

FOSSIL CAVE MEGAFUNAL DISCOVERY AND RETRIEVAL, 2009

– Neville Skinner

For me the discovery of important megafaunal bones had started with a dive in Fossil Cave (5L81) back in August 2008, at a time when Matt Skinner was preparing for his CDAA Penetration (Advanced Cave) course and keen to dive as many sites as possible. Megafauna relates to large animals (mammals & flightless birds), usually heavier than 30kg, that have become extinct since the last ice-age, i.e. from 1.6m to 10,000 years ago approx.

The '5L81' refers to the official cave reference number recognised by the Cave Exploration Group (of) South Australia (CEGSA) Inc., replacing its original south-east reference number 'S123' in the mid-1970s with its Lower south-east number of '5L81' ('5' referring to the state of SA, 'L' for the Lower South East, and '81' because it was the eighty-first cave registered in the then newly-defined LSE area).

Until recent times the recorded name for Fossil Cave was 'The Green Waterhole'; although it has also been referred to as the 'Greenwater Hole Cave' in some past reports. I imagine this naming was because of the green plants that grew from the waters edge across the surface, combined with the green moss that grew on the rocks and the ever-green foliage within the doline. When horses were the normal mode of transport a hundred years ago, they probably drank from The Green Waterhole, and likely fed on the green grass that grew in the doline, supplemented by the apples that were planted along the roadside for that purpose.

During the writing of this article I wrote to fellow cave diver Peter Horne asking for clarification on the Green Waterhole name. Peter had compiled a considerable history about the feature through coordinating a major mapping and bone-retrieval project in the cave during the late 1980s, and he subsequently informed me that in the South Australian Government Gazette of 4th May 1989 (page 1215) it was 'recommended that the names Goulden Waterhole and The Green Waterhole be altered to Goulden Hole and Fossil Cave respectively'. I am presently waiting to hear if this eventually happened (it is possible that it may not have), and if so, when. Readers ought to be aware of the cave renaming since the significant discovery of fossil bones there in the 1970's, as the name 'Green Waterhole' remains valid for searching on past articles.

Earlier in 2008 Bruce Bulled discovered a new room in Fossil Cave, which he had shown to Matt and others on a previous dive but which had not yet been fully explored. This was a good opportunity to explore this new room. After entering the water Matt reeled and I followed. Following the obligatory check of the main area of the cave, we headed to that part of the cave where the new room was located. When I first saw it I realised why it had not been discovered sooner – it was a well concealed opening, about 400-

500mm across, between rocks that led into a small room.

Matt shot into the entrance of the small room like a rat up a drainpipe, with me close behind, until I realised there may not be enough room for the two of us. At that point Matt had hardly gone 2m in to check out the room and was now on the other side of it. Perhaps I had over inflated my expectations a smidgen I was thinking, as I waited for Matt to find a space to turn around before heading out again. While Matt stopped to investigate a window in the floor I noticed a tunnel heading off to my right, which had a few bones sitting on a ledge adjacent to its entrance (see Figure 1) that Matt had not yet noticed.

As Matt was swimming toward me ready to leave the room, I flashed my torch at the tunnel entrance, and since Matt had the reel he entered the tunnel first with me in close pursuit. It was evident from the silt pouring down from our bubbles, and the white silt mounds half-blocking the tunnel entrance, that no-one else had previously entered that area. We could see that the tunnel went for several metres and appeared to open out into another room.



Figure 1: Silt pile at bottom of fissure, on ledge at entrance to tunnel (NRS)

Taking great care not to disturb or damage any bones that might be contained in the silt mounds blocking the tunnel, we carefully pushed these aside and pulled our way in (by now I'm quite accustomed to following in zero viz). Matt continued to the end of the tunnel that widened as we entered, then dropped down into the lower corner section and poked his head into a second tunnel. Wow! Everything in this section was covered in totally undisturbed virgin silt, which meant that very quickly silt was raining down from the ceiling at an increasing rate. I watched from the side and above as Matt disappeared into the lower section tunnel, now almost hidden by silt. At that point I reassessed whether I should stay where I was as this would likely result in an untidy collision with Matt on his return, so I decided to move back to the tunnel entrance and wait for him to reappear, as it would compromise diver safety to blindly follow.

I was very pleased for Matt because he had been trying desperately to get into another area nearby that I now believe might be linked. Perhaps this was the lead Matt had been searching for all along. When Matt reappeared, grinning from ear to ear, we both exited the cave and agreed to come back another day and check this area out further. Matt told me he had travelled another 2-3m to the end of the tunnel, but it had become too silty to see much detail.

It was not until May 2009 that we eventually returned, due to Matt having to complete his Penetration course, after which our focus switched to diving Pen-rated sites for several months to achieve Tank Cave access for Matt.

This time we headed straight for the new area, where Matt reeled into the tunnel while I explored the area of the first room adjacent to the tunnel entrance. To my surprise, I realised I could see Matt down below me through a gap in the rocks. I shone my torch down at Matt as he was looking in the direction of what appeared to be a megafauna jaw, along with other bones directly in front of him and signalled to him not to touch them.

Matt was clearly very excited on his return and we exited the cave feeling very pleased with ourselves. We then discussed the importance of not touching the fossils because they would be extremely fragile and may fall apart when handled.

Most divers are not aware that ancient fossil bones become the property of the state museum in the state in which they are found, the instant they are removed from the water. (In our case, special arrangements were made by the Flinders University to have these specimens located at the University, rather than at the SA Museum.) It is illegal to remove bones from sites without permission and an approved collection permit. Fines can be imposed by the SA Government on divers removing fossil bones without these approvals.

As mentioned previously, fossil bones can be very fragile and may fall apart when removed from their gravity-free environment. Bones should not be removed to the surface until arrangements for their removal have been put in place that includes containers to put them into, before carrying them through or lifting them out of the water.

They can also become flaky and fall to pieces when they dry out. Old bones become very thin over time due to dissolution in the water with time. They need to be kept damp until treated by specialists. Never try to clean them underwater; this should be left to the trained specialists in controlled conditions.

The exact location of the bones must be recorded before, or at the time, they are moved (refer Figure 7). This information is vital in establishing links to previous or future finds in the same area that may be related. Sometimes fossil bones are discovered in apparently different areas and it isn't until later it is realised this is the same animal that has partially slipped into a new

position due to subsidence or interference by another animal for example.

After the fossil bones have been removed a marker is usually left behind to identify the area where the bones lay in case additional follow-up checks for 'missing' bones are required. These markers are also useful links back to written reports regarding the location of bones in the past.

I suggested to Matt that we come back with the camera and document them before they were disturbed by anyone. Matt was concerned about the possibility of other divers damaging the bones when entering the confined space where they lay.

The following month we returned with Matt's camera, and this time we both entered the confined area at the bottom together. I could see from below and behind Matt that he was having trouble holding the light and taking photos of the jaw at the same time, so I moved forward underneath him just as he set his primary light aside to take the photos using internal flash. Matt was quite surprised when suddenly my light appeared on one side of the jaw being photographed and his light appeared on the other side, providing underwater 'studio' lighting on-site!

Once Matt had photographed the jaw for identification purposes (refer Figure 2 & 3), seemingly from every conceivable and imaginable angle, we carefully returned it to the exact spot from whence we had found it.



Figure 2: Location and ID photos of first *Sthenurus* jaw taken in-situ (MS)



Figure 3: Jaw replaced in silt where found after ID photos taken (MS)

Matt then emailed the images to Mr. Steve Bourne, DEH Deputy Regional Conservator for the South East Region, for identification. Here's what Steve said:

'It's *Simosthenurus occidentalis*, one of the extinct browsing kangaroos. Gavin Prideaux from Flinders Uni ID'd it to species. Limb bones are more than likely the same animal. Discussing with him about possible collection. There was a complete skeleton of this species recovered from there a few years ago. Good find though.'

Steve then began the process of obtaining Government approval for the removal of the fossils from the cave to Flinders University of SA, where they could be examined by Dr. Prideaux and hopefully linked back to the other specimens taken from the same site over the last 30-40 years.

According to a detailed research report by the South Australian Underwater Speleological Society Inc.¹, fossil bones were first discovered in Fossil Cave back in 1964 by Mr. G. McKenzie, which subsequently resulted in many fossil bones being located and removed from the site in January 1968 by Messrs. McKenzie and Brian Brawley, 'including six extremely well-preserved sets of skulls and jaws'. This discovery was reported in 'The Border Watch' newspaper on 27th February 1968, and resulted in further expeditions taking place later in 1968, early 1969 and in June 1974.

Following the discovery of more bones in the cave in late 1978 by divers from the Flinders University, the area was thoroughly checked using a star-picket grid pattern to assist in recording bone locations. During this search a 'nearly complete and excellently preserved skeleton of a *Sthenurus kangaroo*' was found, and it was the assemblage of this skeleton that showed the species was 'in fact relatively short, stocky, large-necked animals'.

Sthenurus (Latin for 'Strong Tail') is the name of the genus to which the species *Simosthenurus occidentalis* belongs. These are believed to have been extinct for 50,000 years. An impression of what this browsing kangaroo looked like and more information may be found on the DEH website at:

<<http://www.environment.sa.gov.au/parks/sanpr/naracoortecaves/ea4.html>>

It is a credit to those early cave divers that complete skeletons were still able to be removed from on top of the rocks in Jan 1979², some 10 years after these sites had become popular dive sites, and almost 6 years after the formation of the CDAA. It is the remains of 80 star pickets and 750m of line that were installed in Fossil Cave during the Christmas break of 1978 that can still be seen in the cave today².

Upon seeing pictures of the jaw found in Fossil Cave in 2009, Mr. Neville Pledge (Senior Palaeontologist, SA Museum) said 'The specimen certainly is 'megafauna'; it is a jaw from an immature sthenurine, possibly '*Procoptodon occidentalis*. [used to be *Simosthenurus occidentalis*.], but I can't be certain without examination and measurement.'

After negotiating with Steve Bourne, as well as Dr. Prideaux and others, it was agreed we would remove the fossil bones on the weekend of 15-16th August 2009.

We also invited cave-divers Mark Nielsen, who had been involved in previous bone retrievals from Fossil Cave, to join us and share his expertise, and Grant Pearce as well as CDAA Site Director Rob Brennan who was not able to make it that weekend.

Matt Skinner, Mark Nielsen and I started the day late on the morning of Sat 15th August with a pleasure dive in The Pines to ensure our gear was ready for the dive later in Fossil, hitting the water at 11:45am!

We did not want to start the dive in Fossil Cave in the company of the landowner and others to find we had gear issues. Not that we expected any of course. We were also careful to avoid decompression obligation as we were prepared to spend considerable time under the water, and we knew we would be bounce diving for the time we were there.

On arrival at Fossil at about 1:30pm, we went straight in so Matt could take some video footage of the area, before coming back out to await the arrival of the others.



Figure 4: Bone deposits at end of tunnel, in lower area (MS)

Grant Pearce was expected to arrive first, followed by Steve Bourne (DEH) and Dr. Prideaux who were coming from the Naracoorte Caves to receive the fossil bones from us as we brought them to the surface. We did not want the responsibility of taking these back to Adelaide with us for fear of something happening enroute.

Grant arrived around 2:30pm or thereabouts with the marking pen we needed to mark our removal containers. We used the extra time to brief Grant on how we planned to remove the bones and get them to the surface safely, and to ensure we were ready to hit the water.

Once Steve and Gavin had arrived, we spent 10-15 minutes discussing what they wanted (in terms of silt samples, etc) before donning our dive gear once again. Silt samples are required to allow chemical/geological analysis of the immediate environment in which the bones are located. If analysis of the bones reveals the presence of any unusual elements, then the silt may be tested to ascertain whether the bones have been contaminated by their surroundings.

Matt, Mark and I entered the water together, with Matt and Mark 'de-fossilising' the tunnel area together, and myself in the main chamber area and off to the side. It was clear from the beginning there was no room for three divers inside the tunnel, so we agreed beforehand that I would remove the fossils from outside of the main rock-pile and adjacent to the tunnel entrance which we believed may belong to the same animal. I also spent some of this time checking the rock-pile over to ascertain how the fossils made it into where they were found. During this time I noted I could see Matt's light inside the rock-pile from the top, looking down through a 300mm wide vertical fissure in the major section of rock that forms the bulk of the rock-pile. Presumably this fissure was created when the roof section fell down onto the rock-pile and broke, but I still found it extraordinary that the two sides of the fissure appeared to be so precisely parallel over their considerable length (10m?) and depth (4-5m).

Steve and Gavin were on-site from approx 3:10pm until 4:15pm. Before they left I advised them that a second jaw had been discovered that was in excellent condition, with all teeth intact, and that this would be retrieved next, but unfortunately they had run out of time and were unable to wait. They agreed for us to drop the remaining bones off to them at Naracoorte Caves on our way back to Adelaide, rather than expecting them to return the next day at 5pm to take delivery of same. This would not only save them the cost of the return trip plus 2.5 hours travel, but would also put us an hour ahead of schedule on our return journey.

It was shortly after Steve and Gavin had left the site on the Saturday that I removed the second *Simosthenurus occidentalis* jaw, which was indeed a fine specimen. I made no attempt to clear the silt off the jaw prior to removal, as the coating of wet silt helps to prevent the bones from drying out. We wrapped the bones in chemical-free paper provided by Gavin, and then wet the paper to prevent the bones from drying out. I am aware that it is not good to wrap fossil bones in

newspaper and the like, because printers ink and kerosene can contaminate the bones and render them useless for DNA sampling if required.

We finished up around 4:45pm that afternoon; Matt was running low on air and we were all keen to ready ourselves for an ale and meal. All the bones including the jaw were carefully placed on paper in separate plastic bags according to location; the bags were labelled and then put into a cardboard carton that we (very carefully) took back to our lodgings for safekeeping. The carton spent the night safely stored under the bed.



Figure 5: Second undisturbed *Sthenurus* jaw prior to removal (NRS)



Figure 6: Second *Sthenurus* jaw after removal, covered in black silt (NRS).



Figure 7: Peg 3; location of the second *Sthenurus* jaw marked after removal (NRS)

Due to the extremely poor visibility within the rock-pile and the fact we were returning the next morning, we decided that rather than remove our

guideline to the surface, we would disconnect the end of it at the surface and leave it at the 4-5m mark where it could not be readily accessed by visitors.

On Sunday morning we decided to go straight to Fossil Cave as it was apparent that if we were to get to Naracoorte by 4pm then we would have to be gone by 2pm or earlier, as we still had to return to Mount Gambier to pick up our gear. We also agreed this time it would be better to separate into three groups of one, to maximise private space and facilitate more efficient collection. Mark would focus on a potential new area we referred to as area #5 that was halfway between area #1 on the upper level and area #2 at the far end of the tunnel on the lower level. Matt would revisit area #1 near the entrance on the upper level, believed to be the source of bones falling into the lower level, and I would spend more time checking area #3 where I located the second *Simosthenurus occidentalis* jaw as well as further examination of the surrounding area.

Each area, typically around 1-2 square metres in size, was defined by a peg bearing the numerals 2009 for year of survey and a unique number within the range 1-5 (refer Figure 7). This is done to mark each area and provides a reference/record for any future studies or expeditions.

On arrival at Fossil Cave on the Sunday, we reconnected the line and I took my camera in for a few photos within the rock-pile, to the end of the tunnel. Upon entering I was quite surprised at how milky the water was from the previous day. Taking care to not disturb the silt further, I very carefully swam to the end of the tunnel and took one bad-viz photo (Figure 8) before withdrawing and inviting Mark in for a look prior to recommencing the task of collecting the fossil bones as planned. Later, Mark also commented on how silty it was in there.



Figure 8: Peg 2; silt pile at bottom of new area, directly below Figure 7 (NRS)

On further examination of the surrounding area, I was quite intrigued by the deep fissure in the rock-pile. During the course of trying to see the location of the top of the fissure from below, a line with a jump reel at the end of it was left hanging from the top by Matt, but still we could not see this line from below. I believe this to be due to the build-up of deposition from above into the lower section of the fissure, which blocked the angled

view to the surface some 3-4m further along the fissure, and that the key to finding more of the skeleton lies within this deposition at the bottom of this fissure. One would assume that much of this deposition would have occurred in more recent times due to the softening of the surrounding rock. I was surprised to later learn that it was a distance of 20m from the entrance of the tunnel into the rock-pile to the far end of the tunnel; it doesn't seem at all like it when you are swimming through. Matt had marked his line and after getting out of the water had measured it to obtain an accurate measurement.

We left the site at around 2:10pm (I think) on Sunday and it was a rush to get to Naracoorte at 4:25pm, where the palaeontologists were waiting for us in the car park (we had rung and let them know we were on the way and running a little late). I was surprised to run into Dr. Grant Gartrell with the same group, but later learnt that that week was 'Palaeontology Week 2009'. This also explained why Gavin was busy at Naracoorte Caves that weekend and wasn't keen to do the fossil collection at that time.

Gavin was delighted with the second *Simosthenurus occidentalis* jaw that I had found sitting on a shelf in black silt in near mint condition (as good as it gets), but probably no more so than the rest of the fossils because each is just as important as the other in assembling the skeleton. Disappointingly, Matt was not able to travel to Naracoorte with us as he was heading off in the other direction to Melbourne and was concerned about getting clear of the forests before dusk, due to the high incidence of kangaroos on the Victorian side of South-East SA.

After leaving Naracoorte Caves, Mark and I headed into town for a well-deserved feed at the local pub, only to find we were one hour too early for the pub meal we had been salivating for, so we settled instead for a feed at Pinkies Ribs. Afterwards I thought, not a good idea, too many bones...

We have been told that because of this discovery, all fossil bones previously taken from Fossil Cave and stored at the SA Museum have subsequently been relocated to the Flinders University, where a research grant has been made available for a short-term contract position for a palaeontologist to sort and collate those bones, along with any others from Fossil Cave that may have been stored at Flinders University.

Of particular interest to myself was the way the new area seemed to have been formed. The ceiling and walls/sides are scalloped limestone, similar to what may be seen in most caves where the water has dissolved the limestone away leaving an ornate effect such as one sees in Tommy Graham's, Engelbrechts West and Tank caves, to name but a few. The 'floor' on the other hand is made up of boulders, some small, some quite large. So why are the roof and sides of the new area scalloped when the rest of Fossil Cave is smooth?

I believe that what can be seen is in fact the roof of the cave that has fallen down and landed on

top of the original rock-pile formed when the current entrance doline collapsed. This would explain that large 300mm wide fissure, which I believe was formed when the roof came down onto the rock-pile and broke, with the lower section sliding down the slope 300mm more than the section above it. It also explains that nice round, rather smooth, gently sloping bottom that can be seen when one stands at the entrance to the water filled cave and examines the area under the water (only small sections of the large fissure can be seen from the top, since more recent roof collapses have added another layer of flat rocks that covers most of it over). This same effect can also be viewed by divers in several other places where there exist small rooms, many too small for divers to enter.



Figure 9: Roof collapse on top of rock pile/boulders, showing subsequent roof collapses (NRS)

This suggested to me that browsing kangaroos would have possibly slipped and fallen down into the crack in the collapsed roof whilst searching for, or attempting to drink, the water at a time when levels were much lower than those seen today, before eventually sliding down the slope into their final resting place.

The SAUSS report states ‘Greg Bulling and Chris Hales went to the cave on the weekend of October 18th (1987) and undertook an extremely valuable reconnaissance dive, locating a new and very rich bone site at the bottom of a 4-metre deep fissure.’ What wasn’t clear in the report is whether the bones were removed by some means of extracting them from the top of the fissure (see figure 10), or whether Greg and Chris had actually accessed the same area as ourselves, thus obtaining access to the fissure from the bottom. However this seems unlikely, otherwise the two jaws and other bones would most certainly have also been discovered and removed at that time.

On January 18th 2010, I received an email from Dr. Prideaux who said ‘you guys collected a more encouraging bunch of bones than I first

REFERENCES:

1. South Australian Underwater Speleological Society (SAUSS) Report #1: ‘Fossil Cave – 5L81 UNDERWATER PALAEOLOGICAL AND SURVEYING PROJECT 1987–1988’. Author: Peter Horne. <<http://sites.google.com/site/mgreports/5L81-FossilCave-SAUSSResearchReport1.jpg>>
 2. CDAA Occasional Paper No 2 Sept 1981 (from topics presented at the CDAA bi-annual conference 22 Sept 1979). Pages 4–12 (Williams, Rogers & Hiscock).
 3. <<http://mgreports.googlepages.com/5L81-PalaeontologicalWork-May2006.pdf>> (P. Horne)
 4. <<http://www.environment.sa.gov.au/parks/pdfs/005605.PDF>> – Pages 6-8 (L. Reed/S. Bourne)
- More reading may be found through a Google search of ‘Green Waterhole Cave’+Australia.

anticipated’, and went on to advise that amongst the bones retrieved was the humerus (upper arm bone) of a magpie-sized bird (not yet identified to species), a pair of lower jaws and several limb bones of *Macropus giganteus* (grey kangaroo), several limb bones of a wallaby, possibly *Macropus rufogriseus* (red-necked wallaby), pairs of lower jaws of two adult individuals of the extinct short-faced kangaroo *Simosthenurus occidentalis*, plus numerous limb bones, ribs and a vertebrae, and the most complete jaw ever found of *Palorchestes parvus*, the smaller of the Pleistocene marsupial ‘tapirs’. Dr. Prideaux also said that there were ‘some important specimens that we already have that are missing bits’, so every bone is just as important as the first. This was indeed exciting news; it meant our work was worth the effort and that our reward lay in the knowledge we had achieved something worthwhile for the world to share.



Figure 10: Looking down into the fissure portal from above (NRS)

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Thanks to Bruce Bullied for discovering the new area, and to Matt Skinner for his work liaising with DEH (Steve Bourne) in the subsequent retrieval of the bones. Many thanks also to Peter Horne for his advice and guidance on who to contact, how to record the fossil bone locations before removal, how best to retrieve the bones without causing damage to them, for providing a copy of his original SAUSS Research Report (No.1), and for additional research of historical facts.

And many thanks to Steve Bourne for organising the retrieval, and to Dr Gavin Prideaux for his help in the retrieval, collation and safe storage of the bones, and subsequent information about those bones included in this report.

Photos: Matt Skinner (MS), Neville Skinner (NRS)