

U3A Port Fairy
Science...naturally!

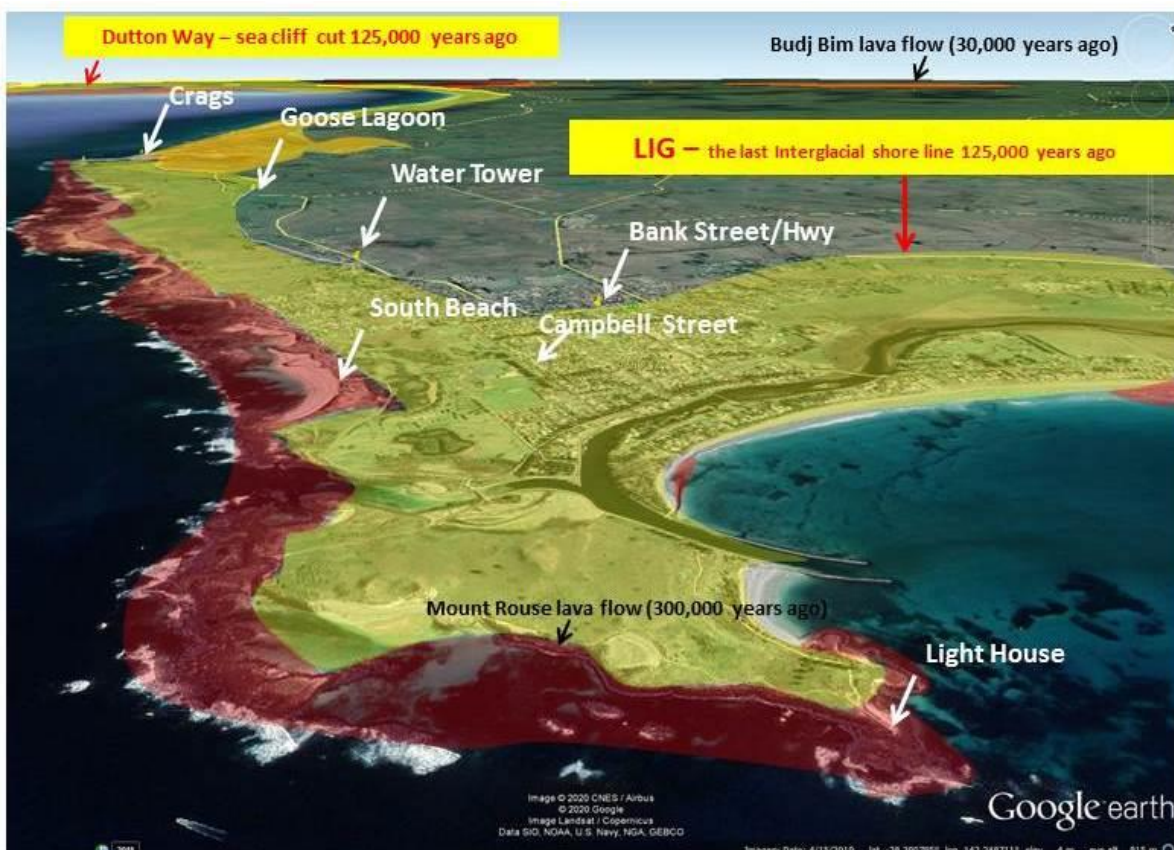
The Port Fairy Calcarenite – Self guided tour (a meditation)

Mike Raetz 26 May 2020

This, the second Geo-tour near Port Fairy part of the U3A self-guided series to relieve the tedium of COVID-19, highlights the *Port Fairy Calcarenite*; a skin of sand deposited during the *Last Inter Glacial* period about 125,000 years ago. The first Geo-tour discussed the 300,000 year old Mount Rouse basalt lava flow so evident along South Beach. The Port Fairy Calcarenite directly overlies that 300,000 year old lava throughout Port Fairy. It is mostly 2-5m thick and houses built on this ancient sand are stable as it makes a great foundation and perfect drainage.

[*Calcarenite* is a sand made from calcium mostly derived from ground up sea shells. *The Last Inter Glacial* period (also known as “LIG”) was the last time sea levels were about as high as they are now. Inter means between, used here to mean a time between two glacial periods.]

The extent of the Port Fairy Calcarenite is shown below; limited by the ancient shoreline at the top of Bank Street from which sea levels retreated after reaching 7 metres higher than present sea level.



Pleistocene sea level 125,000 years ago peaked @ + 7m

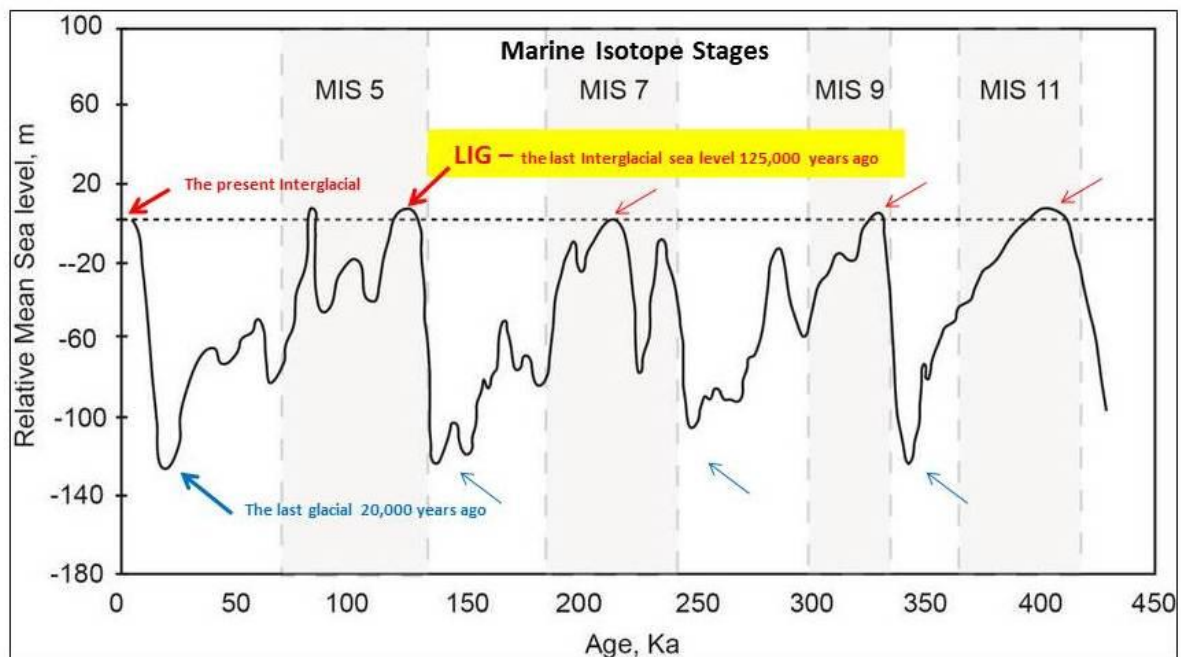
Deposited the Port Fairy Calcarenite throughout Port Fairy
as a thin skin of stranded beach and shallow water marine sand (pale yellow) overlying the Mount
Rouse basalt lava (pale red)

Why a Meditation? I can show you some low sand hills (and we will get to those locations); but mostly you will need your imagination as grass and buildings obscure this ancient sand. Therefore I wish you to meditate on the context:

- Time of the LIG - 125,000 years ago humans were still coming out of Africa but had not arrived here. The world emerged from an earlier ice age and seas had risen by 120 metres to roughly where they are now [more or less]. This rise peaked at about 7 metres above the present sea level cutting a sea cliff at the Dutton Way and depositing the Port Fairy Calcarene.
- Over the next 100,000 years the world would again sink into the another ice age, the Last Glacial period before present [about 20,000 years ago] and sea levels again fell 120 metres. Local volcanoes Budj Bim, Napier and Tower hill would erupt around 30,000 years ago. People struggled to survive; the average age of Pleistocene man was only 30 years. Times were tough.
- Then sea levels rose again world-wide until about 8,000 years ago by which time they had reached present levels [more or less by a few metres]. Locally Lake Condah filled and connected to the then nearby sea at Tyrendarra so aquaculture could resume. World-wide agriculture established civilisation as we know it.

So a lot of drama played out over the last 125,000 years. That is part of the drama of the upper Pleistocene period shown on the time line graph below.

[The *Pleistocene* period is the last 2 million years and locally we think of the upper Pleistocene as the last 500,000 years. This is represented in coastal sediments (the Bridgewater Formation) seen between Cape Bridgewater to Warrnambool. The LIG is just the last cycle of several interglacial periods.] [The most recent period, roughly the last 10,000 years, is termed the *Holocene* period.]



Pleistocene sea level curve

Showing Glacial periods (blue arrows) and interglacial periods (red arrows)

The Locations - what do these sediments look like?

Stop 1 – Campbell Street. If you stop by the gate at number 44 (directly opposite the aquatic centre) and look north into the backyard. You will see the ground rise a few metres. You are looking up a gentle ancient sand dune. If one were to dig a hole in the back yard one finds just below the topsoil about 50cm of the hardest limestone then bingo - down into perfect loose drainage sand. All the post war “austerity housing” along this part of Campbell Street is situated on the flank of a LIG sand dune. Typically the upper parts of these calcareous sand dunes have self-cemented over many thousands of years into a very hard limestone cap – a form of natural cement.

[I know this because I used to live here and dug post holes. I have heard expert opinion that it would take more than 10,000 years to form such a hard cap, so this cannot be a recent sand hill].

Stop 2 – The Central Business area of Port Fairy. Edmund Gill described it this way..*“the flat occupied by the business area of Port Fairy was once a seabed; the horizontally laid shelly sand accounts for its flatness. During the digging of sewerage trenches in recent years both the shelly sand and the underlying basalt have been revealed”.*

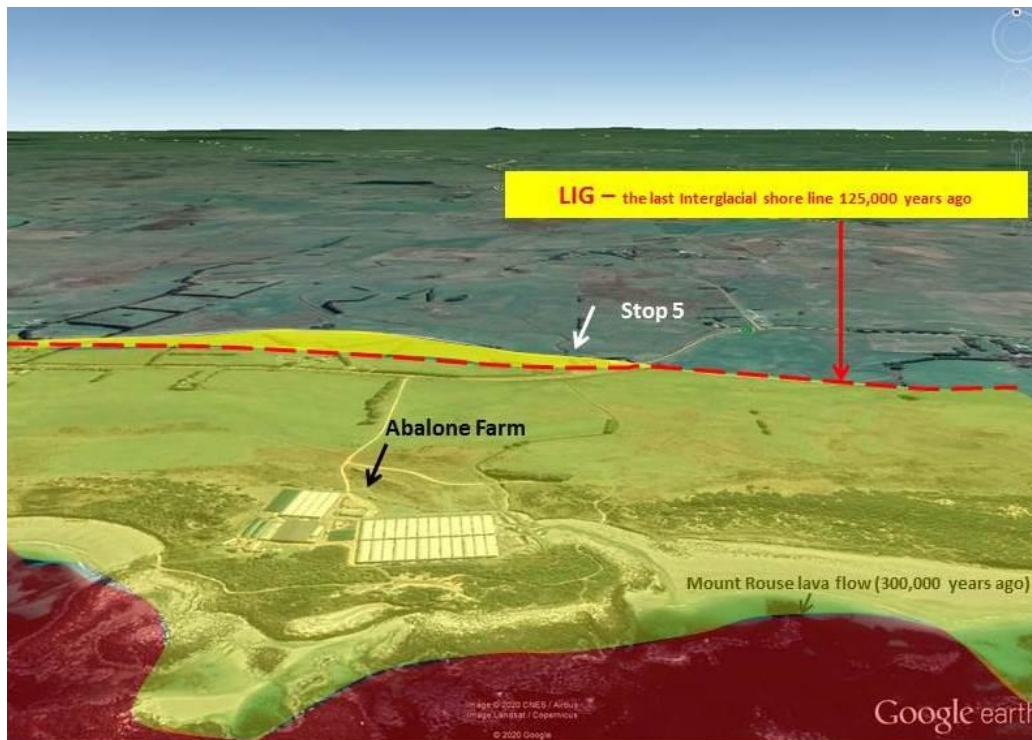
[Edmund Gill was one of the leading naturalists to work on this coast. He worked for Museum Victoria and published extensively on the geology, geomorphology and archaeology of the region. His wife Kathleen came from Warrnambool and together they published *The Geology of Port Fairy, Western Victoria, Australia* in the Victorian Naturalist, V90 pp251 – 255].

Stop 3 – Bank Street intersection with the Highway. Again it’s best to refer to Edmund Gill because today the secrets are hidden..*“before myxomatosis was discovered during a rabbit plague..they [rabbits] assisted considerably by digging out what was under the ground...in many places around Port Fairy they dug out sand rich in marine shells, including some not now living on the Victorian coast... On the north-east corner of the intersection of the Princess Highway and Bank Street, well rounded basalt boulders, shells and shell sand are cemented together. This is part of the ancient shore.”*

[Gill goes on to say that.. *“at that time the sea reached the Crossley Scarp and overlapped the basalt in the lower lying areas. It occupied Goose Lagoon, and also the flats between Narrawong and the east side of Portland”.*]

Stop 4 – The Water Tower on the Highway just west of Port Fairy. This Tower sits on top of a LIG sand dune and shows a hard calcrete capping, also displayed in landscaped retaining walls of the new houses on the west side. The ancient shore line would be on the flat over the hill to the south along Thistle Place. The low land to the north of the highway is basalt, so this ancient dune sits on the Basalt and marks the 125,000 year old shore line.

Stop 5 – The Goose Lagoon Drain. This is one of the most significant natural history sites in our region. It was discovered by Edmund Gill when the drain was made. We are grateful to Prof John Sherwood from Deakin University Warrnambool who showed the site to us. It is on private land and over an electric fence just north of the Highway and not really a safe place to stop. The location is just east of the Abalone Farm turn off where an old stone bridge on the Highway marks the drain. This drain appears to dewater the region near Goose Lagoon situated about 1.5 km to the west and north of the Highway. Gill noted extensive mollusc beds at the base of cemented dunes that marked the 125,000 year shore line. That included varieties now extinct on the Victorian coast.



Pleistocene sea level 125,000 years ago peaked @ + 7m
Deposited the Port Fairy Calcarenite (light Yellow) up to the shoreline with mollusc beds (red dash)
backed by a wind blown sand dune (bright yellow)



The Index Fossil

The Turban Shell *Ninella torquata* is an index fossil for the Port Fairy Calcarenite because it is extinct on the Victorian Coast

Stop 6 – The Craggs. This is one of the regions notable tourist spots and it allows us to look at older members of the Bridgewater Formation; earlier interglacial cycles below the Port Fairy Calcarenite. As you drive south from the highway to the Craggs you are driving over an ancient dune field probably

at least 300,000 years old. Quite similar to the geology on which Warrnambool is built. This is the Bridgewater Formation.

There is a complex relationship here of multiple sand dunes relating to earlier sea levels that overlap. Recent sand dunes have climbed the cliffs to cover ancient dunes at least 300,000 years old. The older dunes stand at the cliff face and are washed by waves on the ocean platforms at the base of the cliffs. The sediments represent earlier interglacial periods of high sea levels that stranded dunes in the landscape when the seas retreated. After the sea level dropped these sand dunes, made of ground up mollusc shells, sat in the landscape and were case-hardened over some 20,000 years. Many were covered by “Terra Rossa” a red desert fine wind-blown sand.



Coast between the Craggs and Port Fairy

A complex picture of overlapping coastal sediments related to ancient sea levels

Finally we can reflect on the marvel of these overlapping ancient dunes writing history in the rocks on our coast for at least 300,000 years. That is the entire time over which Homo sapiens evolved and the world experienced multiple ice ages and dramatic sea level changes.



Coastal cliffs near the Craggs

McKechnies Headland

The cliff photographed here is on private land but shows the best exposures of the Bridgewater Formation I have seen anywhere. In evidence is *cross-bedding*, which so defines wind-blown sand dunes (*aeolianite*).



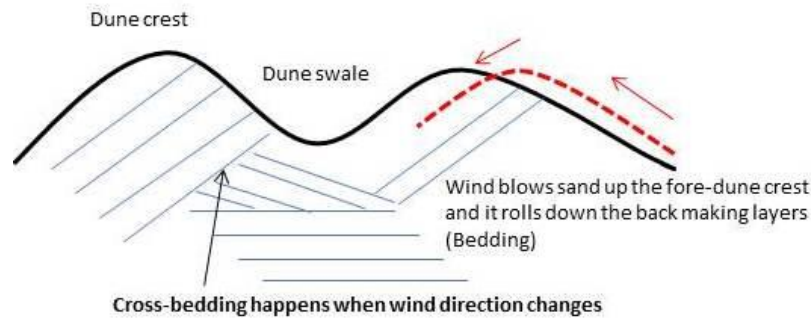
Coastal cliffs near the Craggs

McKechnies Headland inset

Each dune cycle is capped by calcrete (a natural dissolution and cementing of the calcareous sand exposed to the atmosphere). The base of the calcrete zone invariably has distinct root like solution pipe tubular features. Finally fine red siliceous sand, typical of sand that blows from inland deserts fills in solution hollows and forms a sharp top above which a new dune cycle rests.

When standing at the Craggs viewing platform, try and see the crossbedding in the rock stacks below.

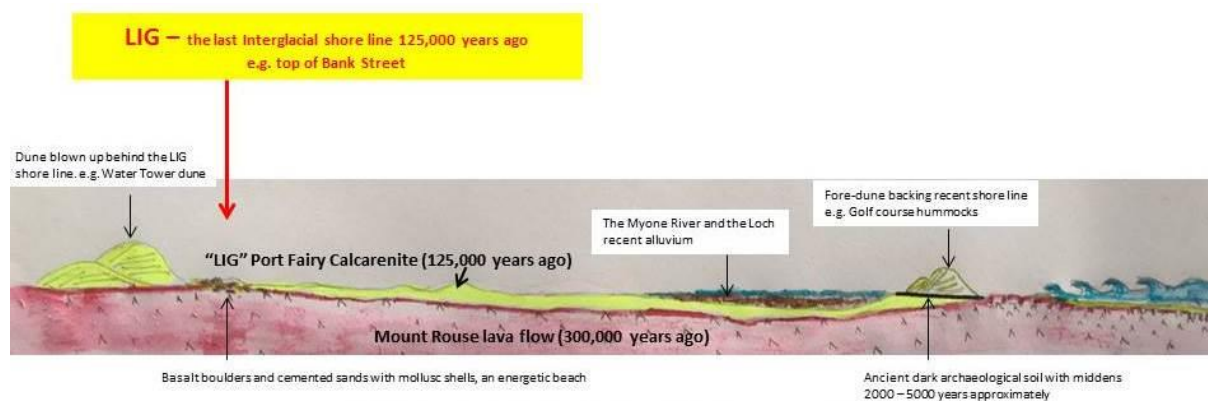
[Aeolianites are deposits of wind-blown sand with diagnostic steeper angles of repose on bedding surfaces when compared to water laid deposits. Crossbedding is formed by wind rolling sand over the fore-dune crest and down the back of the dune where it is preserved as layers. These layers are referred to as bedding. When the wind direction changes so does the attitude of the bedding. On internal cross sections of the sand dune this gives the appearance of “crossbedding”].



Summary Observations.

Stops 1- 5 concerned the Last Interglacial cycle (the LIG) some 125,000 years ago. These sediments are part of the Bridgewater Formation (and form a member that has been referred to as the Port Fairy Calcarene). The Bridgewater Formation is defined at Cape Bridgewater into several older members as well, some of which are exposed at Stop 6, the Crags and McKechnies Headland.

The LIG at its peak sea level flooded all of Port Fairy and deposited sediment. But elsewhere it eroded the coast. Notably there is an ancient sea cliff along the Dutton Way near Portland and this area continues to struggle with erosion as sea levels rise. A famous natural history site at Point Ritchie (Moyjil) at Warrnambool has an elevated wave cut platform relating to the LIG (+ 7m) as well as one other wave cut notch in the cliffs well above present sea level.



Cross-section through Port Fairy
 From the highway to the coast in a diagrammatic sense

[Note the archaeological soil only rarely preserved below recent dunes due to land clearing].

If you wish to discuss anything feel free to Email me at geotourvic@gmail.com