National Rock Garden

Celebrating the Geological Heritage of Australia

Newsletter No. 20

November 2020

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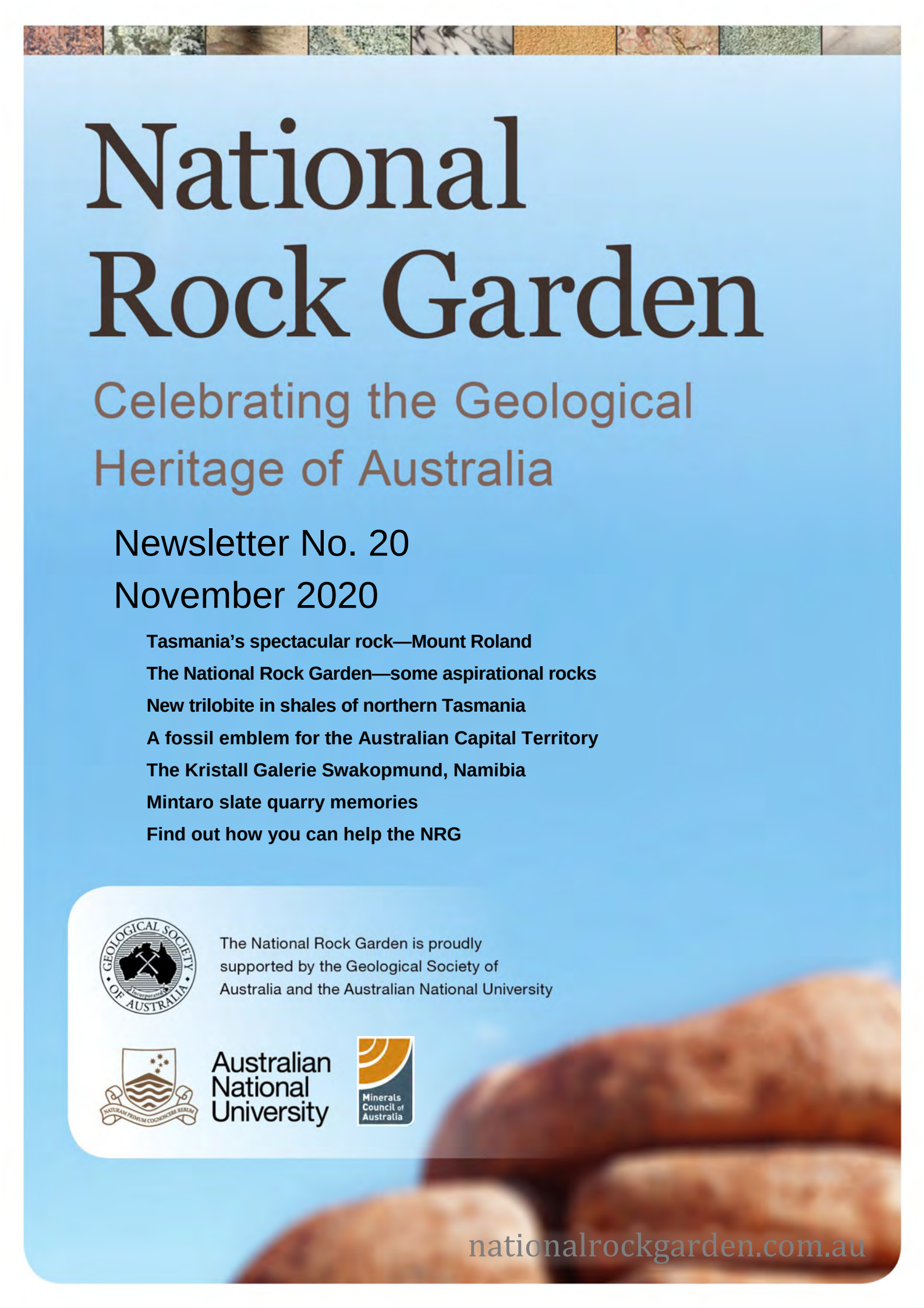

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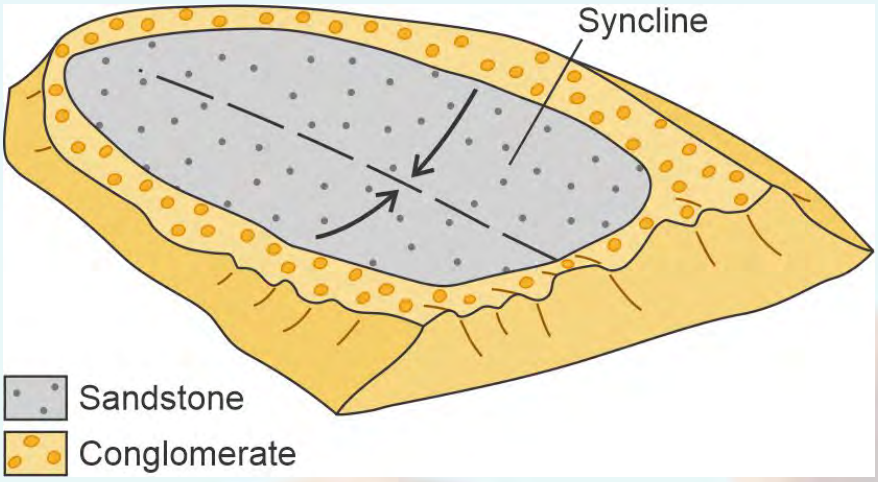
Tasmania's spectacular rock—Mount Roland

Ken McQueen, NRG Steering Committee

Mount Roland is an imposing monolith with a majestic presence at the north-western edge of Tasmania's central plateau. It has an elevation of 1,234 m above sea level and stands 10 km southeast of the small town of Sheffield in northern Tasmania. The mountain is composed largely of conglomerate, a sedimentary rock formed in large rivers or alluvial fans. On the very top and behind the frontal peak there are also some overlying sandstones. The conglomerate is siliceous (quartz-rich), very hard and resistant to erosion and chemical weathering. We would love to get a large sample for the National Rock Garden.

View of Mount Roland from the north near Claude Road, 5 km south of Sheffield. Image courtesy K. McQueen.

Mount Roland has the structure of a large synclinal fold (trough-shaped structure) with a relatively flat top, which slopes more gently back towards the southeast. Some peaks on the top of the mountain show bedding surfaces dipping or sloping towards the centre of the syncline (towards the east on the right side and towards the west on the left side of the mountain).



Schematic diagram of the key geological features of Mount Roland. Image courtesy K. McQueen.

Outcrop of Mount Roland conglomerate showing crude bedding structure. Image courtesy K. McQueen.

The conglomerate and sandstone making up Mount Roland are part of a geological unit named the Owen Group, of Late Cambrian to Early Ordovician age (Corbett 2003). The conglomerate contains well-rounded cobbles and pebbles of quartzite, sandstone, chert and reef quartz in a sparse sandy matrix. These materials were probably derived from earlier highlands of Proterozoic rocks containing quartzites and sandstones in the uplifted Tyennan and Rocky Cape blocks in the central west and far northwest of Tasmania.

Close up of Mount Roland conglomerate. Image courtesy K. McQueen.

The Owen Group is named after Mount Owen, a peak near Queenstown on the west coast of Tasmania, which is composed of the same conglomerate rock. In 1863, Charles Gould named a number of mountains on the west coast after famous nineteenth century scientists, including Mt Lyell (Charles Lyell, geologist), Mt Murchison (Roderick Murchison, geologist) and Mt Owen (Richard Owen, biologist/palaeontologist). Mount Roland was originally named Rolland's Repulse after Captain John Rolland, who traversed the high country between the mountain and nearby Mount Van Dyke in 1823. Unfortunately, the indigenous name for Mount Roland is not known. The nearby Gog Range was known by the Aborigines as Kooparoona Niara, which means Mountains of the Spirits.

Light dusting of snow on Mount Roland in April. Image courtesy K. McQueen.

Given its majestic presence and origin as an erosional remnant of hard, similar-age sedimentary rocks, Mount Roland could be considered Tasmania's equivalent of Uluru in Central Australia. As with Uluru, the changing position of the sun on the towering northern face of the mountain results in a myriad of different light patterns and mountain moods from dawn to dusk. Changing cloud formations and a winter snow capping add further dramatic atmosphere.

It is possible to explore and climb to the summit of Mount Roland along trails from Gowrie Park, which also take the visitor through a range of different vegetation zones. The view from the summit is awesome.

A moody view from the top of Mount Roland. Image courtesy Jodie McQueen.

References

Corbett, K. D., 2003. Bedrock geological map of the Que River – Sheffield area, north-west Tasmania, 1:100 000 scale. Mineral Resources Tasmania.

The National Rock Garden—some aspirational rocks

Mike Smith and Ken McQueen, NRG Steering Committee

As the National Rock Garden (NRG) progresses to the next stage of acquiring the large rocks identified by our State Rock Selection Sub-Committees (RSSCs), the NRG Steering Committee is developing an aspirational priority list of key samples. Some of those significant rocks are discussed in this article.

From an educational perspective, a very desirable rock for the NRG is a specimen of Precipice Sandstone, which is one of the important groundwater aquifers within the Great Artesian Basin. The rock is a medium to coarse-grained, porous sandstone consisting of quartz, feldspar and volcanic fragments in a silica-clay-goethite matrix. It was deposited in the Early Jurassic in braided and meandering streams and rivers.

This specimen came from a quarry at Stanwell in Queensland. The hole in the rock is an external mould of part of a tree that was buried with the sands that make up the rock. The Queensland RSSC is investigating the options to acquire such a specimen.

Left: Detail of a sample of Precipice Sandstone in the Geoscience Australia TimeWalk.
Image courtesy Mike Smith.

Another good example of a current target rock is the approx. 1.7 billion year old Paleoproterozoic Hores Gneiss, which hosts the massive Pb–Zn–Ag sulphide mineralisation of the Broken Hill Line of Lode. The unit is a medium to fine-grained gneiss with evenly distributed, abundant garnet porphyroblasts. A porphyroblast is a large mineral crystal in a metamorphic rock which has grown within the finer grained matrix. Biotite gneissosity (layering) is well developed and pegmatitic quartzo-feldspathic segregations are common. The NSW RSSC is negotiating access to a suitable specimen for the NRG.

Detail of Hores Gneiss.
Image courtesy Barney Stevens.

One aspirational rock from Victoria is the Grampians Sandstone, which supplied the facades of many important buildings in Melbourne, including Parliament House, the Town Hall, the State Library, the Treasury Building, the old Post Office in Elizabeth Street and the Port Authority Building in Market Street. The rock is a marginal marine/fluvial sandstone of early Paleozoic age. Large blocks have been inspected at Heatherlie Quarry (locally known as Mount Difficult Quarry – see image above) established in the 1860s, and located on the eastern side of the Grampians off Mt Zero Road.

Large blocks of Grampians Sandstone at the Heatherlie Quarry. Image courtesy Mike Smith.

Kalbarri National Park in WA is the location of the Silurian Tumblagooda Sandstone, which contains the trackways (footprints) from *Kalbarria* (an arthropod with 11 pairs of legs), making an interesting story for children and others! A challenge for the NRG will be locating specimens for which we can obtain approval for transfer to the ACT. The Kalbarri Skywalk which opened in June 2020 is a brilliant engineering feat overlooking the Murchison Gorge (See https://parks.dpaw.wa.gov.au/site/kalbarri-skywalk).

Did you know that the Murchison River is one of the only rivers in WA which has no introduced fish species?

Left: Polished slabs of Tumblagooda Sandstone installed as seating and as tables at the Kalbarri Skywalk. Image courtesy Marcus Harris.

The NRG is planning to add Mt Isa's Eastern Creek Volcanics, considered a significant source of indigenous stone tools on the traditional lands of the Kalkadoon people. These Paleoproterozoic rocks are a series of copper-enriched tholeiitic basalts which occur adjacent to the giant sediment-hosted Mount Isa copper deposit in Queensland. The volcanic rocks are often cited as the source of metals for the deposit. The Queensland RSSC has recently inspected field exposures of these rocks.

Right: Outcrop of Eastern Creek Volcanics south of Mt Isa. The fracturing evident in this photo may make it hard to secure a large coherent specimen. Image courtesy Ian Withnall.

An example from Tasmania of one of our target rocks is the Cambro-Ordovician Owen Conglomerate, which is described earlier in this newsletter. This is an attractive and significant rock which makes up some of the spectacular mountains in western Tasmania, including Mount Owen, near Queenstown and Mount Roland, just south of Sheffield. The Tasmanian RSSC is seeking a potential specimen for the rock garden.

Left: Outcrop and boulders of Owen Conglomerate in the Tyndall valley—perhaps a large boulder could be released to the NRG.
Image courtesy Ralph Bottrill.

Conclusion

To acquire these and other important rocks the National Rock Garden will need assistance and significant funding for their transport and preparation. The NRG is calling for such support from the Geoscience community and from the general public.

Any assistance is most welcome including tax-deductible funding donations and in-kind assistance in generating scientific rock descriptions or lay-person rock descriptions which will be linked to the QR codes on rock plaques.

Support and donations can be directed through either of the authors or through the Chair of the Steering Committee, Emeritus Professor Brad Pillans (using brad.pillans@anu.edu.au).

New trilobite in shales of northern Tasmania

Dr Patrick M. Smith, Technical Officer, Australian Museum

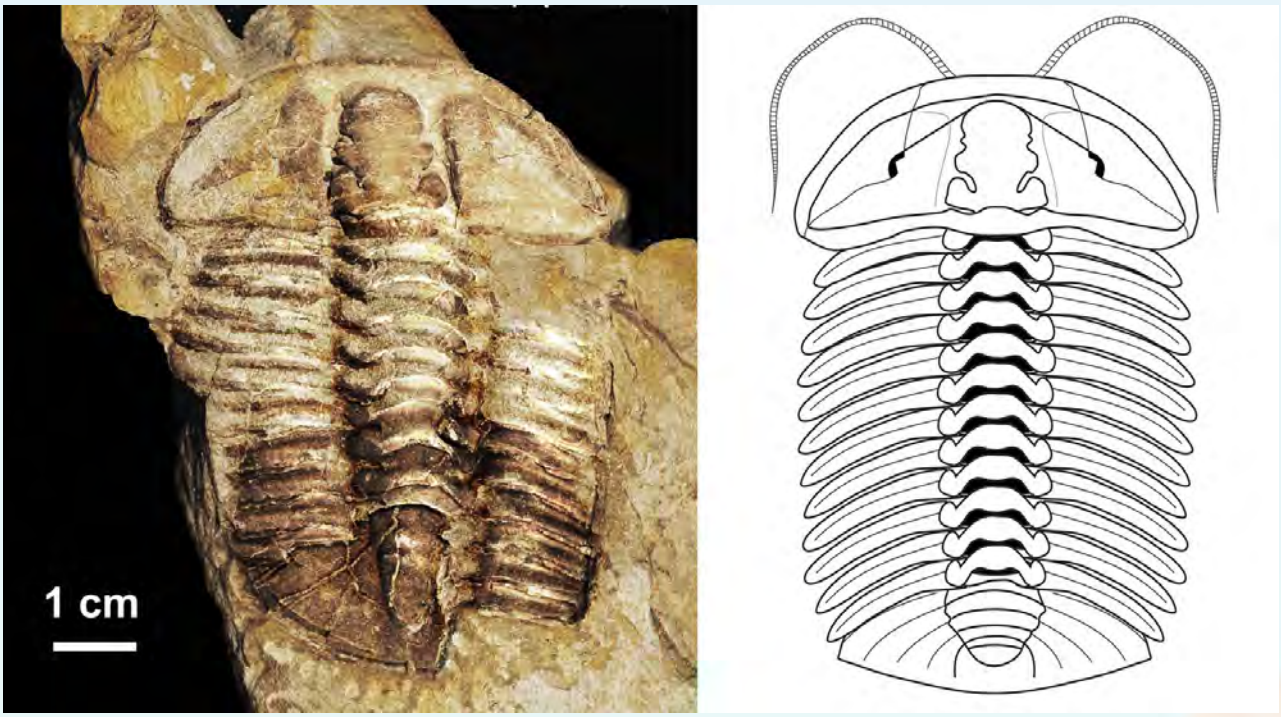
A new species of trilobite (a type of extinct marine animal) has been discovered in shales belonging to the Gordon Group in northern Tasmania. These rocks were deposited approximately 450 million years ago during the Late Ordovician Period, when Australia was part of the great landmass Gondwana. This was a time when complex marine ecosystems were just starting to develop, and when the first primitive plants were appearing on land.

Australian scientists, Dr. Patrick M. Smith, Australian Museum (AM) and Dr. Malte C. Ebach, University of NSW (UNSW), have called the newly discovered trilobite after the actor Tom Baker, aka Doctor Who, by means of the rather impressive name of *Gravicalymene bakeri*. The first part of the name identifies the genus to which the species belongs, while the second part, the specific name, uniquely identifies the species within the genus. Palaeontologists call this “Binomial Nomenclature” or more simply the "two-term naming system".

The discovery is reported online (pre-press) in the most recent volume of *Alcheringa* the Australasian Journal of Palaeontology (Smith and Ebach, 2020).

Naming the new fossil after Tom Baker, Dr Smith explained that he had been inspired to follow a career in science thanks to Baker’s particular incarnation of “Doctor Who". Patrick commented that he was not old enough to remember Tom Baker’s episodes which were originally aired between 1974 and 1981. However, while growing up as a teenager in the early 2000’s, he followed the show keenly and became convinced that a career in science was guaranteed to improve the world.

“In particular, it inspired me to study the concept of ‘Time’—as the Doctor travels through time. Hence, the area of science I specialise in is biostratigraphy, which is all about dating the age of Earth and its rocks” said Dr Smith.



Gravicalymene bakeri*, a new species of trilobite discovered in northern Tasmania and named after the actor Tom Baker. Image courtesy Patrick M. Smith.*

Patrick's co-author, Dr. Malte Ebach, who first found the trilobites, said that palaeontologists often discover fossils in unusual circumstances. He explained the method of discovery as follows: "In the late 1990s I was caught short while driving through Gunns Plains in Tasmania. Relieving myself on a convenient boulder I noticed that it was covered in trilobites. Palaeontologists discover fossils in the most surprising ways". And of course, Dr Ebach is also a Doctor Who fan. He was inspired to explore that natural world by Doctor Who, and especially the actor Tom Baker.

Tom Baker, who is based in the U.K., has said that he was thrilled to hear the news that an ancient and incredibly rare specimen had been named in his honour.

Arguably the second most famous fossil group after dinosaurs, trilobites are known by their distinctive three-lobed body. Their closest living relatives are segmented creatures such as crustaceans (e.g. prawns and crabs), chelicerates (e.g. spiders, scorpions, and mites), insects, millipedes, and centipedes.

While trilobites were common in Australia during the Ordovician, this new species is part of a genus that has previously only been found in Europe and North America at this time. Appearance of the genus in Tasmania may suggest that Australia was somehow connected to these other continents by oceanic currents.

The specific characteristics of which make this new fossil of particular interest are combination of a relatively straight anterior margin on the head; a semi-cylindrical glabella (nose-like element) which gently tapers forward; little to no deflection in the axial furrows adjacent to the largest glabella lobe; 12 thoracic segments; six axial segments on the pygidium; and four faint to almost effaced pleural ribs on the pygidium.

For help with some the technical terms used in the previous paragraph, please visit the Australian Museum web page: https://australian.museum/learn/australia-over-time/fossils/what-are-trilobites/

References

Patrick M. Smith & Malte C. Ebach, 2020. A new Ordovician (Katian) calymenid, *Gravicalymene bakeri* sp. nov., from the Gordon Group, Tasmania, Australia, Alcheringa: An Australasian Journal of Palaeontology, DOI: 10.1080/03115518.2020.1797874

Richard A. Fortey, 2001. Trilobite!: Eyewitness to Evolution. HarperCollins, New York, USA. 269 pp.

https://www.scientificamerican.com/article/a-429-million-year-old-trilobite-had-eyes-like-those-of-modern-bees/

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.

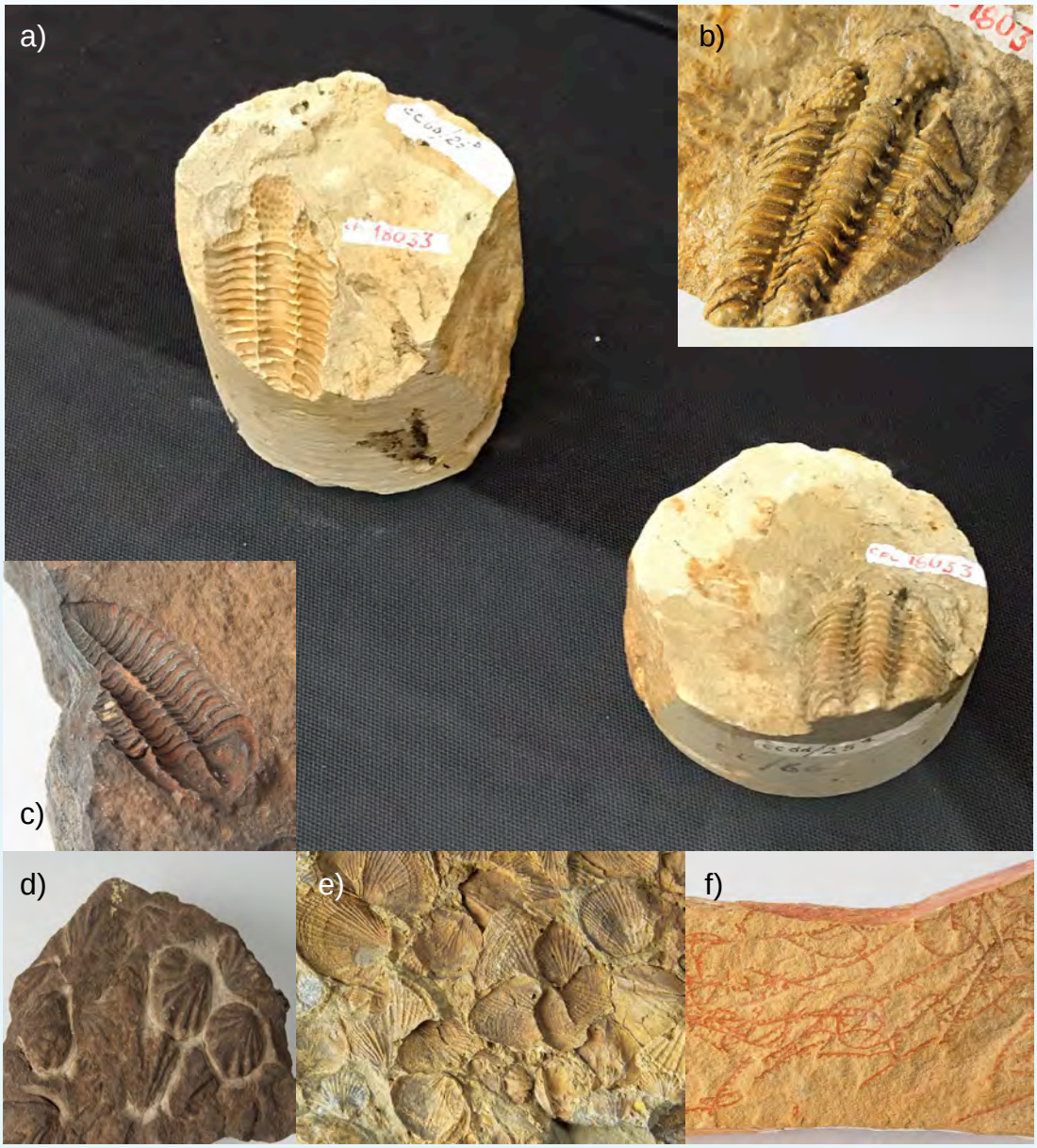
A fossil emblem for the Australian Capital Territory

Marita Bradshaw, NRG Steering Committee

The Australian Capital Territory has chosen its fossil emblem, it is *Batocara mitchelli*, a Silurian trilobite. This ancient marine arthropod won the popular vote against a strong field of other Palaeozoic invertebrates found in the ACT—two brachiopods, *Retziella capricorniae* and *Atrypa duntroonensis*, a graptolite, *Monograptus exiguus*, and another trilobite *Apocalymene coppinsensis.* An expert committee of geoscientists, palaeontologists, and science communicators selected these options and then online voting was open to Canberra residents for several weeks. More than a thousand people took the opportunity to consider the shortlisted fossils and learn more about life in the ancient seas that covered the nation's capital around 430 million years ago. The result of the poll was announced on Wednesday 21 October by Minister Mick Gentleman at Geoscience Australia, and *Batocara mitchelli* was successful with around 30% of the votes.

Announcement of the ACT fossil emblem by Minister Mick Gentleman at Geoscience Australia. Image courtesy Michelle Cooper.

Though trilobites have been extinct for around 250 million years they are one of the most familiar fossils with their characteristic three-lobed exoskeleton coming in a great variety of sizes, shapes and ornament, reflecting the diverse marine environments they occupied and their evolution over nearly 300 million years from the Cambrian to the Permian. With their eyes, multiple jointed legs for scuttling or swimming, and ability to roll up like a modern slater, trilobites just have more personality than the more sedentary shelly brachiopods and the enigmatic graptolite, a colonial filter feeder. No doubt, *Apocalymene coppinsensis* was also an engaging trilobite, but *Batocara mitchelli* is a worthy winner being the most common trilobite in the ACT and having distinctive knobby ornamentation on its head (cephalon) and tail (pygidium). A 3D model of the trilobite can be found at the weblink below, along with more detail about the other fossils and Canberra's geology https://artsandculture.google.com/story/a-c-t-fossil-emblem/twKCTqZZczzjKA.



Contenders for ACT Fossil emblem: two brachiopods, Retziella capricorniae *(d) and* Atrypa duntroonensis *(e); a graptolite,* Monograptus exiguous *(f); and two trilobites (a–c),* Apocalymene coppinsensis *(c) and* Batocara mitchelli *(a,b).*
Images courtesy Inspiring Australia website (b-f) and Michelle Cooper (a).

Batocara mitchelli has been found, along with corals and brachiopods, in the Silurian Canberra Formation. Limestone lenses (Canberra limestone or Acton limestone) within this unit occur along the Molonglo River and gave the Canberra region its early European name of 'Limestone Plains'. Most of these limestones are now covered by the waters of Lake Burley Griffin, but there are fossiliferous outcrops near the National Museum of Australia on the Acton Peninsula and on the slopes of Mount Majura. A large fossiliferous specimen of the Canberra limestone can also be seen in the National Rock Garden, where it is the ACT's representative in the Federation Rocks.

Only fragments of *Batocara mitchelli* are usually found, often just the heads and tails as trilobites shed their exoskeletons as they grow (much like modern day crabs), and the three-lobed skeletons easy disaggregate. However, an almost complete fossil was fortuitously intersected in drilling for the foundations of the Treasury Building in Parkes and this specimen of *Batocara mitchelli* is now proudly part of the Commonwealth Palaeontological Collection.

In the Silurian, Canberra was located near the convergent boundary of the Gondwanan continent and the global ocean of Panthalassa. What would become Australia was growing eastwards with the accretion of volcanic island arcs, continental slivers and thick sediment piles, and the intrusion of granite bodies from below. Selecting a trilobite as ACT's fossil emblem reminds us that here we have preserved a patch of the ancient seabed and evidence of creatures that lived over 400 million years ago, putting us in touch with "deep time". *Batocara mitchelli* now joins the ACT's other emblems, it may not be as pretty as the Royal Bluebell, or as cute to some as the Southern Brush-tailed Rock-wallaby, but it is the most venerable and is certainly less noisy than the Gang-Gang Cockatoo.

Both Western Australia and New South Wales, have Devonian fish as their fossil emblems, Mcnamaraspis *kaprios*, the Gogo Fish from the Kimberley, and *Mandageria fairfaxi*, found at the Canowindra fossil site. South Australia has *Spriggina* from the world-famous Neoproterozoic Ediacaran fauna of the Flinders Ranges. This 550-million-year-old soft-body fossil is the first animal with a bilaterally symmetrical body. The posts of fossil emblem are still vacant for the other states and the Northern Territory, and for Australia. Perhaps an extinct marsupial from the Pleistocene megafauna would be suitable national fossil emblem, a *Diprotodon* or *Thylacoleo* (especially given the popularity of cats on social media)?

Explore the winning fossil and the other candidates from the comfort of your home through this online exhibition.

Those in Canberra may like to take the Australian Capital Territory fossil emblem rock and fossil self-guided tour.

The Kristall Galerie Swakopmund, Namibia

J.R. Lord, Geologist/Geochemist, Brisbane

The Kristall Galerie is an educational geoscience facility located in Swakopmund, on the coast of northwestern Namibia, about 280 km west of Windhoek, the capital and largest city of Namibia.

The Galerie was founded in 1998 and, according to its website, has the world's largest quartz crystal cluster on display, as shown in the spectacular image below. The quartz cluster is from a pegmatite, an intrusive igneous rock with very large crystals that forms in the later stages of a magma chamber's crystallization. Milky and smoky quartz form the bulk of the quartz core. Individual quartz crystals measure up to 2 m in length and 2 m in circumference (Schneider, 2020).

World's largest quartz crystal cluster on display. Image courtesy Kristall Galerie website.

The source of these quartz clusters is a zoned, rare-metal pegmatite which was mined for its tourmaline in the Erongo Region of Namibia. The pegmatite has a strike length of approximately 2.3 km, dips almost vertically and its width ranges between 250 and 340 m (Roering, 1963).

Green tourmaline occurs together with the large quartz crystals and sometimes there are so-called "watermelon" tourmalines, a variety having a pink core and a green rim. The tourmalines are partly or totally enclosed by the quartz crystals (Schneider, 2020).

The quartz crystals from Otjua are often doubly terminated, thus identifying them as 'floaters', i.e. they grew while floating in the mineralizing fluid, rather that growing onto a surface. There is no record in the literature for the largest quartz 'floater' ever found but with a length of 2.2 m and a circumference of 1.8 m, it might well be that a floater from Otjua fits that title. One floater has an estimated weight of 1 ton and is part of a cluster displayed in the foyer of the Kristall Gallerie in Swakopmund. (Schneider, 2020)

Outside the gallery there are several large quartzite boulders showing quartz veins that are a brilliant example of open-space filling, with successive generations of amethyst and white quartz growing from the vein edges towards the centre.

The forecourt of the Krystall Galerie in Swakopmund. Photo from DestiMap.

Open-space quartz veins growing from both sides of the crack in the host rock towards the centre, Kristall Galerie, Swakopmund, Namibia. Image courtesy Russ Lord, 2002.

Similar open space fillings have been observed in rocks on display at the Natural History Museum in London and an example is shown below.

Open-space filling: multiple generations of quartz and amethyst growing from the vein edges towards the centre, Natural History Museum, London. Image courtesy Russ Lord, 2019.

Left: Multiple open space filling episodes from a specimen in the National Museum in Prague. Here you have at least three minerals sequentially precipitating—one white (probably quartz), one red (possibly hematite?), and one a crème colour. The specimen is ~20 cm across. Image courtesy Russ Lord, 2010.

Readers will be familiar with similar textures growing into open space with geodes/thunder-eggs (see right).

Right: Concentric zoning in a geode from Brazil, 8 cm diameter. From the Lord collection, 2020. Image courtesy Russ Lord.

Left: Concentric zoning in a geode from Uruguay, size 20 cm across. From the Lord collection, 2020. Image courtesy Russ Lord.

References

Roering, C., 1963. Pegmatite investigations in the Karibib District, South West Africa. Unpublished Ph.D. thesis, University of the Witwatersrand, 130 pp.

Schneider G., 2020. The Kristall Galerie houses the largest known crystal cluster in the world, http://www.namibiangemstones.com/index.php/about-us/largest-crystal-cluster.

Mintaro slate quarry memories

Brad Pillans, Director, National Rock Garden

The story about Mintaro Shale in our last NRG newsletter (Newsletter No. 19, May 2020) prompted one of our “Friends of the NRG”, Ros Walcott, to forward the newsletter to a scientist friend of hers in the US, John Kearney, who was born in Orroroo, South Australia, in 1945.

It turns out that John’s grandfather, Daniel Kearney, worked in the Mintaro slate quarry probably in the 1900-1920s. John also says that he has been to the quarry, first when he was 9-10yrs old and then again in later life. His cousin Brendon, a previous director of the Royal Adelaide Hospital, who has visited John in Alabama every year since 1984, has an antique print of the quarry – see photo below. His observation is that the floor of the quarry is now much lower than in the print, so it was probably made in the early 1900’s.

Also, Brendon Kearney’s father, Bernie Kearney (who was the Director of Education in South Australia and the Northern Territory at one time), was the son of Daniel and donated an altar of Mintaro slate to the new Cathedral in Darwin when it was built in the 1960’s. The altar was in memory of Daniel Kearney.

Mintaro slate quarry, probably in the early 1900s. Image courtesy the Kearney family.

The Federation Rocks display at the National Rock Garden

National Rock Garden

Celebrating the Geological Heritage of Australia

Although work by committee members and friends of the National Rock Garden is voluntary, we nevertheless incur the regular costs of an incorporated entity. There are also costs 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.

The acquisition and display of the Adelong Norite in November 2018 and the Mount Gibraltar Microsyenite in March 2018 was each a great success, with good local, regional and national publicity. We are currently documenting proposed new rock garden display specimens and planning a major fund-raising campaign to construct an Interim Gallery Display.

While the committee pursues major funding from corporate and government sources, the ongoing costs must be met. We therefore seek donations from individual geoscientists who recognise the importance of geoscience and geoscience education to the future of Australia.

WE WOULD REALLY APPRECIATE YOUR FINANCIAL SUPPORT

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Email: bradpillans@anu.edu.au

A cheque made out to the National Rock Garden Trust is also acceptable.

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: bradpillans@anu.edu.au or michelle.cooper@ga.gov.au.

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Keep up with the latest NRG news, rock movements, rocks of the month and a whole lot more. Like us on Facebook:
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Newsletter compiled and edited by Mike Smith and Michelle Cooper.