria basins. *The Australian Geologist* 114: 30-34

Glikson AY.(2000) Woodleigh - the world's 4th largest impact structure. *Meteorite*, 6: 18-20

Gorter J D, Glikson AY (2000) Late Eocene to pre-miocene buried crater and breccia lens at Fohn-1, North Bonaparte Basin, Timor Sea: a probable extraterrestrial connection. *Meteoritics and Planetary Science* 35, 381-392.

Hanley LM, Wingate MTD.(2000) SHRIMP zircon age for an Early Cambrian dolerite dyke: an intrusive phase of the Antrim Plateau Volcanics of northern Australia. *Aust. J. Earth Sc.*, 47, 1029-1040

Jian P, Liu D, Yang W, Williams, I.S.(2000) Petrographic and SHRIMP studies of zircons from Caledonian Xiongdiian eclogite, northwestern Dabie Mountains. *Acta Geologica Sinica*, 74, 766-773.

Klemme S, O'Neill HS (2000). The effect of Cr on the solubility of Al in orthopyroxene: experiments and thermodynamic modelling. *Contributions to Mineralogy and Petrology*, 140, 84-98.

Klemme S, O'Neill HS (2000) The near-solidus transition from garnet lherzolite to spinel-lherzolite: Experiments in the system CaO-MgO-Al₂O₃-SiO₂. *Contributions to Mineralogy and Petrology*, 138, 237-248.

Mapeo RBM, Kampunzu AB, Armstrong RA (2000) Ages of detrital zircon grains from Neoproterozoic siliciclastic rocks in the Shakawe area: implications for the evolution of Proterozoic crust in northern Botswana. *S.A. Journ. Geol.* 103(2), 156-161.

Mory A, Iasky R, Glikson AY, Pirajno F(2000) Woodleigh,Carnarvon Basin, Western Australia: a new 120 km-diameter impact structure *Earth Planet. Sci. Lett.*177: 119-128

Mory AJ, Iasky R, Glikson AY, Pirajno F (2000) Reply to discussion of "The Woodleigh structure, Carnarvon Basin, Western Australia a multi-ring impact structure of 120 km diameter" (*Earth Planet. Sci Lett.*, 177, 1-2: 119-128) by U.W. Reimold and C. Koeberl. *Earth Planet.Sci. Lett.* 184, 359-365.

Robb LJ, Freeman LA, Armstrong RA (2000). Nature and longevity of hydrothermal fluid flow and mineralisation in granites of the Bushveld Complex, South Africa. *Transactions of the Royal Society Edinburgh: Earth Science*, 91, 259-282.

2001: (* includes ANUEMU staff)

1. Ballard J.R., Palin, M.J., Williams, I.S., Campbell, I.H. & Faunes, A. 2001: Two ages of porphyry intrusion resolved for the super-giant chuquicamata copper deposit of northern Chile by ELA-ICP-MS and SHRIMP, *Geology*, 29: 383-386
2. Boger, S.D., Wilson, C.J.L. and Fanning, C.M., 2001. Early Paleozoic tectonism within the East Antarctic craton: The final suture between east and west Gondwana? *Geology*, 29, 463-466.
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5. * Brink F.J, Withers RL, Norén L (2001) Non-stoichiometric, rutile type, solid solutions in the FeIIIF₂ - FeIII OFsystem. *Journal of Solid State Chemistry* 161: 31-37
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7. Butera KM, Williams IS, Blevin PL, Simpson CJ (2001) Zircon U-Pb dating of Early Palaeozoic monzonitic intrusives from the Goonumbla area, New South Wales. *Australian Journal of Earth Sciences* 48: 457-464.
8. Cairns CJ, McQueen KG, Leah PA (2001) Mineralogical controls on element dispersion in regolith over two mineralised shear zones near the Peak, Cobar, New South Wales. *Journal of Geochemical Exploration* 72: 1-21.
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14. Conor, C.H. and Fanning, C.M., 2001. Geochronology of the Woman-in-White Amphibolite, Olary Domain. *MESA Journal*. 20, 41-43
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16. English PM (2001) Formation of analcime and moganite at Lake Lewis, central Australia: significance of groundwater evolution in diagenesis. *Sedimentary Geology* 143: 219-244
17. Evans IR, Howard JAK, Withers RL, Evans JSO (2001) Ab initio structure determination of BiPb₂VO₆ from powder diffraction data. *Chemical Communications*, 1984-1985
18. Evans P (2001) 'Wood Products' Weathering'. In *The Encyclopedia of Materials Science and Technology*. Elsevier Editors in Chief KHJ Buschow, RW Cahn, MC Flemings, B Ilschner, EJ Kramer and Mahajan
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6. PERSONNEL STATISTICS

Staff list

Facility Coordinator

Sally Stowe, MSc Hons(Auck), PhD

Senior Technical Officers

Frank Brink, BAppPhys (SA) MSc(LaTrobe)

Roger Heady, BAppSc(CCAE), GradDipElec(CCAE), GradDipResMan(CCAE), PhD

Cheng X. Huang, MSc (Beijing Agricultural), PhD (La Trobe) (*from July*)

David Llewellyn, DipEng(Bruce TAFE)

Technical Officer

Ruolan (Lily) Shen, DipTCM(Guangzhou)

Administrative Assistant

Meg Mitchell (BSc.Macquarie (from February))

Summer Scholar

Anastasia Warmuth (to February)

Visitor

Dr Jamileh Ghoddusi (Mashad University, Iran) from October

7. FINANCE

(Note that the ANUEMU finances are handled and formally reported within the RSBS cost/administrative centre)

Major Equipment (funded 2001)

Sources of funds for major items of equipment are the EM Reserve, the ANU Major Equipment Committee and more recently the ARC. Minor and medium-priced equipment (below about \$100K) has previously been bought from combinations of the operating grant, external earnings and contributions from users, but the increased proportion of recurrent funds now devoted to salaries and the impact of the ARC levy are have significantly reduced this capability. It has been offset by calling on the EM Reserve for several medium-priced items over the last two years.

Equipment Grant from EM Reserve (ANU) for CCD camera (\$70,000)

Dual-Beam Focused Ion Beam/SEM system:

ARC Linkage-Infrastructure - Stowe S, with Dr TJ Senden and Prof P Munroe (UNSW)
(\$320,000) UNSW (\$10,000)

ANU Major Equipment Committee (\$150,000)

EM Reserve (commercially confidential at time of press)

Operating Funds

In 2001 the ANUEMU received an operating grant of \$407,400 plus \$6,687 salary supplementation to cover salaries and on-costs, operating expenses and minor equipment.. Overheads such as electricity,

water, most administration and part of staff development costs are covered by RSBS. Additional non-capital income in 2001, from ANU and external sources, totalled \$31664 not including cash or in-kind recoveries of consumables, staff development and workshop fees. The equivalent in 2000 was \$33,082. (These amounts refer to funds actually received or paid out in 2001).

From ANU users:

RSES

PRISE Precise Radiogenic Isotope Services	\$4,000
AGSO/RSES	\$3,000
Hermann APDF	\$1400
Rubatto APDF	\$1500

RSPHysSE

Rode research grant	\$500
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BAMBI

Tierney research grant	\$350
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Total **\$10750**

External Earnings:

Robson Laboratories (fibre monitoring, via ANUTECH)	\$8370
ProSciTech	\$4444
Boston University USA. (Prof.Samuel Hammer)	\$2750
CSIRO/Natl Botanic Gardens	\$1100
Australian Scientific Instruments	\$1000
Australian Peanut Company	\$900
Sustainable Technologies Australia	\$700
Wagga Wagga Agricultural Institute	\$500
Miscellaneous	\$1150

Total **\$20914**

Nominal costings to School or Departmental level are prepared on request. There have been no significant cost overruns since 1990.

In the past the Unit has been able to run very efficiently because its block funding was sufficient to allow forward planning of basic functions in a situation where the pattern of use across campus and across different equipment types shifted markedly from year to year. Increasing external income and more efficient operation roughly compensated for a constant allocation of funds from the ANU.

That situation is now changing because of the ARC levy, imposed on the ANUEMU at 4 % pa.

ANUEMU is deriving external funds from an increasing variety of sources, although the total is rising only slowly, as we have been hit by an additional problem at the same time. The government bodies which were our main source of external funds have had cuts to their own research budgets, and we are having to compensate for the loss of these as well. Nevertheless in 2002 external earnings are expected to exceed the rapidly shrinking non-salary-related portion of the operating grant from the ANU, and on current projections will need to be subsidising salaries by 2004. Significant further growth from the non-research-related sector is likely to be limited by demand and available staff time, and cannot replace the shortfall in recurrent funding from within the ANU.

Income opportunities:

From ANU users grants etc:

Income (apart from direct cost recoveries) totalled \$10,750, mainly from RSES. Four individuals allocated funds to EMU from their research grants, a welcome trend we hope will gain momentum. We probably need some better form of interaction with the ANU's grant monitoring procedures.

Government organisations – income from government organisations (mainly AGSO and CSIRO) was at one time the principal regular source of external funds, but has declined to \$5345 from a high of \$17,775 in 1999.

Commercial sources. The major income is derived from an analysis service, managed through ANUTECH, for airborne particles and other OHS-related samples from building sites(\$8370, down from \$10,455 in 2000). Total earnings from commercial sources were \$14,864, including \$4444 from the sale of value-added EM-related laboratory supplies.

Other Universities.. This is probably the external source of funds which involves least distortion of the original aims of the Unit, and which impacts least on the service that can be provided to ANU users. Researchers and students from other Australian universities may use the EMU on the same basis as ANU researchers. Income from other Australian and overseas universities was \$3,000 in 2001

Workshops - recoveries from workshop charges at best cover costs. Apart from their basic educational role, the main value of such workshops lies in publicising the facilities of the unit.

The most appropriate and cost-effective role for the EMU in bringing funds into the ANU may be in providing infrastructure and support for academic endeavours that have commercial or government backing. However there is an increasingly evident need for a mechanism to provide the EMU with some remuneration linked to the services provided for such projects.

8. ORGANISATION

The ANUEMU is a central facility serving both the IAS and the Faculties and currently performing about equal amounts of biological and physical sciences work. The Unit is housed within RSBS and uses its administrative and support structures. The Director of RSBS, assisted by the Facility Coordinator and an advisory Committee, has overall responsibility for its operation.

The terms of non-ex-officio members of the "EM Advisory Committee" expired at the end of 2000. In accordance with the review report, a restructured "**Microscopy Strategic Advisory Group**" (MSTAG) was formed in 2001. Its members are:

Professor John Gibson (Interim Director RSBS) *ex officio* (Chair)

Dr Sally Stowe Facility Coordinator *ex officio*

Dr Paul Cooper BOZO - (Nominee of the Dean of Science) to

Dr Ian Jackson RSES

Dr Tim Senden Applied Maths Dept, RSPHYSSE (Scanned Probe Facility Coordinator)

Dr Bruce Walmsley JCSMR

Dr Ray Withers RSC

Dr Zbigniew Stachurski, FEIT (Director of Centre for the Science & Engineering of Materials)

Dr Helen O'Neill BAMBI

Professor David Ellis Geology Dept, Faculty of Science

Dr Rosemary White Microscopy Centre, CSIRO Plant Industry - External Advisor

Associate Professor Simon Ringer, Director Sydney University EMU- External Advisor

(The ANU administrative organisation is currently undergoing many changes. At the time of press, the newly formed Research Committee is examining various advisory structures).

User Input. Feedback from users comes from responses to news and queries on the users' email list, and from written surveys of all ANU EMU users and a number of other interested parties (such as major users of other EM facilities on campus or in the ACT), conducted by the Unit to canvas requirements for equipment and various organisational matters. In 2001 bulletin boards were started for both MSTAG and users - but drew no response. They may be restarted in a different form later.

Staffing. Until recently there has been no reception or administrative support position as such. In 2001 a part-time administrative assistant was employed, funded by external earnings. She proved very useful indeed, although it is questionable whether, even if funds were to become available to reestablish the position, it should have higher priority than specialist microscopy staff. The potential of the unit is still severely limited by staff numbers and appointment levels much lower than those in comparable Australian units.

9. COLLABORATION AND OUTREACH

Collaborations within ANU

The ANUEMU is structured to draw no distinction between the Faculties and the Institute, and in its normal operation often serves as a focus of interaction between departments. In addition several staff members are involved in collaborative projects:

Brink FJ, PhD project supervised by RL Withers and JG Thompson (RSC). Crystal structure of metal oxy-fluorides.

Heady RD (Departmental Visitor in Forestry Dept) with PD Evans, Forestry Dept. Callitroid thickening in *Callitris* pine. Differentiation of commercially important wood species by ultrastructure
with J Banks, Forestry Dept. Studies of Wollemi Pine.

Stowe S (Visiting Fellow in Developmental Neurobiology Group, RSBS) with SH Chung and M Ghoddusi, Biophysics Group, RSPHYSSE. Replica imaging by EM and AFM to investigate molecular structure, particularly of ion channels in situ.
with G Stange, Visual Sciences Group, RSBS. Biomimetic systems -optics and ultrastructure of dragonfly ocelli.

Collaborations with other Australian Institutions

Huang CX with ME McCully, CSIRO Plant Industry. CryoSEM studies of dissolved element distribution and air embolism in roots.
with Dr Rana Munns, CSIRO Plant Industry, Ion distribution in salt tolerant durum wheat genomes.

Ghoddusi J with A Hume, Canberra Veterinary Hospital and W Ryan, All Creatures Veterinary Hospital, Canberra. Dental pulp deterioration associated with periodontal disease.

Many other visitors to other ANU departments used the ANUEMU.

The ANUEMU facilities were used by the University of Canberra, Australian Defence Force Academy, Charles Sturt University, Wagga Wagga Agricultural Research Institute, CSIRO Divisions of Entomology, Plant Industry and Forestry, Australian Geological Survey Organisation, Therapeutic Goods Administration, Australian National Botanic Gardens.

ANUEMU is a member of the Microscopy and MicroAnalysis Consortium of the ACT (MACACT).

Collaborations with international institutions

For Professor Samuel Hammer (Boston University, USA; SEM of lichens) working with Roger Heady, and Dr Jamileh Ghoddusi (Mashad University, Iran; TEM of feline dental pathology) working with Sally Stowe, the ANUEMU was the primary focus of their visit to ANU. Also many overseas

visitors with affiliations to other departments also used the ANUEMU facilities.

Outreach Activities:

The EMU was a sponsor of the Australian Workshop on Nanotubes and Fullerenes 2001, May 3-4, 2001, The Australian National University.

Heady RH, Stowe S and Shen L contributed to the activities of the National Youth Summer School.

Stowe S administers the AUSTEM listserver, for the Australian and New Zealand microscopy community.

Involvement with government, industry and commerce.

Heady, RH. with P Evans and R Cunningham, for North Eden Furniture. Study of feasibility of distinguishing between *Eucalyptus sieberi* (silvertop ash) and *E. muellerana* (yellow stringy bark) using SEM.

The EM Facilities were used by CSIRO Entomology, Forestry and Plant Industry Divisions, Australian National Botanic Gardens, Australian Geological Survey Organisation, Therapeutic Goods Administration, Sustainable Technologies Australia, ADC Australia, Peanut Company of Australia, ProSciTech Ltd..

Involvement with Professional Bodies

Brink FJ, Huang C, and Stowe S attended the biennial symposia of the Australian Microbeam Analysis Society and Australasian Scanned Probe Microscope Society (February 2001, Sydney).

Heady RH refereed manuscript for IAWA Journal.

Stowe S Editor of EM Newsletter (Journal of Australian Society of Electron Microscopy and Microscopy Society of Australia)

Member Executive Committee, Australian Society of Electron Microscopy.

Dr SJ Stowe
Facility Coordinator,
ANU Electron Microscopy Unit
March 2002

10.APPENDICES

(i) School and Departmental use of ANUEMU in 2001

RSBS site. The last column shows the relative use by groups, weighted to take account of the different demands on the Unit's resources by users of ultramicrotomes, computers, light microscopes and scanning and transmission electron microscopes.

Group(number of users)	'TOMES	PCs	LMs	ALL SEMs	ALL TEMs	weighted hrs	% use by ANU groups
Weight	0.1	0.2	0.2	1	1		
Commercial (8)	29	32	29	121	7	143.1	
Government(13)	16	13		141	24	169.2	
Other Universities(19)		28		209	91	305.6	
Arch and Anthro(1)				8		8.0	0.1
BAMBI(2)	4				17	17.4	0.2
BOZO(6)	4	8	2	21	10	33.4	0.4
Chemistry (3)	15	49		32	165	208.3	2.8
FEIT(7)		22	16	113	5	125.6	1.7
Forestry (8)		216	58	304		358.8	4.8
Geology(34)	8	169	122	1192	105	1356.0	18.1
Other(3)				29		29.0	0.4
RSES(39)		11		2172	6	2180.2	29.1
RSPAS(2)				12		12.0	0.2
RSPHYSSE (22)		2	2	580	103	683.8	9.1
JCSMR(12)	8	29	11	48	103	159.8	2.1
RSBS(58)	1452	1384	939	1046	224	1879.8	25.1
RSC(8)	8	13		32	240	275.4	3.7
ANUEMU & courses unattributed(9)	16	43	52	44	50	114.6	1.5
	28	16	10	20	14	42.0	0.6
Total Hours	1588	2035	1241	6124	1164	8102.0	100.0

CM300 TEM on RSES site

GROUP	2000 HOURS	2001 HOURS
RSPHYSSE	473	441
RSES	210	77
RSC	31	59
Geology	25	0
Total	739	577

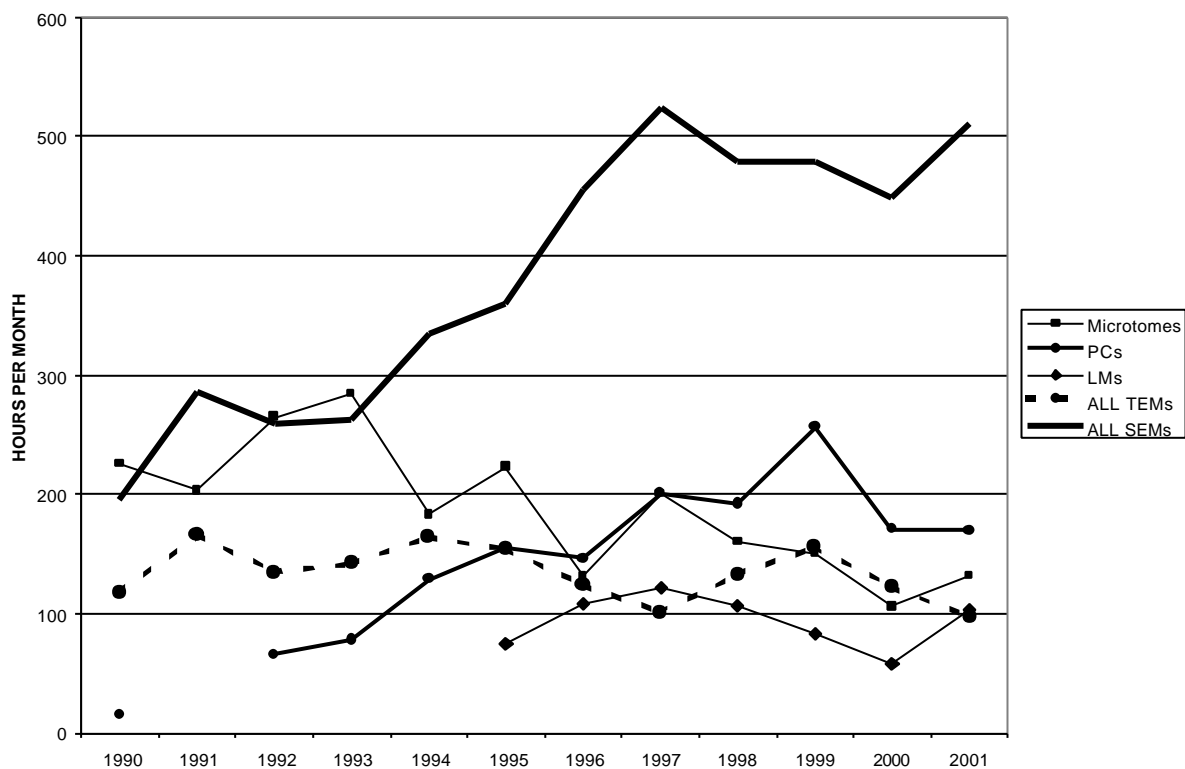
(iii) Number of ANUEMU Users (RSBS site) 1989-2001

YEAR	RSBS	OTHER IAS	FACULTIES	OTHER	TOTAL
1989	25	21	42	19	107
av. 1990-93	43	51.8	65.8	24.8	180.8
av. 1994-97	63.5	88.8	68.8	34.5	262.8
av. 1998-99	66	75	88	32.5	260
2000	63	91	85	38	277
2001	58	91	70	40	259

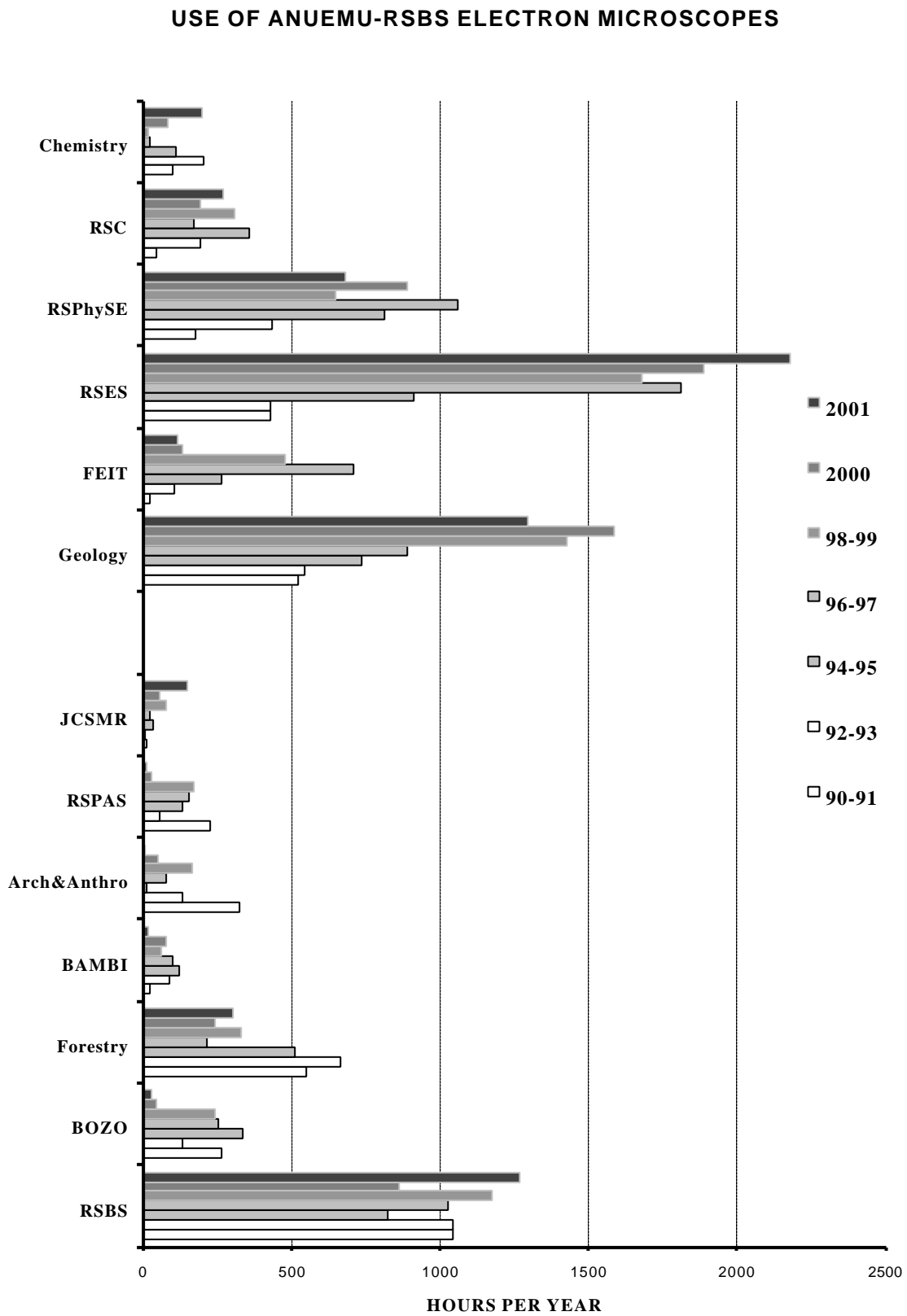
(Undergraduate courses and other student groups are counted as one user)

The numbers of users have been roughly constant for some time following a steep increase in the first few years of operation.

(iii) Trends in ANUEMU-RSBS Equipment Use 1990-2001



(iv) Distribution of ANUEMU Electron Microscope Use across the University, 1990-2001



Back cover micrograph – Frank Brink