

MINERALS BRIEF

Regolith Science in Mineral Exploration

September 2006 Edition No 11



Dr Ravi Anand wins the 2006 Butt Smith Medal

CSIRO and LEME scientist Dr Ravi Anand (right) has been awarded the Butt Smith Medal for his outstanding contribution to geoscientific research.



The award acknowledges Dr Anand's long-term dedication and excellence in the development of geochemical mineral exploration techniques for Australia's deeply weathered landscapes.

Awarded by LEME and CSIRO's Exploration and Mining Division, the Butt Smith Medal recognises sustained excellence in Australian geoscience research.

The award takes its name from two eminent geoscientists, Dr Charles Butt and Dr Ray Smith, whose long association with LEME and CSIRO has made significant research contributions to the Australian minerals exploration industry.

LEME Chief Executive Officer Dr Steve Rogers said it was fitting that Dr Anand becomes the second recipient of the Butt Smith Medal.

"For more than three decades Dr Anand has followed in the footsteps of Dr Butt and Dr Smith to emerge as a leader in regolith research," Dr Rogers said.

"His work into understanding how geochemical anomalies form in deeply weathered terrains has contributed to the mineral industry's appreciation that regolith is an essential consideration when designing exploration strategies and interpreting geochemical data."

CSIRO Exploration and Mining Chief Dr Peter Lilly added that recently Dr Anand has discovered an association in plant biogeochemistry and mineralisation.

"Some of Dr Anand's newer research has shown that deep-rooted mulga trees in transported regolith over some Australian mineral provinces act as hydraulic pumps for dissolved metals," Dr Lilly said.

"His work has raised the awareness of a biological process that can create geochemical anomalies in the plant's biomass near the surface, which could become a valuable indicator for mineral explorers."

The Butt Smith Medal complements Dr Anand's other research accolades including the Sir Ian McLennan Achievement for Industry, CSIRO Research and Stillwell Awards.

The inaugural Butt Smith Medal was awarded in 2004 to Perth geoscientist, Dr Richard Mazzucchelli, whose frontier research directly contributed to successful exploration programs for nickel, gold and copper.

Dr Anand will officially receive the Butt Smith Medal in November as part of the LEME Regolith Symposia at the Hahndorf Resort in the Adelaide Hills of South Australia.

For further information about the Butt Smith medal, contact: gregory.lawrence@csiro.au

Queensland's regolith map now on the drawing board

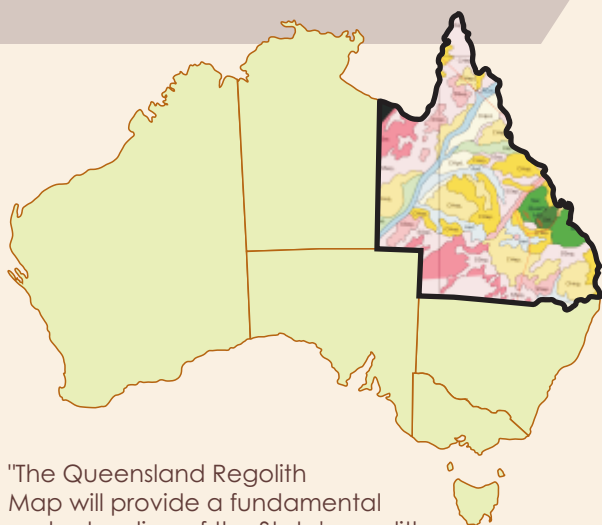
One of the successful outcomes resulting from the launch of LEME's Northern Territory Regolith Map and the Atlas of Regolith Materials earlier this year is a project to create the same suite of products for Queensland.

Following initial discussions with the Queensland Government, the Centre has agreed to collaborate with the Queensland Department of Natural Resources, Mines and Water to produce a Statewide 1:2.5 million-scale regolith map and associated atlas. The Department, through the Geological Survey of Queensland, has included the Regolith Project in their four year \$20 million Smart Exploration Initiative, which commenced in 2005-06.

Known as the Queensland Regolith Mapping Project, the collaborative exercise is expected to take two years to complete and will draw on existing data from the Burdekin and Fitzroy Catchments of central Queensland and available geological mapping from the Geological Survey of Queensland and Geoscience Australia. Some data will also be sourced from the National Action Plan for Salinity and Water Quality and other relevant regolith projects.

Leading the project for LEME, and one of the driving forces behind the NT Regolith Map, is geoscientist Mike Craig (Geoscience Australia) who said an understanding of the regolith is now widely acknowledged by industry as a necessary and effective prerequisite for mineral exploration.

"The importance of understanding the regolith is also being recognised increasingly by natural resource managers as a vital dataset for land management decisions," Mr Craig said.



"The Queensland Regolith Map will provide a fundamental understanding of the State's regolith materials distribution and associated landscape evolution while providing important clues about where new mineral deposits and water resources are more likely to be found.

"It will also give important clues about the areas prone to salinity and sediment movement, as well as changes in river flow over time."

This project, coupled with the NT Regolith Map, will provide an extended regional regolith-landform framework and Atlas set across much of the top end of Australia.

"Hopefully, future successful outcomes arising from the Qld Regolith Map, Atlas and supporting Geographic Information System (GIS), on top of the well-received NT products, will generate interest in extending this work to show the surface distribution of regolith features across the whole of Australia," Mr Craig said.

LEME research shows bacteria can create gold grains

Bacteria play an important role in gold grain formation according to a recently published paper by LEME researcher Dr Frank Reith (CSIRO) featured in the July edition of the prestigious international journal, *Science*.

Dr Reith's research has shown that bacteria play a significant role in the formation of secondary gold grains.

His study of gold grains from the Tomakin Park and Hit or Miss Gold Mines in southern New South Wales and northern Queensland, respectively, led to a series of discoveries, which showed that specific bacteria present on these gold grains precipitate gold from solution.

"The origin of secondary gold grains is a controversial topic that is widely debated within the scientific community," Dr Reith said.

"There are those who believe the grains are purely detrital, while others believe they form by chemical accretion.

"A third theory suggest that microbial processes are involved in gold grain formation which may be responsible for one of the largest gold deposits in the world, the Witwatersrand Deposit in South Africa."

Applying molecular biology techniques, Dr Reith discovered a living biofilm on the surface of gold grains collected.

DNA profiling of this biofilm identified 30 bacterial species with populations unique to the gold grains when compared to the surrounding soils.

One species was identified on all of the DNA-positive gold grains from both locations. DNA sequence analysis of this species identified it as the bacterium *Ralstonia metallidurans*.

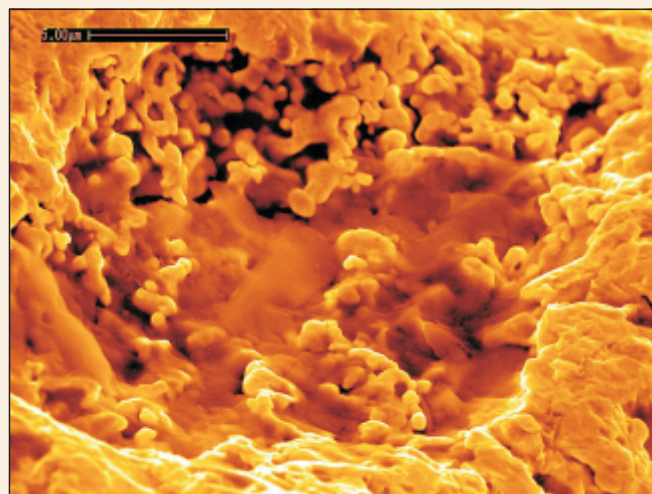
"The next step was to see if we could observe gold precipitation in the presence of a culture of this bacteria," Dr Reith said.

"By placing a culture of the *R. metallidurans* bacteria in the presence of dissolved gold, which is highly toxic to microorganisms, I observed active gold precipitation.

"A unique attribute of *R. metallidurans* is that it is able to survive in concentrations of gold that would kill most other micro-organisms."

This research has significance for the mineral exploration industry – as current models of gold formation do not include a biological mechanism.

"There also may be new opportunities for the bio-processing of gold ores now that we have discovered bacteria that precipitate gold out of solution," Dr Reith said.



SEM image of a gold-encrusted biofilm on the surface of a gold flake found in the Palmer River goldfields of Northern Queensland.

PhD student wins AESC Best Student Poster Award

LEME Adelaide University PhD student Anna Petts has taken out *Best Student Poster* at the 2006 Australian Earth Science Convention (AESC) in Melbourne earlier this month.

The informative poster entitled *Nature's Drillers and Geochemical Samplers: Termites and their implications for regolith geochemistry in northern Australia*, summarised Anna's PhD project work in determining the potential use of soil biota as a biogeochemical sampling medium and regolith mapping tool in the Tanami Desert, located near the Western Australian and Northern Territory borders.

Anna's ongoing research focuses on the use of termite mounds as regional geochemical indicators and establishing a regolith-framework for estimating the depth of transported cover.



Anna receives her award from GSA President, Andy Gleadow.

"In the Tanami, termites have been observed tunnelling tens of metres below the surface in search of ground-water. Some of this material, which can contain anomalous geochemical signatures, is taken back to the mound," Ms Petts said.

"In effect, this means that mound-building termites, through their digging, undertake similar activities to regional geochemical sampling."

Her field research includes sampling mound material for metal content, regolith-landform mapping, geobotanical analysis. A Geographic Information System (GIS) will be used to incorporate the multivariate data generated by her project.

"Already, I have determined a relationship between termitaria density, vegetation assemblages and regolith landforms," Ms Petts said.

Anna's award winning poster can be viewed here:
<http://crlcleme.org.au/images/Posters/APetts-AESC-Poster-Jul06.jpg>

LEME Minerals Exploration Seminar well received

The latest Centre research to help the Australian mineral exploration industry find new mineral deposits was discussed in detail at the 2006 LEME Minerals Exploration Seminar held on Friday, 11 August.

More than 100 representatives from exploration companies, big and small, as well as State Government Agencies, attended the Seminar to hear LEME researchers discuss their latest work to find new geochemical and geophysical ways to locate mineralisation in areas of transported regolith.

Topics discussed on the day included the inside story on the making of the Northern Territory Regolith Map and Atlas of Regolith Materials, a discussion on regional geochemical trends in laterites found in the south-western part of the Yilgarn Craton, and the potential of the humble spinifex plant in becoming a new medium to detect geochemical anomalies above mineralisation.

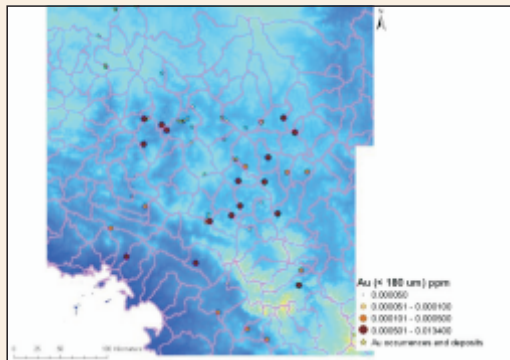
The response to the presentations and feedback received by LEME staff were very encouraging. The high degree of interest in LEME research was reflected by the large number of Centre publication purchases made on the day.

Abstracts associated with Seminar presentations topics can be downloaded here:
<http://crlcleme.org.au/NewsEvents/Events/MinexSeminarAug06.html>



Seminar audience considers the findings of another LEME Minerals Exploration Presentation.

Geochemical survey picks up gold anomalies



Preliminary results from LEME's Central Gawler Craton Geochemical Survey conducted earlier this year has detected several gold anomalies.

Conducted by LEME's Program 3 research stream into the environmental applications of regolith geoscience, the survey has detected high gold concentrations in most river catchments known to contain gold deposits or occurrences.

These results show the survey's methodology has potential to be applied to the mineral exploration industry. This potential will be further assessed when the complete dataset becomes available.

Contact: paul.shand@csiro.au

LEME Technology Transfer

Upcoming presentations 2006-07:

- 26 - 28 September 2006 - Broken Hill Exploration Initiative Conference, Broken Hill, NSW
- 14 - 19 June 2007 - 23rd International Applied Geochemistry Symposium, Oviedo, Spain
- 19 - 24 August - Goldschmidt 2007, Cologne, Germany

Recent Publications

(Available via our website <http://crcleme.org.au>)

- OFR 200 - Calcrete Geochemistry in the Cobar-Girilambone Region, New South Wales (Ken McQueen)
- OFR 201 - Laterite Geochemical Database for the Southwest Yilgarn Craton, Western Australia (M. Cornelius, P.A. Morris and A.J. Cornelius)
- 2006 LEME Minerals Exploration Seminar Abstracts (downloadable from <http://crcleme.org.au/NewsEvents>)

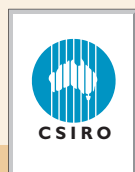
Past issues of the Minerals Brief can be downloaded from: <http://crcleme.org.au/Pubs/index.html>

Greg Lawrence, CRC LEME Communications Officer
+61 (08) 6436 8786
gregory.lawrence@csiro.au

CRC LEME Head Office

postal: c/- CSIRO Exploration & Mining PO Box 1130 Bentley WA 6102
phone: (08) 6436 8695 fax: (08) 6436 8560
email: crcleme-hq@csiro.au web: <http://crcleme.org.au>

CRC LEME is the cooperative research centre for regolith geoscience with some 130 contributing researchers from eight Core Parties around Australia. We generate and apply regolith knowledge for mineral exploration and environmental management.



Your organisation can benefit from CRC LEME expertise.

<http://crcleme.org.au>