National Rock Garden

Celebrating the Geological Heritage of Australia

Newsletter No. 28
December 2024

The National Rock Garden is proudly supported by the Geological Society of Australia and the Australian National University and the Minerals Council of Australia

Australian National University

Minerals Council of Australia

www.nationalrockgarden.org.au

Relocated National Rock Garden now ready for visitors

Brad Pillans, Director, National Rock Garden

In May, after more than 12 months of careful planning, the National Rock Garden successfully relocated to the National Arboretum Canberra. Now, the construction fences are down and the site is accessible to the public!

Although our move was only over a distance of about a kilometre, we are now within the grounds of another national institution which attracted more than 1 million visitors in 2023 and has extensive infrastructure including a visitor centre with a café, a bookshop and extensive views over Canberra and Lake Burley Griffin.

National Rock Garden Stage 1 path excavations, 17 May 2024. Image courtesy B. Pillans.

Construction work on Stage 1 of the new NRG site began in May 2024 and was completed in July, allowing us to transfer our existing rocks, and add some new ones, including our furthest-travelled rocks—two large boulders of charnockite from Mawson Station in Antarctica. Funding for Stage 1 was generously provided by our partners, the Geological Society of Australia and the Minerals Council of Australia.

The Federation Rocks display at the new NRG site, 1 October 2024. The rocks are arranged in order of the date of establishment of the state or territory. The largest rock is the South Australian rock—approximately 2 m high and weighing 15 tonnes. Image courtesy B. Pillans.

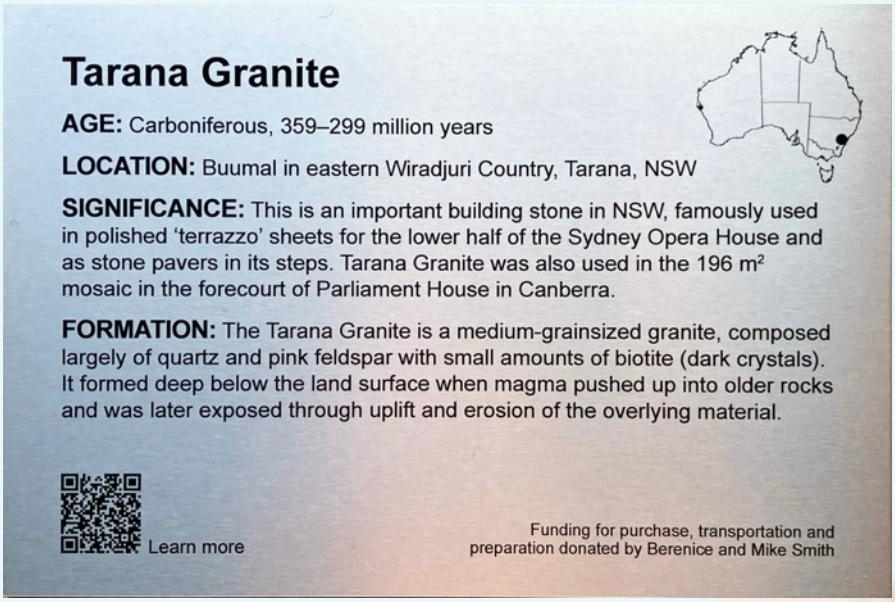
The concept design for the garden, created by Harris Hobbs Landscapes, features a series of themed rock clusters, linked by gently graded, fully wheelchair-accessible paths. The layout will be integrated with a complementary planting of Weeping Wilga trees (*Geijera parviflora*) in an indigenous-inspired pattern. Stage 1 sees the installation of an entry feature rock, plus five rock clusters, including the Federation Rocks and an Indigenous welcome feature. Entry is from Forest Drive, the main access road to the Arboretum visitor centre, which is located only 150 m south of the NRG site.

Northwest view to Mt Painter, over NRG Stage 1, with paths completed and the first 20 rocks on display, 19 December 2024. The feature rock in the foreground is a 10-tonne block of banded iron from the Pilbara region in Western Australia. Image courtesy B. Pillans.

With completion of Stage 1 (approx. 30% of the 1-hectare NRG site), fundraising and preparation for Stage 2 (the remaining 70% of the site) has kicked into high gear and we are hoping to begin Stage 2 construction early in 2025. In the meantime, we encourage you to visit the National Rock Garden when in Canberra and spread the word that we are ready for visitors!

We at the NRG are looking forward to a very productive and rewarding 2025 and wish all of our Friends and supporters a very Happy New Year.

Building a rock garden isn't cheap. If you are thinking about making a charitable donation, the NRG has Deductible Gift Recipient status so you can claim any NRG donation on your tax return. Details on how to donate are on the NRG website: https://www.nationalrockgarden.com.au/support/.



New plaques for our display rocks include a QR code which provide a link to the NRG website for further information.
Image courtesy B. Pillans.

Deep ocean specimens on their way to Canberra

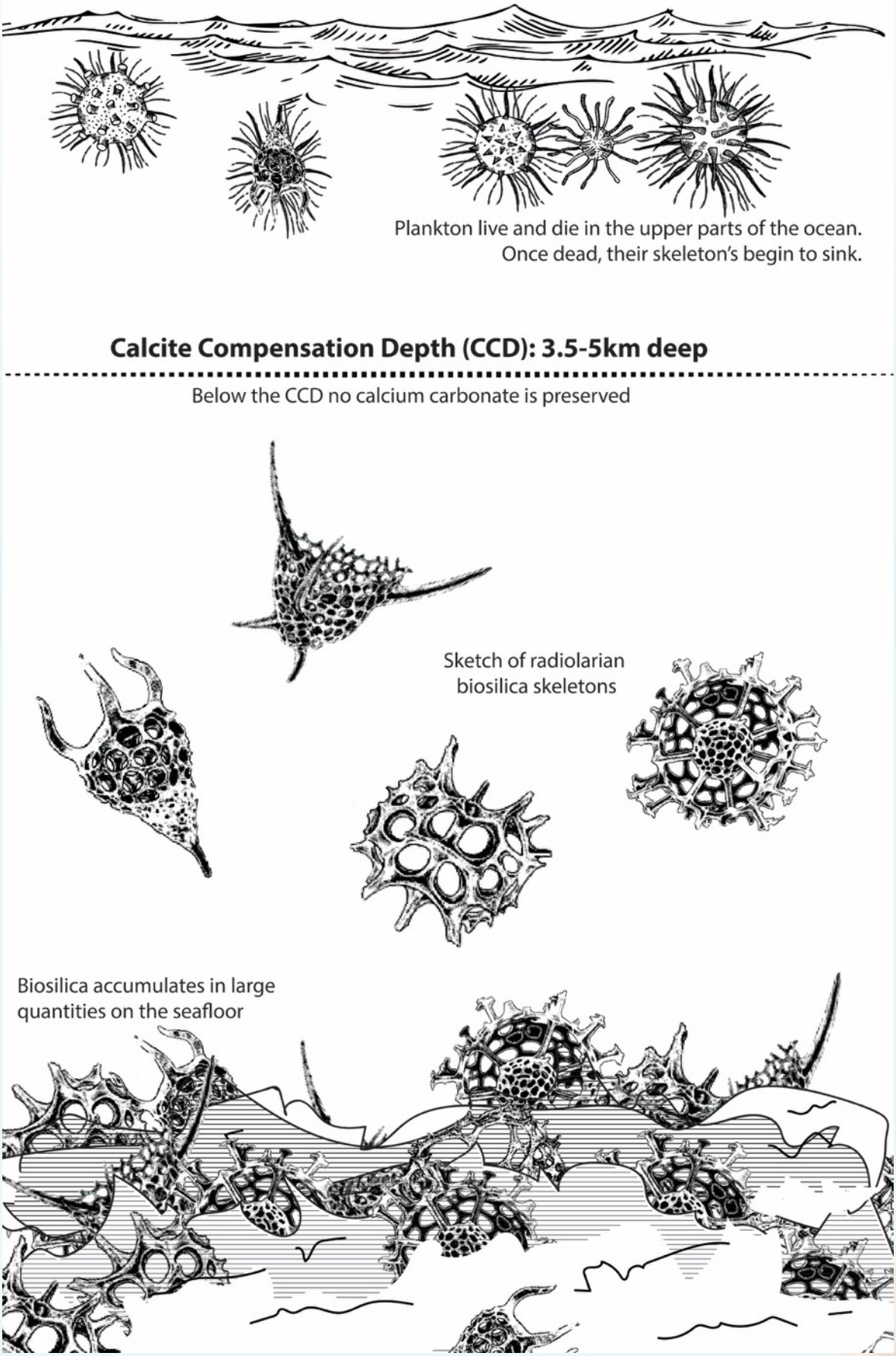
Mike Smith, Director, National Rock Garden

NRG Newsletter No 25 reported on our aspirations to acquire several specimens of radiolarian red-ribbon chert from below the wall of Chaffey Dam, in the Nundle area of central NSW. During November, three boulders of approximately 4 tonnes each, were loaded onto a crane truck under the supervision of staff from the Chaffey Dam management team.

Uplift and loading of two chert boulders of approximately four tonnes. The white wall in the background is the top of Chaffey Dam. Image courtesy M. Smith.

This rock is characterised by its striking reddish-brown hue and intricate banding, composed almost entirely of tiny (~0.5 mm) silica microfossils. Its silica-rich content originates from the skeletal remains of countless marine organisms known as radiolarians. When these plankton die, their organic walls decompose, and their skeletons sink down to the seafloor. If they sink below 3–5 kilometres all calcium carbonate dissolves and biosilica (silicon dioxide from biological remains) begins to accumulate. Accompanying the silica microfossils are fine clays—derived from fine wind-blown dust and from ash clouds produced by distant volcanoes. In the case of the NRG's specimens, this has occurred far away from any mainland river source of sediment in the deep ocean.

Silica isn't compatible with clay and limestone, and during compaction, the silica near the bedding base will dissolve away, enhancing the sedimentary beds in the cherts and preserving the radiolarian microfossils in the middle of the beds. Red and black colours within the rock reflect the deposition/precipitation of iron and manganese from the sea water. These oxide minerals also settle on the ocean floor. The rock's composition tells a story of the rhythmic alternation between quartz-rich fossil beds and clay-rich and metal-rich interbeds, showcasing a unique geological history.



Cartoon showing how this unusual rock was formed. Image courtesy S. Kachovich.

This sedimentary material was originally deposited as soft, flat-lying sediment during the Ordovician Period. Subsequently, over millions of years, these formations were compacted and contorted, and emplaced on land—now forming an elevated outcrop of highly durable rock.

While this specimen is very important from a strictly scientific perspective, it is also very important for engineering works. The hardness of the chert made it suitable for the construction of Chaffey Dam, a major geotechnical project completed in 1979. In order to provide sufficient water for the city of Tamworth and surrounds, and to meet modern safety requirements, the dam was raised in 2016 by 8 m to its current height of 62 m. It is now 500 m long and holds 100,500 ML.

The chert's physical properties also play a crucial role in the material culture of Australian Aboriginal peoples, and the NRG Steering Committee will seek advice from the Traditional Custodians in order to include relevant Indigenous cultural information in the website description which will be accessible via the QR code on the rock plaque.

The three boulders have been placed in temporary storage, pending the future completion of additional rock platforms and pathways at the NRG site in the Arboretum. The Steering Committee thanks the Sydney Minerals Exploration Discussion Group (SMEDG) which provided the funds for the two stages of transportation of the three specimens, as well as their preparation for display.

Two of the Chaffey Dam specimens destined for the National Rock Garden. Image courtesy M. Smith.

References

New South Wales Government 2024. Chaffey Dam. https://www.nsw.gov.au/visiting-and-exploring-nsw/locations-and-attractions/chaffey-dam. Last accessed 27 December 2024.

Kachovich, S. 2013. Significance of radiolarian biostratigraphy of the southern New England Orogen, New South Wales. Honours Thesis, Faculty of Science, Medicine & Health, University of Wollongong Research Online https://ro.uow.edu.au/thsci/48

Kachovich, S. and Smith, M., 2023, Specimens from the Great Ocean Depths, Soon to Travel to the National Rock Garden, Canberra. NRG Newsletter, November 2023 https://www.nationalrockgarden.com.au/featured-article/specimens-from-the-great-ocean-depths/

National Rock Garden volunteer recognised

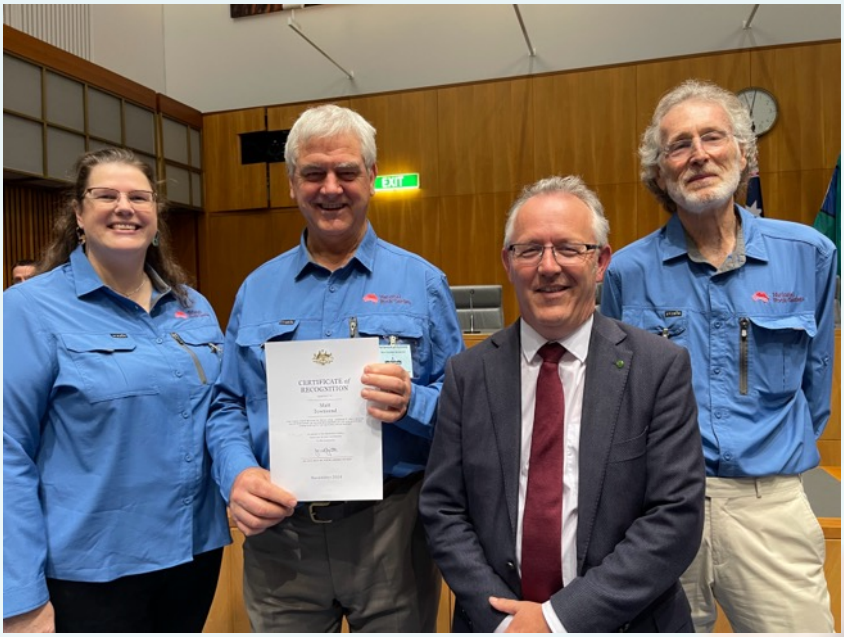
Michelle Cooper, Director, National Rock Garden

Congratulations to the NRG's Matt Townsend who was recognised by MP David Smith at the 2024 Bean Volunteer Recognition Evening in late November. A member of the NRG Steering Committee since 2013, Matt was recognised for his expert analysis of construction options and systematic design of work sequences to minimise cost and optimise efficiency. His calm and reasoned communication on difficult technical issues is also highly valued by the committee.

Matt's talent and hard work were key to the completion this year of Stage 1 of the National Rock Garden and his continuing contributions will ensure that Stage 2 will be delivered with equal success. His ability to collaborate across multiple disciplines, coupled with his deep understanding of both project management and technical requirements, has consistently contributed to the progression of the NRG's ambitious goals. As the team moves forward with Stage 2, Matt's leadership and expertise will remain integral in navigating challenges, refining processes, and driving the project toward successful completion.

Congratulations Matt!

Matt Townsend with David Smith MP. Image courtesy M. Cooper.



Left: Matt's certificate of recognition. Right: NRG Steering committee members (L–R) Michelle Cooper, Matt Townsend, and Brad Pillans with David Smith MP (second from right). Image courtesy A. Marsden.

Rocks, plants, and time: Exploring London's Evolution Garden

Dr Marita Bradshaw, National Rock Garden Steering Committee

While the NRG takes shape on a hillside in the Bush Capital, another rock garden has opened this year—this one in busy central London. It is the Evolution Garden at the Natural History Museum (NHM), South Kensington. Though different in setting, scale and style, both projects are telling stories about the deep past using rocks and plants and can take visitors on a thought-provoking adventure through time.

Emerging from the tunnel from South Kensington tube station, you find yourself in a canyon constructed out of some of Britain's oldest rocks, including 2.7-billion-year-old Lewisian Gneiss. Once you emerge out of the rock canyon, you are at the start of a timeline, beginning with the Cambrian period 540 million years ago. Each metre represents 5 million years and rocks, fossils and plants from the different geological periods are displayed. The Natural History Museum's Evolution Timeline is similar in concept to the Time Walk at Geoscience Australia in Canberra, where the 4.6 billion years of Earth history is laid out over 1.1 kilometres.

The Timeline wall at the Evolution Garden, NHM, London. Paleo-Proterozoic to Archean Lewisian Gneiss overlain by red Neoproterozoic Torridonian sandstone form the start of the rock wall canyon. Image courtesy the Trustees of the Natural History Museum.

Visitors to the Evolution Garden in London will see some familiar Australian plants—tree ferns *Dicksonia antarctica*, used to invoke the coal-forming Paleozoic forests of ancient Britain and the iconic Wollemi pine *Wollemia nobilis*, a living fossil from the Cretaceous that has been planted to recreate the Mesozoic environment of the dinosaurs. If you are not heading to London soon, you can walk in a large grove of Wollemi pines a bit closer to home, in Forest 32 at the National Arboretum Canberra.

Bronze dinosaur footprints are amongst the many discoveries visitors to the Evolution Garden can make. Image courtesy the Trustees of the Natural History Museum.

The NRG is already drawing inspiration from this rock garden on the other side of the world and hopes to further develop this relationship in the years ahead. Anyone visiting London is encouraged to spend some time in the wonderful Evolution Garden at the Natural History Museum, South Kensington.

Fern, the full-size, bronze Diplodocus supported by Kusuma Trust in the Evolution Garden, Natural History Museum, London, with Wollemi pine (Wollemia nobilis), tree ferns (Dicksonia antarctica) and other plantings. Image courtesy the Trustees of the Natural History Museum.

Exploring ideas: Educators visit the National Rock Garden

Michelle Cooper, Director, National Rock Garden

The National Rock Garden was delighted to host a group of Earth Science teachers and educators in December. The aim of the visit was to raise awareness of the NRG with educators and prompt them to consider the potential for excursions to the Garden in the coming year. Representatives from both the NRG and the National Arboretum Canberra were also eager to hear from educators about the types of activities they envision at the Garden and the support they may need to implement them.

Dr Marita Bradshaw welcomed the group and provided an overview of the collection of large rocks now displayed at the new site. She also shared the Steering Committee's vision for future expansion. Heather Tregoning, Education Officer, outlined the type of groups the Arboretum already hosts, possible complementary activities within the Arboretum, booking procedures and more.

The group enjoyed a guided walk through the display, engaging with the rocks, asking questions, and brainstorming ideas for educational activities. The discussion was full of inspiring suggestions, and we're excited to begin exploring these possibilities further!

A group of educators learning more about some of the newest rocks in the National Rock Garden. Image courtesy M. Cooper.

Teachers, educators and National Rock Garden volunteers in front of the Federation Rocks display. Image courtesy S. Blewett.

Myrtle Springs magnesite to join the National Rock Garden

Anastasia Morfiadakis, National Rock Garden Steering Committee and Wolfgang V. Preiss, Visiting Honorary Research Fellow, University of Adelaide and Geological Survey of South Australia

In June 2024, a remarkable addition to the National Rock Garden collection was made with the donation of a 2.1-tonne block of Myrtle Springs magnesite, generously provided by A. & M.J. Musolino. Special thanks go to Mr. C.M. (Ric) Horn of Hornet Resources, the company's consulting geologist, for his enthusiastic support and facilitation of this donation.

The donated magnesite specimen in the yards of the mining company A. & M.J. Musolino. Image courtesy A. & M.J. Musolino.

Magnesite (magnesium carbonate, $MgCO_3$) is a versatile industrial mineral essential for applications such as high-temperature furnace linings, lightweight alloys, and magnesium-based chemicals used in industries ranging from aerospace to medicine.

The Myrtle Springs specimen originates from the Skillogalee Dolomite, a 790-million-year-old formation in South Australia's Adelaide Superbasin. At Myrtle Springs, magnesite appears as rounded fragments (1–3 cm) embedded in a fine-grained dolomite matrix. These features reflect its formation in shallow lagoons, where continental and marine waters mixed, separated from the open sea by natural barriers similar to modern Coorong dunes in South Australia. The rare conditions required to create sedimentary magnesite make this specimen a geological treasure.

Magnesite continues to play a critical role in emerging technologies, including magnesium batteries, lightweight alloys for electric vehicles, and materials for renewable energy infrastructure. The inclusion of the Myrtle Springs magnesite in the National Rock Garden highlights not only its historical significance but also its relevance to the modern world.

Mrytle Springs is located 30 km north west of Leigh Creek, a former coal-mining town in eastern central South Australia. In October 2024, the NRG Steering Committee arranged for Phoenix Trucking of Fyshwick, ACT, to transport the magnesite to Canberra. The specimen is now in temporary storage while funds are being raised for the construction of additional rock platforms and pathways at the new National Rock Garden site within the National Arboretum Canberra.

Stay tuned for updates as the magnesite block takes its place among the nation's most iconic rocks!

The Myrtle Springs magnesite specimen at Fyshwick. Image courtesy B. Pillans.

If you have an idea for a newsletter story, or there is a rock that you would like to see featured in a future NRG newsletter, please let us know via email or Facebook.

In Dr Ludwig Leichhardt's steps, briefly, 180 years later

Brad Pillans, Director, National Rock Garden

Friedrich Wilhelm Ludwig Leichhardt is perhaps best remembered for disappearing while trying to cross Australia from east to west in 1847. However, his overland expedition of discovery from Brisbane to Port Essington, in 1844–45, was a monumental success. In September this year I briefly walked in Leichhardt's footsteps near the coal-mining town of Blackwater, Queensland.

The following background information is summarised from his entry in the Australian Dictionary of Biography (Erdos 1967). Leichhardt was born in Prussia in 1813 and studied languages and philosophy at Berlin and Gottingen Universities, before travelling to England and France to study medical and natural sciences at the Royal College of Surgeons, the British Museum and the Jardin des Plantes. Although he never completed a university degree, in later years he was addressed as 'Doctor' Leichhardt, in recognition that he was a man of learning. In 1841 his close friend, William Nicholson, paid his fare to Australia to allow him to pursue his study of natural sciences. After arriving in Sydney in early 1842, Leichhardt spent time studying the geology, flora and fauna of Sydney region, the Hunter Valley and Morton Bay. In August 1844, Leichhardt and six companions sailed from Sydney to Morton Bay to begin a privately funded expedition to Port Essington. Four more joined the group in Moreton Bay, from whence they travelled west to the furthest European outpost (Jimbour) on the Darling Downs, not far from the modern town of Dalby. The party's venture into the unknown began in earnest, when they left Jimbour on 1 October 1844, with Leichhardt as leader.

I now continue the story with reference to Leichhardt's expedition journal, which he published after his return (Leichhardt 1847). Although the journal is now available online, I was fortunate to purchase a facsimile copy at a recent Lifeline bookfair in Canberra—for the princely sum of $3!

Needless to say, Leichhardt's journey was an arduous undertaking in those times—two of the party turned back after several weeks and in June 1845, another member, John Gilbert, was killed by Aboriginal people in the Gulf of Carpentaria. After 14 months, during which time the expedition had been given up for dead, the remaining seven members of the party reached Port Essington on 17 December 1845, having traversed some 3000 miles of country previously unknown to Europeans. From my reading of Leichhardt's journal, it seems that they survived largely because of the excellent bush skills of two Aboriginal members of the party, Charley and Brown. However, Leichhardt himself became a very good bushman as the expedition progressed. His detailed journal entries on geology, botany and zoology, also reveal him to be an accomplished naturalist. He also made regular meteorological observations as well as calculating latitude and longitude (the latter less reliably than the former). Many rivers, creeks, hills and mountains, which were named during the expedition, retain those names on modern maps.

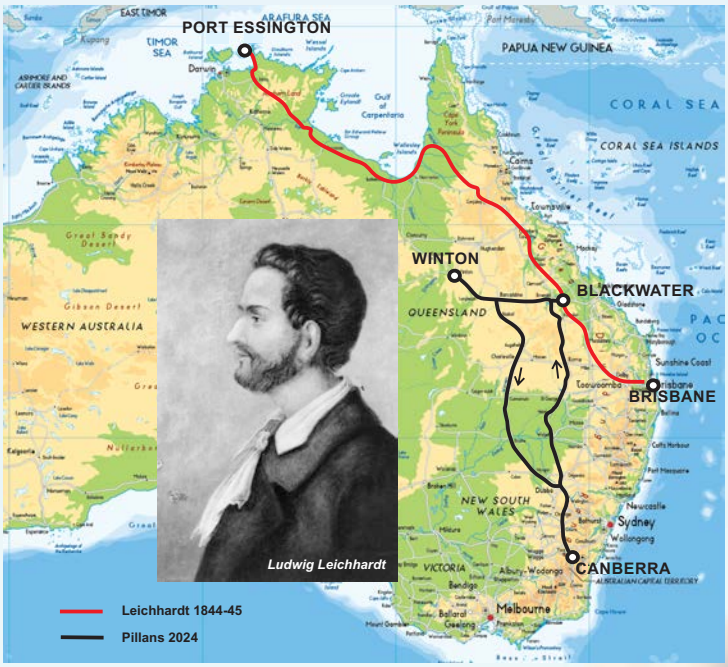


Figure 1. Map showing the respective routes of Ludwig Leichhardt (1844–45) in red and Brad and Sue Pillans (2024) in black, each covering a total distance of 4,800 km, with their paths crossing near Blackwater. Inset: Image of Leichhardt courtesy of the State Library of Queensland.

I now wish to highlight Leichhardt's field observations near the modern coal mining town of Blackwater. It is here that I walked in Leichhardt's footsteps, albeit briefly, 180 years later. In September, this year, my wife (Sue) and I did a road trip from Canberra to Winton (and back), ostensibly to visit the famous Australian Age of Dinosaurs Museum at Winton. In doing so, we travelled around 4,800 km in just 12 days, averaging about 400 km/day in the air-conditioned comfort of a modern car. Coincidentally, Leichhardt's journey covered the same distance, but it took him just over 400 days at an average of around 12 km/day. He was travelling on horseback, after all.

Our respective paths, briefly crossed, just west of Blackwater, where Leichhardt travelled north along Comet Creek to its junction with the Mackenzie River, both of which he named. His journal entry on 10 January 1845 reads:
'The plains are basaltic, and occasionally covered with pebbles of white and iron-coloured quartz and conglomerate, and are in the vicinity slight elevations, which are probably composed of sandstone and conglomerate, and usually covered with low scrub and cypress-pine. Sandstone crops out in the gullies of the valley, in horizontal strata, some of which are hard and good for building, others like the blue clay beds of Newcastle, with the impressions of fern-leaves identical with those of that formation. At the junction of Comet Creek and the river, I found water-worn fragments of good coal, and large trunks of trees changed into ironstone. I called this river the "Mackenzie," in honour of Sir Evan Mackenzie, as a small acknowledgement of my gratitude for the very great assistance which he rendered me in the preparations for my expedition.'

Four days later, some 20 km downstream, Leichhardt reported more coal, this time in situ. Journal entry 14 January 1845:
'We passed some very high cliffs, which showed a fine geological section of horizontal layers of sandstone and coal-slate. There were also some layers of very good coal, but the greater part of those visible were of a slaty character.'

Leichhardt's observation of coal at the junction of Comet Creek and the Mackenzie River, marks the discovery of coal in the Bowen Basin—Australia's largest coal-producing basin today. His pioneering geological work is recognised with the biennial Leichhardt Award by the Bowen Basin Geologist's Group. See: https://bbgg.cqu.edu.au/?page_id=746.

A major mine currently operating in the Blackwater area, within 30 km of Leichhardt's original discovery, is the Curragh mine, operated by Coronado Global Resources. After NRG Advisory Council member, Tom Kapitany, put me in touch with geologists at the Curragh mine, I asked whether they might donate a specimen of fossilised wood from their mine to the NRG. A positive response then led to a mine visit by Sue and me en route to Winton, to select a suitable display specimen—we actually chose two. The picture below shows Curragh mine geologist, Chris Alickson, with his hand on one of the selected rocks.

I am pleased to report that both specimens have now been delivered to Canberra, where they are being prepared for display. I thank Coronado Global Resources for donating these interesting specimens.

Figure 2. Coronado Global Resources geologist, Chris Alickson, with his hand on one of the selected fossil wood specimens from the Curragh mine, near Blackwater, Queensland. All the pieces appear to be broken sections of a single large tree, but we do not yet know the tree species. Image courtesy B. Pillans.

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Erdos, R., 1967. Leichhardt, Ludwig (1813–1848), *Australian Dictionary of Biography, Volume 2*, National Centre of Biography, Australian National University, https://adb.anu.edu.au/biography/leichhardt-ludwig-2347/text3063, published first in hardcopy 1967, accessed online 27 December 2024.

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Postscript: The Australian Age of Dinosaurs Museum, Winton

As I mentioned above, our road trip to Winton was to visit the Australian Age of Dinosaurs Museum, near Winton, said to house the world's largest collection of Australian dinosaur fossils. We stayed 3 nights in Winton and opted to do the VIP tour, over 2 days, of the Dinosaur Museum and Dinosaur Stampede Monument at Lark Quarry Conservation Park, the latter some 100 km south of Winton.

Day 1 included guided tours of the museum exhibits, housed in the main building, as well as the fossil preparation laboratory and a self-guided walk through the outdoor "Dinosaur Canyon", the latter including life-like dinosaur models (Figure 3).

Day 2 included our visit to the spectacular dinosaur tracks at Lark Quarry, where more than 3000 footprints from a 95-million-year-old stampede of turkey-sized dinosaurs (*Skartopus australis*) are preserved. There is also a line of much larger footprints, attributed to a dinosaur called *Tyrannosauropus,* which appears to have been hunting the stampeding herd of *Skartopus* (Figure 4). No bones are preserved with the footprints, so it is not possible to say much about either dinosaur, except that they were bipedal therapod dinosaurs. The whole exhibit is housed within a large building to protect it from the elements. In the evening, we also joined a star-gazing group, with expert commentary and telescopes set up to view the night sky.

In a word, the dinosaur museum is FABULOUS, and I highly recommend it to anyone.

Figure 3. Brad 'feeding' the dinosaurs at the Australian Age of Dinosaurs Museum, Winton. Photo courtesy S. Pillans.

Figure 4. Dinosaur footprints at Lark Quarry, with a line of large prints, circled (about 40–50 cm across) left by a predator chasing a group of stampeding prey as evidenced by the plethora of small prints (4–5 cm across) that record a moment of panic as the prey ran for their lives in all directions. In the absence of fossil bones, the footprints are referred to as trace fossils. Photo courtesy B. Pillans.

The National Rock Garden, Canberra

WE NEED YOUR FINANCIAL SUPPORT

Although work by committee members and friends of the National Rock Garden is voluntary, we nevertheless incur the regular costs of an incorporated entity. We therefore seek donations from individuals who recognise the importance of geoscience and geoscience education to the future of Australia.

Stage 2 of the National Rock Garden requires substantial funding for footpaths, rock display pads and an NRG pavilion. Significant funding is also required for transport and delivery of rock specimens, preparation of specimens for display, creation of descriptive plaques for the rocks, and maintenance of the NRG site. While we will be encouraging corporate contributions for the high-cost transportation of larger rocks from interstate, we welcome all donations, however large or small.

Please make a tax-deductible donation:

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Mail: National Rock Garden Trust Inc. PO Box 576, Crows Nest, NSW 1585
Email: brad.pillans@anu.edu.au
Cheques can also be made out to the National Rock Garden Trust and sent to the address above.

Feedback and further information

We welcome feedback and suggestions on the development of the National Rock Garden and would love to hear from you! Email us at: brad.pillans@anu.edu.au or michelle.cooper@ga.gov.au.

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Newsletter edited by Michelle Cooper.