

ANDYSEZ 58

Early accounts of karst features in Quaternary “soft” limestones in Western Australia Andy Spate

My late father, the distinguished geographer, O H K Spate (1911-2000) left me a slim book which I had not investigated until recently - much to my shame. The 95-page book's title page is:

“A Sketch of the Physical Structure of Australia, so Far as it is Presently Known”

by J. Beete Jukes, M.A., F.G.S.

late Naturalist of H.M.S. Fly. 1850.

This little book is packed with interesting observations - including such passages as:

Lapse of time would tend still further to modify these different assemblages [of plants and animals] by extinction of the old species and the introduction of new ones, until at last the more distant groups exhibited a specific contrast ... (page 94).

Think rabbits, cane toads or introduced weeds!

Jukes's map and text draws heavily on the work of many others (as one would expect). Part of the map, from Cooktown in Queensland to the Torres Strait, is based on surveys by the HMS Fly and HMS Bramble in 1842-1845, with additions from the “Charts of Captain King R.N.” I can discern no reference to the amount of time Jukes and the HMS Fly spent in Australia.

There are many references to limestone but nothing on caves and karst, other than the paragraphs discussed below.

However, given that the work and map was produced in the 1840s and 1850s, it seems remarkably accurate - for example, the Nullarbor, south-east South Australia and western Victoria and parts of the east Gippsland coast are shown as Tertiary.

But the Leeuwin-Naturaliste is mapped as granite and other metamorphics. The Kimberley, and parts of the Northern Territory, is mapped as “Age unknown, but supposed to be palaeozoic [sic].” We now know that it is much, much older than that.

The book is octavo in size and extremely fragile. The two maps are on an imaginably thin tissue paper! Goodness knows what it is worth - my father paid £2/15/- in 1951! It now looks like the original book in good condition would sell at about USD\$3,000. There are many facsimiles available online - and many other mid-19th Century Jukes's books - he seems to have been a very interesting man. If anyone would like to see a scan of the whole book and maps, please contact me. Or find an online book.

Both Jukes and Charles Darwin (1846) encountered Quaternary calcarenites on visits to Western Australia. These are the so-called syngenetic dune limestones (Jennings 1985) in which we find the caves at Margaret River, Yancheep and elsewhere in WA and in south-eastern Australia, as well as a range of other karst features such as the pinnacles of Nambung National Park and the “Petriified Forest” at Cape Bridgewater in Victoria.

These two visitors are almost undoubtedly the first scientists to have discussed, albeit briefly, the features of these limestones in at least Australia and maybe worldwide. Just two paragraphs ...

This ANDYSEZ looks at their two contributions and introduces what will become the next ANDYSEZ.

In Jukes's book, at pages 60-61, we find:

In traversing the plain from the sea, you first pass for about ten miles over a district of loose white sand, quite impassable for wheel carriages, but covered by the usual forest of the country, and producing fruits and vegetables in considerable quantities in the gardens of the colonists. It consists partly of grains of quartz and partly of calcareous grains, probably rolled fragments of shells and corals. In several places it passes into the state of a rather soft friable limestone, sufficiently firm to be used for building stone. In other places are seen rising from the sand what appear to be trunks of fossil trees, having not only the external form of trees, but much even that resembles their internal structure. These occur throughout the colony in places wherever this white sand is found, and they have been frequently described at King George's Sound, where Mr. Darwin believed them to be calcareous concretions formed in the hollows left by decayed trees. In a little cliff near Freemantle, however, near the entrance of the Swan, I saw some of these dendritic masses fully exposed, and from their peculiar structure and conformation I believed them to be nothing more than stalactites formed in the sand by the percolation of rain water dissolving and taking up the carbonate of lime found in the sand, and re-depositing it in fantastic forms wherever a predisposing cause happened to determine it. I believe the limestone in these sands likewise to be formed in the same way, as the bedding had frequently a rather highly inclined or contorted dip, evidently not due to movements of elevation, but the result of their original formation. In this case I suppose rain to have sank through the sand, dissolving the carbonate of lime in its passage, till it at length became saturated or could sink no farther, and that, as it evaporated, the carbonate of lime was deposited in a crystalline condition, binding up all the adjacent grains into a more or less solid stone.

He obviously didn't believe in paragraphs!

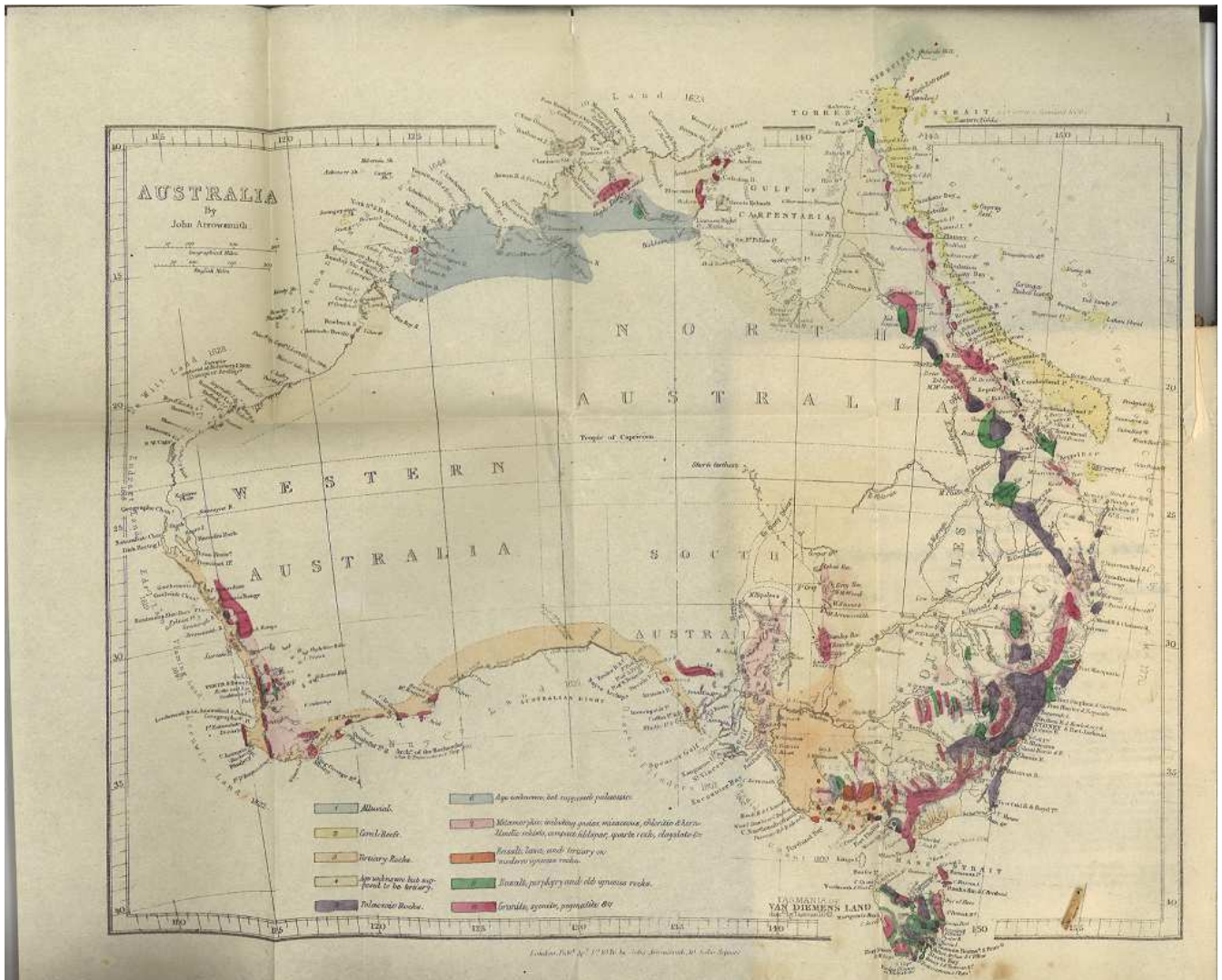


Figure 1 J Beete Jukes' pioneering geological map of Australia. Although the book was published in 1850, the near-unreadable text at the bottom says that the map was published in 1846 by Johnathan Arrowsmith, 40 Soho Square.

Darwin's book is considerably larger, with the second edition running to a "mere" 520 pages. Jukes may have only seen the first edition, as the years between Jukes's and Darwin's books seem too short when one considers the travel times between England and Australia in those days. The new Qantas 17-hour flights from Perth to England have nothing in comparison to the sailing voyages from England to Australia - four months!

Darwin's title page is:

JOURNAL OF RESEARCHES
 INTO THE
 NATURAL HISTORY AND GEOLOGY
 OF THE
 COUNTRIES VISITED DURING THE VOYAGE OF H.M.S. BEAGLE ROUND THE WORLD,
 UNDER THE
 Command of Capt. Fitz Roy, R.A.
 BY CHARLES DARWIN, M.A., F.R.S.
 SECOND EDITION, CORRECTED, WITH ADDITIONS.
 LONDON:
 JOHN MURRAY, ALBEMARLE STREET.
 1845

One day I accompanied Captain Fitz Roy [sic] to Bald Head; the place mentioned by so many navigators, where some imagined that they saw corals, and others that they saw petrified trees, standing in the position in which they had grown. According to our view, the beds have been formed by the wind having heaped up fine sand, composed of minute rounded particles of shells and corals, during which process branches and roots of trees, together with many land-shells, became enclosed. The whole then became consolidated by the percolation of calcareous matter; and the cylindrical cavities left by the decaying of the wood, were thus also filled up with a hard pseudo-stalactitical stone. The weather is now wearing away the softer parts, and in consequence the hard casts of the roots and branches of the trees project above the surface, and, in a singularly deceptive manner, resemble the stumps of a dead thicket. (P 450)

These quotes indicate that both gentlemen were groping to understand what was happening in the dune limestones - and their ideas are pretty good. Many other people have grappled with the karst geomorphological issues on the calcarenites since the mid-19th Century.

You might like to relook at ANDYSEZ 57 (Spate 2017) to refresh your minds about 'karren', although some of things that Darwin, Jukes and I will discuss are not mentioned there, as you will see.

Before we look at Darwin and Jukes, we need to look at some other things not mentioned in ANDYSEZ 57. These are rhizomorphs. To quote Ken Grimes (2017, p 517):

“Rhizomorphs (or rhizocretions [or rhizoliths]) are hard calcified root structures that are commonly associated with [solution] pipes. Rhizomorphs are common in calcareous dunes and have an obvious branching root structure. They form from carbonate that has been precipitated around the root, and thus are thus thicker than the original root - which may be identifiable as a thin hollow core if that has not been infilled by younger cement.”

Figures 2 and 3 display rhizomorphs. Note the solution tube in the centre of Figure 2. I also did not discuss pinnacles such as are found in Nambung National Park, WA, and at many other places across Australia and the world - we will come to them later - next ANDYSEZ. They are perhaps relevant to Darwin's and Jukes's observations.



Figure 2 (above) and Figure 3 (below)

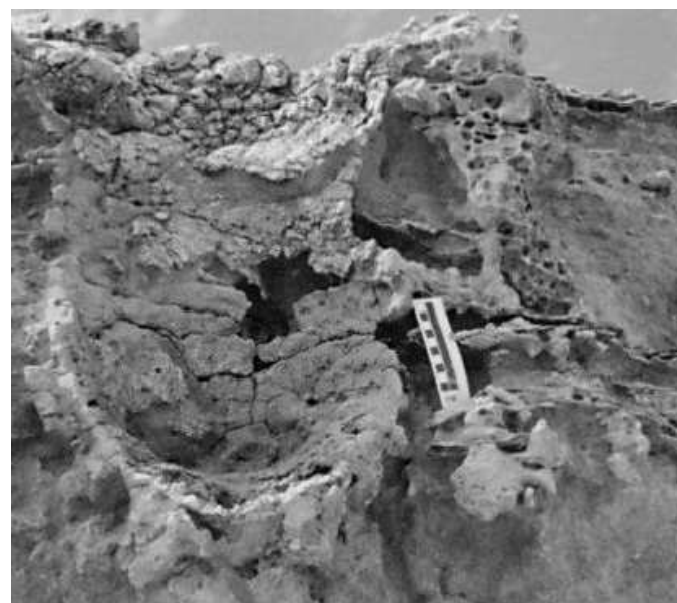


Being contrarian, but chronological, let's look at Darwin first. What did he see?

It seems that Darwin may have seen rhizomorphs, although that is not entirely clear but it appears likely. He mentions others seeing "corals". Note that he has mentioned bedding in the sands which we now know are calcareous dunes - solidified in most places. He certainly has seen solution tubes standing clear of the surface and interpreted them as "petrified trees" - many others have come to the same conclusion, including the Victorian national parks' people who persist in erecting interpretive signs about petrified forests despite being advised that such an origin is most unlikely (Grimes 2004). Ken pointed out that big trees do not grow at densities as shown in Figure 4. Nor is there evidence of tree roots, but the tubes have rounded bottoms as shown in Figure 5. Petrified forests seem to be on the outer - but more to come.



Figure 4 (above) and Figure 5 (below)



Now let's look at what Jukes had to say. He certainly seems to have observed rhizomorphs and solution tubes, again describing the latter as "petrified forests" - as many others have done since.

It seems that Jukes has observed much the same things that Darwin did - again interpreting remnant solution pipes as "petrified forests". He notes the dune bedding of the calcarenites and the mode in which they become limestone - very perspicacious.

I believe that he also observes rhizomorphs and correctly identifies the nature of the sands as shell and coral fragments [bryozoan algae skeletons are also present]. Both Darwin and Jukes misuse, in our modern thinking, the word "stalactites".

Both men have observed our aeolian calcarenites - of which we have more than anywhere else on Earth - early on in Australia's European history and deserve to be remembered as such.

And, on a lighter note, demonstrating that we are one nation, these calcarenites are known as:

- Tamala Limestone in Western Australia;
- Padthaway Formation in South Australia
- Bridgewater Formation in Victoria;
- Old Dunes on King Island, Tasmania; and
- Neds Beach Calcarenite in New South Wales.

Figure 6 shows a view of pinnacles at Nambung National Park, WA. Matej Lipar and many others have discussed these karst features here and elsewhere over many decades - they are much more complex than earlier discussions have made out.

Lipar and Webb (2015) provide the most definitive explanation of their origins. We will visit their findings in ANDYSEZ 59 in a future edition of the Journal.

CAPTIONS FOR FIGURES 2 to 5

Figure 2. Large rhizomorph mass with a solution tube in the centre (from the web but I lost the link).

Figure 3. Smaller rhizomorphs from Penguin Island, WA (from the web but I lost the link).

Figure 4. Solution tubes at Cape Bridgewater, Victoria (from Grimes 2004).

Figure 5. Solution tube bases at Cape Bridgewater, Victoria - no evidence of tree roots (from Grimes 2004).

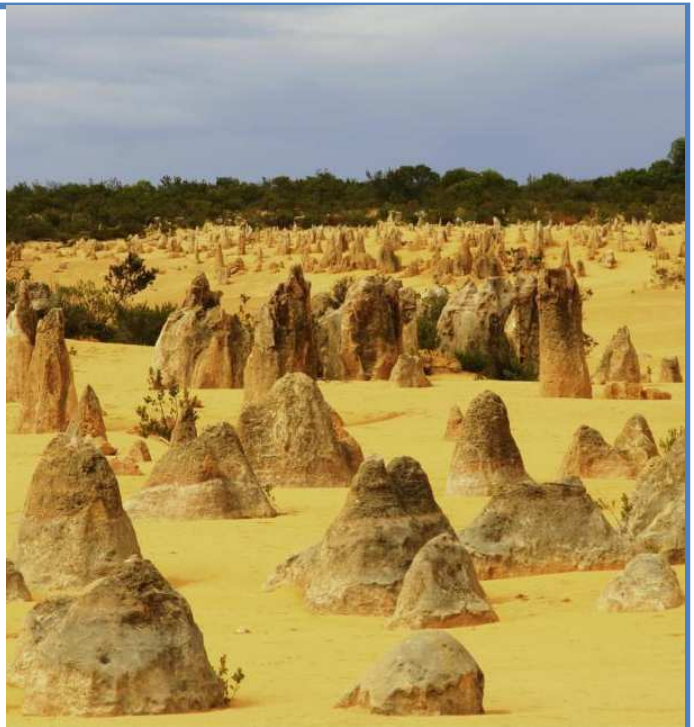


Figure 6. The Pinnacles, Nambung National Park, WA (from Lipar and Webb 2015)

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