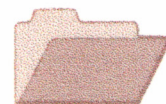




CRCLEME

Cooperative Research Centre for
Landscape Evolution & Mineral Exploration



**OPEN FILE
REPORT
SERIES**

THE REGOLITH PROFESSIONALS OF TOMORROW

CRC LEME Education and Training

**A record of achievement
and
A guide to students**

G. M. Taylor, S.M. Hill and B. Kovacs

CRC LEME OPEN FILE REPORT 81

June 2000

CRC LEME is an unincorporated joint venture between The Australian National University, University of Canberra, Australian Geological Survey Organisation and CSIRO Exploration and Mining, established and supported under the Australian Government's Cooperative Research Centres Program.



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The Cooperative Research Centre for Landscape Evolution and Mineral Exploration (CRC LEME) has brought together the regolith groups from the University of Canberra, Australian National University, Australian Geological Survey Organisation and CSIRO Exploration and Mining in an unincorporated joint venture.

The Cooperative Research Centre Program is an Australian initiative in which separate research groups with common interests are brought together under a single banner. The centres are set up by the Australian Government and aim to work with industry to focus and promote excellent research in Australia.

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PREFACE

This document presents and summarises five years of achievements in Education and Training in the Cooperative Research Centre for Landscape Evolution and Mineral Exploration. The Centre has developed comprehensive activities, ranging from undergraduate scholarships, to encourage students to pursue regolith studies, to professional short courses for practicing geologists.

This report will serve to: -

- guide prospective and present students and student advisors in CRC LEME as to what they can expect from the Centre and what the Centre expects of them;
- provide an insight for employers of exploration geologists, university geoscience academics, and other CRC's into the quality and breadth of experience of students, at all levels, graduating from universities associated with CRC LEME;
- provide ideas and stimulate academics to broaden their sights to include regolith studies in their curricula and stimulate other CRC's to consider some of the strategies CRC LEME has developed in Education and Training; and
- provide a consolidated insight into CRC LEME's Education and Training for its core-parties and the CRC Secretariat.

As Director I am proud to be leading a team that has achieved much over a comparatively short time and feel privileged to have interacted with participants in the many educational and training activities of the Centre. It is particularly heartening to have seen the enthusiasm with which members of CRC LEME, from across the country, have cooperated to deliver courses and become involved in advising students of the Centre.

I am particularly pleased to see the educational activity of the Centre growing at Curtin University of Technology, where the Centre now jointly funds a lecturer, and am looking forward to seeing regolith studies augmented in their curriculum. The regolith courses at the University of Canberra and the Australian National University are providing a steady supply of graduates to industry and other employers, so taking regolith knowledge and skills generated through the Centre's activities into the workplace.

Raymond E Smith
Director, CRC LEME
June 2000

INTRODUCTION

The CRC core parties

The Cooperative Research Centre for Landscape Evolution and Mineral Exploration (CRC LEME), which was established in July 1995, is a research and knowledge transfer organisation, consisting of four core parties:

- University of Canberra;
- Australian National University;
- Australian Geological Survey Organization; and,
- CSIRO Division of Exploration and Mining.

CRC objectives

It has the overall objective of achieving research excellence in regolith geology as it relates to mineral exploration and knowledge transfer. Specifically, its objectives are to:

- establish a framework for the greater understanding of the three-dimensional evolution of the Australian landscape;
- translate knowledge of the evolution of Australia's landscape into a greatly improved ability to recognize major mineral deposits;
- integrate industry-supported research with education to ensure a suitable knowledge and skills base for industry, general Earth science communities and for further research;
- inform and guide decision-makers about the relevance and contribution of regolith geology and geochemical research to Australia's future.

CRC activities and strategic themes

The activities of CRC LEME are organized around six strategic themes:

- mapping the regolith in three-dimensions;
- exploration in areas of basin cover;
- regolith evolution;
- regolith expressions of ore systems;
- terminology and classification; and,
- synthesis GIS/expert systems.

Although by far the greater majority of research is directed toward the minerals industry the science is also applied, where appropriate, to other problems involving regolith geology. Education and Training and the Technology Transfer activities of CRC LEME Application and Utilisation cross all these themes and convey the knowledge developed in the various research themes to industry, government and the public.

CRC management, locations, size and finance

A Board, comprising members of the core-party organizations and industrial representatives, directs the Centre. An Executive Committee is responsible to the Board for the functioning of the Centre. A Science Advisory Council, drawn from users (government, industry and universities), serves to keep the science relevant to Australia's needs. CRC LEME operates mainly from Perth and Canberra with small nodes in Sydney and Adelaide. The Centre has some 50 scientists, with appropriate support staff, and undertakes field-based research across the Australian continent as well as some overseas work. The Centre is financed from a variety of sources, including the Australian Government, the minerals industry and the core

party organizations. During the 1998/9 financial year, CRC LEME turned over some \$12.2 M with the resources distributed as shown in the pie-chart of Figure 1.

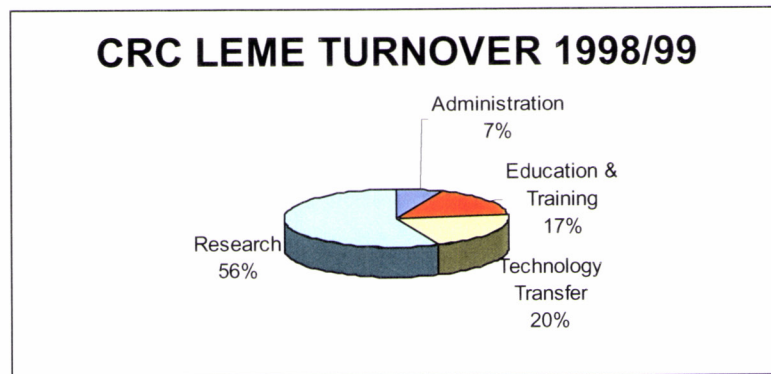
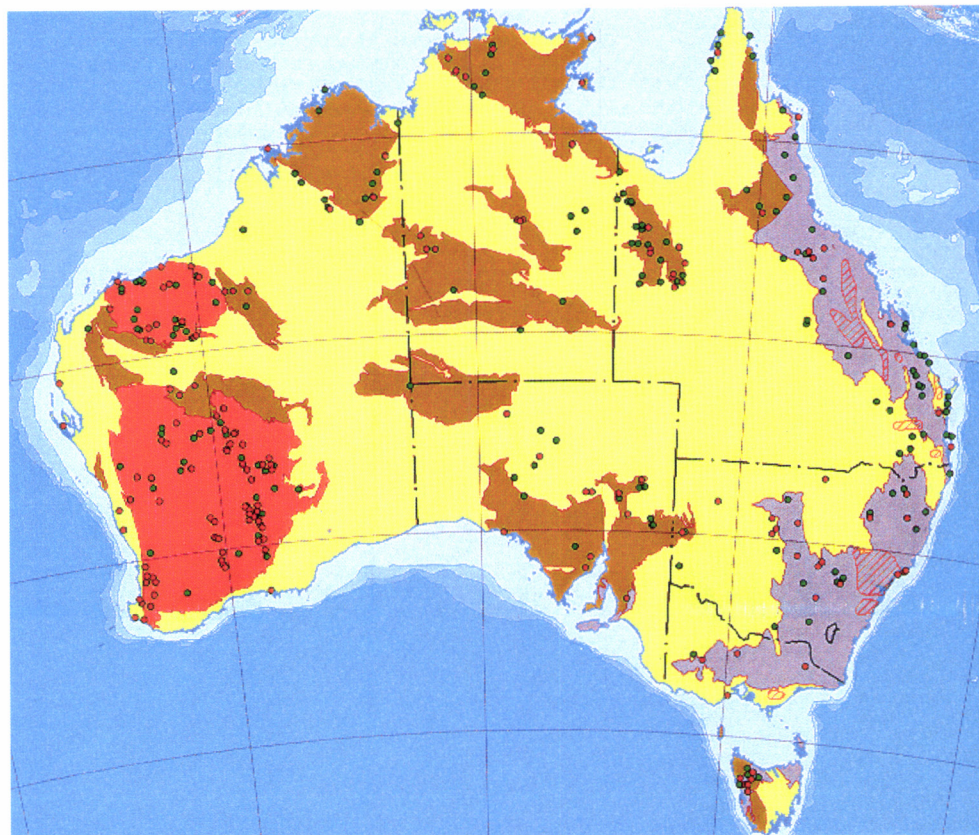


Figure 1. Pie chart of CRC LEME's turnover for the 1998/99 financial year



● and ● represent major ore deposits

Red, brown and mauve polygons represent bed-rock outcrop and include large areas of regolith.

Yellow areas are basin cover and regolith dominated terrains.

Figure 2. Regolith geology of Australia

CRC LEME EDUCATION AND TRAINING

Objective

The objective of CRC LEME Education and Training is to markedly strengthen the teaching and research training in landscape evolution and mineral exploration in Australia.

Challenge

Regolith comprises all the Earth materials 'between fresh rock and fresh air' and includes predominantly weathered or rotten rock, as well as hill slope, stream and wind-blown sediments. Australia is dominated by regolith. Perusal of the geological map in Figure 2 shows that about half the continent is covered by shallow marine and terrestrial basin sediments and, of the remainder, shown as Palaeozoic or Precambrian outcrop, more than half is covered by significant thicknesses of regolith. The majority of Australia's ore deposits occur in areas of outcrop. It is logical to suspect that there must be a significant number of major ore deposits hidden beneath the 75% of continental regolith. It is also in these areas of regolith and basin sediments that many of Australia's environmental issues occur.

Regolith geology is not perceived as a traditional sub-discipline of geology and, as a consequence, is not widely taught in Australia. In fact, it is not widely taught internationally. Although regolith geology is based on traditional geological and geomorphological science, it has not been regarded as important in either undergraduate or postgraduate education. Until recently, those practicing in regolith geology have had a background mainly in the more traditional areas of geology and geomorphology. Because of the wide distribution of regolith in Australia it is essential that more attention be paid to it in educational institutions, particularly in universities. For these reasons the education and training role of CRC LEME is particularly important.

Tasks of Education and Training

CRC LEME Education and Training operates from the University of Canberra but involves all members of CRC LEME who wish to take part. It is a diverse group that undertakes a number of main functions including:

- scholarship administration;
- producing educational materials;
- organizing the Australian Regolith Conferences;
- running a Masters program in Regolith Geology;
- undergraduate teaching;
- organizing and running the National Undergraduate Regolith Geology School;
- representing CRC LEME on the Minerals Tertiary Education Council (MTEC) of the Minerals Council of Australia (MCA);
- developing and running short courses for practicing professionals; and,
- providing advice and mentoring to all CRC LEME students.

There are many other minor functions that are the responsibility of the CRC LEME Education and Training; these are discussed below.

STAFF AND LEADERSHIP

CRC LEME Education and Training has been successful because of strong support for its activity from the Board and the Director. As well as having this support, Education and Training staff have been able to work with a team that have made developing our Education and Training activities much easier than they might have been. All those involved with CRC LEME Education and Training recognize this leadership and close team approach and have been quick to respond to it.

Education and Training Coordinator

Before CRC LEME began, **Graham Taylor** was head of the School of Resource, Environmental and Heritage Sciences at the University of Canberra where he learned to manage cross-disciplinary teaching and research effectively which, together with his thirty-odd years as an educator, ideally suits him for this position. Graham has a strong empathy with students and long experience in assisting both undergraduate and research students. Graham began his career as a sedimentologist, published his first regolith geology paper in 1972 and he has been researching and teaching regolith geology since.



Education and Training Core Team

Steve Hill helps people see and understand the details of landscapes rather than just look at them through teaching at universities and through short courses for industry. When not involved in teaching, he researches the landscapes of Broken Hill and the Eastern Highlands in South Eastern Australia. He is passionate about ongoing interactions of a wide range of environmental factors in the landscape, as applied to chemical dispersion pathways in landscape evolution models and mineral exploration. He enjoys mapping regolith and studying biological soil crusts, plants, soils and indurated regolith.



Bernadette Kovacs is the Personal Assistant to the Education and Training Coordinator, and is also the 'materfamilias' of CRC LEME Education and Training. She runs the Education and Training office from the University of Canberra. She is actively involved in all administrative matters, organisation of short courses, workshops, seminars, the National Undergraduate Regolith Geology School, conferences, monthly finance reports and logistics. Bernadette liaises with all staff and post-graduate students involved in Education and Training and is the first point of contact for people new to CRC LEME at the University of Canberra.



Glen Fisher is the senior technical officer for the Education and Training team. He instructs and trains research students and staff in the use of four wheel drive vehicles and all field equipment. Glen's experience as a graduate in geology and his practical ability in the bush ideally suit him to handle this role. He improves awareness of occupational health and safety matters, particularly with regard to fieldwork. Staff and students alike benefit from his planning and organisation. Glen has an extensive network for purchasing and providing technical laboratory requirements.



Mehrooz Aspandair was appointed late in 1999 to develop undergraduate and research student regolith geology programs at Curtin University of Technology, Perth. Mehrooz is a graduate of ANU with a PhD in Regolith Geology. His research has been at Parkes and Charters Towers and he is highly competent in mineralogy and geochemistry.



CRC LEME Staff partly involved in teaching

A number of colleagues undertake significant roles in teaching and assisting undergraduates and research students at UC and ANU, including Ken McQueen, Tony Eggleton, Robyn Westcott, Judy Papps, Ian Roach, Leah Moore, Chen Xiang Yang, John Field, Richard Greene and Jonathon Clark. Other staff, based in Adelaide and Perth, who are involved mainly in research, carry out minor but vital roles in teaching regolith and geochemistry at non-core party universities and shortcourses and in supervising students.

Staff from CSIRO Exploration and Mining have contributed to undergraduate teaching at Curtin University of Technology (Photogeology and Exploration Geochemistry) for many years. This has been consolidated into CRC LEME Education and Training. Since 1995, student numbers have varied from 33-50 per year in these courses. Staff involved are Ray Smith, Charles Butt, Ravi Anand, David Gray and Ian Robertson.

There are too many of our colleagues in the Centre involved to mention all by name here. They appear in various tables throughout this document. Those of us responsible for CRC LEME Education and Training offer our thanks to those that have so willingly assisted over the last five years.

CONTACTS

CRC LEME has a well maintained web page at ANU at:
<http://CRC.LEME.anu.edu.au/>

Apart from covering the CRC's scientific achievements, this web page lists details of CRC LEME staff and their contact addresses and telephone numbers.

Education and Training

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FUNDING

Education and Training work was funded in-kind and in cash to about \$2.2 M in the 1998/99 financial year, representing some 17% of the CRC budget (refer to Figure 1). The majority of the money was expended on salaries and scholarships, however other significant activities received substantial funds. The National Undergraduate Regolith Geology School (NURGS) was funded to \$30 K and production of learning materials to about \$50 K.

STUDENTS

Since its inception, CRC LEME has had 73 students studying in its various nodes (excluding undergraduates without a CRC LEME Scholarship). The majority of students are based in Canberra but, increasingly, the Centre has students based elsewhere. This is expected to increase as the Centre matures and grows.

Table 1: Research student numbers enrolling (or joining CRC LEME) each year and the numbers completing successfully (in brackets) for the period July 1995 to January 2000.

Degree	1995	1996	1997	1998	1999	2000
PhD	5 (0)	4 (1)	5 (2)	2 (1)	5	
Masters	4 (0)		(1)	2 (1)	(1)	
Honours	10 (1)	6 (11)	6 (4)	6 (7)	14 (10)	10

Table 2: Numbers of students enrolled at various universities associated with CRC LEME for the period July 1995-January 2000.

University of enrolment	1995	1996	1997	1998	1999	2000
UC	5	7	6	10	8	
ANU	8	12	14	15	13	
CUT	1	2	2	1	2	
UWA	1	3	1			
Melbourne					1	
UofA			1		4	3
Univ of Sth Aust						2
UNSW					1	1

A large number of undergraduate students study regolith subjects at both UC and ANU. Because of possible course combinations it is difficult to quantify students graduating with significant regolith experience. At UC, about 12 graduate with more than 40% regolith in their course. At Curtin University of Technology (CUT) CRC LEME staff, based in Perth, have taught in the undergraduate geology program, but regolith geology, in general, has made up less than 10% of the course of graduates. This situation is expected to change with the appointment of Mehrooz Aspandiar, in late 1999, to Curtin University of Technology.

Past students

Students that have previously been involved with CRC LEME's Education and Training Program are one of the Centre's most valuable resources. These students range from undergraduates and postgraduates at the core party institutions to students who have attended short courses and other initiatives such as the National Undergraduate Regolith Geology School (NURGS). Beyond this, the indirect influence our Education and Training activities have had on other people, not formally enrolled as graduates, is difficult to quantify. However, the heightened awareness of our activities within the Australian geoscience community is a significant outcome.

Another important outcome for the Australian geoscience community are graduates with an increased awareness and understanding of landscapes and regolith materials. Considering the widespread nature of regolith and the importance of landscapes in accounting for materials on the surface of the Earth, our graduates have vital skills. A major output is more people with skills in a field that was previously difficult for employers to find.

Our graduates are highly sought after by minerals exploration industry worldwide. Many exploration companies now recognize that the terrains they are exploring are dominated by regolith, of which many of their current employees have little formal understanding. The contributions of our graduates to Australian geoscience continues long after their association with CRC LEME, and will contribute to the discovery of world-class ore deposits.

Some of our graduates continue their quest for knowledge of regolith and landscapes and advance the frontiers in this emerging science discipline. Some of these will move into postgraduate research programs, either within CRC LEME or at other institutions. The research frameworks established by these students are providing the foundations for future research and breakthroughs in regolith and landscape geology. As the quality of our graduates is recognized and appreciated within the Australian geoscience community, the Education and Training legacy of CRC LEME will continue to influence many generations of students.

Past and present research students

Tables 3 and 4 list all current and past research students of the Centre, up to and including those enrolled by February 2000. Present students are listed with their project in a summary form; those of past students have the full thesis title listed. 'Program' refers to the program they were working in:

1. Shields Program;
2. Tasman Fold Belt Program;
3. Basins Program; and,
4. Synthesis Program.

Conference presentations by students

CRC LEME research students have presented oral and poster papers at a number of local, national and international conferences since 1995. This has provided excellent experience for our students and enhanced the reputation of CRC LEME. A list of all presentations is given in Appendix 5.

SCHOLARSHIPS

CRC LEME offers the following scholarships on a competitive basis:

- | | |
|--|---------------|
| • Postgraduate research | approx \$21 k |
| • Postgraduate top-up | approx \$5 k |
| • Honours year | \$7 k |
| • Undergraduate | \$1 k |
| • Undergraduate Summer (research experience) | \$3 k |

The distribution of these scholarships among the universities is shown in Table 5.

Table 3. Current students –degrees underway

Surname	Given name	Institution	Project	Supervisor/ advisor	Start	Finish	Program	Outside funds	CRC LEME Scholarship	Result
PhD										
Bierwirth	Phil	ANU	Hyperspectral remote sensing: applications to surface mineralogy	Chopra (ANU)/Cudahy (CSIRO)	7/99	4/02	3/4	APA	X	
Cotter	Stephen	UC	The nature, origin and geochemistry of chert breccias at Mt Isa	Taylor/Anand/Moore	6/98	5/01	1	APA	X	
Craig	Mike	UC	Regional regolith and landscape evolution in the eastern Goldfields, Yilgarn Craton - Western Australia	Taylor/McQueen/Pain	1/98	2/01	1	AGSO		
de Broekert	Peter	ANU	The nature of sedimentary regolith on the Yilgarn Craton	Anand/Eggleton	2/96	12/98 (6/00)	1		X	Extended
English	Pauline	ANU	Lake Lewis Basin, central Australia: tectonic, climatic and hydrologic processes in the basin and landscape evolution	Pillans/Chappell	2/94	10/00	3/4	APA		
Foster	Luke	ANU	Landscapes, geochemistry, and GIS at Marlborough, Qld	Eggleton/Pain/John (ODME)	2/97	1/01	2		X	
Gatehouse	Robyn	ANU	Aeolian regolith & its significance for exploration	Pillans/Pain/Chen/Chappell	9/96	5/00	4		X	
Hill	Steve	ANU	Landscape history at Broken Hill	Eggleton/Taylor	2/93	4/00	3	APA/CRAE		
Hill	Leanne	ANU	Chemical dispersion pathways in a variety of landscapes	Eggleton/de Caritat/Field	2/99	2/02	4	APA	X	
Keaneko	Watcharaporn	ANU	Crystal chemistry of garnet and its weathering	Eggleton/Ellis/Fitzgerald	3/97	3/00	4	Burapha University, Thailand		
Laffan	Shawn	ANU	Inferring regolith characteristics using topography and vegetation	Lees(ANU)/Eggleton	1/95	1/98	4	APA		
Mahizhnan	Anna-malai	CUT	Red-brown hardpans on the Yilgarn	Wilde/Anand	2/97	12/00	1	APA	X	
McLean	Wendy	UNS W	Groundwater quality, recharge and sustainability in the lower Namoi Valley.	Jankowski/Lavitt/de Caritat	3/99	3/02	3	APA + 490k from Cotton Growers & DLWC	X	
McPherson	Andrew	ANU	Regolith development in upland areas of the Murray-Darling Basin SE NSW; salt and its implications for land management and mineral exploration.	Eggleton/Lawrie (AGSO)	3/00	2/03	4		X	
Shirliff	Greg	ANU	Weathering of waste rock at Ranger Uranium Mine, NT, Australia	Eggleton/Jones/de Caritat	2/99	12/02	4	?	X	
Spry	Melissa	UC	Landscape evolution at Cobar	McQueen/Taylor/Pain	7/97	7/00	2		X	
Tan	Kok Piang	ANU	Regolith geology and geochemistry of Portia and North Portia prospects, Benagerie Ridge Magnetic Complex, Cumamona, SA	Eggleton/de Caritat	3/97	2/00 (7/00)	3	Pasminco	X	extended
Whitbread	Michael	UC	Alteration haloes at Century and Cobar	McQueen/ Moore	1/99	2/02	1	Pasminco	X	
Masters (coursework)										
Eberhard	Rolan	ANU		Eggleton			4			
Rabone	Graeme	UC		Taylor	1/98	2/00	Education			
Masters										
Holzaphel	Michael	UC	Land management and salinization at Back Creek, NSW	Moore/Chen/Pain	6/00	5/02		NSW DLWC		
Honours										
Brachmanis	Jaclyn	UC	Regolith-landforms of Kinalung West (Broken Hill)	Hill/Taylor/de Caritat	2/00	11/00	3		X	Accepted
Debenham	Simon	UC	Regolith/landforms of Triple Chance East (Broken Hill)	Hill/McQueen/de Caritat	2/00	11/00	3		X	Accepted
DeSouza-Kovacs	Nadir	UC	Palaeodrainage in the Temora-West Wyalong region and mineral Exploration	Moore/Chan	7/99	6/00	2		X	Accepted
Fitt	Mark	ANU	The <i>in situ</i> /transported regolith boundary at Gidginbung, NSW	Collins/Anand	7/99	6/00	4		X	
Gilchrist	Wendy	UWA	Models of geochemical dispersion in the Tanami region.	Butt/Gilkes	7/99	5/00	1		X	Offered
Gonzalez	Osvaldo	UC	The geology and landscape history of the El Capitan area near Cobar	McQueen/Moore/Roach	3/00	12/00	2			
Hartley	Kerri-Lyn	MU	AU and CU calcrete geochemistry at Moonta SA	Lintern/Sheard/Hergt	2/99	11/99 (6/00)	1		X	Extended
Kilby	Megan	ANU	Sulfur budget - Ranger Mine NT	Eggleton	3/00	12/00			X	Accepted
Klingner	Darren	UA	Pleistocene Lake Bungunna	Bone/Gostin/Clarke	2/00	12/00	3	University of Adelaide		
Kyan	Danielle	UC	Interpretation of HYMAP data from the Gawler	Tapley/Taylor/Wilford	2/00	11/00	1		X	Accepted
Lewis	Ancret	UC	Neotectonics and the origin of the SE Highlands	Hill/Roach	7/99	5/00	2		X	Accepted
Maly	Ben	UC	Regolith/landforms of Quondong West (Broken Hill)	Hill/Taylor	2/00	11/00	3			
Povey	Dwayne	UA	Challenger regolith materials	Lintern/Sheard/Fraser	2/99	11/99 (2/00)	1	GFV PIRSA		Extended
Roarty	Todd	UC	Land management and water rock interactions in the Boorowa region	Moore/Chen/Pain	3/00	12/00	3	NSWDLWC		
Ross	Rachael	ANU	Movement of P and other trace eCRC LEMeNTs in Adelaide Ck.	Eggleton/Ollie	4/99	2/00	4			
Senior	Anthony	UC	Regolith/landforms of Pinnacles West (Broken Hill)	Hill/McQueen/de Caritat	2/00	11/00	3		X	Accepted
van der Wielen	Simon	UA	Challenger mapping	Lintern/Sheard/Bishop	2/99	11/99 (2/00)	1	GFV, PIRSA		
White	Geoffrey	UA	Pleistocene evolution of the lower Murray River	Bone/Gostin/Clarke	2/00	12/00	3	University of Adelaide		
Willis-Jones	Bobak	CUT	Regolith geology near Sandstone WA	Aspandiar/?	2/00	11/00	1		X	
Undergraduate										
Chamberlain	Tessa	UC	Undergraduate	Taylor	3/99	11/00			X	
Martin	Kevin	UC	Undergraduate	Taylor	3/99	11/00	E&T		X	
Merrill	Geoff	UC	Undergraduate	Taylor	3/99	11/00	E&T		X	
Morley	Nigel	ANU	Undergraduate	Clarke	1/99	12/00	4		X	

Table 4. Past students – completed degrees

Surname	Given name	Institution	Project	Supervisor/advisor	Start	Finish	Program	Outside funds	CRC LEME Scholarship	Result
PhD										
Aspandiar	Mehrooz	ANU	Landscape evolution and regolith history, Charters Towers	Eggleton/Taylor/Orr (Posgold)	5/94	8/98	2	OPRS		Pending
Brand	Nigel	UWA	Chemical and mineralogical characteristics of weathered komatiitic rocks, Yilgarn Craton, WA, discrimination of nickel sulphide dearing and barren komatiites.	Butt/MacNaughton (UWA)	3/94	6/97	1	WMC		Awarded
Ma	Chi	ANU	The ultra-structure of kaolin	Eggleton	2/93	10/96		OPRS/ANU/Comalco		Awarded
Tonui	Eric	ANU	Regolith mineralogy and geochemistry at the Northparkes Cu-Au deposits.	Eggleton/Taylor	2/93	12/98	2	ADCOS, Northparkes		Awarded
Masters										
Huang	Xiaoyan	UC	Biogeochemistry techniques for environmental monitoring and mineral exploration: a case study at the Temora Goldmine.	McQueen/Maher	8/95	2/98	2	GMA	PRC	Awarded
Cross	Andrew	UC	Magnetite character and comp and provenance with respect to porphyry copper, Irian Jaya	McQueen/Radford (Normandy)	1/95	3/00	4	Normandy	X	Submitted
O'Brien	Jane	UC	Palaeoclimatology from Tertiary fossil wood	Taylor	8/95	11/99	4	Private		Awarded
Honours										
Adamson	Steve	ANU	Regolith & Exploration Geochemistry of the Beechmore Block, Parkes, NSW	Eggleton/Taylor	7/95	6/96	2	Northparkes	X	H2A
Baker	Andrew	UA	Metal geochemistry of regolith in the Mount Lofty Ranges and associated alluvial fans of the Adelaide Plains.	Sheard/Lintern/Foden	3/99	11/99	1	PIRSA		H1
Butterfield	Grantley	ANU	Regolith and trace eCRC LEMEnts at Mt Dromedary, NSW.	Eggleton/Moore	2/98	3/99	4			H2B
Carragher	Alison	UA	The use of partial extractions for exploration	Lintern/Sheard/Foden (UA)	2/99	11/99	1	AMDEL PIRSA		H2A
Crawford	Marcus	ANU	Regolith geology of the Burdekin downs/Fletcher area, north Queensland.	Eggleton/Orr (Posgold)	7/96	6/97	2	Posgold		H2B
Della-Marta	John	CUT	Regolith evolution and mineralogical characteristics at the Jundee deposit, Wiluna region, WA.	Anand/Collins (CUT)	1/97	12/97	1	GCM		H2A
Dries	Shanta	CUT	Geochemical characteristics of the regolith at the Fender deposit, Murchison Province, Western Australia	Butt/Wilde (CUT)	3/95	11/96	1	In kind		H2A
Foo	Mark	CUT	Host of gold and ore-related eCRC LEMEnts in ferruginous materials in mineralized environments – implications for exploration.	Anand	1/99	11/99	Apps			H2A
Foster	Kylie	UC	Remote sensing and GIS evaluation of the Balacava East area near Broken Hill	Hill/Moore	2/98	11/98	3	Acacia, Triako, NSW Discovery 2000	X	H2A
Foster	Luke	UWA	Regolith-landform characteristics and secondary nickel dispersion in the regolith of the Central Ultramafic Belt, Forrestania, WA.	Anand/Frost/McNoughton (UWA)	1/96	10/96	1	Outokumpu		H2A
Foster	Luke	ANU	Regolith-Landform characteristics and secondary nickel dispersion in the Regolith of Central Ultramafic Belt, Forrestania, WA	Eggleton/Taylor	7/95	6/96		Comalco	X	H1
Gibbons	Lisa	UA	Regolith study of the Old Well gold prospect, Tarcoola district, Gawler Craton, SA.	Lintern/Both, Bone	4/97	11/97		MIM		H1
Holzappel	Michael	ANU	Regolith-landscape evolution and silcrete investigation: Redan East, Broken Hill Block, NSW.	Eggleton/Hill	2/98	11/98	3		X	H2A
Kiasatspar	Goran	UA	Geochemical study of the salinity and pollution of groundwater, surface waters in the Murray Basin, Renmark to Morgan, SA.	Clarke	1/99	12/99	3			H3
Johnson	Craig	UC	Regolith geology and geochemistry of the Gidji area, Kalgoorlie, WA.	McQueen/Longworth (Goldfields)	8/97	8/98	1	Goldfields	X	H1
Jones	Grant	UC	Regolith geology and geochemistry of Triple Chance West, Broken Hill, NSW.	Hill/Taylor	2/99	11/99	3	Pasminco	X	H1
Lee	Sam	ANU	The geochemistry and mineralogy of the Marlborough nickel laterite	Eggleton/Foster	7/98	6/99	4	Preston Resources		H2A
Leslie	Christopher	ANU	High-resolution seismic imaging of palaeochannels near West Wyalong, NSW.	Eggleton/Papp/Jones	2/99	11/99	4		X	H2A
Madden	Jane	UWA	Regolith evolution & geochemical dispersion in transported overburden at Deep South deposit, Mt Gibson, WA.	Anand/McNoughton (UWA)	1/96	10/96	1	Camelot		H1
Maney	Paul	CUT	Geochemical and landform characteristics of the Novoria area, Marvel Loch, WA.	Collins (UWA)/Butt	3/96	11/96	1	Mt Edon Gold Mines		H1
McIntosh	Clare	ANU	Rock weathering, soil formation models and the implications for mineral exploration at Boorowa, NSW.	Field/Moore	2/98	12/98	2			H2A
McPherson	Andrew	UC	Differentiating in situ and transported regolith in a weathering profile at Mandamah, NSW.	Taylor/Chen	2/96	10/96	2	GMA	X	H2A
Porritt	David	UC	Acid sulphate soils of the south coast of NSW	Chen/Taylor	1/95	11/95	4	Private		H3
Pottenger	Daniel	ANU	The nature and distribution of the regolith in the Bulong area, WA, and its implications for gold exploration.	Eggleton/Butt/Taylor/Opdyke	2/97	11/97	1	General Gold Resources	X	H2A
Pulford	Anna	ANU	Cainozoic landscape evolution of the East Australian Highlands: constraints from Miocene basalts, Blue Mountains, NSW.	Evan de Biek/Eggleton	2/97	11/97	2			H2A
Reilly	Nerrida	UC	Investigations of the regolith at No 5 Tank, NW of Cobar, NSW, Australia	McQueen/Taylor	2/97	1/98 (2/98)	2	Pasminco	X	H2A
Shirdiff	Greg	ANU	Massive gypsum, ferricretes and regolith-landform mapping of western Balacava, Broken Hill, NSW.	Eggleton/Hill	2/98	12/98	3		X	H1
Smith	Bernadette	ANU	Calcrete, their nature and association with gold and other metals.	Eggleton/Lintern	2/96	12/96	1/3	Northparkes/Pasminco Ex. private		H2B
Spry	Melissa	ANU	Evolution of the coastal lowlands, southern NSW, evidence from basalt flows at Broome	Eggleton/Gibson	2/96	11/96	4			H2A
Tan	Kok Ping	UC	A study of eCRC LEMEnt SD and weathering history at the McKinnons gold deposit, Cobar, NSW Australia	McQueen/Chen	7/95	6/96	2		X	H1
Thomas	Brett	UA	Gypsum cements in Cenozoic sediments in the Murray Basin, SA, their age and origin.	Bone/Clarke	1/99	12/99	3			H2A
Willis	Steven	UC	Regolith geology and landscapes of the Thackarings West area, Broken Hill, NSW.	Hill/Chen	2/99	11/99	3		X	H2A
West	Darryl	UC	Regolith geology and landscape evolution of the Redan west area, Broken Hill, NSW.	Hill/Wilford/Cho	2/98	11/98	3	Normandy, Triako/Acacia	X	H1

Table 5: CRC LEME Scholarships awarded and university at which the students enrolled.

	1995		1996		1997			1998		1999			2000		
	UC	ANU	UC	ANU	UC	ANU	CUT	UC	ANU	UC	ANU	Other	UC	ANU	CUT
PhD				2	2	1			1	1	2				
Top-up							1	1				1			
MSc	1														
Hons.	1	2	1		2	1		2	3	4	2	2	4	1	1
U/G								3		3	1				

PhD, top-up and research scholarships

The number of PhD and Top-up scholarships offered is designed to keep the number of students on them at 8 per year, so the number varies from year to year. During 1999 only Honours year scholarships were offered for commencements in 2000. Research Scholarships and top-ups are awarded to increase the number of students receiving research training in regolith geology and landscape evolution.

Honours year scholarships

Honours Year Scholarships enable fourth-year undergraduates to get training in independent project work and research training. CRC LEME places great value in all its Honours students as they receive a rigorous training in regolith geology, particularly mapping, and are then available for further study towards a higher degree, or to join industry where their skills are much in demand.

Undergraduate scholarships

Undergraduate scholarships provide students entering their second year of study at UC and ANU with \$1000, a CRC LEME staff mentor and a paid trip to a regolith conference. The award is designed to increase interest in regolith and ensure a flow-on to further study. These students become part of the 'LEME Team'.



Students on the road to regolith discovery, investigating chemical weathering; Mt George Station, Broken Hill region.



Second and third year undergraduates consider the landscape from the Middle Pinnacle, Broken Hill.



Honours students from VIEPS on a LEME/VIEPS short course; Mt Bolton, Victoria.



Students on a LEME/VEIPS Honours course scrambling for regolith; Ballarat region, Vic.



"I'm ready to join the team"; Quondong West, Broken Hill region.



'Sticks and stones may break bones and explain PhD projects too!' Tony Eggleton using mudmap technology; Hiawatha, NSW.



Students learning how to use a satellite phone, near Sandy Creek, Silver City Highway, Broken Hill.



First year students being introduced to regolith processes, Warri Bridge, NSW.



Undergraduates experiencing regolith processes, Shoalhaven River, NSW.



Lectures in the pub at Broken Hill during NURGS '99.



Second and third year students studying a regolith-landform map at Poolamacca Station, Broken Hill region.



Honours students sampling regolith at Kinalung West, Broken Hill region.

Summer scholarships

Summer Scholarships are awarded for students to join one of CRC LEME's research projects for two to three months. Exposure to methods and skills required in regolith and landscape research ensure these students are prepared for continuing work in regolith geology. A report, published in LEME NEWS, written by two Summer Scholars, is attached as Appendix 7.

The strong enthusiasm and interest of young undergraduates are important but need to be channeled into outcomes such as completed degrees, research projects and scientific experience. This requires an investment from both students and research groups such as CRC LEME. In 1997, the Education and Training program initiated a summer scholarship program to provide undergraduate students with an opportunity to experience a research environment beyond the confines of a traditional undergraduate course. With the support of a CRC LEME Summer Student Scholarship, students can conduct research with a CRC LEME research scientist during their summer non-teaching period (November to February). Summer students experience the responsibilities and rewards of being a part of a large research team; the CRC LEME research scientists in turn are rewarded by contributing to the development of a young geoscientist as well as having of them contribute to CRC LEME projects.

A full summer research scholarship is valued at \$3,000 (tax free), although partial scholarships have been awarded to some students. Recipients must have completed either their 2nd or 3rd year undergraduate studies and should already show an enthusiasm for research within CRC LEME. This scientific scheme helps to construct an important bridge between the undergraduate study environment and Honours and postgraduate research, resulting in 14 out of 15 summer scholars continuing as Honours students within CRC LEME.

Summer students have been situated at all of CRC LEME's core party institutions, working on a diverse range of projects involving field based studies, remote sensing and other laboratory-based projects (Tables 6 and 7). All summer scholars submit a research report on completion of their appointments.

Table 6. Summer scholarships 1997/1998

Scholar	Project	Supervisor	Destination
Nadir deSouza Kovacs	Gawler Regolith Mapping	Mike Craig and John Wilford (AGSO)	CRC LEME honours 1999/2000
Kylie Foster	NSW Calcretes	Steve Hill and Ken McQueen (UC)	CRC LEME Honours 1998
Kerri Hartley	Gawler Calcretes	Mel Lintern (CSIRO)	CRC LEME Honours 1999/2000
Megan Kilby	Gilmour Regolith	Colin Pain (AGSO)	CRC LEME Honours 2000
Christopher Leslie	Regolith Mineralogy	David Tilley (ANU)	CRC LEME Honours 1999
Ancret Lewis	Gilmour Regolith	Colin Pain (AGSO)	CRC LEME Honours 1999/2000
Darryl West	Gawler Regolith Mapping	Mike Craig and John Wilford (AGSO)	CRC LEME Honours 1998

Table 7. Summer scholarships 1998/1999

Scholar	Project	Supervisor	Destination
Nadir deSouza Kovacs	Gilmour Regolith	Colin Pain (AGSO)	CRC LEME Honours 1999/2000
Mark Fitt	Regolith GIS (mapping)	Mike Craig (AGSO)	CRC LEME Honours 1999/2000
Grant Jones	Broken Hill Regolith	Steve Hill (UC)	CRC LEME Honours 1999
Chris Leslie	Regolith Evolution	Tony Eggleton (ANU)	CRC LEME Honours 1999
Steven Willis	Broken Hill Hymap	Eva Papp and Julie Kamprad (AGSO)	CRC LEME Honours 1999
Simon Debenham Ben Maly Zoe Phillips	Tanami Regolith Tanami Regolith Yilgarn Regolith	John Wilford (AGSO) John Wilford (AGSO) David Gray (CSIRO)	CRC LEME Honours 2000 CRC LEME Honours 2000 Completing UG course

Due to financial constraints, Summer Scholarships were not generally available for 1999/2000, although some CRC LEME programs considered the scheme so valuable that they sponsored students over this period from project funds.

Services to research students

Research students are part of a research team working on a particular project and are not managed, on a day-to-day basis, by Education and Training. However, Education and Training, in liaison with the core-party universities where appropriate, provide them with a number of services namely:

- awarding and administration of scholarships;
- monitoring of progress;
- liaison between research staff and students as necessary, particularly with regard to delivery of courses and research student supervision;
- organization of travel, short course and conference attendance fees as necessary;
- provision of training; and,
- provision of courses on occupational health and safety, four-wheel driving, off-road driving and other generic skills.

Selecting students

Students studying in CRC LEME are those whose supervisor or advisor are CRC LEME staff. CRC LEME accepts the selection processes of the University of enrolment of the students.

For CRC LEME scholarships, Education and Training administers a selection committee. The selection criteria are those for Australian Postgraduate awards and are based primarily on Honours grade for PhD or Masters applications. For Honours applicants, it is based mainly on undergraduate record. Normally, applicants should have a credit average to be eligible. Additionally, applicants must demonstrate an interest in regolith geology, geochemistry or landscape evolution.

Summer Scholarships may be awarded to undergraduate students who have studied regolith geology in their course and who have demonstrated an intent to continue in this area. Undergraduate Scholarships are open to students at UC and ANU. Applications close at the

end of first year and selection is based on an essay topic, posted at the time scholarships are advertised.

Research student information

At the University of Canberra, information for research and undergraduate students is available at:

<http://www.canberra.edu.au/>.

Students already enrolled may find all the information required regarding their role and the university's at:

http://wasp.canberra.edu.au:80/stuadmin/grad_studies/adobepdf.htm.

At ANU most information relevant to postgraduates can be located at:

<http://www.anu.edu.au/graduate/>

Additionally, CRC LEME provides the following information regarding student and CRC LEME responsibilities.

MUTUAL RESPONSIBILITY

For success, students and CRC LEME, must share mutual responsibilities. First some definitions: -

Student: A person who may or may not hold a CRC LEME scholarship and who is studying with a supervisor or advisor who is a staff member or an associate of CRC LEME.

CRC LEME: The staff and resources of CRC LEME including all staff and associates at all its centres and nodes.

CRC LEME's responsibility to students

CRC LEME has the following responsibilities to students:

- All resources necessary, as deemed appropriate by the supervisor, to satisfactorily complete the degree shall be made available to students of CRC LEME.
- To honour its scholarship agreements.
- To provide supervision according to the AVCC Guidelines as outlined in the document "AVCC Code Of Practice For Maintaining And Monitoring Academic Quality And Standards In Higher Degrees".
- To ensure students have the resources for the courses for which they are enrolled.
- To include students as part of the CRC LEME Team.

Student responsibilities to CRC LEME

On the other hand, students have the following responsibilities to CRC LEME:

- CRC LEME expects all CRC LEME Scholarship holders to meet their Scholarship agreements.
- All CRC LEME students are to act in the best interests of CRC LEME in all their professional work while engaged in their studies.
- All CRC LEME Honours and postgraduate students are to provide two copies of their thesis to CRC LEME (at CRC LEME's cost).
- All students are to be familiar with and are to comply with all of their core party's occupational health and safety requirements.

- All students are to obtain the permission of their supervisor, project leader or program leader before releasing any CRC LEME related work into the public domain.
- Students are to accept their responsibilities as outlined in the AVCC's "AVCC code of practice for maintaining and monitoring academic quality and standards in higher degrees".
- All students should participate in CRC LEME activities as part of the CRC LEME Team.

AVCC CODE OF PRACTICE FOR MAINTAINING AND MONITORING ACADEMIC QUALITY AND STANDARDS IN HIGHER DEGREES

CRC LEME subscribes to this code and expects all staff, associates etc to abide by it in their dealings with students of CRC LEME.

Responsibilities of the supervisor

The supervisor has responsibilities, which include:

- providing appropriate academic support throughout the candidature to enable the candidate to achieve the highest standard of research s/he is capable of;
- suggesting ways that the candidate can make the most effective use of time. This will involve discussing the nature of research with the student and the standard expected for particular degrees, the choice of the research topic, the planning of the research program, and the availability of library resources in the field and bibliographical and technical assistance;
- maintaining close and regular contact with the student and establishing at the beginning the basis on which contact will be made. This will facilitate the supervisor's role in advising the student on the pace of progress, and ensuring that a reasonable timetable is set to permit the degree to be completed in the appropriate time;
- requiring written work from the student on a pre-arranged and agreed schedule so that their progress can be assessed at regular intervals;
- monitoring carefully the performance of the student relative to the standard required for the degree, and ensuring that inadequate progress or work below the standard generally expected is brought to the student's attention. The supervisor should help with developing solutions to problems as they are identified;
- using the regular reporting procedures established by the institution as the minimum means by which any difficulties and problems discussed with the student during the year are noted; and supervisors should indicate the action taken or advice given. If the problem is not resolved, the Head of the academic unit, in the first instance should be involved; and the Head and the relevant institutional committee should be notified in writing of continuing problems between reporting periods;
- comment on the content and the drafts of the thesis and, at the time of submission, certify that the thesis is properly presented, conforms to the Regulations and is therefore, *prima facie*, worthy of examination;

- advise the relevant institutional committee of the names and credentials of suitable examiners;
- fulfilling other institution-specific obligations regarding supervision; and
- providing career advice and assistance as appropriate.

Responsibilities of the candidate

The responsibilities of the candidate include:

- diligently and intelligently proceeding with the research as agreed between the candidate and the supervisor;
- becoming familiar with, and abiding by, the institution's Regulations governing the degree;
- discussing with the supervisor the type of help considered most useful, and keeping to an agreed schedule of meetings which will ensure regular contact;
- taking the initiative in raising problems or difficulties and sharing responsibility for seeking solutions;
- maintaining the progress of the work in accordance with the stages agreed with the supervisor, including in particular the presentation of any required written material in sufficient time to allow for comments and discussions before proceeding to the next stage;
- discuss the progress towards, and impediments to, maintaining the agreed timetable with the supervisor at regular intervals;
- providing a formal report to the appropriate committee, through the supervisor, at periods specified by the institution;
- adopting at all times, safe working practices relevant to the field of research and adhering to the ethical practices appropriate to the discipline and the institution; and
- accepting the responsibility for producing the final copies of the thesis, its content, and ensuring that it is in accord with the relevant requirements, including the standard of presentation.

Supervision

Supervisors should ensure that research students have accurate information about any planned, long period of leave (or retirement) during the candidature and the arrangements made to provide for supervision during absences.

Co-supervisors should be appointed at the outset of the program, particularly if any lengthy absences of the principal supervisor are planned or if expertise additional to that provided by the supervisor(s) is required. This could be a staff member from the same institution, from another institution or from industry.

Any co-supervisor should be involved as soon as practicable in the development of the candidate's research plan and should maintain a level of communication with the candidate and the supervisor to allow adequate supervision whenever necessary.

If a co-supervisor(s) is appointed, the place of primary responsibility must be clear. The principal supervisor, normally a member of the academic staff of the institution, carries the responsibility of coordinating communication between the supervisors and the student.

In some cases, e.g. where the topic is multi-disciplinary or staff are inexperienced, an advisory committee could be formed to advise the student and any possible advantages of team supervision could also be explored. Whatever supervisory arrangement, however, the place of primary responsibility must be made clear.

Staff with proven and current research records and experience in supervision should normally be preferred for sole supervision of a candidate, and then only if absences and the like can be adequately covered. Less experienced members of staff should be co-supervisors in the first instance and supported by appropriate mentoring and/or training.

The full document is available at:

http://www.avcc.edu.au/avcc/pubs/cophd.htm#Responsibilities_of_the_Supervisor

SKILLS TRAINING

CRC LEME Education and Training organizes courses or arranges for students to attend courses of value to them including:

- field safety and 4-wheel driving (Appendix 6);
- writing and communicating science;
- research planning;
- computer-based mapping and GIS;
- intellectual property;
- regolith mineralogy and X-ray diffraction;
- first aid.

These courses have been run with other Canberra-based CRC's and with UC when appropriate. Students are trained in specialized skills as required for the research on a one-on-one basis. Such skills include:

- electron microscopy;
- specialized chemical analysis techniques;
- electron microprobe analysis.

GRADUATE DESTINATIONS

Table 8 indicates, where known, the directions taken and employment obtained by students who completed or enrolled for degrees with CRC LEME Education and Training. Their performance is regarded as a highly satisfactory outcome, particularly in view of the current downturn in the minerals industry.

Table 8 Graduate Destinations

PhD

<i>Surname</i>	<i>Given name</i>	<i>Commencement & Completion date</i>	<i>Destination</i>
Bristow	Andrew	withdrew	Andrew is working as a consultant/contractor in West Africa.
Aspandiar	Mehrooz	5/94 - 8/98	Completed PhD, Returned to India now working at Curtin University
Brand	Nigel	95 - 97	Completed PhD, Senior Geochemist, WMC Exploration
Ma	Chi	2/92 - 10/96	Completed PhD, employed at CAL. TECH., USA
Laffan	Shawn	1/95 - 1/98	Still doing his PhD but working part time in the Geography Dept, ANU as a Lecturer
Tonui	Eric	1/93 - 12/97	Completed PhD , working for CRC LEME at AGSO, accepted a Post-Doc at NASA from July 2000

MASTERS

<i>Surname</i>	<i>Given name</i>	<i>Commencement & Completion date</i>	<i>Destination</i>
Cross	Andrew	1/95 - 12/97 (3/00)	Completing his masters thesis and working for a CRC in AGSO, Canberra
Lau	Libbie	2/98 - 6/98	Libbie withdrew her scholarship, currently now working as a consultant geologist
Huang	Xiaoyan	8/95 - 2/98	After completing her PhD returned to China, worked in a Bank, has now applied to do PhD in Canada
O'Brien	Jane		Teaching science at Canberra Girls' Grammar

HONOURS

<i>Surname</i>	<i>Given name</i>	<i>Commencement & Completion date</i>	<i>Destination</i>
Adamson	Steve	7/95 - 6/96	Completed honours at ANU, Canberra
Baker	Andrew	3/99 - 11/99	
Butterfield	Grantley	2/98 - 3/99	Working for AUSLIG
Carragher	Alison	3/99 - 11/99	
Crawford	Marcus	7/96 - 6/97	Working in the Solomon Islands with a geological company.
Della-Marta	John	1/97 - 11/97	Working for Normandy
Dries	Shanta	3/95 - 11/96	Working for Normandy
Foo	Mark	1/99 - 11/99	Now unemployed
Foster	Kylie	2/98 - 11/98	Working for CRC LEME at AGSO, Canberra
Foster	Luke	1/96 - 10/96	Doing his PhD at ANU, Canberra
Gibbons	Lisa	4/97 - 11/97	Completed honours, University of Adelaide
Holzapfel	Michael	2/98 - 11/98	Working for AUSLIG, enrolled for Maters at UC
Johnson	Craig	8/97 - 8/98	Working with Goldfields Consolidated, KAL., WA as a Expl. Geologist
Jones	Grant	2/99 - 11/99	Working for CRC LEME at AGSO
Kiastpur	Goran	1/99 - 12/99	
Lee	Sam	7/98 - 6/99	Doing Masters at Curtin Uni, WA.
Leslie	Chris	2/99 - 11/99	Working at AGSO
Madden	Jane	1/96 - 10/96	Working for Rito Tinto
Maney	Paul	3/96 - 11/96	Unknown
McIntosh	Clare	2/98 - 2/99	Working as a senior computer software operator/programmer with the Taxation Office – using skills learnt through GIS.
McPherson	Andrew	3/96 - 12/96	Doing a PhD at ANU
Porritt	David		Works for BRS
Pottinger	Daniel	2/97 - 11/97	Working in exploration at Kalgoorlie
Pulford	Anna	2/97 - 11/97	Completed honours at ANU, Canberra
Reilly	Nerrida	2/97 - 2/98	Working for CRC LEME at AGSO
Shirliff	Greg	2/98 - 12/98	Doing PhD at ANU, Canberra
Smith	Bernadette	2/96 - 12/96	Worked in WA with a mining company, now working in Woolworths, Belconnen.
Spry	Melissa	2/96 - 11/96	Doing PhD at University of Canberra
Tan	Kok Piang	7/95 - 6/96	Doing PhD at ANU, Canberra
Thomas	Brett	1/99 - 12/99	Completed honours, University of Adelaide
West	Darryl	2/98 - 11/98	Working for ALL-GAS as a GIS Officer, Brisbane
Willis	Steven	2/99 - 11/99	Travel

UNDERGRADUATE PROGRAMS

At the University of Canberra and the Australian National University, undergraduate programs in regolith studies are available as shown in Tables 9 and 10. At Curtin University of Technology, regolith geology has been taught in the past as part of a third year geochemical exploration subject. With the recent appointment of Dr Aspandiar, it is expected there will be growth in this option at CUT. The regolith study undergraduate program at the University of Canberra is shown below in bold.

Table 9. Undergraduate programs with regolith studies at University of Canberra		
Year	Semester 1	Semester 2
1	Dynamic Earth Concepts in Biology Chemistry 1A Data Analysis in Science	Landscape Processes Plants & Animals Physical Principles Science, Environment & Society
2	Earth Science Fundamentals Australian Soils Remote Information Systems	Earth Science Fundamentals Regolith Studies Elective
3	Earth Science Applications Remote Sensing Land Appraisal	Earth Science applications GIS Land Appraisal

Regolith subjects are shown in bold.

Table 10. Undergraduate programs with regolith studies at ANU		
Year	Semester 1	Semester 2
1	Earth systems + (at least 1 Chemistry subject)	Earth Science
2	Australian Soils Mineralogy Introduction to GIS & Remote sensing Sedimentology & Surficial Processes	Soil Ecology & Management Introduction to Structural & Field Geology Resources & Geochemistry Petrology
3	Field Geology &/OR Soil Mapping Geological Information Systems Exploration Geophysics	Regolith Land Management & Environmental Geoscience Water Resource Management Economic Geology

Regolith subjects are shown in bold.

NATIONAL UNDERGRADUATE REGOLITH GEOLOGY SCHOOL (NURGS)

The National Undergraduate Regolith Geology School (NURGS) is an initiative to increase the availability of regolith geology to a wider spectrum of students at CRC LEME core-party universities. Typically, university departments are unable to make time available from their regular teaching programs to allow CRC LEME staff to teach in their undergraduate programs. CRC LEME initiated NURGS in 1998 to familiarize students from across Australia with regolith geology.

CRC LEME annually invites 15 separate Australian universities to nominate a successful senior undergraduate to attend NURGS. Attendance is entirely financed by CRC LEME. The nominated students gather at a suitable locality for an eight-day short course in regolith

geology, geochemistry and landscape evolution. The School began in 1998 when 13 students attended in Charters Towers and it was held subsequently in Broken Hill in mid-1999 with 12 students. In 2000 the School will be in Kalgoorlie.

The main objectives of NURGS are to:

- provide an opportunity for students to learn the fundamentals of regolith geology;
- familiarize students with the research of CRC LEME;
- familiarize students with the applicability of regolith geology to the mineral exploration industry; and,
- encourage students to consider the option of taking up regolith geology and/or geochemistry as an area of study.

NURGS has already shown a number of benefits to CRC LEME including:

- the profile of CRC LEME was augmented amongst i) students who attended, ii) their colleagues at their home universities, iii) the staff and, particularly, iv) heads of their departments (see testimonials in Appendix 1);
- six students undertook an Honours program in regolith geology; three of these transferred to UC to do so;
- CRC LEME staff, from across the Centre, were able to teach both formally and in the field to some very bright and enthusiastic students; and,
- awareness of regolith geology and its importance was spread nationwide.

For the students who attend, there is the obvious benefit of learning about regolith geology, something they would otherwise not have covered in their undergraduate career (see Appendix 1), but also the students were able to:

- meet other students from different Australian universities in an informal learning environment;
- form associations with each other and CRC LEME staff that will continue as they begin to practice; and,
- experience positive and enjoyable learning.

Appendix 2 is the NURGS curriculum from the Broken Hill School.

INTEGRATION OF EDUCATION AND TRAINING ACTIVITIES WITH A CRC LEME RESEARCH PROJECT IN BROKEN HILL

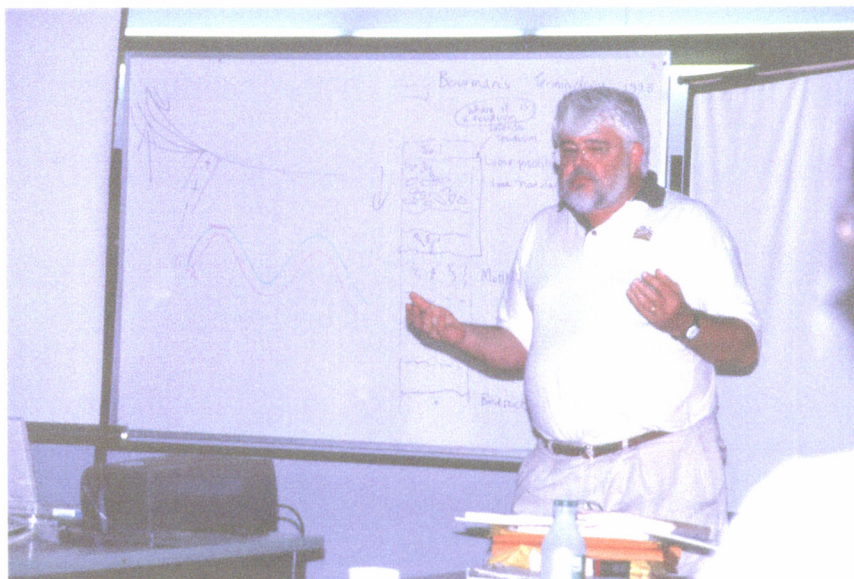
Since its inception, CRC LEME has had a wide range of research interests in the Broken Hill region. The main objective of this research has been to establish a framework to understand the three-dimensional evolution of the landscape and to aid the discovery of concealed world-class ore deposits. The Broken Hill region is an ideal place for this type of research because, since the initial discovery of the world famous silver-lead-zinc line of lode, mineral exploration techniques, concentrating on bedrock exposed areas, have failed to discover another major deposit. Although regolith materials cover much of the landscape here, they have received minimal research or exploration attention prior to CRC LEME's involvement. Although the main focus of CRC LEME's involvement has been through the Basins Program and the strategic theme of mineral exploration in areas of basin cover that overlie and flank the Broken Hill Block, there has been a close integration with Education and Training activities.



Research students showing off their work at a short course for the NSW Geological Survey, Broken Hill region.



Students engrossed in the geochemical data handling component at NURGS '98, Charters Towers. Photo by Ray Smith.



'Regolith is a dynamic subject and needs enthusiasm and argument.'
NURGS '98' Charters Towers. Photo by Ian Robertson.



Ray Smith showing fellow lecturers and students some igneous geology in a regolith landscape. NURGS '98, Charters Towers. Photo by Ian Robertson.



Bernardette Kovacs, Glen Fisher and Ian Robertson in contemplation during the NURGS '99 field component; Broken Hill, NSW.



Staff from the NSW Geological Survey on a Short Course studying regolith carbonates at Corona, NSW.



Pasmaingo geologists on a regolith workshop; Great Goulburn, Broken Hill region.



The end of a long day and still going! Koonenberry Mountain, NSW.

An important feature of CRC LEME's Education and Training activities in the region is the diversity of involvement, maximizing the range of possible outcomes and interactions between people. This has included participation from CRC LEME scientists from each of the Centre's core parties (CSIRO, AGSO, ANU and UC) with the education and training of undergraduates, postgraduates and professional geoscientists. Most importantly, this provides a range of opportunities for CRC LEME students to interact with various research scientists and company and government geologists. Included here are some examples of the integration of Education and Training activities with other CRC LEME activities in the region.

UC Undergraduate Field Trips: An introduction to the landscape

A field visit to the Broken Hill region is a highlight of the undergraduate training program at the University of Canberra and ANU. This is an opportunity to introduce the students to the diverse range of regolith and landscape features of the region. UC students also spend two days mapping and sampling regolith in the Warratta area, east of Broken Hill. For many, this is their first exposure to mapping and sampling regolith materials. Visits are also arranged to some of the mines and company offices to allow students to see, first hand, the nature of future employment opportunities and the diversity of personalities within the local geoscience community.

Summer Scholars: Welcome to the research team

Three summer scholars have made valuable contributions to the Broken Hill research team. In 1997/98 Kylie Foster began studying regolith carbonate materials from the region, which has led to her enduring interest in how these materials can be used as exploration sampling media in this region. Some of this work has culminated in national and international publications. In 1998/99, Grant Jones and Steve Willis began their association with the Broken Hill project, through the summer scholarship scheme, researching geochemical dispersion models and Hymap data acquisition, respectively.

Honours Students: Detailed approaches breaking new ground

For the period 1998-2000 CRC LEME has had 10 Honours students working in the Broken Hill region. These students have been a part of a structured program of detailed regolith-landform mapping and other specialist studies on the southern Broken Hill Block – Murray Basin margins. This is proving to be one of CRC LEME's greatest research successes.

These projects are structured into two main parts:

- A) detailed regolith-landform mapping, characterisation and development of local regolith and landscape evolution models for an area corresponding to one half of a 1:25,000 map sheet;
- B) detailed specialist studies of an attribute of regolith geology that is an important aspect of their mapping area. Previous studies have focussed on specific regolith sampling media (such as carbonates, silcretes, ferricretes, gypsum), models of geochemical dispersion and residence in areas of known mineralisation, remote sensing and GIS (such as use of Landsat TM, radiometrics and HyMap data).

Industry support for this work continues to increase from year to year and, most importantly, provides students with valuable experience of inter-relationships and applications of their research to both a larger research team and external clients. The detailed regolith mapping done by these students is a major driving force behind the publication of 1:25,000 regolith-landform maps across this region, of which the students are co-authors. The Broken Hill

region benefits from this increased knowledge and many of these students have transferred their expertise to mineral exploration programs in other parts of Australia.

PhD students: Providing strong research foundations beyond the knowledge frontiers

CRC LEME PhD students have played a vital role in the evolution of regolith research in the Broken Hill region. This has provided both a regional framework and foundations for further research, as well as tackling specific research problems. S. Hill, K.P. Tan, P. Bierwirth, L. Hill, W. Keankeo all have projects related to the Broken Hill region.

Short courses: Knowledge dispersal to the public and private sectors

With the great diversity of research outcomes improving our understanding of the regolith and landscape materials in the Broken Hill region, particularly by CRC LEME students, there has been a great need to ensure that this knowledge reaches potential users. CRC LEME Education and Training has been particularly active in the Broken Hill region by organising short courses and field workshops. Short courses have included participants from the NSW Geological Survey and local mineral exploration companies such as Pasminco Exploration. Approximately once a year the region is host to the Broken Hill Exploration Initiative Conference, and CRC LEME scientists and students are involved in oral and poster presentations and in conducting field courses. The field courses provide students with the opportunity to show interested geologists some of the highlights from their research as well as opportunities for more informal interaction.

NURGS 99: Maximum impact across the nation

The regolith and landscape features of the Broken Hill region and the increased knowledge that CRC LEME research has generated was an excellent basis for the National Undergraduate Regolith Geology School (NURGS) in 1999. Students from universities around Australia could see first-hand the highlights of CRC LEME's research in the region. In particular, 1999 Honours students Steve Willis and Grant Jones, allowed participants to discuss the implications of being an Honours student with CRC LEME and see the nature of their research programs. This must have been successful as two of the NURGS students from the class of '99 are now engaged in Honours projects with CRC LEME in the Broken Hill region; another two are conducting Honours research elsewhere within CRC LEME.

AUSTRALIAN REGOLITH CONFERENCES

CRC LEME Education and Training, and associated staff, have organised two of the last three Australian Regolith conferences, Regolith '94 in Broken Hill and Regolith '98 in Kalgoorlie. Both conferences attracted substantial numbers of delegates; Broken Hill had 150 and Kalgoorlie 230. The abstracts for both have been published as well as the Proceedings of Kalgoorlie (see publication list). Although Regolith '94 in Broken Hill was pre-CRC LEME, it was organised by staff of the present Education and Training team, during the bid for the CRC.

CRC LEME SEMINARS

CRC LEME Education and Training has run a seminar series in Canberra since the commencement of the CRC. It has been held during the six months of the university teaching year so students can attend. During this time, some 70 seminars have been held at UC and AGSO. Appendix 3 list seminars given over the last four and a half years in Canberra.

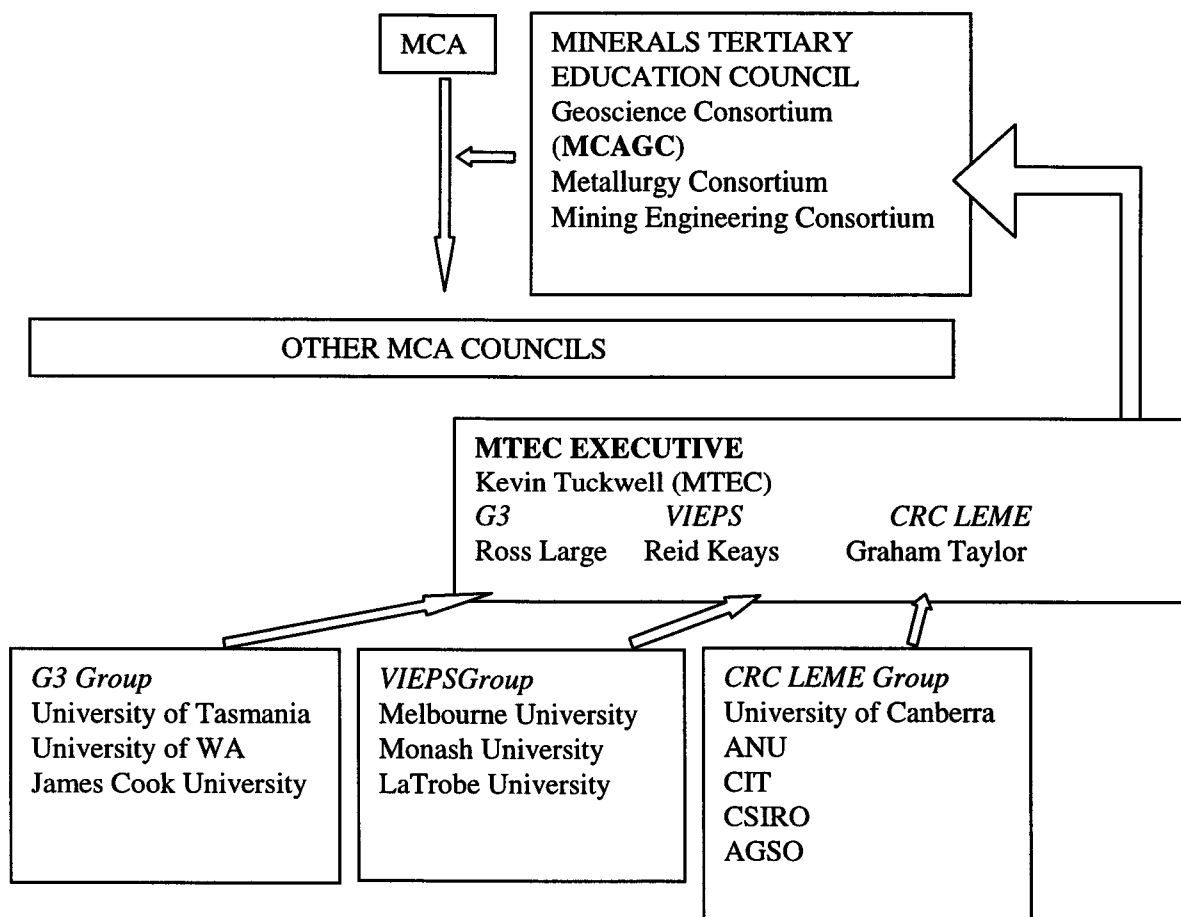
As well as providing an outlet for CRC LEME science, the seminar series provides a venue for research students to air their research in a friendly and supportive environment. Seminars are generally well attended, with about 20-25 attendees from within and outside CRC LEME.

In addition to the formal seminar series, casual discussion groups are held by the research students to discuss ideas, problems and impasses in their research. These sessions are convened by a research student when he or she wishes to discuss an issue relating to his or her research.

MINERALS TERTIARY EDUCATION COUNCIL

Following the issuing of the discussion paper *Back from the Brink* by the Minerals Council of Australia (MCA) in early 1998, a consortium of three geoscience groups has been selected cooperatively to further minerals education in Australia with MCA sponsorship. The three groups are CRC LEME, VIEPS and G3 (JCU, UT and UWA). Consortia of universities in mining and metallurgy have also been formed.

They will operate under the following structure:



The purpose of this enterprise is to address the issues raised in the discussion paper *Back from the Brink*. These are to:

- create a select network of centres [now Groups] and link these with industry such that each should:
 - I. collaborate with the others to offer world-class minerals programs and innovative coursework;
 - II. have a structured practical experience program;
 - III. have an academic staff mix that provides first-class teaching while maintaining research skills;

- IV. have a commitment to attracting talented students;
- V. be located close to a research facility; and,
- VI. have the long-term support of their parent university with a commitment to also deliver full fee-paying students.
- create a system of alternate pathways that will ensure the minerals industry benefits from the greater depth and strength of graduates in the wider tertiary education system [not applicable to Geoscience]; and,
- establish the Australian School of Mineral Resources [now MTEC] to create a world-class centre for postgraduate minerals education. Coursework will cover:
 - I. conversion courses for non-minerals;
 - II. masters coursework in advanced technical areas;
 - III. short courses for continuing professionals; and,
 - IV. the courses must be accessible to industry through innovative coursework design and delivery.

MTEC has committed some \$4.2M for funding in 2000, about one third of which will be available to MCAGC. The budgets provided in the MCA Executive submission include winning a submission for a DETYA Science Lectureships Initiative. This bid is headed by Dr Kevin Tuckwell from MTEC.

The Geoscience Consortium of MTEC will:

- deliver a national Honours program in exploration geology;
- deliver a national Masters program in exploration geology;
- concentrate effort in enhancing the understanding of the minerals industry amongst 1st year students; and,
- deliver professional short courses.

PROFESSIONAL SHORTCOURSES

Within CRC LEME, Education and Training is responsible for short courses that serve more than one client. Since 1995 Education and Training has run 36 short courses (Appendix 4). These have been run in various centres in Australia. Many of the courses are designed to familiarize clients with the fundamentals of regolith geology, mapping and geochemistry.

Many of the courses also form part of the UC and ANU Joint Masters by Coursework program. Students from across CRC LEME may attend courses at no cost, provided it is deemed by their supervisor or mentor that they will gain from attending.

Highly successful short courses are also organised by the Application and Utilisation group for single companies or consortia of companies. These differ from the Education and Training Group short courses in that they take place on the client's ground in a consultative environment and are specifically tailored to the client's needs and focus on the client's issues and data.

CONTRIBUTION TO NATIONAL AND INTERNATIONAL EDUCATION

In late 1998, Graham Taylor was invited as guest speaker at the United Kingdom Geoscience Education Consortium. He spoke of lessons from his 30 plus years of Earth Science teaching, the benefits of the CRC program to Australia and how that has increased educational opportunities for tertiary students.

Ken McQueen is joint author of a HERDSA book on field teaching. This book covers all aspects of field teaching from setting goals to detailed planning and occupational health and

safety issues. It is a major contribution to the teaching of geology (as well as other field science) in Australia.

In early 2000, three CRC LEME staff members attended the Third International Geoscience Education Meeting in Sydney. All three presented a paper (see Publications). One also presented a poster. This gave CRC LEME a major opportunity to flag its achievements at a major international forum. Delegates from 23 countries attended.

On the local scene, UC and CRC LEME is:

- hosting the meetings of ACT geoscience secondary teachers with meetings planned bimonthly;
- involved with the Minerals Council of Australia in leading field trips to accessible venues for local school teachers;
- in negotiations with the Geological Society of Australia to assist in the implementation of the new NSW secondary curriculum in Earth and Environmental Science;
- CRC LEME staff are available to talk on matters regolithic at local and regional secondary schools; and,
- in the development stages is a plan to assist university students to “learn through teaching”. This will have students of UC and CRC LEME moving into secondary schools and giving lessons on regolith and environmental issues.

PUBLICATIONS

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APPENDIX 1 – NURGS TESTIMONIALS

Testimonials from students and Head of Geology Department's whose students attended NURGS.

NURGS 1998 - Charters Towers

Comments from Ray Smith, Director, CRC LEME:

I am writing to congratulate you on the success of the first running of this school last week in Charters Towers.

All of us who participated in giving the course saw it as emphatically fulfilling its purpose as you intended, namely, raising the awareness of regolith geosciences across Australia in an influential way. We have every reason to expect the fourteen students will take back some of the enthusiasm for regolith studies shown during the week to their departments and student cohorts. Some of the students are likely to be encouraged by their experiences at NURGS to take on further studies, some perhaps with CRC LEME. Furthermore, the week will have crystallised their outlook on potential careers. Certainly, the course has raised CRC LEME's profile across Australia, tapping into student contingents until then essentially untapped.

It was terrific to see the students from diverse backgrounds working together united by their enthusiasm for things regolithic. We remarked amongst ourselves during the course that it was particularly pleasing that the students were of high calibre and very motivated. Clearly we attracted some of the best from across the country. One student mentioned selection from as many of 10 of his colleagues who put their hands up for nomination.

I was particularly pleased to be part of NURGS and to be present for the whole week.

Graham, you can be justly proud of the achievement. I also recognise the substantial effort put into making NURGS happen. Prominent were the organisational arrangements by Bernadette and besides your own efforts, the teaching load carried out by Steve, Tony and Ian, as well as preparation by Allison. Well done.

Student comments: Matthew Steemson, Curtin University of Technology, Perth, WA

Sunny North Queensland provided the ideal setting for the inaugural National Undergraduate Regolith School (NURGS) held in Charters Towers from the 12-18 July, 1998, where a good time was had by all participants, including CRC LEME speakers. The days were spend learning much about a relatively new earth science, whilst nights

were spent socialising with students from 13 other Australian Universities and CRC LEME speakers at selected night spots around Charters Towers and by the hotel pool. I'd highly recommend to those students who are unsure about regolith studies or are interested in pursuing regolith studies at a postgraduate level to try and attend future NURGS's, I guarantee you will learn much, meet new people and in the process have a good time.

Student comments: Nerilie Abram, University of Sydney

The regolith school was very interesting and introduced me to many new concepts. The lecturers' high level of knowledge and enthusiasm made the course fun as well as educational. The organisation of the course could not be faulted and I would like to thank everyone who was involved in the development and running of this course, which increased my knowledge and greatly exceeded all my expectations. Thank you to everyone at the CRC LEME.

Student comments: Matthew Hynes, University of Canberra

Thank you for the NURGS experience. It really helped me narrow down my options for next year. I will apply for Honours at UC and attempt to do the CRC LEME sponsored summer work (I have to do professional practice). The week in Charters Towers has proven to be very useful. Most of my lectures now are revision! I seemed to learn heaps more when I knew that there was no assessment at the end - I have no idea why. I couldn't pick out any specific topic I liked best, probably the landscape evolution.

Socially NURGS was really good too. I have been able to keep in contact with a few of the students and I await replies or addresses from the rest. The staff was also approachable and I found out many other facts about the world. I learnt about cars off Ray, butterflies off Tony, and paper planes off Ian. I also think that Steve's jokes added a certain relaxing quality and class to the week that would have been missing had we relied solely on the slapstick tom-foolery of the other members of staff. But most importantly, I now know why emu's have such long necks - very impressive!

Comments from Greg McNally, Senior Lecturer in Earth Science, University of New South Wales:

Thanks for your kind remarks of 19th August regarding Kathryn Hugo, which I have passed on to her, and for accepting her for the Regolith Geology School at Charters Towers. She has told me that it was very informative and that she was especially pleased with the high ratio of lecturers to students. I have no doubt, too, that she gained much from mixing with other bright students from the other universities.

Comments from Dr Clive Burrett, HOS, University of Tasmania:

Many thanks for supporting Kieren Howard at the Regolith School. He tells me the course was brilliant and that he learnt a lot.

Comments from Paul Ashley, Assoc. Prof., Economic Geology, Division of Earth Sciences, University of New England:

Hello Graham. Thanks for your recent letter regarding the success of the recent National Undergraduate Regolith Geology School. I have had a discussion with Ben Graham since his return and evidently he found the whole experience most worthwhile. Thank you again for organising the school and for making the opportunity available for students. It is good that another School is planned for next year. I hope that we may be in the position to again make a nomination of a suitable student. Cheers Paul.

NURGS 1999 - Broken Hill

Comments from Stewart Greenhalgh, Douglas Mawson Professor, Head of Department, University of Adelaide:

I appreciated receiving your letter of October 25 regarding Claire Haesy's positive participation in the Broken Hill/White Cliffs school last July. It is always pleasing to receive such comments about our students.

She enjoyed being able to learn without the pressure of exams. She was so pleased that she had the opportunity to attend the school. We had to make special arrangements for her to join the third year field mapping camp from Broken Hill but it was obviously worth it.

You people at CRC LEME have obviously done the right thing to get such a reaction from one of our brighter, more motivated and discerning students. Well done!

Student Comments: Claire Haesy, University of Adelaide:

It was fantastic. It was the best time I have ever had in my geological education. The instructors were laid-back. They gave us time to take it all in. I learnt so much. Socially it was very good too. They made everyone get along. We got to know each other and found out about what we did at our universities; what was different. Everything about the school was great. I left *amazingly happy*.

Comments from Paul Ashley, Associate Professor, Economic Geology, University of New England, Armidale:

Goodday Steve and thanks very much for your letter dated October 25 regarding outcomes of the CRC LEME National Undergraduate Regolith Training School. The School is clearly a worthwhile initiative and it gives the selected students an excellent opportunity to get to understand regolith (at least a little) and to interact with researches such as yourself.

Thanks again for enabling Mark to attend and we may look forward to the School for next year.

Student Comments: Mark Dawson, University of New England, Armidale:

- Good field examples of regolith forms;
- Friendly staff;
- Well structured school with lectures back up practically with field examples;
- Well presented lectures; and
- Good social occasion.

Geoffrey Clarke, School of Geosciences, University of Sydney:

Ta for your letter with respect to Danielle Kyan. She enjoyed the course and it seems to have motivated her sufficiently to come down there for Honours. We are all pleased that she found something to her liking and had been stimulated by it.

Student Comments: Danielle Kyan, University of Sydney:

In July 1999 I ventured out to Broken to meet up with a bunch of eager 3rd year geology students, from all around Australia, to attend NURGS '99. When I arrived I knew very little about Regolith Geology but I returned to Sydney with a wealth of new knowledge. The set up provided a great way to access this new information with the lectures and practical field work complimenting each other through out the week. Besides just being a well set up short course, NURGS and the LEAM TEAM paved a way for new opportunities for all the students, of which I have taken advantage of and am now beginning honours in an area I have never considered before. To make this trip even more enjoyable the CRC LEME team provided the perfect social setting and a way for the students and staff to get to know on another. It was a great week and I returned home with many new friends and many more opportunities, and I would recommend the school to anyone with the slightest interest in something new and exciting.

APPENDIX 2 – NURGS '99 CURRICULUM

CRC LEME National Undergraduate Regolith Geology School Broken Hill 10-18 July 1999

Saturday 10th July: FIRST CONTACT

Meet at the Miner's Lamp Hotel (Southern Cross Bar) 5pm.

Dinner at the Miner's Lamp

Sunday 11th July: LECTURES

8:30am Introduction (Steve Hill)

9:15am Weathering and Regolith Development (Graham Taylor)

10:15am *Morning Tea*

10:30am Mineral Weathering and Fabric Interpretation (Ian Robertson)

12:30 *Lunch*

1:30pm Landscape Evolution (Melissa Spry & Graham Taylor)

Developing a regional landscape evolution model. Models and paradigms in Australian landscape evolution (Melissa Spry)

2:30pm • Landscape Evolution Processes and their application to landscapes (Graham Taylor)

3:30pm *Afternoon Tea*

4:00pm • Landscape Evolution (continued)

4:45 Conclusion

Monday 12th July: FIELD TRIP

8:30 Depart Broken Hill

9:00 1. Mt Darling Range

9:30 2. Farmcote

10:30 3. Seventeen Mile Creek

11:30 4. Long Tank – Redan Creek

2:00 5. Balaclava

3:30 6. Copper Blow

5:00 Return to Broken Hill

Tuesday 13th July: LECTURES

8:30 Regolith Sampling Media and Applications (Ian Robertson)

10:30 *Morning Tea*

11:00 Indurated Regolith (Steve Hill)

12:30 *Lunch*

1:30 Regolith Sampling Media and Related Statistics (Ian Robertson)

Regolith Geochemistry Computer Exercise (Ian Robertson)

3:30 *Afternoon Tea*

4:00 Regolith Sampling Media and Applications: Finish Computer exercise and conclusion (Ian Robertson)

Wednesday 14th July: FIELD TRIP

8:30 Depart Broken Hill

9:30 1. Corona: ferricrete and carbonates

- 11:00 2. Boulder Tank
- 12:30 3. Lynray – Teilta (Lunch)
- 2:00 4. Kantappa Block: Fe-silcrete
- 2:30 5. Campbells Creek
- 3:30 6. Umberumberka Fan, Mundi Mundi Rangefront
- 4:15 7. Silverton Railway Cutting
- 4:30 8. Silverton

Thursday 15th July: FIELD TRIP

- 8:30 Depart Broken Hill
- 9:15 1. Thackaringa Serpentinite
- 10:30 2. Mingary mottled saprolite
- 11:30 3. Ophara Mine
- 1:00 Return to Broken Hill for Lunch
- 6:30 BBQ Dinner and awards

Friday 16th July: OVERNIGHT FIELD TRIP- Day 1

- 8:30 Depart Broken Hill
- 9:00 1. Stephens Ck – Yancowinna Ck divide
- 11:00 2. Fowlers Gap: Johnstone's Tank – Sandy Creek
Lunch
- 1:30 3. Peak Hill
- 3:00 4. Three Hills
- 4:00 5. Kayrunerra
- 5:00 Arrive at Underground Motel, White Cliffs

Saturday 17th July: OVERNIGHT FIELD TRIP – Day 2

- 8:30 Depart White Cliffs
- 9:00 1. White Cliffs Opal Diggings
- 11:30 2. Mootwingee: Homestead Gorge
- 3:00 Return to Broken Hill

APPENDIX 3 – CENTRE SEMINARS, CANBERRA

CRC LEME Seminars held in Canberra from 1996 to 1999.

Seminar/Discussions Semester 1 1996

SEMINARS	
MARCH 7	Simon Eldridge University of Canberra - Master student <i>"Effects of Mapping Scale on soil Map Quality"</i>
APRIL 4	Roslyn Chan AGSO <i>"The implications of Bathurst Regolith-Landform in mapping results for:"</i> a) <i>A better understanding of the landscape evolution of SE Australia</i> b) <i>Future CRC LEME Regolith-landform mapping in the Lachlan Foldbelt"</i>
MAY 2	Prof Mao Jian Quan School of Resource and Environmental Engineering, Guizhou Institute of Technology, P.R.China <i>"Karst Features and Weathering in Guizhou Province P.R.China"</i>
MAY 30	John Dixon Dept of Geography, University of Arkansas, USA <i>"A New Model for Spatial Variations in Weathering"</i>
JUNE 13	Ian Roach University of Canberra - PhD student <i>"The Volcanic History of the Monaro"</i>
DISCUSSIONS	
MARCH 21	David Tilley Australian National University <i>"The Widespread occurrence of Akdalaita and eta-alumina in pisoliths"</i>
APRIL 18	Colin Pain AGSO <i>"Regolith in 4 dimensions"</i>
MAY 16	Ken McQueen University of Canberra <i>"Some Regolith and Landscape Features of the Cobar area and relationship to Ore Deposits"</i>
JUNE 27	X Y Chen University of Canberra <i>"Quaternary landforms & sedimentation in arid central Australia"</i>

Seminar/Discussions Semester 2 1996

LOCATION	SPEAKER	TITLE	DATE
UC	Pauline English - PhD Student - ANU	Lake Lewis Basin, Central Australia: Tectonic, climatic and hydrologic processes in basin and landscape evolution (Seminar)	25 July 1996
UC	Steve Hill - PhD Student - ANU	Apparent Regolith - Landform Features of so-called Regional Significance in the Broken Hill Region (Seminar)	22 August 1996
UC	Tony Eggleton - ANU	The Glossary of Landscape and Regolith Terms	17 October 1996
UC	Ma Chi - PhD Student - ANU	The Structural Nature of Kaolinite (Seminar)	24 October 1996
UC	Robert Abell - AGSO	The Geomorphology of Norfolk Island (Seminar)	31 October 1996
UC	Martin Thoms - RE&HS - UC	Sand/Placer Accumulation in Gravel Bed Rivers	21 November 1996
UC	Gregory Summerell	Predictive Modelling of Parna Deposition (Seminar)	28 November 1996
UC	Xiaoyan Huang - Master Student - UC	Biogeochemistry for Mineral Exploration and Environmental Monitoring - A Case Study at the Temora Gold Mine	5 December 1996

Seminar/Discussions 1997/98

LOCATION	SPEAKER	TITLE	DATE
UC	David Gibson (AGSO)	Recent Tectonics and Landscape Evolution in the Broken Hill Area	6 March 1997
UC	Brad Pillans (ANU)	Regolith Dating Methods	20 March 1997
UC	Shawn Laffan (ANU)	Inferring Regolith Characteristics Using Surface Features	3 April 1997
UC	Bryan Ruxton (UC – guest)	Some Structures of the Regolith	1 May 1997
UC	Richard Greene (ANU)	Surface properties of Regolith Clay Constituents and their Implications for Soil Management	15 May 1997
UC	Max Brown (Guest)	Cainozoic Tectonics and Landforms in South East NSW	29 May 1997
UC	X Y Chen (UC)	Parna (dust deposit): Identification? Deposition Process? Chronology?	12 June 1997
UC	Graham Taylor (UC)	Can you be sure it's not continuous?	7 August 1997

LOCATION	SPEAKER	TITLE	DATE
UC	Mike Thomas (UK)	The role of weathering in tropical landform development	13 August 1997
UC	Brad Opdyke (ANU)	Terrestrial origins of magnesite and Mg Calcite	21 August 1997
UC	Marcus Crawford (ANU)	Charters Towers Regolith – Possible sample media for exploration	18 September 1997
UC	Greg McNally (Univ of NSW)	Duricrusts from an engineers perspective	2 October 1997
CSIRO – Perth	Alain Decarreau	Crystallochemistry and genesis processes of clay minerals approached by IR spectroscopy	8 October 1997
CSIRO – Perth	Yves Noack	Weathering of Pyroxene: Natural Studies and Thermodynamic approach	8 October 1998
UC	Leah Moore (UC)	Volcanic Landforms of the Long Valley Caldera, Northern California	23 October 1997
UC	George Cho (UC)	Ramblings in search of a landscape: A visit to Ireland, Scotland and England	30 October 1997
UC	John Field (ANU)	Weathering of Basalts	6 November 1997
UC	Jean Dominique Meunier (Marseille)	Phytoliths, Weathering and Palaeoenvironment	10 November 1997
UC	Prof Karna Lidmar-Bergstrom (Univ of Stockholm)	Pre-Quaternary landscapes and weathering in south Sweden	17 November 1997
UC	Bernie Joyce (Univ of Melbourne)	Regolith Studies in Victoria: review and prospects, and opportunities for CRC LEME	27 November 1997
UC	Mike Velbel (Michigan Univ)	Chemical weathering rates of silicate minerals, and landscape evolution in the southern appalachian	2 April 1998
UC	Tony Eggleton (ANU)	My holiday in WA and other laterites: Talk and Discussion on the origin and nomenclature of laterite	9 April 1998
UC	Prof Mao Jianxiang (Tsinghua Univ Beijing)	Environmental Implications of coal utilisation in China	28 April 1998
UC	X Y Chen (UC)	Australian calcretes: occurrence, morphology, genesis and classification	30 April 1998
UC	Prof Bob Bourman (Univ of SA)	Out of Africa – Evolution of Southern African Landscapes	13 May 1998
ANU	Rod Klassen (Geological Survey of Canada)	Tracks and trails of the Laurentide Ice Sheet – A Canadian perspective`	21 May 1998

SEMINAR/DISCUSSION 1998/99

LOCATION	SPEAKER	TITLE	DATE
AGSO, Canberra	Dr Wyss Tun (Hong Kong University)	Pedogenesis as a stratigraphic marker from a stable siliciclastic-dominated self	13 August 1998
AGSO, Canberra	David Gibson & Roslyn Chan (AGSO/CRC LEME)	Aspects of palaeodrainage in the North Lachlan Fold Belt, NSW	27 August, 1998
AGSO, Canberra	Leah Moore (UC/CRC LEME)	Landscapes of North West Namibia: A Regolith Perspective	3 September, 1998
AGSO, Canberra	Ravi Anand (CSIRO/CRC LEME)	Ferruginous materials ('Laterites'/Ferricretres) in weathered terrains	10 September 1998
AGSO, Canberra	Eric Tonui (AGSO/UC/CRC LEME)	North Parkes - Towards an understanding of regolith processes in the North Lachlan Fold Belt, NSW	8 October, 1998
AGSO, Canberra	Cliff Ollier (CRES/ANU)	Regolith in Tibet and NW China	29 October 1998
AGSO, Canberra	Neil Lavitt (AGSO/UC/CRC LEME)	Approach and application of integrated hydrogeochemical models: A case study from the Lower Mooki River catchment	5 November 1998
AGSO, Canberra	Doug McKenzie (Land & Water, DAFF)	'Terroir' – The role of regolith in wine production	5 November, 1998
AGSO, Canberra	Rien Habermehl (AGSO)	Hydrogeology of the great Artesian Basin, Australia	3 December 1998
AGSO, Canberra	John Wilford, Mike Craig & Andrew Johnston (AGSO/CRC LEME)	Regolith-Landform mapping and its implications for exploration over the Half Moon Lake Region, Gawler Craton, SA	10 December 1998
AGSO, Canberra	Eva Papp (ANU/CRC LEME)	Statistical analysis and interpretation of time domain ground-based electromagnetic data, Keringal Gold Deposit, Western Australia	3 March 1999
AGSO, Canberra	Mike Craig (AGSO/CRC LEME)	Regional regolith and landscape evolution in the Eastern Goldfields, Yilgarn Craton - Western Australia	16 March 199
AGSO, Canberra	Ken McQueen (UC/CRC LEME)	The nature and distribution of regolith carbonates in SE Australia and their potential as a sampling medium in geochemical exploration	14 May 1999
AGSO, Canberra	Dr Jonathan Clarke (ANU/CRC LEME)	Environmental evolution of the south-east Yilgarn: The palaeovalley record	25 May 1999
AGSO, Canberra	Ian Robertson (CSIRO/CRC LEME)	1. Ferruginous lag geochemistry on the Yilgarn Craton of Western Australia: Practical aspects and limitations 2. Prospecting beneath colluvial-alluvial cover at Quasar and Harmony in the central part of Western Australia: The value of interface sampling	11 June, 1999
AGSO, Canberra	Michael Whitbread (CRC LEME/UC)	The expression of lithogeochemical alteration haloes of the century and Elura Zn/Pb deposits in the near surface weathering environment	20 July 1999
AGSO, Canberra	Dr Tim Munday (CRC AMET/CSIRO Perth)	Regolith electrical structures associated with Kimberlite Dykes - An example from the Archaean Yilgarn Craton, Western Australia	3 August 1999

LOCATION	SPEAKER	TITLE	DATE
AGSO, Canberra	Tony Eggleton (CRC LEME/ANU) & Dr Patrice de Cartitat (CRC LEME/AGSO)	Update on CRC LEME Synthesis and Basin programs	17 August 1999
AGSO, Canberra	Dr Jonathan Clarke (CRC LEME/ANU)	Quaternary sediments of inshore Bonaparte Gult - results from marine diamond exploration	31 August 1999
AGSO, Canberra and CSIRO Perth	Brad Pillans (CRC LEME/ANU)	Paleomagnetic dating of Australian regolith: New results and future potential	28 September 1999 and 15 October 1999
AGSO, Canberra	Steve Willis (CRC LEME/UC)	Regolith geology of the Thackaringa-West area, Broken Hill NSW, with an evaluation of hyperspectral mapping aids	11 October 1999
AGSO, Canberra	Bernie Joyce (Univ of Melb)	Where the mountains meet the (Palaeo) sea: Shield, foldbelt and basin relationships in western Victoria: Current regolith and landscape evolution studies	19 October 1999
AGSO, Canberra	Grant Jones (CRC LEME/UC)	Regolith geology and geochemistry at Triple Chance West, Broken Hill NSW	26 October 1999
AGSO, Canberra	Graham Taylor (CRC LEME/UC)	Education and Training in CRC LEME and maybe a visit to Iceland	9 November 1999
AGSO, Canberra	Jean Dominique Meunier (French Research Group CEREGE)	Biogenic silica in tropical forest ecosystems: pool or sink	16 November 1999
AGSO, Canberra	Colin Pain (CRC LEME/AGSO)	Beijing, China: Tectonics and some temples	23 November 1999
AGSO, Canberra	Pauline English (RSES)	Hydrological processes and landscape evolution in Botswant	30 November 1999

APPENDIX 4 – CENTRE SHORT COURSES

CRC LEME Short courses run by Education and Training since 1996, their location and number of attendees.

CRC LEME SHORTCOURSES 1996/97

LOCATION	STAFF	COURSE	NO'S	DATE
Canberra	Tilley, D.B., Eggleton, R.A.	X-ray diffraction and clay mineralogy	10	23-37 September 1996
Brisbane	Craig, M.A., Anand, R.R., Hill, S.M., Wilford, J.R., Chan, R., Gibson, D.	Regolith Maps, what they are and how to use them	44	12 November 1996
Adelaide (MESA)	Butt, C.R.M., Gray, D.J., Lintern, M.L., Sheard, M.	Calcrete geochemistry in gold exploration	40	2 December 1996
Orange	Butt, C.R.M., Zhou, T., Scott, K.M., Anand, R.R., McQueen, K.G., Eggo, A. (Consultant)	Exploration geochemistry in regolith dominated terrains	18	9-13 December 1996
Hobart (CODES)	Butt, C.R.M., McQueen, K.G., Anand, R.R., Gray, D.J., Scott, K.M., Cohen, D., UNSW	Exploration geochemistry	43	7-11 April 1997
Fremantle (Applied Geosciences Industry Training Group - Geotrain Aust)	Robertson, I.D.M.	WA Mineral Exploration Technology Overview	130	21-22 April 1997
Canberra	Taylor, G., Johnson, S., UC	Presentation Skills (In conjunction with CRCs for FE, VB, PS)	25	15 April 1997

CRC LEME SHORT COURSES 1997/98

LOCATION	STAFF	COURSE	NO'S	DATE
Canberra	Mike Craig, CRC LEME/AGSO; John Wilford; Steve Hill	Regolith Mapping and Interpretation (CRC LEME Staff)	13	4 July 1997
Perth	Ray Smith, CRC LEME/CSIRO, Ian Robertson; Colin Pain	Geological Processes in the Regolith	31	7-11 July 1997
Perth	Mike Craig, CRC LEME/AGSO; John Wilford; Steve Hill	Regolith Mapping and Interpretation (CRC LEME Staff)	11	25 July 1997
Adelaide	M.J. Lintern, D.J. Gray	Gold Exploration using calcrete geochemistry	28	10 September 1997
Canberra	Tony Eggleton, CRC LEME/ANU, David Tilley	X-Ray Diffraction and Clay Mineralogy	9	22-26 September 1997
Darwin	Mike Craig, CRC LEME/AGSO; John Wilford; Colin Pain; Graham Taylor; Ian Robertson	Regolith Geology/Regolith Mapping	10	16-20 February 1998
Kalgoorlie	Charles Butt, CRC LEME/CSIRO; Ravi Anand; Ken McQueen; David Cohen; David Gray; Andrew Sanders (GSWA)	Exploration Geochemistry	19	16-20 February 1998
Canberra	R.A. Eggleton, D.B. Tilley	XRD and Clay Mineralogy for CRC LEME Researches	8	23-24 February 1998
Melbourne	Bernie Joyce, VIEPS/University of Melbourne; Steve Hill	Regolith Geology Fundamentals (Applications to the SE Australian Landscape)	24	26-27 March 1998
Melbourne	Bernie Joyce, VIEPS/Univ of Melbourne; Steve Hill; Andrew Kotsonis (Univ of Tasmania)	Regolith Field Geology (Applications to the SE Landscape)	18	28-29 March 1998
Melbourne	David Lawie, VIEPS	Regolith Geochemistry	30	30-31 March 1998
Canberra	G Fisher	Field Safety for New CRC LEMERs	12	3 April 1998
Canberra	Michael Velbel, Michigan State University	Mineral-Water Interactions	9	6-9 April 1998
Canberra	Assoc Prof Sue Johnston (UC)	Presentation Skills	25	15 April 1997
Kalgoorlie (Regolith '98)	Ian Tapley; Mike Craig; Steve Fraser; John Wilford	Remote Techniques for Regolith Mapping and Characterization	25	3 May 1998
Kalgoorlie (Regolith '98)	Keith Scott; David Gray; Ravi Anand; Mel Lintern	Sampling Media in Various Australian Regolith Regimes	36	2 & 3 May 1998
Canberra	Ray Smith; Ian Robertson	The Handling of Geochemical Data	26	21 May 1998

CRC LEME SHORT COURSES 1998/99

LOCATION	STAFF	COURSE	NO'S	DATE
Charters Towers	Graham Taylor/Steve Hill, UC, Tony Eggleton, ANU, Ray Smith/Ian Robertson, CSRIO, B Kovacs (admin support) – CRC LEME STAFF	National Regolith Geology School	14	12-18 July 1998
Broken Hill	G Taylor, S Hill, K McQueen & I Robertson		8	16-18 October 1998
Perth	George Cho, CRC LEME/UC	Intellectual Property and Legal Issues for Geoscientists workshop	30	30 November 1998
Canberra	George Cho, CRC LEME/UC	Intellectual Property and Legal Issues for Geoscientists workshop	11	11 December 1998
Canberra	Richard Greene, CRC LEME/UC	Aeolian Dust Symposium	50	25-26 November 1998
Canberra	Glen Fisher, CRC LEME/UC	Field Safety		February 1999
Canberra	Tony Eggleton, CRC LEME/ANU	X-Ray Diffraction	14	22-26 February 1999
Melbourne	Steve Hill, CRC LEME/UC, Bernie Joyce, Univ of Melbourne/VIEPS	Regolith Geology	16	16-17 March 1999
Melbourne	Steve Hill, CRC LEME/UC, Bernie Joyce, University of Melbourne/VIEPS	Regolith Field Geology	14	19-20 March 1999
Melbourne	David Lawrie & David Gray, University of Melbourne/VIEPS	Regolith Geochemistry	18	22-23 March 1999
Hobart	Charles Butt (with CODES)	Regolith and Exploration Geochemistry	18	8-12 March 1999
Cobar	K McQueen, I Robertson	Workshop Review for Peak Gold Mine	6	7-9 June 1999

APPENDIX 5 – CONFERENCE PRESENTATIONS

Oral and poster presentations given by CRC LEME students at international, national and local conferences.

Local, National or Overseas	Participants	Role	Event	Venue (Location)	Date
National	A McPherson, M Spry, Ma Chi, E K Tonui, B Smith	presenters	Regolith '96, The State of the Regolith, 2 ND Australian Conference on Landscape Evolution & Mineral Exploration	Brisbane	13-14 November 1996
National	Tan Kok Piang	attendee	3 RD National Conference of the Specialist Group in Economic Geology	Canberra	30-31 January 1997
National	E K Tonui	attendee	AusIMM Annual Conference	Ballarat	12-15 March 1997
National	Tan Kok Piang	attendee	Broken Hill Exploration Initiative '97	Broken Hill	27-30 May 1997
National	L Foster, S Laffan, N Reilly, M A Whitbread, M Spry, K P Tan	presenters	Regolith '98, New Approaches to an Old Continent, 3 RD National Regolith Geology Conference	Kalgoorlie	2-9 May 1998
National	Melissa Spry, Darryl West, Kylie Foster, Craig Johnson	speakers	Postgraduate Research Corroboree	University of Canberra	15 June 1998
National	Kylie Foster, Darryl West (<i>winner of poster presentation for 1998</i>)	presenters	Postgraduate Research Corroboree	University of Canberra	15 June 1998
National	Melissa Spry	speaker	14 TH AGC	Townsville, QLD	6-10 July 1998
National	Stephen Cotter	attendee	14 TH AGC	Townsville, QLD	6-10 July 1998
National	K P Tan	attendee	14 TH AGC	Townsville, QLD	6-10 July 1998
National	K Foster; M Holzapfel; G Shirtliff; K P Tan; D West	attendees	Broken Hill Exploration Initiative	Broken Hill, NSW	18-23 Oct 1998
National	Melissa Spry; Kylie Foster	presenters	8 TH ANZGG Conference	Goolwa, Adelaide	15-21 Nov 1998
National	K P Tan	presenter	Symposium On Aeolian Dust	Canberra, ACT	25-26 Nov 1998
National	Stephen Cotter	attendee	AEG Lecture Series	CSIRO, North Ryde, NSW	7 Dec 1998
National	Steven Willis	attendee	2 Day Regolith Geology Workshop	University of Melbourne	16-17 March 1999
National	Steven Willis	attendee	2 Day Regolith Field Geology	Melbourne – Ballarat	19-20 March 1999
National	Steven Willis	attendee	2 Day Regolith Geochemistry Workshop	University of Melbourne	22-23 March 1999
Local	Steven Willis	attendee	5 Day XRD Workshop	ANU – Canberra	22-26 Feb 1999
Local	Steven Willis	attendee	2 Day Field Safety Course	UC – Canberra	Early Feb 1999
National	Grant Jones	attendee	2 Day Regolith Geology Workshop	University of Melbourne	16-17 March 1999
National	Grant Jones	attendee	2 Day Regolith Field Geology Workshop	Melbourne – Ballarat	19-20 March 1999
National	Grant Jones	attendee	2 Day Regolith Geochemistry Workshop	University of Melbourne	22-23 March 1999
Local	Grant Jones	attendee	5 Day XRD Workshop	ANU – Canberra	22-26 Feb 1999
Local	Grant Jones	attendee	2 Day Field Safety Course	UC – Canberra	Early Feb 1999
National	Michael Whitbread	attendee	Hydrothermal Geochemistry	University of Tasmania	15-20 March 1999
National	Stephen Cotter	attendee	Exploration Geochemistry & Hydrothermal Geochemistry	University of Tasmania	8-20 March 1999

APPENDIX 6 – FIELD SAFETY COURSE OUTLINE

The course run by Glen Fisher, is designed to develop knowledge and care during the operation of field based activities. Enhancement of understanding of 4WD vehicles and their operation, assessment of driving conditions, first aid techniques and familiarity of communication equipment is essential for personal safety and that of colleagues. The course is compulsory for new research staff and students of CRC LEME alike. All participants are issued with a field safety manual which acts as an ongoing reference whilst preparing and participating in fieldwork. Some of the important components of the course include:

Field trip planning

Compiling a detailed list of requirements is probably the most crucial factor in organising fieldwork. Often the importance of submitting an itinerary of travel to a reliable contact or applying for the necessary permits for access may be overlooked. The wide range of items and processes are discussed that will allow planning of a safe and successful journey.

4WD vehicles and driving techniques

Many people are unfamiliar with operation of this type of vehicle. Students will understand how 4WD vehicles work and how to perform basic maintenance and care of their vehicles. Instruction is given in driving the vehicle in all types of road and weather conditions. Special attention is given to the different terrains to be encountered.

Recovery and equipment

A large range of 4WD equipment for vehicle recovery, safety or accessories that may assist vehicle performance are available. There will be instruction and hands on use of these items. It is important to consider the season and climate for the duration of the trip. The minimal safety equipment requirements that the driver should expect of any 4WD vehicle are discussed.

Communication

Remote locations require reliable and effective communication. There is introduction to UHF radio, satellite telephones, EPIRP units and instruction in their use with regard to appropriate communication procedure and protocol. A number of case studies are used to confirm the effectiveness of these devices in extreme situations.

First aid

The basic needs are covered and it is strongly recommend that everyone completes an accredited first aid course. In remote field areas, assistance may be hundreds of kilometres away. In life-threatening situations, correct actions may mean the difference between life and death.

Common Sense

This section summarises most of the above but concentrates more on the approach and reaction when something goes wrong. Taking time to stop and think will enable determining the appropriate course of action. An emphasis is placed on ability to assess capability and skill level.

Hazard recognition and control is discussed in relation to field safety. Lastly, students and staff are reminded of their responsibility, etiquette and duty of care.

APPENDIX 7 – SUMMER SCHOLAR'S REPORT

Report from two CRC LEME summer students working in the Broken Hill region, Summer Scholars - Mick Turner and Rod Dann.

Early February 2000 saw Patrice de Cartitat and two UC summer students, Mick Turner and Rod Dann, head to the Mundi Mundi Plains west of the Broken Hill Block. The 10-day field trip was carried out as part of an ongoing hydrogeochemical study being undertaken by the Basins group of CRC LEME to try to gain a better understanding of the geochemical evolution of groundwater in the area, and its potential as a sampling medium for mineral exploration. During December, January and February before the trip Mick Turner was kept busy preparing analysing and plotting the results of regolith samples from an earlier trip as well as creating a database of geochemical atlases and the techniques used to produce them, from all over the world. Rod Dann spent most of January on the phone to land-holders or supply companies, organising which properties to visit, which bores were working, making sure that all instruments were working properly, and that chemicals and sample containers were ready. On the Mundi Mundi approximately 10 stations were visited with 29 boreholes sampled. With the temperature on the first three days hovering around a rather warm 46 degrees before cooling off to the low forties by the end of the trip, many water tanks were used as swimming pools, much to the surprise and laughter of more than one property owner.

Representative groundwater was sampled from windmills and bores equipped with submersible pumps, or from open holes pumped with our own sampling pump. This often meant pumping water out of the bore for more than 30 minutes until the pH, dissolved oxygen, electrical conductivity, temperature and Eh (redox potential) readings stabilised, suggesting we were into the fresh groundwater, as opposed to water that has been sitting in the casing changing its chemical characteristics. Apart from the above parameters, measurements of alkalinity and sulfide, reduced iron, nitrate and ammonium concentrations were performed in the field at each site. At each location, samples were taken for major cations, anions, trace metals (including gold), fluoride and iodine, and oxygen, hydrogen, sulphur and carbon isotope analysis. More groundwater samples will be collected around the Broken Hill area and other basins in Australia. Regolith samples were also taken at each site to characterise its composition and examine relationships, if any, to the groundwater composition. The desired outcome is to be able to assist exploration companies by suggesting areas of potential mineralisation. This will result from a better understanding of the behaviour and movement of metals in these notoriously difficult exploration areas.

From a student's perspective, the time we spent on this project was an invaluable opportunity to see the theory we have learnt put into practice, used and applied in meaningful ways. Theoretical detail becomes meaningful and memorable when it has been observed in practical situations. We both very much appreciated the opportunity we had to learn hands-on about an area that interests us both.

Table 8 Graduate Destinations

PhD

<i>Surname</i>	<i>Given name</i>	<i>Commencement & Completion date</i>	<i>Destination</i>
Bristow	Andrew	withdrew	Andrew is working as a consultant/contractor in West Africa.
Aspandiar	Mehrooz	5/94 - 8/98	Completed PhD, Returned to India now working at Curtin University
Brand	Nigel	95 - 97	Completed PhD, Senior Geochemist, WMC Exploration
Ma	Chi	2/92 - 10/96	Completed PhD, employed at CAL. TECH., USA
Laffan	Shawn	1/95 - 1/98	Still doing his PhD but working part time in the Geography Dept, ANU as a Lecturer
Tonui	Eric	1/93 - 12/97	Completed PhD , working for CRC LEME at AGSO, accepted a Post-Doc at NASA from July 2000

MASTERS

<i>Surname</i>	<i>Given name</i>	<i>Commencement & Completion date</i>	<i>Destination</i>
Cross	Andrew	1/95 - 12/97 (3/00)	Completing his masters thesis and working for a CRC in AGSO, Canberra
Lau	Libbie	2/98 - 6/98	Libbie withdrew her scholarship, currently now working as a consultant geologist
Huang	Xiaoyan	8/95 - 2/98	After completing her PhD returned to China, worked in a Bank, has now applied to do PhD in Canada
O'Brien	Jane		Teaching science at Canberra Girls' Grammar

HONOURS

<i>Surname</i>	<i>Given name</i>	<i>Commencement & Completion date</i>	<i>Destination</i>
Adamson	Steve	7/95 - 6/96	Completed honours at ANU, Canberra
Baker	Andrew	3/99 - 11/99	
Butterfield	Grantley	2/98 - 3/99	Working for AUSLIG
Carragher	Alison	3/99 - 11/99	
Crawford	Marcus	7/96 - 6/97	Working in the Solomon Islands with a geological company.
Della-Marta	John	1/97 - 11/97	Working for Normandy
Dries	Shanta	3/95 - 11/96	Working for Normandy
Foo	Mark	1/99 - 11/99	Now unemployed
Foster	Kylie	2/98 - 11/98	Working for CRC LEME at AGSO, Canberra
Foster	Luke	1/96 - 10/96	Doing his PhD at ANU, Canberra
Gibbons	Lisa	4/97 - 11/97	Completed honours, University of Adelaide
Holzapfel	Michael	2/98 - 11/98	Working for AUSLIG, enrolled for Masters at UC
Johnson	Craig	8/97 - 8/98	Working with Goldfields Consolidated, KAL., WA as a Expl. Geologist
Jones	Grant	2/99 - 11/99	Working for CRC LEME at AGSO
Kiastpur	Goran	1/99 - 12/99	
Lee	Sam	7/98 - 6/99	Doing Masters at Curtin Uni, WA.
Leslie	Chris	2/99 - 11/99	Working at AGSO
Madden	Jane	1/96 - 10/96	Working for Rito Tinto
Maney	Paul	3/96 - 11/96	Unknown
McIntosh	Clare	2/98 - 2/99	Working as a senior computer software operator/programmer with the Taxation Office – using skills learnt through GIS.
McPherson	Andrew	3/96 - 12/96	Doing a PhD at ANU
Porritt	David		Works for BRS
Pottinger	Daniel	2/97 - 11/97	Working in exploration at Kalgoorlie
Pulford	Anna	2/97 - 11/97	Completed honours at ANU, Canberra
Reilly	Nerrida	2/97 - 2/98	Working for CRC LEME at AGSO
Shirliff	Greg	2/98 - 12/98	Doing PhD at ANU, Canberra
Smith	Bernadette	2/96 - 12/96	Worked in WA with a mining company, now working in Woolworths, Belconnen.
Spry	Melissa	2/96 - 11/96	Doing PhD at University of Canberra
Tan	Kok Piang	7/95 - 6/96	Doing PhD at ANU, Canberra
Thomas	Brett	1/99 - 12/99	Completed honours, University of Adelaide
West	Darryl	2/98 - 11/98	Working for ALL-GAS as a GIS Officer, Brisbane
Willis	Steven	2/99 - 11/99	Travel