

Future of the Australian Regolith Geoscientists Association (ARGA)

Discussion Paper

INTRODUCTION

The Australian Regolith Geoscientists Association (ARGA) is an incorporated organisation which draws together geoscience professionals from government, academia and industry, with a strong collective interest in regolith geoscience. The members of ARGA are building upon the legacy of several decades of Australian regolith research, and are looking for ways to promote and further enhance the important role that regolith science plays in Australia. Regolith geoscience is critical in the Australian context as over 70% of the continent is covered by transported material and many parts of the areas where outcrop does occur are weathered to varying degrees.

A SHORT HISTORY OF REGOLITH GEOSCIENCE IN AUSTRALIA

The history of regolith science in Australia stretches back to the mid-19th Century. The following section outlines some of the key contributions to regolith science in Australia since that time.

CSIRO Land Research Surveys (Land Systems mapping)

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) led the development of regolith landform mapping in Australia (see <http://www.publish.csiro.au/nid/289.htm>). Immediately after World War 2, CSIRO embarked on a plan to systematically map northern Australia and Papua New Guinea, commencing in 1946 and with the final report being delivered in 1977. The Land Research Surveys mapped “land systems”, which are composite units exhibiting similar soil, topographic and vegetation attributes. This mapping was intended to underpin the agricultural (and other) development of many parts of northern Australia, and was the forerunner to the regolith-landform and soil-landscape mapping techniques used today.

The results of the Land Research Surveys are now freely available from the CSIRO through: <http://www.publish.csiro.au/nid/289/issue/5812.htm>.

Centre for Australian Regolith Studies (CARS)

The Centre for Australian Regolith Studies (CARS) was a joint venture between the Australian National University and the University of Canberra. The Centre introduced a joint undergraduate and postgraduate teaching program between the two universities, the only one of its kind in Australia at that time. In the several years of CARS’ existence five CARS Occasional Publications were produced, including monographs on weathering, the influence of organic matter and fire on regolith and soil erosion, and abstract volumes on the Monaro Volcanic Province (NSW) and new developments in regolith mapping.

The Centre’s activities were subsumed into the Cooperative Research Centre for Landscape Evolution and Mineral Exploration (CRC LEME) in 1995. The Centre was not renewed after CRC LEME was discontinued in 2008.

The Centre's publications are available for free download via the ARGA web site: (<http://regolith.org.au/publications.html>).

Cooperative Research Centre for Landscape Evolution & Mineral Exploration (CRC LEME)

The Cooperative Research Centre for Landscape Evolution and Mineral Exploration (CRC LEME 1; 1995-2000) and the Cooperative Research Centre for Landscape Environments and Mineral Exploration (CRC LEME 2; 2001-2008) are collectively referred to as CRC LEME.

The CRC LEME 1 core parties included:

- The Australian National University
- CSIRO Exploration & Mining
- CSIRO Land & Water
- Geoscience Australia
- The University of Canberra

The CRC LEME 2 core parties included:

- The Australian National University
- The Bureau of Rural Sciences (withdrew 2001)
- CSIRO Exploration & Mining
- CSIRO Land & Water
- Curtin University of Technology
- Geoscience Australia
- Minerals Council of Australia
- New South Wales Department of Primary Industries
- Primary Industries and Resources South Australia (GSSA)
- The University of Adelaide
- The University of Canberra (withdrew 2001)

The activities of CRC LEME primarily focused on research facilitating mineral exploration within and through the regolith, development of models of landscape evolution for Australia, assessing Australia's groundwater potential and understanding environmental geohazards such as dryland salinity and acid sulphate soils.

CRC LEME's activities have left a significant and enduring legacy of skilled researchers from its honours and postgraduate student cohort (117 and 81 completions respectively). Many of these ex-students are now working in the Australian and international mining industry or as research scientists within Geoscience Australia, State and Territory geological surveys, CSIRO and universities. CRC LEME also produced a huge volume of data and information in the form of monographs, reports, articles, maps and educational material which continues to be freely available via the CRC LEME website (<http://crcleme.org.au>). CSIRO has agreed to continue to host the CRC LEME website into the foreseeable future. Additionally, many of the maps are also now available for free download and as print-on-demand maps (on a cost-recovery basis) from respective State/Territory geological surveys and Geoscience Australia.

CURRENT REGOLITH GEOSCIENCE ACTIVITIES

The breadth of regolith geoscience research undertaken today in Australia is not readily captured, owing to the number and diversity of organisations involved in such activities. The examples below provide a sample of key programs to which regolith geoscience contributes.

The UNCOVER agenda

As part of the National Mineral Exploration Strategy (<http://www.coenergyCouncil.gov.au/publications/national-mineral-exploration-strategy-december-2012>), the Australian Academy of Science conceived the UNCOVER initiative (<http://www.uncoverminerals.org.au/>) – a program aiming to encourage increased investment in mineral exploration in Australia. UNCOVER identifies four key geoscience themes:

1. Characterising Australia's cover – the National Cover Map
2. Investigating Australia's lithospheric architecture – the National Map of the Deep Crust and Upper Mantle
3. Resolving the 4D geodynamic and metallogenic evolution of Australia – the 4D Metallogenic Map
4. Characterising and detecting the distal footprints of ore deposits – the National Distal Footprints Map.

ARGA represents many scientists working on the UNCOVER program across government (particularly Geoscience Australia), university and private industry sectors. Members of ARGA are directly involved in themes 1 and 4 above, and are providing advice to others working on themes 2 and 3. Four of the top ten priority focus areas of the UNCOVER Roadmap are in the Characterising Australia's cover theme, all of which are linked to regolith science.

Exploring for the Future

The Australian Government's initiative to boost Australia's attractiveness as a destination for investment in resource exploration is manifested in a 4 year program targeting improved understanding of mineral, energy and groundwater resources in northern Australia.

Geoscience Australia, in conjunction with State and Territory agencies, are employing regolith geoscience to contribute to the identification and characterisation of potential mineral, energy and groundwater resources concealed beneath the surface.

<http://www.ga.gov.au/about/projects/priority-projects/exploring-for-the-future>

Water for Food (WA)

Water for Food is a \$127.5 million Royalties for Regions State Government program delivering fifteen projects with the aim of significantly increasing irrigated agriculture across Western Australia.

<http://www.waterforfood.wa.gov.au/>

The primary objective of Water for Food is to identify water and land resources, as well as irrigation technologies, that can enable Western Australia's fresh food and animal protein production to increase its contribution to regional economies. Regolith geoscience is being employed to identify and characterise potential groundwater resources and assess land suitability.

Australian Soil Resource Information System (ASRIS)

The Commonwealth, State and Territory governments each conduct soil mapping at a variety of scales for agricultural and natural resource management purposes. Soil maps consider the upper part of the regolith, the *pedolith*, and the landscape, climate and vegetation that influence its formation. Soil maps are published as individual map sheets and at various scales of the Australian map series, together with accompanying reports, and are collated in the Australian Soil Resources Information System (ASRIS <http://www.asris.csiro.au/>). This is an ongoing collaboration between CSIRO and State/Territory agencies, and brings together soil mapping and other data at all scales from across Australia.

National Exploration Uncover School (NExUS)

The new initiative “National Exploration Uncover School” (NExUS) was established in 2016 by Graham Heinson and Richard Lilly at the University of Adelaide to expose 3rd year undergraduates, honours students and recent graduates to the opportunities and challenges facing the exploration and mining industry as search areas move increasingly under cover. NExUS includes several regolith geoscience mapping and sampling components to address the lack of regolith in the current university earth science curriculum around Australia.

CONTRIBUTORS TO REGOLITH GEOSCIENCE IN AUSTRALIA

A number of organisations, several of whom had involvement in one or more generations of CRC LEME, have regolith geoscience expertise.

Universities

- Australian National University
- Curtin University
- Monash University
- University of Adelaide
- University of Canberra
- University of South Australia

Geological Surveys

- Geological Survey of New South Wales
- Geological Survey of South Australia
- Geological Survey of Western Australia
- Northern Territory Geological Survey

At GSSA and GSWA all geologists within the regional mapping team have been trained in regolith mapping over the last couple of years in internally-run courses. Regolith mapping has now been fully integrated into regional mapping and geological map compilation.

CSIRO

CSIRO Land & Water and CSIRO Mineral Resources in particular are substantially involved in regolith research. Regolith geoscience has strong relevance to a number of National Research Flagships, including:

- Energy
- Food Futures
- Minerals Down Under
- Sustainable Agriculture
- Water for a Healthy Country

Geoscience Australia

Geoscience Australia (GA) is currently playing a key role in the Australian Academy of Science's UNCOVER initiative as part of the National Mineral Exploration Strategy and current and future research focusing on key areas of UNCOVER. Exploring for the Future (EftF) has multiple projects in northern Australia in both the mineral and groundwater space. GA maintains expertise in regolith geology and geochemistry, hydrogeology, hydrogeochemistry, regolith mapping and near-surface geophysics.

Companies and other individuals (many ex-CRC LEME)

Ian Robertson ([http://aquashutterbug.net.au/ Work/Index.html](http://aquashutterbug.net.au/Work/Index.html))

Lisa Worrall – Protean Geoscience (<http://proteangeoscience.com/>)

Greg Shirtliff – Toro Energy

Michael Holzapfel – OM Manganese

Michael Whitbread – Rio Tinto

Kathryn Fitzsimmons – Max Planck Institute (Germany)

Chris Gunton – Arcadis Environmental Services

Shawn Laffan – Associate Professor University of NSW

Matthew Lenahan – Principal Geochemist AECOM

Alistair Usher – Australian Academy of Science

Toshi Fujioka - Australian Nuclear Science & Technology Organisation

CHALLENGES IN REGOLITH GEOSCIENCE

The general slowing of the mineral exploration industry has affected the way that the industry operates. Industry is now more conservative in terms of operations and, together with decreasing staff numbers, has led to an increased emphasis on trusted methods such as drilling. Industry would like to see a better understanding of cover (regolith) and minerals systems in terms of both the geochemistry and geophysics. This includes improvement in dealing with large datasets which can potentially lead to better decision-making in terms of the tools and data used for exploration.

The State and Territory Geological Surveys undertake work in regolith science in response to requests from industry. The products that have been produced to date by the State Surveys are being well utilised. However, the challenges in the State Surveys are linked to limited staff numbers available to undertake regolith science work, and geoscientists who have a limited understanding of regolith science which can be linked to a lack of training in universities. The State Surveys are required to provide regolith data by staff trained in generating regolith data. However, there are very few graduates who have regolith mapping skills with an in-depth understanding of regolith and its importance.

At CSIRO, there was an expansion in regolith geoscientists to a peak of approximately 30 scientists in the mid-2000s with CRC LEME. However, since the closure of CRC LEME, there has been a steady decline in the number of regolith geoscientists, largely related to the retirement of key researchers. CSIRO maintains a strong capability in geochemistry and hydrogeochemistry.

Funding is an overarching challenge for CSIRO, GA, the State and Territory Surveys and the universities, and has required creativity and collaboration. Some successful examples include:

- UNCOVER initiative which presents a united geosciences community including CSIRO, GA and State and Territory Surveys
- Capricorn Distal Footprint research: a collaboration between GSWA, UWA, Curtin University and has been awarded \$17 million over three years

Similarly, recruitment freezes and caps on the numbers of permanent staff in government and universities have affected the knowledge base in these organisations.

From the environmental perspective of regolith science, funding for projects is largely sourced from inter-disciplinary collaborations focusing on water quality and natural resource assessment. Other projects such as those related to coal seam gas development and monitoring have developed techniques to mitigate environmental problems.

Teaching of regolith science at universities is largely focused around individuals and is constrained by a lack of specialists in the field and an increasing pressure to reduce the diversity of courses on offer. As a result, there is little continuity in teaching regolith science.

WHERE ARE WE NOW?

A number of suggestions were discussed at the 2014 ARGA biennial conference in Bunbury to address these challenges:

- Formation of a specialist group within the Geological Society of Australia (GSA). However, it was noted that this may restrict membership to only those who come from a geoscience background within ARGA, and exclude those who do not come from a geoscience background.
- Formation of a regolith geoscience-focused CRC. Deep Exploration Technologies CRC (currently in operation until 2018) has moved towards a technology focus, rather than geology and regolith science, creating a potential opportunity for a new earth science-focused CRC.
- Contribution to the National Curriculum in the earth sciences. There is the opportunity to train not only new regolith scientists, but also new science teachers.
- Internships, cadetships and summer scholarships provide an opportunity for industry and government organisations to link with universities. This can potentially address the limited number of graduates with limited training in regolith science. Industry links are valued by students.
- Establish a list of guest presenters who could give lectures or short courses in regolith science. Students can then see the value in applying regolith science to their discipline, e.g. the application of regolith knowledge in land management, geography, ecology, etc., and let students know that regolith science is not just about mineral exploration. This also means that an entire course in regolith science does not need to be established and a core of regolith scientists/ARGA members can facilitate regolith training at universities.
- Establish a database or list of theses at all levels which are related to regolith. A substantial proportion of regolith science research is conducted by students and is under-utilised. AMIRA has successfully established a database for all geology-related theses.
- Provide a forum for increased collaboration between groups and organisations, and to attract competitive funding grants.
- Formation of a LinkedIn group for regolith science, which could potentially be a more useful alternative to the Facebook Group as more professionals are likely to use it.

The importance of presenting a regolith science perspective and a united front to the wider geoscience, exploration and mining community was noted. There has been a marked increase in collaboration between State Surveys, GA and CSIRO, with crossover occurring between states and institutions largely credited to the relationships formed from CRC LEME.

During ARGA's Annual General Meeting in February 2017 the idea of forming of a specialist group within the Geological Society of Australia (GSA) was again raised due to the concern of declining membership, dwindling numbers of postgraduate students taking on regolith-related topics, and the lack of regolith science courses at universities (resulting in decreasing numbers of students with regolith knowledge entering the mining and related industries).

Regolith is a wide-reaching geoscience discipline and that it seems logical that an organisation such as ARGA should look to merge with an existing active and holistic geoscience society to maximise

synergies. It was noted that around a third of ARGA members are already members of the GSA. Accordingly, it was decided to investigate options for integrating with the GSA.

The Proposition

The ARGA Committee endorses a vote on the merger with the GSA for the purpose of maintaining and growing regolith geoscience in Australia. Two options are currently being considered. The first is essentially to establish ARGA as a specialist group of the GSA. The second is to merge ARGA into the existing Environmental Engineering and Hydrogeology Specialist Group (EEHSG) of the GSA. Should a majority of ARGA members support the idea of a merger the ARGA committee will engage with the GSA to determine the best option for ARGA members, and to identify a process and timing for the transition. Should the first option be chosen, the GSA will put a joint proposal to its members for a vote on establishing ARGA as a specialist group of GSA.

Timing of the proposed merger is flexible however the most logical implementation would be following the April 2018 ARGA conference-this event could be used as the last official conference for the organisation. Regardless of which merger option is chosen, the new regolith geoscience presence should be showcased at the 2018 Australian Geoscience Council Convention, including a special regolith session and/or workshop.

What does ARGA bring to the GSA?

- A diverse group of active professionals in regolith geoscience, who are working to better understand a significant part of Australia's geology which has traditionally been of secondary interest to explorers, but which is becoming increasingly critical.
- Linkages into complementary sciences e.g. soil science, geomorphology, hydrogeology, ecology.
- Further diversification of the GSA.
- Skills base to support training and education to bridge the gap in regolith knowledge in Australia.
- Potential to attract new members to GSA, particularly from industry.

What does GSA offer ARGA?

- Stronger engagement with the geoscience community, and in particular with industry, who have historically benefited directly from regolith research (e.g. CRC LEME).
- A platform to increase visibility and demonstrate the relevance of regolith science to the broader geoscience community through established communication channels such as TAG, AESC, etc.

What would happen to ARGA's finances?

GSA has informed ARGA that existing funds will be moved across to the GSA, but will be managed by the specialist group. Some costs will be incurred in setting up a new page for the GSA website and linking the old ARGA website.