

Day 11- Geraldton to Perth, via more stromatolites.

Due to a couple of complications it was yet another late one getting in and to set up the campsite at the Belair Gardens Caravan Park in Geraldton.

The main complication in mid-afternoon yesterday when one of the 4WD vehicles got bogged climbing a dune out of Carbla Point, after much digging, bracing and with some assistance from 'Super Ranger', the Landcruiser made its way out without any damage or sign of wear to the clutch!

Once in town, the all important supplies run, which should take 10 minutes takes over an hour!

Especially when you go via shops that close at 7 o'clock and it was now 7.05 pm (hmmm!) and you happened to have the only vehicle that was available for use, which also happened to be the vehicle that occasionally decided that starting was optional (See Day 8). So with life's essentials including 4 loaves of bread for breakfast the 'hunter and gatherer' team returned to base camp around 8 pm.

The evening festivities were well appreciated by all with a big barbecue, a few short speeches thanking the main players and a continued scientific discussion on the nature of stromatolites. The only interruption was Chris McKay's fireworks show mid-discussion, well it could not have been planned any better-as we all sat there facing the south-west two sizeable fireballs decided now was a good time to attempt atmospheric entry. After the initial buzz, it was agreed that they must have been around 10 metres across and skipped back into space due to the way that they dimmed after being in view for around 10 seconds. It was after the second meteor and some expert instructions from Chris that some of us hit the catering supplies of Aluminium foil to shield our tents throughout the night!

Back to the serious stuff-on the way back to Perth, there were two options. The Gravity Discovery Centre (<http://www.gravitycentre.com.au/>), the education and outreach facility to the Laser Interferometer Gravitational Wave Observatory linked to UWA Physics, also known as LIGO-Australia (<http://www.ligo.org.au/>) based at Gingin or to go via Nambung National Park near Cervantes-for what you might ask?

Stromatolites of course.

Nambung National Park is situated 162 km North of Perth (Along the new Indian Ocean Drive), apparently in the Wheatbelt region. Nambung is an aboriginal word from the local dialect meaning winding, after the local river and nothing to do with the curious structures we were about to see.



First on the agenda was to go via Lake Thetis to see another example of Stromatolites. Lake Thetis is found around 3 km south-east of Cervantes and takes its name from the ship that surveyed this part of the coastline in 1847-48.





(Above) a series of shots of the water's edge at Lake Thetis

The lake itself is around 300 metres wide and between 2-2.5 metres deep during winter and was believed to be formed around 3,000-4,000 years ago. It is characterised by microbial mat communities close to the lake's edge, which is ground water fed. The water in Lake Thetis is saline, up to around 1.5 times that of sea water (39 to 53 g/L-higher concentrations of salts including Na, K, Ca & Mg when the water level is low), alkaline (pH ranging between 8.2 and 8.6) and nutrient poor, but does contain small animals, such as insects, worms, small fish and crustaceans, including those from the Amphipoda order up to a few cm in length. In the central deepest part you find Flocculent Sulfur Bacterial mat (Purple Sulfur Bacteria) and diatoms. Above and around the lake a range of coastal and scrub bird life was also spotted through the reeds, grasses and acacia.

(Technical data extracted from 'Lake Thetis, Western Australia: an Example of Saline Lake Sedimentation Dominated by Benthic Microbial Processes, Grey et al, Aust. J. Mar. Freshwater Res., 1990, 41, 275-300')



(Above) A rock sample from near the water's edge that contained a cavern with a small crustacean.

Just when we thought we had all understood the processes of microbialite formation, this lake location provides something unique, the presence of this flocculent mat with the stromatolites.

What was discovered on the walk around survey was stromatolites and thrombolites, a microbial mat community that clumps rather than giving the dome structures. It also was evident through observation and reading that some of these stromatolites display columnar branching-narrow, closely spaced and almost parallel columns, which are extremely rare in modern stromatolites, but appear in fossil records of Precambrian (4.5 billion to around 542 million years ago) examples.





So a number of other factors to consider, including the timing of the lake formation, source of water and the prevailing winds (South-west in summer and northwest in winter), perhaps explaining some of the differences in density and distributions of the communities.

The key question then is why aren't there stromatolites everywhere today?

Science teams are examining the conditions at particular locations in an attempt to understand this very point. The symbiotic relationship between the cyanobacteria and sediment is essential, and important too are the saline and alkaline water conditions, but what is apparent is protection from the elements and prey. In secluded locations such as Hamelin Bay, Carbla Point, Lake Clifton, Lake Richmond, Government House Lake and Lake Thetis, where wind and water action is gentler than compared to beach front positions and survival seems to go a lot better when there are less things that can eat you, such as hidden lakes and particularly if you examine the early Pre-Cambrian, when it was stromatolite cities doing their best to pollute the Earth with Oxygen.

Understanding location and formation processes would certainly help greatly when looking at how to direct a rover, or later an astronaut, to investigate areas that may show stromatolite growth and therefore answering the question about life on Mars.



(Above) Chris McKay and Mark Gargano taking a moment out for a photo shoot- we came, we saw, we conquered-well the stromatolites didn't put up much resistance!

The second stop within Nambung National Park was the Pinnacles Desert, located 17 km down Indian Ocean Drive towards Perth. This unusual landscape where you find thousands of rocky columns in the middle of a coastal dune system. An unusual place that takes your breath away simply from the appearance and an uncanny feeling that you have just entered an ancient cemetery.



(Above) An image taken at the entrance to the Pinnacles Desert. This one is from a St Joseph's School Student Spaceward Bound from a couple of years ago, where students 'picked a pinnacle' for a quick photo-shoot-not that different to scientists really!

The materials for the limestone of the pinnacles originally comes from sea shells. Over time these shells were broken down into lime rich sands that were transported here through wave and wind action. Rain which is slightly acidic, dissolves some of the CaCO_3 , which finds its

way to the lowest point. As the dune formation dries out, this is precipitated out around the sand at the base of these structures, which begins the binding process.

In addition to this, vegetation at the surface stabilises these particular areas, forming a protective layer at the surface. The acidic soil continues the leaching process with calcrete forming and where lines of weakness are found, plant roots find their way in there. Areas that were not well supported erode away mostly through continued rain and wind action and more stable areas as time progresses forms these monolith type structures.



These structures have survived so well, as it is believed that they were only re-exposed by the wind from underneath the dune system in the mid-Holocene. Aboriginal evidence through artefacts suggest that this site has been well known and utilised by indigenous people for around 6,000 years (Although very probably only intermittently between coverings, thus the pinnacles have survived so well). What is interesting is that the Pinnacles Desert was only allegedly 'discovered' in 1956 (Although Dutch Maps show the area from 1658-there's those Dutch again), and was virtually unknown until the 1970's-only really being a part of the tourist itinerary since the 1990's. It really what is amazing what you can find in your own backyard.



(Above) Dr Rosalba Bonaccorsi demonstrating the walk like a pinnacle!

Even with the poor weather that held out for so long on our field days, 3 cars filled intrepid travellers persisted to view and get up close with these structures. After almost an hour investigating the desert park, a quick stop at the information centre before hitting the road for a bit over two hours to get back home-well at least to Trinity College at the University of Western Australia. After returning to Perth, and before we got too comfortable, it was time to unpack and tidy vehicles as all of our trusty 4WD's needed to be filled up and returned back to Perth airport that night, nothing like packing in a full day!



(Above) The hardened Spaceward Bound Pinnacle desert adventure team. Can you pick the two individuals that shop at the same store?