

THREE YEARS OF MTEC

Ian C. Roach

MCA Lecturer, CRC LEME, Department of Geology, Australian National University, ACT, 0200

The Minerals Tertiary Education Council (MTEC) was formed by the Minerals Council of Australia (MCA) in 2000 to take up the challenges for Australian minerals tertiary education documented in *Back from the Brink*, the MCA's review of the state of Australian minerals tertiary education in the late 20th century (MCA 1998). *Back from the Brink* recognised the decline in tertiary minerals education in Australia (as part of a world-wide decline), and recommended actions to address the growing lack of suitably trained graduates in Earth Sciences, Mining and Metallurgy—at Honours and postgraduate level—for the Australian minerals industry.

MTEC brought together a consortium of universities involved in minerals research and teaching. In the Earth Sciences, 8 universities made up the consortium: Australian National University and University of Canberra (representing CRC LEME); University of Melbourne, Monash University and La Trobe University (as the Victorian Institute of Earth and Planetary Sciences—VIEPS); and, James Cook University, University of Tasmania and University of Western Australia (as the G3). Each of the three groups were to fulfil different roles: VIEPS to coordinate Honours-level education; the G3 to coordinate postgraduate-level education; and, CRC LEME to teach regolith geoscience at both Honours- and postgraduate-level into both programs. Nine Full Time Equivalent (FTE) lecturers were appointed at the participating universities around Australia, nominally as Lecturer Level B, across the three disciplines. Some of the appointments were fractional, resulting in up to 14 MTEC Lecturers (later to be called MCA Lecturers) actually appointed, with up to 7 in the Earth Sciences.

The MTEC initiative was initially funded for three years from a mixture of Commonwealth and Industry funds. Further funds were to be secured after review in the third year. In 2001, MTEC was awarded a Eureka Prize for innovation in science teaching across disciplines.

In 2001, following the appointment of the MCA Lecturers (including the author), CRC LEME commenced its program of Honours- and postgraduate-level education for MTEC, which grew out of earlier courses in CRC LEME's Education and Training Program under the guidance of Professor Graham Taylor. This was initially coordinated from the University of Canberra, but from the ANU in 2003 after UC withdrew from CRC LEME in December 2002. By the end of 2003, 5 Honours-level and 1 Masters-level MTEC courses had been developed and delivered *annually* to over 220 participants from Australian and international universities, geological research institutions and minerals industry. CRC LEME's MTEC courses are based in capitol cities or are field-based, depending on their purpose, and draw on the skills and knowledge of staff from each of the core parties of CRC LEME. This program, now coordinated through the Education & Training Program (Program 5), is responsible for unparalleled cooperation within the Centre for the purposes of education and training. Similarly, this program is leading the way in Center staff transferring knowledge from research into education.

What follows is a description of each of the current courses offered by CRC LEME to MTEC since 2001, some paraphrased from the course descriptions in the 2003 VIEPS/MTEC handbook.

LABORATORY-BASED UNDERGRADUATE COURSES

Environmental Mineralogy (EMN)

This Honours-level course is taught by Professor Tony Eggleton, one of Australia's foremost clay mineral researchers, at the Department of Geology, Australian National University (Figure 1). The course is based on the premise that the minerals of the regolith are the primary materials that influence mineral exploration, engineering structures, environmental degradation and rehabilitation and agriculture. Anyone considering a career in any of these disciplines must first have a reasonable understanding of regolith mineralogy.

In mineral exploration the minerals provide a range of sample media and yield spectral signatures detectable by a variety of remote sensing techniques. In engineering the properties of regolith minerals affect the stability of structures as well as providing raw materials for many applications. By 'environment' we mostly refer to our own environment, the Earth's surface. Landscape degradation involves change to or loss of regolith minerals; its amelioration requires a knowledge of mineral-water-chemical interactions. Regolith

minerals are soil minerals, and so are the substrate for all agriculture.

This course is designed in two parts:

1. One week of lectures and structured hands-on practical work at ANU;
2. A project, either done in the following week at ANU, or over a longer period of time at the student's (and lab's) convenience. This may be completed at the student's home university.

The lecture course firstly covers the methods of investigation of fine-grained regolith minerals, concentrating on X-ray diffraction, and also discussing infra-red (PIMA), scanning electron microscopy and electron micro-probe analysis, and cation exchange capacity. Secondly, the nature and properties of the major regolith minerals: clays and iron oxyhydroxides are discussed. This is coupled with intensive experience in the preparation, analysis and interpretation of bulk regolith samples and clay separates using X-Ray Diffraction (XRD). Notes from the course were published informally in 2001, but as Eggleton *et al.* (2002) and Eggleton & Troitzsch (2003).



Figure 1: Professor Tony Eggleton (right) with EMN course participants at ANU, 2003.

Introduction to Hydrogeochemistry (HGC)

This Honours-level course is taught by Dr Dirk Kirste (CRC LEME/Department of Geology, ANU) and Dr Patrice de Caritat (CRC LEME/Geoscience Australia) at the School of Earth Sciences, University of Melbourne. The premise behind this course is that there are many good reasons for studying hydrogeochemistry; in Australia, perhaps the foremost are related to salinity, pollution and mineral exploration. This course provides a framework for the use of hydrogeochemistry in practical applications to address these and other problems. It is designed to follow *Introduction to Hydrogeology (HYG)* (another VIEPS course).

The composition of groundwater evolves continuously along flowpaths in the subsurface because the water interacts with the surrounding materials, be they minerals, organic matter, other bodies of water (e.g., connate water) or even gasses. The controls on water chemistry include evaporation, mixing, dissolution, precipitation, adsorption, etc. The course helps to develop an understanding of the chemical processes that affect the composition of surface- and ground-waters, why and how a hydrogeochemical study should be undertaken.

Topics covered include: water quality; sampling and analytical methods; chemical thermodynamics and the concept of equilibrium; acids, bases and carbonate chemistry; chemical weathering; redox; ion exchange and sorption; controls on water chemistry and how to evaluate them; chemical modelling; and practical applications including salinity, acid-sulfate soils, mineral deposit formation and exploration. Notes for this course were published in Kirste *et al.* (2002) and Kirste & de Caritat (2003).

Hyperspectral Remote Sensing for Geological and Regolith Interpretation (HRS)

This Honours-level course is taught by Dr Alan Mauger (PIRSA), Dr Megan Lewis and Ms Vicki Stamoulis (both University of Adelaide). The course includes lectures introducing different types of multispectral and, in particular, hyperspectral data, the acquisition, calibration and processing of these data and basic approaches to analysis and interpretation. This type of remote sensing is new and innovative and as yet little used in mainstream geological investigations. Applications include the ability to identify mineral species by spectral signatures, temporal variations for environmental monitoring and ameliorating the effects of vegetation, moisture, soil, landforms, slope etc. The course includes a hands-on workshop for novice and intermediate users of remote sensing in the processing, rectification and enhancement of Hyperspectral Remote Sensing data using the ENVI software package. Notes for this course were informally published by the University of Adelaide.

Introduction to MapInfo

This undergraduate- and Honours-level course was taught twice in 2001 by Dr Ian Roach as a hands-on, show-and-tell on the MapInfo Geographic Information System (GIS). The course was designed as a basic- to intermediate-level introduction to the GIS, taking participants through basic terminology (including understanding spheroids, geoids and datums), the MapInfo topology, creating and editing MapInfo tables,

importing data from other GIS and data sources, creating basic maps, creating map layouts and saving layouts to other graphics programs. The course can be taught on-demand in almost any location using portable computers and was also a component of *Regolith Mapping and Field Techniques (RMF)* (below) in 2002. Notes for this course were published as Roach (2001), developed from Roach (2000).

FIELD-BASED UNDERGRADUATE COURSES

Regolith Geology and Geochemistry (RGG)

This Honours-level course was taught principally by Professor Graham Taylor around Melbourne in 2001 and 2002, but was rolled into *Regolith Mapping and Field Techniques (RMF)* (below) in 2003 because of low enrollment numbers. The course provides an introduction to many of the key concepts and applications of regolith geology for both environmental scientists and mineral explorers. It includes an integrated combination of classroom lectures and field study set in the magnificent landscape of Wilsons Promontory and surrounding South Gippsland.

Wilsons Promontory is the southern-most tip of the Australian mainland and contains of a vast array of different regolith materials, many of which have evolved in response to landscape and environmental changes since at least the Mesozoic. This course uses the regolith and landscape features of this area to demonstrate many of the key concepts of regolith geology. In addition, students learn how major and trace elements are dispersed within the regolith and how these dispersion patterns may be used to vector in on ore deposits, point sources of pollution or dryland salinity.

This course leads in to *Regolith Mapping & Field Techniques (RMF)* (below), which is essential to enhance student's skills in making and interpreting regolith-landform maps as well as illustrating many of the concepts and models learned in this course. Notes from this course were informally published in 2001 and as Taylor *et al.* (2002). Teaching staff now include Dr Steve Hill (University of Adelaide), Dr Mehrooz Aspandiar (Curtin University of Technology) and Dr Ian Roach (Australian National University).

Regolith Mapping and Field Techniques (RMF)

This Honours-level is taught by Dr Steve Hill and Dr Ian Roach, assisted by Ms Kylie Foster and Mr Glen Fisher (in 2002). In 2002 the course was based at the Silverton Youth Camp (Figure 2), ca. 25 km west of Broken Hill, but was relocated to the University of New South Wales' Fowlers Gap Arid Zone Research Station, 100 km north of Broken Hill in 2003. The course's premise is about knowing how to read the landscape and its materials, and represent that on a map. This knowledge is essential for anyone hoping to establish a career in regolith science, mineral exploration, land and environmental management and rehabilitation and salinity mitigation.



Figure 2: Happy mappers. Regolith Mapping and Field Techniques (RMF) Honours course group at Silverton (Barrier Daily Truth 2002).

This course provides participants with the fundamentals required for producing a regolith map or, for that matter, any map. Working in groups, participants learn how to use existing maps, aerial photography and

remotely sensed imagery to create their own base maps and collect field data. Participants learn to construct their own regolith-landform map and other derivative (geochemical, geophysical, morphological) maps and to appreciate the fundamentals of regolith geochemical sampling media types and sample collection, GPS location, application of GIS and remote sensing to regolith, hard-rock geology and map production. This course follows on from *Regolith Geology and Geochemistry (RGG)* (above). Notes from this course were published as Roach *et al.* (2002) and Roach *et al.* (2003).

POSTGRADUATE EDUCATION

Regolith Geology and Mineral Exploration

This Masters-level course is the flagship course of CRC LEME, offered annually and coordinated by Dr Ian Roach. The course was offered in Kalgoorlie (2001), Canberra (2002) and Fowlers Gap, 125 km north of Broken Hill (2003) (Figure 3). Teaching staff come from most core parties of CRC LEME, and it is this course that is aimed at participants in professional Masters or industry extension from Australian and overseas minerals industry, as well as postgraduate students who may or may not enter the minerals industry.

The course introduces the regolith from first principles, describing the terminology, introducing landscape evolution and exploration problems in regolith-dominated terrains. Participants are introduced to basic concepts, rock and mineral weathering, interpreting landscapes and basic regolith-landform mapping. They then go on to learn about primary and secondary element dispersion in the regolith, the chemistry of groundwaters for exploration and natural hazard recognition, and the selection and use of regolith materials and biota as mineral exploration sampling media. The course also contains numerous case studies and field visits to active mining areas, active exploration regions, and areas that highlight important concepts. Notes from this course were published as Anand *et al.* (2001), Caritat *et al.* (2002) and Hill *et al.* (2003).



Figure 3: Plenty to smile about. Regolith Geology and Mineral Exploration masters course participants with Dr Steve Hill (pointing, in background) at the Line of Load, Broken Hill (Barrier Daily Truth 2003)

RESEARCH TRANSFER AND TEACHING

One of the primary objectives of CRC LEME's Education and Training Program is to transfer knowledge and skills from the Centre's active researchers to students and industry. This is being accomplished by hosting field-based courses in areas where Centre research is actively occurring, such as the Yilgarn Craton (Kalgoorlie), eastern Australia and central NSW (Canberra) and the Broken Hill Domain, Olary Block and Murray Basin (Fowlers Gap). Course notes, case studies and field examples present real-life examples of Centre research, often before the research is formally published internationally, highlighting cutting-edge regolith geoscience. Increasingly, postgraduate students attending courses are also being encouraged to present aspects of their own research, under the guidance of teaching staff, to further enrich the learning experience and outcomes for course participants. As an example, at the 2003 *Regolith Geology and Mineral Exploration* Masters course, participants were given active studies and field examples from the Broken Hill Domain highlighting: exploration problems (S.M. Hill 2002a); sampling media that can be found in—and growing within—the regolith (Senior & Hill 2002, L.J. Hill 2002); and, the tools to successfully map the regolith in their own tenements (S.M. Hill 2002b, Thomas *et al.* 2002). Participants also learned about some

of CRC LEME's other active research projects at Girilambone (NSW), the Gawler Craton and the Yilgarn Craton, the regolith challenges faced in these "greenfields" areas and the tools that can be used to overcome exploration challenges. Course participants will continue to be challenged by our own research problems, and rewarded by our own solutions to problems encountered exploring within and under the regolith.

MTEC IN THE NEWS—ADVERTISING MTEC (AND CRC LEME)

Another of the tasks of the MCA Lecturers is to make sure that potential course participants actually know about the courses, as well as raise the profile of MTEC and their own institutions. This may not come naturally to trained scientists, however, MTEC has helped by providing training through marketing workshops and by engaging award-winning professional marketing consultants (Ailsa Page and Associates, Melbourne). One part of awareness-raising and indirect marketing is by way of the local press, and this has been exploited to some advantage over the period; a stated aim is to include one good-news story about our activities in the local press during each field course. Articles to date include two front pages of the Broken Hill local newspaper, the Barrier Daily Truth (Barrier Daily Truth 2002, 2003) and one article in the Minerals section of The Kalgoorlie Miner (2001). Other articles have appeared in LEME News, CRC LEME's news magazine that has a large circulation amongst industry stakeholders (LEME News 2001, 2002, 2003) and the newspaper of the University of Canberra (Monitor 2002a, b). Commercial advertising has been placed in The Australian Geologist, the magazine of the Geological Society of Australia (TAG 2003) and is currently in preparation for the Gold Gazette and Minerals Gazette, the trade magazines for Australasia's gold and minerals industries. Concurrently, the Internet is also being exploited, with course details posted on the WWW sites at CRC LEME (<http://crlceme.org.au/>), the MCA (<http://www.minerals.org.au/>), VIEPS, CODES, the Geological Society of Australia, the Australian Institute of Mining and Metallurgy and the Australian Institute of Geoscientists. The conference circuit has also been exploited to raise awareness and to advertise, resulting in publications such as Roach & Hill (2002) and Hill & Roach (2003) and this volume in general. Advertising and media articles are planned into the future, to raise awareness of MTEC, CRC LEME, the MCA and the minerals industry in general.

THE FUTURE OF MTEC IN CRC LEME

The Galvin and Carter Review

In early 2003 MTEC called for submissions for a strategic review of the first three years of the initiative, to be conducted by Jim Galvin and Bob Carter. The results of this review (Galvin & Carter 2003), together with a strategic plan (Balanced Strategic Summary 2003) developed by the entire consortium (Earth Science, Mining and Metallurgy) for any future developments, were presented to the MCA Board in September 2003.

The Galvin and Carter Review was mixed, finding that the dire outlook predicted in *Back from the Brink* had actually materialised, and the state of minerals education in Australia was worse-off after three years of MTEC than it had been before MTEC commenced. They acknowledged that many of Australia's minerals education programs were non-viable in the current climate of globalisation and rationalisation. However, they also found that MTEC was functioning correctly as a catalyst for change and for collaboration between the remaining institutions still involved in minerals education, and that the program was gaining acceptance within Australia's minerals industry and tertiary educational institutions. MTEC was a "work in progress" and could not be properly assessed as to its viability within a three-year timeframe. CRC LEME was also found to be meeting or exceeding MTEC's key performance indicators.

As a result of these two documents (Balanced Strategic Summary 2003, Galvin & Carter 2003), the MCA Board agreed to fund MTEC for a further three year period, extending the program until the end of academic year 2006. MTEC will continue to fund the MCA Lecturers, but will resource courses differently to the initial funding model, in the hope of achieving "more bang for its buck". CRC LEME will be an active participant in the process.

New developments in teaching

As part of the review and strategic planning process, MTEC partners were asked to adopt new methods for reaching and educating minerals industry participants. One of these methods is to move away from traditional teaching in a classroom-based, one- or two-week format, and the other is to move away from face-to-face teaching altogether. CRC LEME is adapting its teaching to meet with new challenges for distance and on-line education in the following ways:

Regolith geology CD-ROM

CRC LEME E&T, in partnership with Learning Curve (an innovator in self-paced electronic learning), is

developing a CD-ROM-based learning resource on regolith geology and mineral exploration in regolith-dominated terrains. This resource is being developed by Dr Ian Roach and Mr Andrew McPherson (a CRC LEME PhD scholar) from CRC LEME's vast research resources of Open File and Restricted Reports, plus additional material written by Dr Charles Butt, the book *Regolith Geology and Geomorphology* by Graham Taylor and Tony Eggleton (Taylor & Eggleton 2001) and *The Regolith Glossary* edited by Tony Eggleton (Eggleton 2001). This work is expected to be completed by mid-2004 and to be available as CD-ROM and on-line.

PATHWAYS

The PATHWAYS program grew out of the difficulty-named MIPCP (Masters Industry Coursework Participation Program). The ideal of the PATHWAYS program is to reach more industry staff by modularising coursework in more manageable "units" of two days duration. Once sufficient units are successfully completed, an industry professional may trade in certificates granted for one whole Masters-level course at participating universities, giving status towards a professional coursework Masters degree. PATHWAYS units are required to be delivered flexibly, possibly on-site at remote locations, allowing easy access to industry professionals who find it increasingly difficult to participate in one- and two-week long courses based in capital cities. CRC LEME currently has five courses in development:

1. Rock Weathering
2. Regolith Sampling Media & Geobotany for Mineral Exploration
3. Introduction to Regolith Geology
4. Introduction to Regolith Mapping
5. Mineral Exploration in Regolith Dominated Terrains

CONCLUSION

The challenges to CRC LEME and MTEC for the future are manifold: industry still hires and fires around the price of commodities, giving variable numbers of course participants year-to-year; the number of universities teaching minerals-related courses continues to shrink; and, CRC LEME has gone from a four core-party Centre to a 10 core-party Centre in the life of the original MTEC agreement. One challenge is to expand CRC LEME's role in MTEC to include the University of Adelaide and the Curtin University of Technology, perhaps not by teaching more courses, but by being more inclusive of staff and students from the new core parties into the current courses. This has been done to a large degree with the University of Adelaide (lecturers and students have been participating since late 2002) but is only now starting to commence with Curtin University of Technology (one lecturer signed on to teach MTEC courses in early 2003).

The next three years will be challenging but ultimately rewarding. CRC LEME already has a firm base of excellence on which to build, and has been acknowledged as a leader in Australian minerals education. It is hoped that with judicious management, continued staff cooperation and increased advertising, CRC LEME's role in MTEC will continue to flourish, and at the end of the next three years, MTEC will continue too.

REFERENCES

- RAVI ANAND, DENNIS ARNE, CHARLES BUTT, MIKE CRAIG, DAVID GRAY, IAN ROACH, IAN ROBERTSON, KEITH SCOTT & GRAHAM TAYLOR 2001. *Regolith Geology and Mineral Exploration Masters shortcourse*. CRC LEME **Report 163**, unpaginated.
- BALANCED STRATEGIC SUMMARY 2003. Available on the MCA WWW site at:
http://www.minerals.org.au/downloads/pdf/MTEC_Strat_Review_OutputsV4_7Au03.pdf
- BARRIER DAILY TRUTH 2002. *Down to earth with regolith*, April 4, p. 1.
- BARRIER DAILY TRUTH 2003. *An eye for exploration*. August 16, p. 1.
- PATRICE DE CARITAT, RICHARD GREENE, LEANNE HILL, STEVE HILL, DIRK KIRSTE, KEN MCQUEEN, LEAH MOORE, NIGEL RADFORD, IAN ROACH, NEIL RUTHERFORD & GRAHAM TAYLOR 2002. *Regolith Geology, Regolith Applications and Mineral Exploration Masters shortcourse*. CRC LEME **Report 178**, unpaginated.
- EGGLETON R.A. 2001. *The Regolith Glossary*. CRC LEME, 144 pp.
- TONY EGGLETON, BERLINDA CROWTHER & ULRIKE TROITZSCH 2002. *Environmental Mineralogy (EMN) – Honours short course*. CRC LEME **Report 176**, unpaginated.
- TONY EGGLETON & ULRIKE TROITZSCH 2003. *Environmental Mineralogy (EMN) Honours short course*. CRC LEME **Report 192**, unpaginated.
- GALVIN J.M. & CARTER R.J. May 2003. *Strategic review of Minerals Council of Australia tertiary education initiatives*. Minerals Tertiary Education Council, Minerals Council of Australia.
- L.J. HILL 2002. Branching out into biogeochemical surveys: a guide to vegetation sampling. In: ROACH I.C. ed. *Regolith and Landscapes in Eastern Australia*, pp. 50-53, CRC LEME.

- LEANNE HILL, STEVE HILL, BEAR MCPHAIL, KEN MCQUEEN, IAN ROBERTSON, IAN ROACH & KEITH SCOTT 2003. *Regolith Geology and Mineral Exploration Masters Course*. CRC LEME **Report 194**, 2 volumes, unpaginated.
- HILL S.M. 2002a. Some issues and challenges for regolith-landform mapping with particular references to the Broken Hill region. In: ROACH I.C. ed. *Regolith and Landscapes in Eastern Australia*, pp. 63-76, CRC LEME.
- HILL S.M. 2002b. Broken Hill 1:100,000 regolith-landform map: development, features and application. In: ROACH I.C. ed. *Regolith and Landscapes in Eastern Australia*, pp. 58-62, CRC LEME.
- HILL S.M. & ROACH I.C. 2003. Regolith geoscience education & training within the western NSW teaching laboratory. Broken Hill Exploration Initiative Abstracts, Broken Hill, NSW. *Geoscience Australia Record 2003/13*, 79-80.
- DIRK KIRSTE, PATRICE DE CARITAT. & IAN HUTCHEON 2002. *Introduction to Hydrogeochemistry Honours Shortcourse*. CRC LEME **Report 172**, unpaginated.
- DIRK KIRSTE & PATRICE DE CARITAT 2003. *Introduction to Hydrogeochemistry Honours Shortcourse*. CRC LEME **Report 188**, unpaginated.
- LEME NEWS 2001. CRC LEME joins the Minerals Council of Australia's education initiative. *LEME News No. 21*, p. 6, 27.
- LEME NEWS 2002. CRC LEME/MTEC - *Minerals Education Australia* 2001-2002 program. *LEME News No. 22*, p. 8, 10.
- LEME NEWS 2003. The successes of MTEC. *LEME News No. 23*, p. 24, 18.
- MCA 1998. *Back from the Brink: Reshaping Minerals Tertiary Education*. Minerals Council of Australia, 1998, 183pp.
- MONITOR 2002a. *Red earth's secrets revealed*. Monitor, the newspaper of the University of Canberra **Issue 5 Volume 12**, p. 3.
- MONITOR 2002b. *Health, geology linked says postgraduate student*. Monitor, the newspaper of the University of Canberra **Issue 11 Volume 12**, p. 3.
- ROACH I.C. 2000. *Beginning MapInfo: basic to intermediate skills for the MapInfo version 5.5 GIS*. CRC LEME **Restricted Report 128**, 41 pp.
- ROACH I. 2001. *Beginning MapInfo: basic to intermediate skills for the MapInfo GIS (second edition)*. CRC LEME **Restricted Report 161**, 62 pp.
- ROACH I.C. & HILL S.M. 2002. Taking technology to field-based learning: teaching regolith mapping in Broken Hill, NSW. *Geological Society of Australia Abstracts 67*, p. 443.
- ROACH I.C., HILL S.M., FISHER G. & FOSTER K.A. 2002. *Regolith Mapping and Field Techniques Shortcourse Notes*. CRC LEME **Report 171**, unpaginated.
- ROACH I.C., HILL S.M. & FOSTER K.A. 2003. *Regolith Mapping and Field Techniques Shortcourse Notes*. CRC LEME **Report 187**, unpaginated.
- SENIOR A.B. & HILL S.M. 2002. Regolith-landforms of the Pinnacles 1:25,000 sheet, western NSW: mapping and geochemical characterisation. In: ROACH I.C. ed. *Regolith and Landscapes in Eastern Australia*, pp. 113-118, CRC LEME.
- TAYLOR G. & EGGLETON R.A. 2001. *Regolith Geology and Geomorphology*. John Wiley & Sons, Chichester, 375 pp.
- THE KALGOORLIE MINER 2001. *Course focuses on regolith geology*, June 14, p. 9.
- THOMAS M. EARL K.L., HILL S.M. & FOSTER K.A. 2002. A framework for regolith-landform mapping in the Flying Doctor Prospect, Broken Hill, NSW. In: ROACH I.C. ed. *Regolith and Landscapes in Eastern Australia*, pp. 127-132, CRC LEME.
- GRAHAM TAYLOR, IAN ROBERTSON, BERNIE JOYCE & ANDREW KOTSONIS 2002. *Regolith Geology and Geochemistry Honours Shortcourse*. CRC LEME **Report 170**, unpaginated.
- TAG 2003. *Regolith Geoscience Courses 2004*. The Australian Geologist **No. 128**, p. 10.

Acknowledgments: to the cast of thousands of CRC LEME staff, students and industry staff who have taught or otherwise helped, listed alphabetically, without whom this would not have been possible: Ravi Anand, Mehrooz Aspandiar, Dennis Arne, Charles Butt, Patrice de Caritat, Mike Craig, Berlinda Crowther, Tony Eggleton, Glen Fisher, Kylie Foster, David Gray, Richard Greene, Leanne Hill, Steve Hill, Bernie Joyce, Dirk Kirste, Andrew Kotsonis, Bernadette Kovacs, David Lawrie, Megan Lewis, Alan Mauger, Bear McPhail, Andrew McPherson, Ken McQueen, Leah Moore, Nigel Radford, Ian Robertson, Neil Rutherford, Keith Scott, Vicki Stamoulis, Graham Taylor, Ulli Troitzsch and Robyn Westcott. I hope I got you all. Also great thanks to Kevin Tuckwell, Alison Way and Fiona Bartier at MTEC, for putting up with my interminable phone calls and for paying the bills. Thanks to Kevin Tuckwell for suggestions improving this manuscript. Ian Roach is contracted 100% by the Minerals Council of Australia through CRC LEME and is based at the Australian National University, from whence he serves the whole CRC.