

**Cooperative Research Centre for Landscape Environments and Mineral
Exploration**

**QUARTERLY REPORT TO LEME STAFF AND STUDENTS
1 October to 31 December 2002**

1 Centre Overview

Not yet available

2. RESEARCH REPORTS

2.1 Program 1: Regolith Geoscience Program Leader: Dr Ravi Anand

OVERVIEW

- A geochronology workshop was held at Research School of Earth Sciences, ANU, on 20th November (the day prior to the LEME Eastern Australia Regolith Conference). The workshop brought together members of the LEME Geochronology & Quantitative Modelling Project, as well as other invited LEME members, including Bear McPhail, Steve Hill, Roslyn Chan, Ken McQueen and Sasha Nemchin. The purpose of the workshop was to review current and future project activities. The workshop presentations be published as a LEME Report.
- Analytical techniques using SHRIMP (Sensitive High Resolution Ion Microprobe) and TIMS (Thermal Ionisation Mass Spectrometry) were developed to date opaline silica. Results of the work were reported at International Goldschmidt Conference in Denver.
- Many of the manuscripts (50) for the thematic volume: regolith-landscape evolution across Australia were received and edited.
- Paper entitled "North-western Murray Basin, South Australia: stratigraphy, sedimentology and geomorphology was published in MESA Journal, October 2002. Sedimentary interpretation of palaeochannel fills over Harris Greenstone Belt completed and sections being drafted. A number of papers on regolith geology were presented at Gawler Craton Workshop.
- As part of the Yandal project, a number of 3-D models of regolith geology were developed.
- A number of Honours projects as part of "electrical and EM regolith studies project" completed during this Quarter. The project has been largely driven by Honours and Postgraduate student research, in collaboration with a number of industrial partners. With five Honours students and four Postgraduate student, productivity has been high with real outcomes for industry.
- As part of the "objecting logging of regolith project" Field SpecPro spectroradiometer which can measure Fe oxides, clays, phyllosilicates, amphiboles, sulphate and carbonates species was ordered. It collects spectra and characterises materials in milliseconds. The instrument is portable and suitable for laboratory and field use.
- Two reports as part of the mineral host project, one dealing with two deposits i.e. Boddington and Mt Percy, and the other one with the Scuddles deposit are completed. This study presents new data about the occurrence and levels of selected trace elements in

a variety of minerals and mineralogical assemblages. This research has real potential in improving exploration procedures in regolith-dominated terrains.

- Workshop on regolith geology and geochemistry was conducted for Metals and Mining Agencies of Japan in Mali. This research has real potential in improving exploration

THEME: MODELS OF REGOLITH-LANDSCAPE EVOLUTION

Geochronology and quantitative models of landscape evolution (Project Leader: Brad Pillans)

Project aims:

To provide reliable numerical ages for regolith materials, and to develop quantitative models of landscape evolution in regions which are important for mineral exploration and land management.

Work plan for the Quarter:

- Fieldwork by Smith in western NSW (with Steve Hill and Ken McQueen).
- Participate in LEME conference, Canberra (all).
- Participate in Australia-New Zealand Geomorphology Conference, Kalgoorlie (Pillans, Fabel, Chappell).
- Laboratory analysis of samples (all).
- Hold workshop to establish priority field sites for 2003.

Progress:

- Measurement and paleomagnetic analysis of data from Cobar area completed.
- Laboratory preparation of quartz extracts for cosmogenic Be-10 begun for samples from the Yilgarn.
- Separation of apatite from Kalgoorlie samples for U-Th/He dating.
- Measurement of standards and calibration of Laser Ablation ICPMS in preparation for measurement of samples from Ranger.
- Analysis of luminescence results from quartz in basaltic soils, North Qld.
- Attended Australia-New Zealand Geomorphology Conference, Kalgoorlie.
- A geochronology workshop, convened by Brad Pillans, was held at Research School of Earth Sciences, ANU, on Wednesday 20th November (the day prior to the LEME Eastern Australia Regolith Conference). The workshop brought together members of the LEME Geochronology & Quantitative Modelling Project, as well as other invited LEME members, including Bear McPhail, Steve Hill, Rosalind Chan, Ken McQueen and Sasha Nemchin. The purpose of the workshop was to review current and future project activities.

Speakers included:

Brad Pillans, ANU (paleomagnetic dating and review of project activities)

Sasha Nemchin (Curtin University) and Juan-Pablo Bernal, ANU PhD student (U-series dating, including U/Pb)

John Chappell and Derek Fabel, ANU (cosmogenic isotopes, landscape evolution and modelling)

Jim Dunlap, ANU (K/Ar, Ar/Ar and U-Th/He methods)

John Magee, ANU (history of aridity and amino acid racemization dating)

Martin Smith, ANU PhD student (geochronology of Western NSW)

The workshop talks will be published as a LEME Report.

Issues and comments:

- Delays in project approval and funding have allowed us to process a backlog of samples.

Outlook and work plan for the next Quarter:

New PhD students and planned fieldwork in 2002 will significantly boost our activity and productivity.

PhD Project: Regolith-Landscape Evolution of the Dundas Tableland-Implications for Land Management (M. Paine)

Project aims:

To establish the Tertiary regolith-landform evolution of the Dundas Tableland, particularly the depositional environment, weathering and heavy mineral distribution within Late Miocene to Pliocene sediments.

Work Plan for the Quarter:

- Complete particle size analysis.
- Establish depositional environments of units established from the interpretation of particle size analysis, geometry of units and petrology.
- Commence heavy mineral separations for further analysis.

Progress:

- Particle size analysis of approximately 180 samples has been completed. Data has been summarised.
- The establishment of depositional environments for each of the units identified has commenced but is yet to be completed. Petrography and interpretation of XRD data is pending.
- Initial heavy mineral analysis has commenced with eight samples currently being analysed with the Auto GSM based at the ARRC. Iluka Resources Limited has agreed to fund approximately half of this work and has provided \$3000 to this end. A further 50 samples will be analysed after an appraisal of the first analytical data has been completed.
- A 4.5 week field trip was to the Dundas Tablelands in western Victoria was undertaken during December 2002 to January 2003. The purpose of the trip was to undertake detailed mapping and sampling of various exposures in the Balmoral area, northern Dundas Tableland and to map, describe and sample exposures in the Chetwynd area, western Dundas Tableland. Dr Mehrooz Aspandiar, who is co-supervisor for the project, attended the first week of the field trip.

Issues and comments:

None at this stage.

Outlook and work plan for the next Quarter:

- Establish depositional environment of the various units comprising the Bondi deposit and document this work.
- Submit remaining samples for heavy mineral analysis.
- Investigate external funding sources for some drilling in the Wannan area.
- Make preliminary arrangements for the dating of detrital zircons selected samples.

PhD project: Landscape evolution Eastern Goldfields, Yilgarn (M. Craig)

Project aims:

The aim of the research is to formulate, describe, test and explain a range of suitable regional and local models which may best account for the variable character and evolution of regolith and associated landforms in the Eastern Goldfields of the Yilgarn Craton, in Western Australia that are consistent with field observations.

Work plan for the Quarter:

- Continue with regolith maps and GIS data construction;
- Plan thesis structure and commence document

Progress:

- Compilation bases for remaining three 250k sheets completed
- Map construction begun
- GIS data continues nearing completion -porting to new software
- Data entry to National Regolith Database begun

Issues and comments: No comments

Outlook and work plan for the next Quarter:

- Continue regolith map compilation and GIS data construction
- Continue data entry
- Continue document construction.

U-Pb & U-Series Dating (Project Leader: Alexander Nemchin)

Project aims:

The aim of this project is to investigate applicability of minerals formed in the regolith for the U-Pb and U-series dating. In particular, minerals to investigate can be broadly subdivided into three groups:

- a) Opaline silica
- b) Iron and Manganese oxides
- c) Carbonates

These mineral groups determine logical subdivision of project into three subprojects

Work plan for the Quarter:

Since early July we have concentrated on the attempt to develop the analytical technique, which will enable us to date opaline silica, using both TIMS (Thermal Ionisation Mass Spectrometry) and SHRIMP (Sensitive High Resolution Ion Micro Probe). SHRIMP analysis is particularly important since the fine scale inhomogeneity with respect to the U-systematics is known in many samples of opaline silica.

The aim of our work in this quarter was to finalise this part of the project and make analytical techniques available for use in regolith studies

Progress:

- a) Opal sample M21277 provided by the Royal Ontario Museum was selected as satisfying most of the selection criteria
- b) SHRIMP procedures were developed and tested during four sessions
- c) Viability of the method was evaluated by running sample previously analysed using conventional thermal ionisation mass spectrometry in Denver.
- d) Further two samples from Yilgarn Craton were analysed using both SHRIMP and TIMS to make sure that both methods give similar results

Consistency of the obtained results suggests that the method can be used for dating of unknown samples of opaline silica.

Results of this work have been reported during the CRC LEME Geochronology group meeting in Canberra in November 2002, International Goldschmidt Conference in August 2002 and discussed with Dr Leonid Neymark from USGS in Denver, who visited us in November.

Two papers are currently in preparation for publication.

Issues and comments:

Nil

Outlook and work plan for the next Quarter:

Work on Fe oxides has been started recently and we are going to concentrate on this part of the project during the following half of the year. We plan to collect series of samples representing different types of Fe-oxides from the sites selected in close consultation with Ravi Anand and study the distribution of U, Th, Pb and intermediate products of U decay. This work will form a background for the further development of dating techniques in the following quarter.

South Australia (SA) sediments (Project Leader: John Keeling)

Project aims:

Through investigations of regolith cover in areas of the Curnamona Province, Gawler Craton and Musgrave Block of South Australia, develop models of evolution of landscape and sediment accumulation that will aid prediction of element mobility associated with mineral deposits.

Work plan for the Quarter:

- Continue regolith mapping in the Mingary area of the Olary Block, Curnamona Province (Crooks).
- Finalise reports on northern Murray Basin drilling (Fabris).
- Prepare report on palaeochannel recognition and mapping using Gawler Craton examples (Hou)
- Sedimentary cover Musgrave Block: compile data for Wintinna 1:250K map sheet (P Rogers).
- Review regolith work program in the Curnamona Province (Crooks, Keeling, Fabris).
- Scope work on sedimentary cover in the Callabonna Sub-basin north of Olary Block (Fabris, Keeling)
- Presentations on sedimentary cover and regolith at Gawler Craton Seminar 5-6 December 2002 (Sheard, Hou, P Rogers).
- Regolith contributions to Explorer's Guide for South Australia (P Rogers, Hou, Fabris, Sheard).

Progress:

- Regolith mapping continues in the Mingary area in conjunction with bedrock mapping program. Line work for Radium Hill North 1:25K map well advanced with release of completed map expected late June 2003 (Crooks).
- Report on northern Murray Basin drilling reviewed and plans being drafted (Fabris).
- Draft report on synthesis of sedimentary deposition and landscape models for the northern Murray Basin completed and being reviewed (Fabris).

- Papers presented at Gawler Craton Seminar and Core Workshop by M Sheard, B. Hou and P Rogers.
- Palaeochannel studies on Gawler Craton: commenced paper for publication on models of heavy mineral accumulation in strandlines associated with palaeodrainage discharge into Eucla Basin (Hou).
- Sedimentological interpretation of palaeochannel fills over Harris Greenstone Belt completed and sections being drafted (Hou).
- Compilation of sedimentary cover on Wintinna 1:250,000 sheet 80% complete. 100K draft plans for Marla, Welborn, Todmorden and Ouldburra received for checking. Photointerpretation completed for Arckaringa and in progress on Wintinna (P Rogers).
- Mesozoic palaeodrainage, Mulgathing Palaeochannel, recognised and reported at Gawler Craton seminar (P Rogers).
- Curnamona field camp held on 16-18 Oct. Regolith site visits led by A Crooks. Discussion on future work programs and student projects (Anand, Keeling, Crooks, Fabris, James, Schmidt-Mumm, Barovich, Brown, Lau).
- Publication of paper on “North-western Murray Basin, South Australia: stratigraphy, sedimentology & geomorphology” in MESA Journal 27, October 2002, pp 20-23. (Fabris).

Issues and comments:

Work on Harris Greenstone Belt, Gawler Craton, planned to wind down during 2003. New regolith projects for the Gawler Craton to be reviewed early in 2003.

Outlook and work plan for the next Quarter:

- Review of projects against LEME and PIRSA strategic plans during January/February.
- B Hou to Perth for 3D modelling of palaeochannel systems using data from the Harris Greenstone Belt, Gawler Craton.
- Work on sedimentary cover in the Callabonna Sub-basin to commence, subject to review outcomes.

Regolith-landscape evolution volume (Project Leader: Ravi Anand)

Project aims:

To provide a framework of regolith-landscape evolution across Australia and show its relevance to mineral exploration and environmental issues.

Work Plan for the Quarter:

- Continue to receive manuscripts
- To complete the first editorial pass through the draft manuscripts.

Progress:

See attached table. Most of manuscripts received and edited.

Issues and comments:

- Many authors slow to provide figures, despite repeated reminders.
- Scientific quality variable due to lack of peer review.
- Substantial proportion of Angelo's (LEME Visual Resources Unit) time needed to draft figures.

Outlook and work plan for the next Quarter

- Independent checks to made of edited manuscripts

- Drafting of figures to be a priority
- Edited and formatted manuscripts to be returned to authors for checking
- Regional/state location diagrams to be drafted
- Commence writing on introductory chapters as well as synthesis of case histories to develop landscape models.

Contributions to CRC LEME regolith–landform evolution volume as at 30/1/2003

Author	Title	Text received	Text edited	Figures received	Figures drafted	Returned for checking
NEW SOUTH WALES (N=11)						
Chen	Wagga Wagga 1:100 000	✓	✓	✓	✓	✗
Chan	Bathurst & Forbes 1:250 000	✓	✓	✓	✓	✗
Gibson	Nth Barrier Ranges	✓	✓	✓	✓	✗
Gibson	Wonnaminta 1:100 000	✓	✓	✓	✓	✗
Gibson <i>et al.</i>	Eulura mine area	✓	✓	✓	✗	✗
Taylor & Roach	The Monaro	✓	✗	✓	✗	✗
Hill <i>et al.</i>	Sth Barrier Ranges	✓	✗	✗	✗	✗
Hill <i>et al.</i>	Tibboburra	✓	✗	✗	✗	✗
Scott	Blayney–Orange	✓	✗	✗	✗	✗
McQueen	El Capitan	✗	✗	✗	✗	✗
McQueen	Cobar	✗	✗	✗	✗	✗
NORTHERN TERRITORY (N=4)						
Nott	Kakadu–Arnhem land	✓	✓	✓	✗	✗
Wilford	Granites–Tanami	✓	✓	✓	✗	✗
Edgoose	Barkley Tableland	✓	✓	✓	✗	✗
English	Lake Lewis Basin	✓	✓	✓	✗	✗
QUEENSLAND (N=8)						
Aspandiar <i>et al.</i>	Charters Towers	✓	✓	✓	✗	✗
Wilford	Selwyn	✓	✓	✓	✗	✗
Jones	Mundubberra 1:250 000	✓	✓	✓	✗	✗
Jones	Mt Morgan – Biloela Basin	✓	✓	✓	✗	✗
Phang <i>et al.</i>	Tringadee	✓	✓	✓	✗	✗
Robertson	Pajingo	✓	✗	✓	✓	✗
Robertson	Little Eva	✓	✗	✓	✓	✗
Anand	Buckley River-Lady Loretta	✓	✗	✓	✓	✗
<i>Pillans (?)</i>	???					
SOUTH AUSTRALIA (N=4)						
Hou <i>et al.</i>	Palaeochannels, NW Gawler	✓	✓	✓	✗	✗
Lintern	Challenger	✓	✓	✓	✗	✗
Tokarev & Gostin	Mt Lofty Ranges	✓	✓	✓	✗	✗
Fitzpatrick	?	✗	✗	✗	✗	✗
VICTORIA (N=5)						
Paine <i>et al.</i>	Dundas Tableland	✓	✓	✓	✗	✗
Taylor	Ballarat Goldfields	✓	✓	✓	✗	✗
Hill	Wilson's Promontory	✓	✗	✗	✗	✗
Orr	King Island	✓	✗	✗	✗	✗
Joyce	???	✓	✗	✗	✗	✗
WESTERN AUSTRALIA (N=20)						
Harper & Gilkes	Cairlocup	✓	✓	✓	✗	✗
King	Darlot	✓	✓	✗	✗	✗
Scott & Lintern	Panglo	✓	✓	✓	✗	✗
Morris	Mt Egerton 1:250 000	✓	✓	✓	✗	✗
Johnson & McQueen	Gidji Palaeochannel	✓	✓	✓	✗	✗
Paine & Cornelius	Gourdis	✓	✓	✓	✗	✗

Paine <i>et al.</i>	Empire	✓	✓	✓	✗	✗
Butt	Mt Percy	✓	✗	✓	✓	✗
Anand	Jarrahdale	✓	✗	✓	✗	✗
Anand	Lawlers	✓	✗	✓	✗	✗
Robertson & Churchward	Telegraph Pit	✓	✗	✓	✓	✗
Robertson <i>et al.</i>	Harmony – Peak Hill	✓	✗	✓	✓	✗
Craig	King River	✗	✗	✗	✗	✗
<i>Clarke (?)</i>						
Churchward	Bottle Creek	✓	✗	✗	✗	✗
Churchward & Lintern	Mt Hope	✓	✗	✗	✗	✗
de Broekert	Lady Bountiful Extended	✓	✗	✓	✓	✗
Killick	Hammersley	✓	✗	✓	✗	✗
King	Robe River pisolite	✗	✗	✗	✗	✗
Anand	Bronzewing	✓	✗	✓	✓	✗
Anand	Mt Magnet	✓	✗	✓	✓	✗

total contributions received = 47

+ promised = 5 (Fitzpatrick, King, Craig, McQueen x 2)

+ potential = 2 (Pillans, Clarke)

Total = 54

THEME: UNDERSTANDING REGOLITH PROCESSES

Objective Regolith Logging (Project Leader: Ravi Anand)

Project aims :

To develop a practical technology for accurate and rapid logging of regolith in drill chips and pulps by identifying and understanding key features of mineralogical and physical characteristics of specific rock types and environments of regolith formation.

Work plan for the Quarter:

- Selection and retrieval of existing weathering profiles from different lithologies for further physical and mineralogical characterisation aimed at building a library of information.
- Generation of new pulp samples
- Purchase of ASD (Analytical Spectral Device) and Bartington MS2 magnetic susceptibility meter to proceed.

Progress:

- Selection and retrieval of old samples & data
Pulp samples (1400) from 40 drill holes of varied lithologies, encompassing samples from Lawlers, Mt McClure, Kanowna Belle, Mt Percy, Mt Keith, Fortnum, Beasley Creek, Lights of Israel and Reedy dating from 1989 to 1994 were retrieved from Floreat geological store. Availability of geochemical data tend to be good and data were gleaned from CD of open file reports. XRD data were extracted where available.
- Generation of new samples and data
New pulp samples processed include 3 drill holes from Gidgee, Enterprise pit profile (Mt Gibson) and Lancefield Permian sediments. Magnetic susceptibility and swirl reflectance data are also generated. XRD of selected samples from Gidgee and all samples from Enterprise undertaken.
- ASD order submitted in December.
- Reflectance spectroscopy in the VNIR region in combination with XRD of two profiles underlying a salt lake (Lake Lefroy) was conducted by an Honours student and evaluated. The ASD FieldSpec was able to identify hematite, goethite, kaolinite (and its disorder index), gypsum, chlorite, biotite and carbonates. Mineralogical criteria -presence of gypsum in sediments and chlorite/biotite weathering products in saprolite - was able to approximately distinguish transported regolith (sandy and clay sediments) from *in situ* regolith developed over mafic and felsic lithologies. Future work will concentrate on refining the kaolinite index and alteration mapping via detection of compositional changes in phyllosilicates associated with hydrothermal alteration.
- Proposal to locate Spectral Core Scanner in Adelaide for 3 months early in 2003 was stalled by PIRSA budget constraints. Likely to happen later in the year.

Issues and comments:

- Retrieving old pulp samples proved challenging as the storage boxes for these samples have not been arranged in sequence as a result of several past reshufflings.

Outlook and work plan for the next Quarter:

- Select samples from existing weathering profiles from different lithologies for further XRD aimed at building a library of information.. With the XRD costing dropping to \$5.00, more samples will be sent for XRD in due course.
- ASD measurements to proceed with arrival of new ASD machine in Jan 02 and correlation of ASD data with XRD and geochemical data.

Mineral Mapping, South Australia (Leader: Alan Mauger)

Project aims:

- Mapping previously unrecognised saprolite at the surface;
- Establishing which minerals survive the weathering process enabling determination of basement mineralogy.

Work plan for the Quarter:

- Commence processing of Pine Creek Hymap data
- Sean Mahoney to complete Honours Thesis.
- Paper on Automated Core Logger to be prepared and circulated among sponsors of AMIRA P685 for approval.
- Paper on Hyperspectral data analysis over Screechowl Creek to be prepared.
- Ian Lau to conduct further field work on White Dam Hymap data.

Progress:

- Prepare mineral distribution map of Tarcoola Mine Site using HyMap data calibrated against ASD spectra from ground samples. Delayed.
- Processing of Pine Creek Hymap data: - Pima'd surface samples received from John Howard, Flinders Diamonds to support hyperspectral survey over Pine Creek kimberlite. Field visit and image processing delayed until Jan-03
- Sean Mahoney completed Honours Thesis and presented results
- Paper on Automated Core Logger – Delayed. Proposal being considered to deploy scanner in South Australia before end of Financial Year 2002-2003. This would include CRCLEME material
- Paper on Screechowl Creek commenced but not completed.
- ASTER – Received software to enable corrections for crosstalk. Produced AIOH Image of Tarcoola. – Requires ground truthing.
- Assisted in CSIRO ground truthing of ASTER mineral maps over Curnamona
- Undertook excursion to Beltana, Beverley and Olary with Ravi Anand and John Keeling.
- Delivered remote sensing lecture at Adelaide University to 3rd Year Undergraduates in Geology
- Ian Lau conducted further field work on White Dam HyMap data. Collected samples for PIMA/ASD with which to calibrate HyMap interpretation.

Issues and comments

Nil

Outlook and work plan for the next Quarter

- CRCLEME Course on ENVI/Hyperspectral Analysis for Geologists –to be presented by Mauger, Lewis and Stamoulis with assistance from Lau (February 17-21, 2003)
- Commence field work and processing of Pine Creek Hymap data
- Interpret PIMA Spectra from Lake Harris Greenstone Belt
- Paper on Automated Core Logger to be prepared and circulated among sponsors of AMIRA P685 for approval.

- Paper on Hyperspectral data analysis over Screechowl Creek to be prepared.
- Paper on Poona Mine re: use of PIMA to map vectors to ore. Co-authors Keeling and Scott.
- Paper on use of ASTER data over Peak and Denison Ranges to be published in MESA Journal (Stamoulis).
- Gibraltar – estimate mineral assemblages from whole rock analyses and compare to PIMA/ASD spectra and HyMap spectra.

PhD project : Mineral mapping (Ian Lau)

Project Aims:

Establish techniques to identify previously unrecognised weathered basement appearing at the surface.

Identify the mineral signatures of concealed mineralised basement as manifested in surficial material

Work Plan for the Quarter:

- PIRSA/ CRC LEME field trip to Olary district in October (3 days)
- Field work in November, ground truthing (10 days)
- Spectral measurements interpretation
- VNIR sampling of Lau and Brown's field samples (2 days)
- MIM core library spectral sampling (5 days)
- ASD spectrometer sampling
- Construction of a three dimensional spectral map of the White Dam, Green and Gold and Wilkins mineralisations
- Learning of programming languages
- IGARSS conference abstract and paper preparation
- ASTER Level 2 data acquisition and processing
- Finish processing hyperspectral mineral maps
- Finish regolith-landform map from orthoimagery and other datasets
- Geophysical dataset integration (Gamma ray spectroscopy)
- Drawing of preliminary regolith landform map from orthoimagery and other datasets
- Processing of hyperspectral imagery into mineral maps

Progress:

- Attended PIRSA/ CRC LEME field trip to Olary district in October
- Prepared for field trip, creating base maps and locations to ground truth
- Constructed spectral logs of percussion drill holes
- One week field trip to area of study collecting samples and ground truthing locations, consisting of 250+ site locations, 600 photos and 250+ samples.
- Completed IGARSS abstract preparation
- Attended AIG Geophysics Symposium
- Attended structural drill core course
- Attended Gawler Craton symposium
- Calibration problems found in corrected dataset resulting in poor extraction of minerals, solution: attempt to recorrect the data.
- Preliminary regolith landform map drawing, unfinished
- Three dimensional interpretation of landforms, unfinished
- Processing of hyperspectral data, unfinished
- ASD instrument was unavailable for use during this period.
- Authorisation for sampling of MIM core was not obtained. If sampling was to be performed an instrument with at least VNIR-SWIR capabilities would be preferred over the PIMA.

- Acquired full radiometric coverage of Hymap flight area
- Acquired TSG software
- Commenced TSG analysis of PIMA samples

Outlook and work plan for the next Quarter:

- ACORN (Atmospheric Correction) reprocessing of HyMap
- Finish processing hyperspectral mineral maps
- Finish regolith-landform map from orthoimagery and other datasets
- Geophysical dataset integration (Gamma ray spectroscopy)
- Sample preparation
- PIMA sampling of November field samples
- Spectral measurements interpretation
- VNIR sampling of Lau and Brown's field samples
- ASD spectrometer sampling if available (early February)
- Tetracorder evaluation
- Learning of programming languages and LINUX operating system
- IGARSS conference abstract and paper preparation
- Drill hole log interpretation and write up of results

Mineral Hosts (Project Leader: Ravi Anand)

Project Aims:

This project investigates the association between regolith minerals and trace elements from various mineral deposits. Emphasis is placed on both in situ (including amorphous phases) and transported materials as well as developing innovative techniques to separate desirable mineral phases. Research will provide an insight into the dispersion processes for trace elements into mineral hosts, the probable mechanisms involved and recommendations for exploration procedures.

Work plan for the Quarter:

- Continued optical petrography
- Detailed scanning electron microscopy using the Philips XL-30
- MicroRAMAN study to establish usefulness of the technique in characterisation.
- Investigate the possibilities of using Electron back-scattered diffraction and OC imaging.
- Electron microprobe analyses.

Progress:

Samples

We have completed our initial sampling strategies including sample site selection and, sub- sampling from already available collections. Using, largely LEME reports and datasets we have identified key samples of interest based on anomalous trace element concentrations, and have prepared polished thin sections.

Analytical techniques

SEM:

Detailed scanning electron microscopy continued this quarter. We have established relationships between minerals that now require trace element analyses to elucidate their role as sinks for the elements of interest. SEM investigations have also allowed us to image bright contrast phases such as zircon and ilmenite that may become important in identifying in-situ/transported transitions in the regolith profile.

MicroRAMAN:

MicroRAMAN spectroscopy is proving an interesting technique for in-situ mineralogical identification in thin sections. We have obtained preliminary results characterising iron oxide mineral phases from cores to cutans in pisoliths. The next stage is to study clay phases and explore the possibility of mapping areas of thin sections.

MicroRAMAN spectra will enable us to gain information on the crystallinity of different phases (e.g. kaolinite) and identify the extent of element substitution in some minerals.

EBSD and OC imaging

Electron back-scattered diffraction and orientation contrast imaging provides crystallographic information using an SEM, allowing us to view the true crystallographic texture in grains over a wider area than possible with TEM. The system requires a “perfect” polish to the thin section surface. We have prepared a pisolitic duricrust sample for investigation using the technique. Orientation contrast imaging of the sample showed little variation at the first attempt, probably indicating that polishing attempts so far, have failed to produce a pristine surface. Potentially, iron oxide nodules may reveal internal crystallographic textures, and we aim to make further attempts to view this using EBSD and OC imaging.

Trace element analyses:

We have now identified mineral associations in several samples (e.g. Mt Gibson and Lawlers) that require trace element analyses. While continuing to investigate other associations using optical and SE microscopy we intend to begin electron microprobe analyses this coming quarter and plan LA-ICPMS analyses also.

Issues and Comments:

We are pleased with current progress and anticipate significant data in this, the second half of the year.

Outlook and Work Plan:

We are now in a strong position to undertake more detailed mineralogical and geochemical analyses (using the techniques below) at Lawlers and Mt Gibson. Significantly this will involve trace element studies using the electron microprobe for point, transect and possibly mapping analyses. It is envisaged that we will plan LA-ICPMS analyses in this quarter also.

- Scanning electron microscopy on the Philips XL-40 SEM
- Electron Backscattered diffraction and orientation contrast imaging
- Electron microprobe point analyses of key phases identified
- Further microRAMAN studies of mineralogical associations
- ASD analyses to investigate suitability for smaller scale rather than purely bulk analyses.
- Concerted efforts on Lawlers and Mt. Gibson samples will then be followed with similar studies of other sampling sites e.g. Mt McClure to widen our knowledge of anomaly development in differing environments and scenarios.

PhD Project: Gold in calcrete (M. Lintern)

Project aim:

The principal objective of the project is “to better understand the formation of Au-in-calcrete anomalies in the regolith and develop more effective procedures for their use in mineral deposit detection”.

Work plan for the Quarter:

- Continue to formulate ideas for project
- Submit final candidacy proposal
- Undertake more analyses on samples from two proposed study sites and further consider suitability for inclusion in project.

Progress:

- Final candidacy proposal accepted and approved by Curtin University.
- Studies indicate the presence of gold in sandy material above the calcrete. Repeat analyses indicate that this is particulate gold. Investigations will continue to determine how this Au arrived there and how it may become incorporated in the calcrete.
- Continued to formulate ideas and scope for project. Read literature.

Issues and comments:

The year finished ahead of schedule since the principal requirement was to submit candidacy to university. Some of the work completed in the South Australian Regolith Project and the Harris Greenstone Belt Project may be supplemented and included in the PhD.

At present the gold in calcrete project is comprised only of my PhD. I would like to see the project expanded and include other studies on this topic but managed under the “umbrella” of this project. The gold in calcrete association is well known but our understanding on how it forms is poorly understood. Clearly, the exploration industry is still unsure on how to rank the myriad of anomalies it has to deal with, particularly in South Australia. Calcrete is the prime regolith material used in exploration in South Australia.

Outlook and work plan for the next Quarter:

- Continue to formulate ideas for project. Read literature.
- Undertake more analyses on sand samples from ET study site to determine extent of the Au anomaly in this material.
- Two of the next three months will be away on long service leave.

Electrical & EM Regolith Studies (Project Leader: Graham Heinson)

Project aims:

- New ground-based electrical and EM techniques, such as multi-receiver electrical and EM systems, nuclear magnetic resonance, audio-magnetotellurics, electrical resistivity tomography, self potentials and tensor resistivity, will be developed to define regolith hydrogeological properties and bedrock mapping beneath cover.

Work plan for the Quarter:

- November 2002

Completi

- December/Jan 2003: Recruitment of two new Ph.D. students and up to four Honours students

Progress:

Completion of Honours projects

- (a) Katherine Broxholme (formerly Selway) UA LEME Honours Scholar: Two-dimensional magnetotelluric response of three-dimensional bodies
Outcome: 1st Class Honours, Newmont Prize for top Geophysics Student
- (b) Barrett Cameron CU : Rapid acquisition of audio frequency magnetotellurics.
Outcome: 2A Class Honours
- (c) Brendan Coleman UA: Collection and inversion of IP/resistivity data
Outcome: 1st Class Honours
- (d) Tania Dhu UA: Environmental monitoring using cross-borehole electrical resistivity tomography
Outcome: 1st Class Honours
- (e) Jared Townsend CU: Comparison of transient electromagnetic sensors for detection of conductive targets beneath conductive overburden
Outcome: 2A Class Honours

Continuation of MSc/PhD

- (a) Brian Barrett MSc UA (LEME Scholar): Salinity management of the River Murray using hydrogeophysical methods
Progress: Completed one year and structured program. Submission Feb 2003.
- (b) Hashim Carey MSc UA: Exploration of mineralisation beneath cover using applied and natural potential methods
Progress: Completed nine months and structured program. Submission Aug 2003.
- (c) Don Hunter Ph.D. CU (LEME Scholar): Applications of nuclear magnetic resonance in groundwater studies
Progress: Completed one year of program
- (d) Margaritta Norvill Ph.D. CU (LEME Scholar): The use of distributed sensor arrays in electromagnetic imaging
 - Progress: Completed one year of program

Commencement of new staff at University of Adelaide

Dr John Joseph (From Geological Survey of Japan, November, 2002)

Dr Nick Direen (From Geoscience Australia, October, 2002)

Issues and comments:

The project has largely been driven by Honours and Postgraduate student research, in collaboration with a number of industrial partners. With five honours students, and four postgraduate students, productivity has been high with real outcomes for industry. Student projects in 2003 will be structured in the same way.

In 2002, Newmont Australia Pty paid a scholarship at the APA rate of \$18 K to Hashim Carey for his MSc work in the LEME project. Hashim has made excellent progress (paper for Geophysics is in preparation) and is expected to finish in August 2003. In 2003, Newmont have committed a further \$5 K towards Hashim's scholarship. To top up the scholarship to APA levels, the AU group (Heinson, Greenhalgh) decided to fund Hashim a half-scholarship of \$9 K from the Project funds.

Outlook and work plan for the next Quarter:

Enrolment of new postgraduate and Honours students in February 2003.

- Brendan Coleman (Ph.D., University of Adelaide)
- Katherine Selway (Ph.D., University of Adelaide)

Completion of postgraduate degree

- Brian Barrett (MSc, University of Adelaide) Scheduled for February 14th.

LEME Project 1.6/2.6 presentations at the forthcoming 16th ASEG Conference in Adelaide, 2003.

Salinity monitoring of the Murray River using towed TEM array - Barrett, B, Heinson, G, Hatch, M & Telfer, A

Environmental monitoring using electrical resistivity tomography - Dhu, T, Heinson, G, Simmons, C, Greenhalgh, S & Halihan, T

Detecting sub-surface groundwater flow in fractured rock using self-potential (SP) methods - Fagerlund, F & Heinson, G

100% duty cycle TEM: Faster acquisition and less noise - Kepic, A & Adams, B

Geophysical monitoring tree root zones - Kepic, A & Campbell, T

Crosshole electrical imaging of aquifer properties and preferential flow paths - Zhe, J, Greenhalgh, S & Zhou, B

LEME Project 1.6/2.6 presentation at the forthcoming 3DEM conference Adelaide, February 2003.

Two-dimensional Magnetotelluric Responses of Three-dimensional Bodies - Broxholme, K. Heinson, G.S. Busutil, S. and Lilley, F.E.M.

Papers

Two-dimensional magnetotelluric responses of three-dimensional bodies - Broxholme, K. Heinson, G.S. Busutil, S., Lilley, F.E.M. (submitted to Exploration Geophysics Feb 2003)

Exploration of mineralisation beneath cover using applied and natural potential methods - Carey, H., Heinson, G.S. and Sexton, M. (to be submitted to Geophysics, February 2003)

Water-borne geophysics for Murray River salt-load detection - Barrett, B, Heinson, G, Hatch, M & Telfer, A (to be submitted to Groundwater, March 2003)

2.2 Program 2: Mineral exploration in areas of cover

Acting Program Leader: Keith Scott

Overview

Since the departure of Nigel Radford in October, I have endeavoured to more fully understand the work being undertaken in the program by meeting with the Program 2 staff in Adelaide and Canberra as opportunities presented themselves. Opportunities to develop significant projects in the Stawell area of Victoria, on calcrete in South Australia and AMIRA P779 (Pearce Element Ratios) are being pursued.

A major recognition of the quality work being done within the program was afforded by the release of regolith mapping products as part of the NSW Department of Mineral Resources Data Release at Broken Hill on 29 November.

Public presentations of work within the program was also afforded by presentations at the Gawler Craton 2002 Symposium in Adelaide on 5-6 December and the Eastern Australian Regolith Conference in Canberra on 21-22 November. Approximately half the presentations at the latter conference were by Program 2 personnel, especially students.

During the quarter, sponsored projects involving \$42k (Triako \$28k, Geol Surv WA \$10k and Straits Resources \$4k) were commenced.

See fuller details below:-

PROJECT 2.1 WESTERN NSW REGOLITH (Project Leader: Patrice de Caritat)

Project: Western New South Wales Regolith

Project aims

Principal objective

Stimulate mineral exploration in Western NSW through greater understanding of the regolith

Specific objectives

- Develop mineral exploration approaches for regolith-dominated terrains in Western NSW, especially those dominated by thin to thick sedimentary cover
- Regolith-landform mapping at 1:25,000 and 1:100,000 scales
- Develop regional regolith and landscape evolution models, and emphasise their importance to mineral exploration
- Develop and host short-courses specific to regional regolith and exploration issues, as well as relating to fundamental themes (such as specific sampling approaches)
- Develop learning outcomes and training opportunities for undergraduate and post-graduate students and professionals in government departments and private industry

Work plan for the Quarter

- Hydrogeochemistry: complete Bancannia field trip
- Eastern Australia regolith conference 21-22/11/02: present project results
- Map release at Broken Hill 29/11/02 + field excursion

Progress (include progress against milestones)

The progress achieved in this project was recently detailed in a document posted on the LEME website (<http://www.crcleme.org.au/Research/p2PROJECTS/nswregdec02.pdf>) and includes some tremendous achievements, some of which are for the reported quarter. Since then, we have all continued our efforts, and here are the main points to report on here:

- Continuing production of Broken Hill 1:25,000 maps, reports and supporting documentation
- Release of Pinnacles, Mount Gipps and Tibooburra at Ministerial launch at Broken Hill on 29/11/02, and putting regolith on the front page of Broken Hill's *Barrier Daily Truth* the next day
- Successfully generated IGS funds to ANU without them contributing to project development or completion
- Successful move to Adelaide by Steve Hill
- Continued progress on Teilta 1:100K map and report, and Flying Doctor report and research
- Preparation of paper on using isotopes in groundwater to recognise buried basement signatures
- Submission of three landscape evolution case studies (Southern Broken Hill Block; Tibooburra Inlier; Western NSW Overview) to Ravi Anand for LEME volume
- Preparation of three mineral exploration case studies (Flying Dr; Great Goulburn; Staurolite Ridge - North Tank) to be submitted shortly to Keith Scott for inclusion in LEME volume

Progress against milestones

Date	Milestone (from Project proposal)	Status
9/01	Commence Project	Done
	Appoint Regolith Geologist and begin compiling Ascot Vale, Oakdale and 1:25,000 regolith-landform sheets (SH & PdC)	Done: Kylie Foster appointed. Maps started changed to Pinnacles, Mount Gipps and Tibooburra
	Presentations at 7 th Australasian	Done: Conference attended and

	Conference on Isotopes in the Environment (PdC, DK, RD)	presentation made
12/01	First Honours projects conclude (Stephens Creek catchment study, Tibooburra Inlier regolith-landforms)	Done: Theses by Rod Dann and Tess Chamberlain submitted and passed (UC)
3/02	Review 1	Done: Meeting held with NSW DMR in Sydney in 2/02
6/02	Release Ascot Vale, Thackaringa and Oakdale 1:25,000 regolith-landform sheets (TBA Geologist, SH & PdC)	Delayed: Maps of Pinnacles, Mount Gipps and Tibooburra released 11/02
7/02	Koonenberry PhD study commences	Delayed: Student identified still completing Honours, then found a job
	Commence further 1:25,000 mapping of the Broken Hill Domain (either north or south of existing belt of mapping)	Done: Wahratta, Rockwell and Mount Gipps maps started
	Presentations at AGC, Adelaide	Done: Conference attended and presentations made
2/03	Commence Yr 2 Honours projects in Tibooburra region	--
3/03	Review 2	--
10/03	Conclude Yr 2 Honours projects in Tibooburra region	--
2/04	Commence Yr 3 Honours projects in Tibooburra region	--
3/04	Review 3	--
6/04	Project concludes	--
Continuation of this project beyond Yr 3 (pending funding) will include the following milestones:		
10/04	Conclude Yr 3 Honours projects in Tibooburra region	--
12/04	Release Koonenberry 1:100 K regolith-landform maps	--

Issues and comments

- Integration of new students from Adelaide needs to occur.
- Invitation to present a short course on "Hydrogeochemistry in Exploration" at the next Intl Geochem Explo Symposium in Dublin (8/03). Will LEME support with funds whatever costs (probably ~\$2K) can not be recovered from the organisers? This is a chance to get LEME visible on the international scene at minimal cost

Outlook and work plan for the next Quarter

- Wahratta map and report
- Finalise documentation of project methodologies
- Complete Teilta 1:100K map by BHEI conference (7/03)
- Report on Broken Hill groundwater results
- Submit abstracts for BHEI conference
- Commence PhD project for Karen Hulme and Honours project for Samuel McDermott

PROJECT 2.2 GIRILAMBONE BELT **(Project Leader: Ken McQueen)**

Work Plan

Work planned for the October-December quarter 2002 included:

- A planning and update meeting to be held on 20th November at GA in Canberra.
- Printing of the final report and map on the regolith landform mapping and drilling results for Stage 2 of the project (Hermidale 1:100 000 area)

- Preparation of regolith-landform maps of the Byrock and Glenariff 1:100 000 sheet areas, prior to Stage 3 drilling in the first half of 2003.
- Construction of a drill hole traverse regolith section to accompany the Byrock and Glenariff maps standard regolith maps. It is envisaged that the section will form a model to be tested by the drilling.
- Planning of drill traverses and initial field work on the next stage of the project in the Byrock-Glenariff area.

Work Done

- The planned Girilambone project meeting was held on 20th November. This was attended by most staff in the project, together with Peter Lewis, Guy Fleming (NSW DMR) and Paul Link (visiting fellow, Idaho State University). We are making good progress on the project and agreement was reached on the schedule of activities in the next stage of the project.
- Most staff in the Girilambone project attended the CRC LEME Eastern Australian node conference “Regolith and Landscapes in Eastern Australia” 21-22 November. Roslyn Chan, Ben Maly, and Richard Greene presented results of some of their work related to the Girilambone project.
- Ken McQueen completed a 1 week field trip to the Cobar area from 25/11-2/12/02. He was accompanied for 3 days by student Martin Smith, who collected a series of samples for palaeomagnetic dating across the Girilambone-Cobar block, and Dr Paul Link (visiting fellow, Idaho State University) who collected a series of samples for detrital zircon characterisation. Ken also visited personnel from Peak Gold Mines and the CSA mine for discussions about ongoing and potential future projects. Details of a possible honours project in the CSA area were firmed up with Cobar Mines Management.
- Roslyn Chan and Ben Maly continued work on the geomorphic and regolith aspects of the Hermidale and Byrock-Glenariff areas. The final report on the regolith, geomorphology, geochemistry of the Hermidale area was printed and a CD version prepared for open file release. The accompanying regolith-landform map of the Hermidale 1:100 000 area was also printed.
- Peter Buckley continued work on the Byrock regolith-landform map, which is now available in draft form. Peter has also completed line work for half of the Glenariff 1:100 000 sheet area including areas that are likely to be drilled in the first half of 2003. Preliminary work has also begun on a three dimensional "drape" of the Byrock regolith map over a digital terrain model. This representation tool will be useful for demonstrations to stakeholders/interested parties and will also be included within the project GIS.
- Mike Hicks collected information from existing drill-hole data in the project area and helped prepare a preliminary Magnetic Basement Interpretation map. Significant interest was shown in this map by mineral explorers at a SMEDG meeting.
- Results on some apatite fission track dating for samples from the Girilambone-Cobar area were received during the quarter from Apatite to Zircon Inc. These results are very exciting and indicate apatite closure ages from ca. 290-178 Ma with long track lengths. Interpretation of these data suggests rapid cooling in the Permian to Jurassic, with the samples remaining at low temperatures since this time. This is consistent with relative stability in the region and limited cover for the last 180 ma at least.

- Work was completed by Keith Scott on evaluation of existing analytical data and a representative suite of samples from Stage 1 of the project (Sussex Sheet) analysed by Analabs were reanalysed by ALS laboratories for comparison between laboratories. Bottom of the hole samples from the Stage 2 drilling were also submitted to GA for whole-rock XRF analysis.
- Using PIMA and carbonate detection results, a suite of samples of transported material was selected from specific profiles for further study by Susan Tate (LEME Summer Scholar) under the supervision of Richard Greene. Susan will be working further on this and similar material as part of her honours project at ANU (Co supervised by Richard Greene, Keith Scott and John Wilford).
- Richard Greene continued work on the characterisation of the properties of the transported aeolian materials that form part of the regolith in the study sites of the Girilambone Project.
- Kamal Khider completed statistical analysis of the Hermidale geochemical data set as part of his PhD study. Results of this work were presented at the November meeting.

Major Issues

- Ben Maly requested that he be allowed to end his contract 2 weeks early in order to be available for work on another contract position in LEME. Ben was able to complete most of his outstanding work duties, and has agreed to be available to finalise some outstanding tasks. Anthony Senior will be replacing Ben Maly as Technical Officer on the project in 2003.

Outlook and work plan

A large part of the last quarter was spent in finalising reports and maps for Stage 2 of the project and in preparation and reconnaissance work for the next stage of regolith-landform mapping and air-core drilling on the Byrock-Glenariff area. It is planned to commence the drilling program in the first half of 2003 (possibly March or April) contingent on timing of funding from the NSW DMR. Additional field activities are planned for February. Work progress is on track.

PROJECT 2.3 HARRIS GREENSTONE REGOLITH GEOLOGY/ GEOCHEMISTRY SA

(Project Leader: Malcolm Sheard)

Project aims

- To understand the regolith geology and geochemistry of the Harris Greenstone Belt (HGB), Gawler Craton, South Australia. Refer to first report for details.

Work Aims this Quarter

- Complete logging & photography of the Phase 2 regolith drill cores ~134m from 3 holes, select sample loci for detailed geochem & XRD work, have draft Lake Harris Regolith-Landform map available.
- Present interim results at & show core at the “Gawler Craton 2002 State of Play” conference in Adelaide.

Work Done

- Logging, photography & digital files made of the Phase 2 fully cored HQ diamond holes was completed in November.
- Draft “Weathered Rock Atlas” for this area edited by MJS & further refined my IDMR.
- Geochemical analysis of field collected regolith samples from the March site visit and drillhole cuttings has been refined and further interpretation-editing underway.
- Regolith-Landform map of the NW corner of Lake Harris area at 1:10,000 scale drafted to preliminary colour stage by PIRSA Spatial Information Drafting Branch. A simpler polygon tagging system, brighter colours used and regolith zonal depth information included than is generally done on such maps.
- Ian Robertson came to Adelaide in November to inspect core, advise on sampling loci choice + appropriate sample tests & interpretation of regolith zonal boundaries.
- Attended & participated in the “Gawler Craton 2002 State of Play” conference in Adelaide. Interim results presented by oral paper, with preliminary regolith-landform map open for critical review + recently acquired regolith drill core displayed.

Major Issues

- Delays in achieving end milestone due to the intrusion of other government business matters, administration issues, requests for information, various meetings, conference paper-display preparation work, lab work – impregnated thin-sections of clays (time consuming), Ian Robertson’s 6 week medical leave, and map drafting taking longer than expected.
- Project Report completion time now extended to ~April-May 2003.

Lessons Learned

- To make time allowance in all projects for the significant intrusion of administration matters, home agency core business, requests for information & input to students (~3.5 weeks/quarter this time).

Outlook and work plan for next quarter

- Continue to work on the 3 x HQ diamond drill cores (assays, XRD etc).
- Photography of ~100 chip trays still to do.
- Continue work on Reports, prepare Project Review items.
- Propose new project work for new FY with funding by PIRSA-OMER and/or TEiSA grants.

PROJECT 2.4 SOUTH AUSTRALIAN REGOLITH (SAR) (Project leader: Mel Lintern)

Project aim

To develop techniques for exploration in regions of transported overburden in the Gawler Craton by understanding the relationships between geochemical dispersion patterns, weathering processes and evolutionary stages of regolith and landform development over a nominated site of concealed materialisation.

Work plan for the Quarter

Publish ET and SAR final reports

Progress

ET report with Charles Butt awaiting final review and approval for release

SAR report awaiting diagrams but text complete. Important findings from the SAR Report include:

- (i) It is important to establish the regolith stratigraphy and landforms for the area being explored since surficial geochemical sampling programs are sensitive to regolith materials and depth of transported overburden. Remote sensing methods such as radiometrics, aerial photography, Landsat TM, ASTER and AIRSAR can give important information on the nature of the topography and as an aid to mapping the distribution of surficial materials. Other ground penetrating methods such as AEM may give sub-surface information such as the presence and depth of palaeochannels.
- (ii) The construction of large scale regolith landform maps (preferably more detailed than 1:10000) is recommended. The maps should provide information on the distribution of regolith materials and provide some indication as to the extent of transported materials and thickness at the prospect scale. Small scale regolith maps e.g. 1:100000 are useful at providing an overview but are not recommended for any sampling programmes as they do not have the required detail.
- (iii) Distinguishing *in situ* from transported regolith is important from the sampling perspective as geochemistry will give very different response depending on the depth of cover. The presence of cover may be inferred from examining field regolith landform relationships, but selected quality drilling can provide definitive information. The use of PIMA spectra has some merit in establishing transported-*in situ* boundaries provided that kaolinite occurs. Geochemistry can be used in some circumstances to discriminate between cover sequences and weathered crystalline basement.
- (iv) Calcrete is the best near surface sampling medium for Au and should be used as a first pass geochemical sampling technique. It occurs usually within a metre of the surface and is readily identifiable using dilute acid. It works best as a guide to mineralization where transported overburden is absent or thin (<5 m), and where there is development of saprolite rather than fresh rock. Local topography may lead to the development of transported anomalies located away from their source mineralization.
- (v) Hilly terrain is well suited to stream sediment sampling and orientation surveys, investigating the most appropriate size fraction(s), are recommended at each site.
- (vi) Biogeochemical methods were shown to be of limited application in the Gawler Craton. Our understanding over how and why metals accumulate in plants and form anomalies remains limited. Several unexplained anomalies require further testing.
- (vii) In the absence of calcrete, other sample media may be used but anomalies are either weaker or more erratic. Silcrete has been shown as a sample medium for the first time (at Challenger). It can be used for Au exploration provided that it has developed within *in situ* materials. Soil often has an aeolian component so the use of fine or coarse size fractions is recommended in order to remove sand that

acts as the chief diluent to elements of interest. Groundwater as a sampling medium was not investigated to any great extent.

(viii) Partial extractions are not recommended *per se* as conventional total extraction procedures were found to be equally as satisfactory, easier to interpret and more cost-effective. They may have some merit for investigating the nature of anomalies and how they form. Selective extractions are potentially of greater benefit since they may be used to understand the behaviour of elements in regolith materials. They indicate if it is worth targeting a particular mineral or size fraction in a sample. There are many different types of selective extraction procedures and a few were tested during the course of this project. Their use in finding buried Cu and Co mineralization was investigated but failed.

(ix) Multi-element geochemistry should be used with caution. Understanding the nature of the mineralization being sought, potential associated pathfinders, the type of regolith material being sampled and the extra cost are important considerations for its use. For Au in the western Gawler Craton, multi-element geochemistry was of limited since mineralization was not associated with rich concentrations of pathfinder elements such as As or Cu, as may be found in the Yilgarn Craton, for example. Furthermore, the paucity of Fe-rich regolith materials, such as lateritic duricrust or ferruginous lag, meant that these metal-scavenging materials cannot be used systematically in an exploration program.

(x) For calcrete, it appears that the isotopes data are consistent with a marine source for the Ca and a biological origin for the C. This is consistent with other studies that have been performed on calcretes from South Australia and in other parts of the world. The S isotopes suggest a marine source although the distribution of discrete accumulations of gypsum in certain portions of the regolith at Challenger Gold Deposit require more explanation.

Issues and comments

None

Outlook and work plan for the next Quarter

Publish ET Regolith Project Final Report.

Publish SAR Final Report – this will be a synthesis of all work undertaken as part of this project. A GIS (including metadata) may be constructed given funding.

PROJECT 2.6 ELECTRICAL AND EM REGOLITH STUDIES

(Project leader: Graham Heinson)

(SEE PROGRAM 1 - PROJECT 1.6)

PROJECT 2.7 REGIONAL SEEPAGE EXPLORATION GEOCHEMISTRY

(Project leaders: Rob Fitzpatrick and Marion Skwarnecki)

Project aims

a) Geochemical dispersion in acid sulfate soils, seeps and regolith Mt Torrens prospect:

The principal objective of this project is to determine whether saline acid sulfate seeps and regolith can be used as exploration sampling media.

b) Regional geochemistry of acid sulphate soils and saline seepages: a potential new exploration tool for detecting base-metal mineralization: To determine whether regional sampling of acid sulphate soils and seeps can detect base-metal mineralization.

Work plan for the Quarter

a) Geochemical dispersion in acid sulfate soils, seeps and regolith Mt Torrens prospect:

- Commence writing two papers on Acid Sulfate Soils for international journals.

b) Regional geochemistry of acid sulphate soils and saline seepages: a potential new exploration tool for detecting base-metal mineralization.

- Interpretation of geochemical data and completion of final report.
- Continue discussions with Paul Wilkes (acting CEO), John Keeling, Ravi Anand, Charles Butt, Wayne Meyer and Mirko Stauffacher to finalise the high-priority new CRC LEME geochemist appointment in Adelaide.
- Prepare and present keynote address "Environmental Science and the Agriculture Industry with emphasis on soils and agronomy: Time Bomb or New opportunities?" at the Australian Synchrotron Project Workshop on New Opportunities for Soil and Environmental Science (3-4 October, Melbourne).
- Present overview of "Geochemical and mineralogical processes in acid sulfate soils: implications for environmental and mineral exploration significance" at the CSIRO Glass Earth workshop in Sydney in early December.
- Continue to develop a colour brochure on Theme: Acid sulfate soils: regolith processes and implications.

Progress

a) Geochemical dispersion in acid sulfate soils, seeps and regolith Mt Torrens prospect:

- Two papers incorporating aspects from the above investigations are being written for Geoderma (near final draft) and Australian journal of Soil research (draft prepared).

b) Regional geochemistry of acid sulphate soils and saline seepages: a potential new exploration tool for detecting base-metal mineralization.

- Swanny and Rob – submitted a plan of action followed by fortnightly progress reports to Dennis Gee on progress.
- Commenced report entitled: Regional geochemical dispersion in acid sulfate soils in relation to base-metal mineralization of the Kanmantoo Group, Mt Torrens-Strathalbyn region, eastern Mt Lofty Ranges, South Australia.
- Presented a keynote address "Environmental Science and the Agriculture Industry with emphasis on soils and agronomy: Time Bomb or New opportunities?" at the Australian Synchrotron Project Workshop on New Opportunities for Soil and Environmental Science (3-4 October, Melbourne).
- Presented an overview of "Geochemical and mineralogical processes in acid sulfate soils: implications for environmental and mineral exploration significance" at the CSIRO Glass Earth workshop in Sydney on 7th December.
- Continued to develop new projects on "Acid sulfate soils: regolith processes and implications"

- Positive discussions were held with Dennis Gee, Keith Scott, John Keeling, Pat James, Ravi Anand, Wayne Meyer and Mirko Stauffacher to finalise the extension of Swanny's contract to the end February.

Issues and comments

Staff matters and appointments

- Current project staff would like to have open discussions with Dennis Gee, Keith Scott, Colin Pain, John Keeling, Ravi Anand, Charles Butt, Wayne Meyer, Mike McLaughlin, Mirko Stauffacher and Ken Lawrie to discuss the appointment of a CRC LEME geochemist in Adelaide: to continue work on a national project involving "Acid sulfate soils: regolith processes and implications" AND also work on new projects with CEM, PIRSA and University of Adelaide.

Outlook and work plan for the next Quarter.

(a) Geochemical dispersion in acid sulfate soils, seeps and regolith Mt Torrens prospect

b) Regional geochemistry of acid sulphate soils and saline seepages: a potential new exploration tool for detecting base-metal mineralization.

- Finalise and submit two papers on Soil-regolith models to Geoderma and Acid Sulfate Soils to AJSR
- Complete four papers on:
 - (i) geochemistry and mineralogy of the Mt Torrens gossan
 - (ii) rock weathering and implications for salinity in the Mt Lofty ranges
 - (iii) geochemistry of acid sulfate soils at Mt Torrens prospect and implications for mineral exploration
 - (iv) regional geochemistry of acid sulfate soils and implications for mineral exploration
- Publication and distribution of the final report.
- If time permits, write a general article on acid sulfate soils and their role in mineral exploration, for the MESA Journal
- Finalise Swanny's work by end of February: including the storage of raw data (SEM and TEM and geochemistry) and regolith samples.
- Continue to develop new projects on Theme: Acid sulfate soils: regolith processes and implications (see issues and comments).

PROJECT 2.8 3-D POTENTIAL FIELD INVERSIONS (Project leader: Stewart Greenhalgh)

Theme: 6 (Geophysical mapping and modelling in regolith terrains)

Project Team:

Adelaide University – **Greenhalgh** (0.1 FTE), **Direen** (0.3 FTE), **Joseph** (0.3 FTE) **Heinson** (0.05 FTE) and student **Heath** (1.0 FTE)

Curtin University – **Wilkes** (0.15 FTE), **Meyers** (0.05) and student **King** (1.0 FTE)

1. Project aims

The principal objective of this project is to perform gravity and magnetic inversions, with the ultimate goal of automatically processing an entire survey to produce 3-D geological pictures and models of the

subsurface, to locate mineralisation under cover. The idea is to work with airborne gradient and tensor data, and to take advantages of new developments in instrumentation eg. FALCON.

Specific objectives are :

1. Develop new interactive potential field modelling and inversion algorithms,
2. Improved understanding of how to incorporate geological constraints into inversion methods,
3. Extraction of regolith information from gradiometry and vector data,
4. New visualisation methods for potential field data.

Deliverables and expected outcomes

Algorithms, computer programs for gravity/magnetic processing and interpretation, including “regolith stripping” to see beneath cover

Feasibility study of vector magnetic gradiometry

Improved geological maps, providing third-dimension constraints

Development of visualisation techniques

Student theses (Honours, MSc and PhD)

Publications and reports

2. Work plan for the quarter

November 2002. Completion of Honours projects by Philip Heath (Adelaide) and Gemma King (Curtin)

December 2002 Recruitment of two new PhD students and up to four Honours students

3. Progress/achievements (against milestones)

3.1 New staff appointments

Dr Nick Direen was appointed as a new Lecturer in Geophysics (Potential Fields) at Adelaide University in October 2002. His previous employer was Geoscience Australia, where he gained valuable post-doctoral experience in processing potential field data. Dr John Joseph was appointed as a LEME-funded Senior Lecturer in Geophysics at Adelaide University in November 2002. He came from the Geological Survey of Japan where he had been working on electromagnetics, airborne magnetics and airborne gravity. Most of his previous experience was in EM investigations in India. Both new staff will be contributing significantly (30% FTE) to the project.

3.2 Completion of Honours projects

Philip Heath completed an Honours project at Adelaide University entitled “Algorithms for the three-dimensional inversion of potential field tensor data “ under the supervision of Stewart Greenhalgh and Graham Heinson. Apart from LEME funding, his project also received support (\$3200) from the ASEG Research Foundation. Philip was awarded a high IIA Honours grade. He was able to demonstrate successful inversion of magnetic and gravity gradient data for a number of synthetic examples. He produced some useful computer programs for modelling, inversion and display.

Gemma King completed an Honours project at Curtin University entitled “A comparison of three-dimensional gravity inversion techniques over the Laverton region of Western Australia “. Her supervisors were Paul Wilkes and Jayson Meyers. The project attracted industry funding from AngloGold Australia. Gemma was recommended for a First Class Honours degree. She was able to show that for a large dataset, involving 1km spacing, use of a geological model did not improve the inversion, but with closer spaced data (250 m) it did improve the results of the inversion

3.3 Establishment of new Supercomputer Facility

In November, the Australian Research Council announced the new major infrastructure and equipment grants. A group of 15 academics at Adelaide University (including Professor Greenhalgh) were successful in their bid (\$1.2M) to establish a new 1 Terraflop supercomputer. Part of the intended use of this 120 node cluster is to process geophysical data acquired by LEME.

3.4 New magnetometers and software

Adelaide University provided an equipment grant of over \$18K to Drs Direen and Joseph to purchase two proton magnetometers for ground-based measurements to support this and other LEME projects. The instruments were delivered in December. We also purchased from Desmond Fitzgerald and Associates software for the standard (non-tensor) processing of potential field data.

3.5 In-house software

Algorithms were written in MATLAB for the inverting gravity and magnetic tensor data using Monte Carlo and Downhill Simplex methods. The algorithms provide the ideal parameters for the inversion and display the original data, final modelled data and the deduced subsurface geological picture. Synthetic tests were performed for a line of dipoles, a dyke and a faulted contact. The program also outputs the RMS errors associated with final parameter selection.

4. Issues and comments

The project was slowed by the delayed appointment of the two new staff members (Direen, Joseph). We had hoped to have them in place by June 2002, but due to factors beyond our control, this was not possible. Another concern has been over project funding and reimbursement of expenses by head office.

5. Outlook and work plan for the next quarter

Philip Heath is continuing on the project as a PhD student at Adelaide University. He was successful with a scholarship application, and commenced candidature on January 20. Philip, along with his academic supervisors, will be presenting a poster paper "The three-dimensional inversion of magnetic and gravity gradient tensor data" at the forthcoming ASEG Conference in Adelaide (February 2003). Gemma King from Curtin will NOT be continuing on with a PhD as originally hoped. She has accepted employment in industry.

We are hoping to get hold of the FALCON gravity gradiometry data which is currently being flown over the Broken Hill orebody and adjacent region. Magnetic tensor data was provided to Mr Heath last year by industry partners, but he didn't get time to process it. His Honours study was largely theoretic and used synthetic data.

The next quarter will be taken up with familiarisation of commercial data, establishment of the new supercomputer, initial testing, further computer programming, literature search on inverse theory, and participation in seminars and conference talks. The Curtin and Adelaide researchers will have the chance to exchange ideas at the February ASEG meeting in Adelaide.

PROJECT 2.10 AEM GAWLER CRATON SURVEY (Project leader: David Gray)

No report

PROJECT 2.11 PARTIAL LEACH ISOTOPE GEOCHEMISTRY (P 618) (Project leader: Geoff Denton)

1. Project aims

- Use the unique fingerprinting and tracing capability of isotopic methods to develop an understanding of the processes by which partial extraction anomalies form and to provide a technique to discriminate “true” from “false” anomalies.
- Focus on the development of a robust exploration tool that can evaluate partial extraction using isotopic methods.
- The research will concentrate on anomalies in soils over covered terrains, not anomalies present in outcropping situations, and will not focus upon the development of partial leaches *per se*.

2. Work plan for the Quarter

The first week of October saw the completion of the field program at the Bluebush, Cannington and HYC case studies. Sampling had been carried out rigorously with 50-70 sample locations at each case study. All locations were profiled with three to four samples. Clearly priorities were needed to be set before commencing the analytical program. A group meeting was held and in light of potential contamination being observed at Cannington it was decided that the samples taken in the contamination study near CAD51 would take priority.

The samples at HYC were required to be split and sent to MIM as they had requested sample for their own work.

The samples taken within the deeper “C” horizon at Rosebery were scheduled for analysis. This was to investigate the penetration of anthropogenic Pb detected in the shallower “A” horizon samples reported at the last meeting.

3. Progress

Analytical work has begun on the samples from the contamination study at Cannington. Preliminary results have been obtained and further analytical work and interpretation is ongoing. Samples from the Cannington study have also been dispatched for multielement analysis. HYC samples have been split and supplied to MIM. All analyses have now been completed for the Rosebery case study. The analysis of the deeper "C" horizon samples concluded in December. The interpretative work for the Rosebery case study has been completed.

4. Issues and comments

As the project progresses it is becoming clear that Pb isotope partial leach geochemistry is investigating some complex processes. Feedback from sponsors suggests that they value the progress made thus far in the project. Isotopic data can discriminate Pb (and hence other metals) in the regolith as being derived from an ore source or country rock.

5. Outlook and work plan for the next Quarter

Our first priority is to complete the contamination study by analysing and interpreting around 25 samples in the region of CAD51 at Cannington. This will involve Pb isotope geochemistry and a commercial multielement partial leach. A similar study will be carried out at the contamination study about L30 drill hole at HYC. When we have ascertained the extent of contamination at these two locations we will consider the future of both case studies in conjunction with sponsors. We also plan to begin analysis at Bluebush.

PROJECT 2.12 DOMINION CHALLENGER (Project leader: David Gray)

No report

PROJECT 2.13 PILBARA MANGANESE – PART 1 AND 2 (Project leader: Jayson Meyers)

No report

PROJECT 2.14 BASE METALS - YILGARN (Project leader: Matthias Cornelius)

Project aims

The project investigates the use of biogeochemical sample media for base metals exploration in different landform settings at Freddie Well, comparing the results with soil and laterite geochemical data from a previous study. A small number of laterite samples, taken during this project, will supplement data from the previous study.

Progress

Fieldwork was completed during the 4th quarter of 2002. The geochemical analyses of organic materials have been completed by Ultra Trace Laboratories in Perth.

Issues and comments

Ashing of the organic samples was more time consuming than anticipated and could not be completed within the planned timeframe.

Outlook and work plan for the next Quarter

The analyses of lateritic residuum will be completed before March 2003. A case history will be prepared for Freddie Well, combining results from this study and previous work by Ray Smith. It will be included in the monograph of geochemical case histories and conceptual dispersion, process and exploration models.

Project P2.15 Mineral Hill Regolith Profiles (Project Leader: Keith Scott)

Project Aims

To understand the mineralogical changes in the profiles of base-metal-rich and Au (base-metal-poor) profiles at Mineral Hill to assist in regional exploration.

Work Plan for Quarter

To document regolith profiles in base metal and Au-rich profiles at Mineral Hill, conduct two technology transfer workshops, produce a report for Triako Resources and make recommendations for further work.

Progress

- 68 samples from profiles provided by TMH 184 and 186 at Parkers Hill (base metal-rich mineralization) and TMH 201 and 204, through Au mineralization in the Missing Link area, were analysed by ICP/ICP-MS and Neutron Activation Analysis (NAA).
- Based on these chemical analyses, the mineralogical zonation in profiles at Parkers Hill and Missing Link was investigated by analysing 52 samples by X-ray Diffraction (XRD).
- Based on the mineralogy and geochemistry, the profiles at Parkers Hill show a progression from sphalerite-galena rich mineralization into partially weathered sulfides with anglesite and capped by a thin tetrahedrite-rich interval before passing into a 30-40 m thick zone dominated by cerussite and an upper (20 m thick) Fe oxide zone.
- For the Au mineralization at Missing Link, Ag, (As), **Bi**, **Cu**, (Mo), **Pb**, Sb, Tl and Zn appear to be useful pathfinder elements, with the elements in bold being the most useful.
- These results have been reported to the mine-based geologists at Mineral Hill on 10 September and to other geological staff, including the CEO, on 20 September at North Sydney.
- A report documenting the work was prepared and forwarded to Triako Resources (Mineral Hill Regolith Research: Mineralogy and Geochemistry at Parkers Hill and Missing Link, CRC LEME Restricted Report 183R).
- A proposal for additional work on profiles at Parkers Hill and Au-rich areas at Pearse was submitted and accepted by the company in December (Total cost - \$27 995).

- Discussions were had with company personnel during December to select the best drill holes for study for this new project.

Major Issues and Comments

The initial research project was completed ahead of schedule and results reported to the company in two workshops and in a formal LEME report (as indicated above). Discussion of the implications of the results has led to a continuing project of broader scope than originally envisaged, *i.e.*, establishing good rapport pays off.

Outlook and plan for the next Quarter

Based on discussions of the results and their implications, a further, 6-month program of collaborative research is being sponsored by Triako Resources.

- The Jan-March quarter will mainly involve mineralogical documentation along additional sections of weathered base metal mineralization at Parkers Hill (profiles through 11 drill holes, provided by the company, and analysed by XRD).
- Mineralogical /geochemical study along a section at the Pearse epithermal Au mineralization will also be undertaken, on receipt of the samples from the company, later in the quarter.

PROJECT 2.16 REGOLITH EXPRESSION OF AUSTRALIAN ORE SYSTEMS

(Project leader: Charles Butt)

Project aims

To assemble and publish:

- 1: a compilation of full length papers on exploration in the Yilgarn Craton in special issues of Geochemistry: Exploration, Environment Analysis (GEEA)
- 2: a monograph summarizing the characteristic expression of bedrock ore systems in the Australian regolith, as a series of conceptual dispersion, process and exploration models, illustrated by relevant case histories.

Work plan for the quarter

Thematic volume: work plan in the past quarter has been to continue to seek, collect, collate and edit relevant case histories from all sources.

Progress

GEEA special issues. Published in April 2002.

Thematic volume. Requests for over 200 selected case histories were made to potential authors, of which 178 were agreed upon. We now received 72 contributions, with 64 still under review. We will not reach the target of 150 case histories.

Issues and comments

Progress of the Thematic volume is dictated by the provision of case histories by authors. We anticipate that we shall have a total of well over 100 case histories. This is down on the original target, but probably the best we shall be able to do. The ongoing changes in the industry have adversely affected many potential authors from accessing material or finding time or enthusiasm to complete their papers, so that most are behind schedule and others have been withdrawn.

Outlook and work plan for the next Quarter

Project staff and 'outside authors' will continue to write case histories and edit the contributions. It is hoped to complete the bulk of the editing of the case histories during the quarter and to commence writing the special chapters.

PROJECT 2.19 NIFTY COPPER **(Project leader: Matthias Cornelius)**

Project aims

Straits Resources Ltd invited Matthias Cornelius of CRC LEME/CSIRO to conduct the investigation of soil samples from their Rainbow Prospect at Nifty. The work includes recommendation, supervision and interpretation of grain size and chemical analyses of 15 soil samples that were collected by Straits Resources, and recommendations for base metal exploration at the prospect.

Progress

Geochemical analyses of soil samples from the Rainbow Prospect were received and interpreted. A report summarizing the results of grain size and geochemical analyses and detailing recommendations for exploration was submitted to Straits Resources in December 2002.

Outlook and work plan for the next Quarter

The project was completed on time and the deliverables submitted to the company sponsor. No further work is planned at this stage.

It is intended to combine the outcomes of the Nifty studies and include these in the monograph of geochemical case histories and conceptual dispersion, process and exploration models.

PROJECT 2.20 YILGARN LATERITE GEOCHEMICAL ATLAS **(Project leader: Matthias Cornelius)**

Project aims

This project is the second stage of a project, aimed at establishing a geochemical atlas for the Yilgarn Craton, using lateritic residuum and lag derived from lateritic residuum. The overall objective of a geochemical atlas of the Yilgarn Craton is to identify major geochemical trends and provinces that could assist exploration and lead to the discovery of new mineral deposits.

The only objective of this stage of the project is the analysis of samples of lateritic residuum using XRF and ICP-MS and OES at Ultra Trace laboratories, Perth. The Geological Survey of WA has contributed \$10,000 for analytical work and is taking samples in current mapping areas.

Progress

To date, the GSWA and CRC LEME have collected approximately 30-40 samples of lateritic residuum.

Outlook and work plan for the next Quarter

Samples will be analyzed in batches of 100 samples or more to reduce the cost of quality control. The first batch of approximately 150 samples will be submitted for analysis in March 2003. Analyses will be submitted to the Geological Survey of WA before the end of June 2003.

2.3 Program 3: Environmental applications of regolith geoscience Program Leader: Dr Colin Pain

Not yet available

2.4 Program 4: Salinity mapping and hazard assessment Program Leader: Dr Ken Lawrie

- Not yet available
-

2.5 Program 5: Education and Training Program Leader: Associate Professor Pat James

1. Work plan for the Quarter

- Attend conferences, meetings and workshops for LEME promotion, student recruitment and research.
- Receive, review, process and distribute applications for LEME scholarships; compile assessment responses from E&T Committee and Executive and make offers to successful students
- Assist with setting up of new cash-funded and in-kind lecturers at Adelaide University; continue to support current staff with LEME FTE involvement
- Develop administrative and support strategies for continuing students and staff across all nodes
- Continue update of student database, respond to student requests for extensions, support etc.
- Encourage development of new workshops and short courses in conjunction with MTEC, VIEPS and other LEME groups
- Continue promotion and implementation of Virtual Regolith Worlds project
- Continue research and supervision in Mineral Mapping project

2. Work done against the work plan

- Attended field workshop with PIRSA and AU staff and students to the Olary area for project generation, from 16-18 October
- Organised visit of Keith Scott and Dennis Gee to Adelaide node in conjunction with AU Honours student presentations.
- Attended SE Australia Regolith conference in Canberra, 20-22 November

- Attended the DMR NSW new Broken Hill “Exploration for Success” data launch on Friday 29 Nov.
- Organised a guest lecture by Dr Cliff Stanley (Canada), Association of Exploration Geochemists Distinguished Lecturer, on Dec 3, entitled “Lithogeochemistry: What you Discover Depends on Where you Stand”
- Attended “Gawler Craton – State of Play” symposium in Adelaide Dec 5-6
- Attended ASCILITE conference in Auckland (Dec 8-11) and presented poster entitled “Full steam ahead”: Managing the learning environment of an Australia-wide complex multi-institution research and research training programme in the earth and environmental sciences, with technology”
- Carried out research and supervision within the Mineral Mapping/Remote Sensing project (Ian Lau – PhD, Sean Mahoney – graduated Hons 2A)
- Received Stephen Cole the Elder teaching prize at AU Graduation ceremony
- Virtual Regolith Worlds – \$25K was requested to develop and implement creative online communication and learning environments for technology transfer from the research projects. \$5K was transferred to support Leah Moore’s salary leaving \$20K as project funds. One major contributor to the project, especially as the WA node link, was intended to be the Communications Officer. This part of the project has not progressed, as this post is yet to be filled. Other components to the project include:-
 - 4 Polycom ViaVideo desktop conferencing systems were purchased (\$4-5K) and distributed to Adelaide (node office), Perth (Aspandiar) and Canberra (UC – Roach, ANU - McPhail). These have been used for cheap & visually enhanced discussions between the nodes. Dennis Gee & Keith Scott have also used the system. One aim is to widen the videoconferencing to allow greater use in place of phone conferencing during staff/executive meetings and discussions. Another aim is to develop multiple (and cheaper) systems for students and staff interaction eg student online discussion forums, online workshops and seminars etc.
 - John Wilford is using \$4-5K funds to complete programming of the CAL module on “Radiometric interpretation”
 - Andreas Schmidt-Mumm has purchased 5 licences for Micromine software for geochemical modelling, to add to 5 licences purchased by AU Geology & Geophysics. The Summer Scholar (Tylkowski) is helping to develop teaching aids to integrate these into the teaching program.
 - Joel Brugger & Graham Heinson are purchasing a web interface for MATLAB (\$4K) to enable geochemical and geophysical modelling and simulations to be made available on the web.
 - Leah Moore agreed to produce a DSHMP website (\$3K), but this part of the project is on hold following the pull-out of UC from LEME.
 - Ian Roach is developing a regolith geology CAL module.

3. Update on student complement

- Following advertisement of 30 LEME scholarships, more than 60 applications were received for Summer, Honours and Postgraduate scholarships. All scholarship applications across the four core party Universities were distributed to the Executive for information and comment. Groups of applications were sent to review panels at each University. Summer Scholarships were ranked and 7 offers were made and accepted by – ANU - Jennifer Leonard to work with John Field. Adelaide University Edeltraud von Furt to work with John Foden, Jason Tilley to work with Joel Brugger, Emma Hissey to work with Graham Heinson, Luke Tylkowski to work with Andreas Schmidt Mumm, Alan Cadd and Jane Thomas to work with Nick Direen.

- During the reporting period, prior to the Xmas break, scholarship offers were sent to the following -: ANU – 5 Postgraduate and 4 Honours students, AU – 10 Postgraduate (this larger offering was taking advantage of a 50% Faculty funding scheme – four further scholarships were in negotiation with SA-DWLBC & AU Soil & Water) and 5 Honours students, CUT – 3 Postgraduate and 5 Honours students. UC scholarship recommendations to 1 Postgraduate and 3 Honours students were held over pending negotiations over transfer to ANU. A full list of acceptances, rejections, APA & other awards etc will be available by end January, but overall 15 new funded Honours Scholars and 25 new funded Postgraduate scholars are expected to enrol in 2003.

4. MTEC shortcourses and workshops

- Through the reporting period a number of short courses and workshops were discussed (see #5). Negotiations with VIEPS staff indicated that they were not encouraging the offering of further LEME courses than were already in place. Thus LEME advertised 5 courses, viz. Environmental Mineralogy, Introduction to Hydrogeochemistry, Regolith Geology & Geochemistry, Regolith Mapping and Field Techniques and Hyperspectral Remote Sensing for 2003.
- In relation to the NTGN and funding for participation at MTEC short courses, discussions were held with Ian Roach, where he indicated that, as UC contributed \$60K and ANU \$15K, pa in cash, if CUT and AU wished to receive similar benefits of access to MTEC courses, then they should also contribute an equivalent \$15K each pa in cash. This was put before AU staff, but discussions have stalled temporarily.

5. Shortcourse and workshops other than MTEC

- Discussions with a number of LEME staff took place about the development of future short courses, including Graham Heinson (Airborne geophysics), Ron Watkins (Environmental geochemistry), Steve Hill (further Regolith/landform mapping), Ian Robertson/Charles Butt/Ravi Anand (regolith mapping/exploration geochemistry), Simon Lang and others (Clastic fluvial sedimentology), Brad Pillans (Regolith Dating), Alan Chivas and others (Stable isotope geochemistry) and other courses in remote sensing, 3D visualisation/modelling and GIS were anticipated. It is hoped to work on the development of some of these courses in the near future.

6. Income

7. Significant events

- SE Australia Regolith conference – vibrant research forum
- AU Honours student presentations– vibrant research forum
- “Gawler Craton – State of Play” symposium -

8. Issues and comments

- Compliment overall improvement in morale of LEME/Executive staff

9. Outlook and workplan for the next Quarter

- ASEG conference preparation

- Monitoring progress of incoming and continuing students
 - Producing outputs for VRW project
 - Involvement in Project reviews and development
 - Continued development of (MTEC) short courses
 - Submit papers for Toulouse Remote Sensing conference and UK Geoscience Education conference in July
-

3. ASSISTANT DIRECTORS - CENTRE CULTURE AND LIAISON

3.3 Assistant Director, Adelaide: Mr John Keeling.

Field Site Visits

- Visits were arranged for 14-15 October with Ravi Anand and Alan Mauger to sites of hyperspectral mapping projects for magnesite near Port Pirie and Myrtle Springs and zinc silicate in altered Cambrian carbonates in the Beltana – Leigh Creek area. The Beltana visit was hosted by Iain Groves and Ian Gregory of Perilya Ltd and joined by David Blight, Executive Director, PIRSA Minerals and Energy Resources. Opportunities were discussed for project work over the Reliance zinc deposit (368,000t @ 28.8% Zn) discovered by Perilya in 2001 below 5-50m of Tertiary-Quaternary transported cover.
- 16 October, with Ravi and Alan, visit to the insitu leach uranium mining operations of Heathgate Resources at Beverley. Heathgate are currently ramping up exploration for additional uranium resources on their current tenements and in joint venture with neighbouring tenement holders. Sites of recent drilling were visited with Dr Andrea Smith, project geologist. The visit was followed up on 5 November in Adelaide with Heathgate management David Brunt, Vice President and Mike Russell, Chief Geologist and Andrea Smith on LEME activities and potential for joint projects. Offers of cooperation were extended and further discussions are to be held together with Joel Brugger and John Foden early in 2003. PhD candidate, Pierre-Alain accepted to commence work on secondary uranium formation and mobilisation in June 2003.
- 17-18 October, field camp at Tickalina Station, Olary district, with Broken Hill Exploration Initiative (BHEI) Team to review current and future project activities in the Curnamona district. Attended by LEME PhD students Aaron Brown and Ian Lau together with Ravi Anand and a strong LEME presence from PIRSA and Adelaide University (Pat James, Andreas Schmidt-Mumm, Karin Barovich). Alistair Crooks led excursions to key regolith sites in relation to his ongoing basement and regolith mapping program on the Mingary 1:100,000 map sheet.

Communication

- Adelaide node meeting was held at Adelaide University on 14 November. Chaired by Pat James and attended by Dennis Gee.
- Discussions held with John Howard, Flinders Diamonds, on hyperspectral results over the Pine Creek kimberlite and indicator mineral sampling by Flinders Diamonds. Field work planned for next quarter.
- 5-6 December attended 2 day Gawler Craton-State of Play workshop together with Dennis Gee, Keith Scott and Pat James from LEME executive. Presentations given by LEME staff David Gray, Malcolm Sheard, Baohong Hou and posters by Hou and Paul Rogers. Well attended by LEME research staff and students.

Other

- 17 December, University of Adelaide Graduation Night at Hilton Hotel. Congratulations to all LEME Honours students who graduated and best wishes in their future activities.
- Annual and long service leave totalling 5 weeks was taken during the report period.