

The background image shows a coastal scene. In the foreground, there are large, light-colored, porous rocks. Behind them is a dark, reddish-brown soil bank. A wooden fence made of vertical posts and horizontal rails runs across the middle ground. To the right, a sandy beach leads to a body of water under a cloudy sky. The text is overlaid on this scene.

**Reading the Rocks
at Ricketts' Point,
VIC**

*Interpreting the Geology &
Geological Processes*

John St J. S. Buckeridge



Reading the Rocks at Ricketts' Point, VIC

Interpreting the Geology & Geological Processes

John S^t J. S. Buckeridge

Melbourne, 2026



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Cover image: Erosion on the foreshore at Ricketts' Point after a storm on 6th June 2026.

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Ricketts Point Marine Sanctuary



Toilets	No fishing	Main road	Dogs on leash (time restrictions apply)	Ricketts Point Marine Sanctuary	Onshore boundary marker
Cafe	No spearfishing	Sealed road	Dogs prohibited on all intertidal rock platforms within the sanctuary at all times	Other Reserves	Offshore boundary marker
Yacht Club	No collecting	Walking track	Bay Trail / shared path	No vessels (Swimming Only)	Offshore boundary
Life Saving Club	Dogs allowed			-2 Depths in metres	
Wheelchair access ramp to water	Emergency Marker				

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 For mobile App search for Avenza PDF Maps



Datum: WGS 1984
 Latitude and Longitude in Degrees Decimal Minutes.

Map courtesy of Parks Victoria: <https://vfa.vic.gov.au/>

Reading the Rocks exposed at the Ricketts' Point Sanctuary, Beaumaris, Victoria.

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Preface

This book has been written to explain the significant geological features on the foreshore at Ricketts' Point and to provide a brief outline of some basic geological principles. It was first published as a chapter, part of a broader text written to assist guides who plan to run “nature tours”, to interpret the biology and geology of the Ricketts' Point Marine Sanctuary (Buckeridge, 2018). This edition expands on that earlier booklet and includes discussion on, and imagery of, the impact of recent erosion and human activities within the sanctuary.

The focus is on the rocks outcropping and exposed¹ at Ricketts' Point, Beaumaris – when and how they were deposited. Throughout the text, there are challenges involving specific tasks. These “tasks” are in a **blue text box**. The answer to each challenge is in a **red text box** – generally on the following page.

The text examines how rocks are classified, how organisms (fossils) are preserved, and the future of Ricketts' Point. It is anticipated that those who venture out on the shore platform and use this booklet will gain an appreciation of the value of the natural environment (which includes loose sediment and rocks, of which fossils may be a component). Using **uniformitarianism**, it is hoped that an appreciation that the present is the key to the past (and *vice versa*) will be gained, and that through this can we plan for a sustainable future.

There are many texts that could be used to supplement this section. In addition to *Geology of Victoria*, I have chosen just three: Buckeridge *et al.*, 2024; McSweeney & Buckeridge (2017) and Ter & Buckeridge (2012). Two of the illustrations in this book are from the McSweeney & Buckeridge. Importantly, the latter three publications pertain specifically to Ricketts' Point.

¹ An exposed rock (or exposure) is not necessarily natural, i.e. it includes features that were produced by humans, such as tracks and structures.

Stratigraphy:

Stratigraphy is the system that is used to understand the order in which rocks occur. The oldest rock formation outcropping near Ricketts’ Point is the grey green, richly fossiliferous Fyansford Formation (23-5.3 million years old). Note that some geologists believe this should now be called the Gellibrand Marl. The Fyansford Formation is exposed immediately to the south of the Beaumaris Motor Yacht Squadron. Between the Fyansford Formation and the overlying Beaumaris Sandstone (*circa* 5.6 to 4 million years old) is a thin nodule bed made up of ochre coloured phosphatic concretions along with vertebrate fossils, such as sharks' teeth (Figure 22) and whale bones.

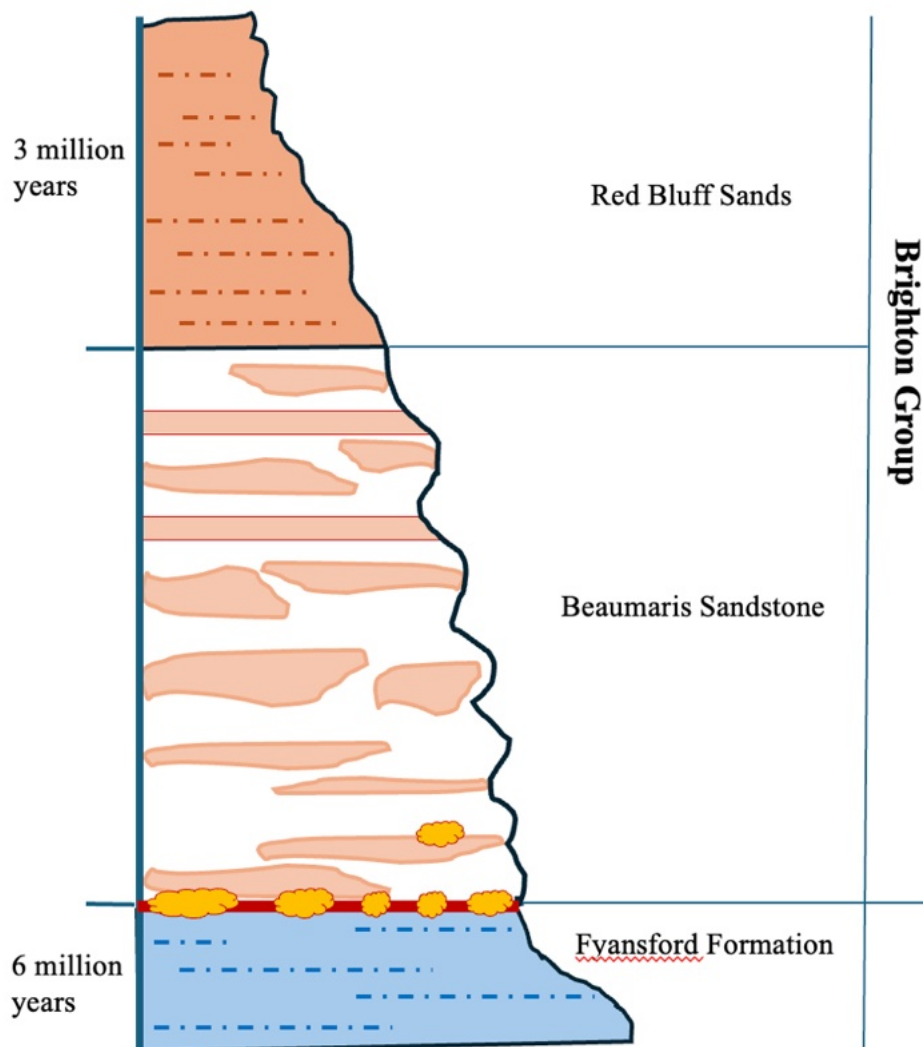


Figure 1: Stratigraphy at Ricketts’ Point. The oldest rock exposed is Fyansford Formation (= Gellibrand Marl), which outcrops immediately to the south of the sanctuary. On the left side are the approximate ages (from Buckeridge, et al. 2024).

How rocks are classified:

Geology is the study of the history of the Earth, especially the Earth's crust and the processes that formed the crust. However, unlike most sciences, the causes of geological events may be extremely complex and may even be unfathomable. In response to this uncertainty, non-definitive terms, such as “may have formed by” and “most likely formed from” are sometimes used by geologists to explain the geological history of a region. Nonetheless, the *processes* that cause the events are generally well understood. We know that the Earth's crust formed through cooling of molten rock or *magma* (**igneous rocks**); that weathering, erosion, deposition, compaction and/or cementation of pre-existing rocks forms **sedimentary rocks** and that the deformation of pre-existing rocks by heat, pressure and stress results in **metamorphic rocks**.



Figure 2: Cliffs near Ricketts' Point: An outcrop to the north of the Beaumaris Yacht Club. The upper, pale cream-coloured rock is Red Bluff Sands, the darker reddish-brown Beaumaris Sandstone underlies this.

Task 1: Examine the rocks exposed below the Ricketts' Point Tea House. Are the rocks igneous, sedimentary or metamorphic?

Note: Most of the rocks at the point are clearly layered (i.e. they possess what are called *bedding planes*) – and this feature is typical of sedimentary rocks, although some metamorphic and igneous rocks can be layered too. Others, particularly those that are dark reddish-brown in colour appear to be more like volcanic scoria (which is igneous).

Nomenclature:

Sedimentary rocks that are made up of particles that are derived from weathering (i.e. as opposed to skeletal remains) include sandstones, siltstones and mudstones. Sandstones are characterized by grain sizes ranging from 2.00-0.06mm), siltstones (0.06-0.004mm) and mudstones (<0.004mm).

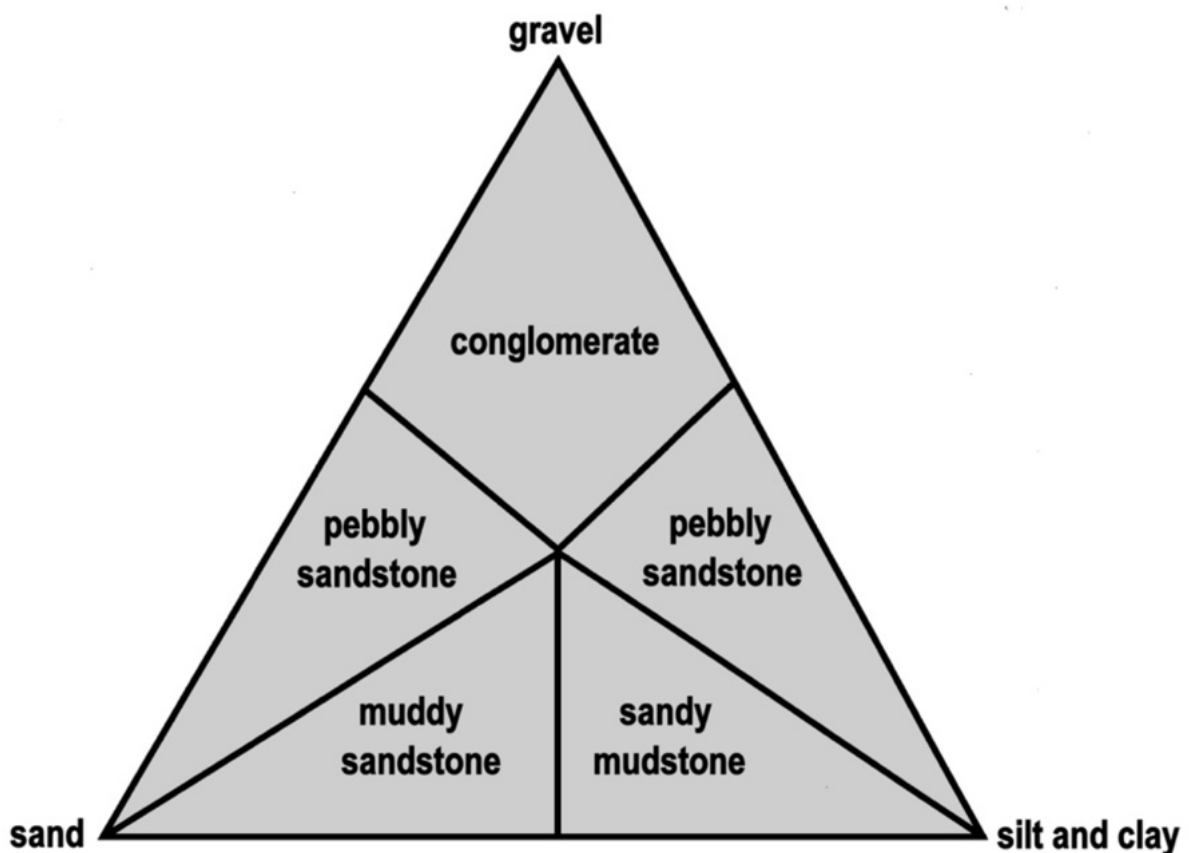


Figure 3: Sedimentary rocks. The above chart is a ternary graph showing the relationship between the dominant grain size and the rock name, e.g. if the rock is comprised primarily of sand grains with some mud, it is a muddy sandstone.

Task 1 answer: The rocks that are outcropping at Ricketts' Point are all sedimentary. The two oldest rock-types (or lithologies), the Fyansford Formation (about 12 million years old) and the Beaumaris Sandstone (about 5.5 million years old) were formed in marine environments; the Red Bluff Sands (less than 5 million years old) is transitional, being partly deposited in both river outwash plains and along the coast.

Almost all the rock outcropping on the shore platform at Ricketts' Point is Beaumaris Sandstone, and this was deposited in shallow coastal waters (McSweeney & Buckeridge, 2017). The Beaumaris Sandstone possesses characteristics typical of most sedimentary rocks. It is well bedded and is comprised primarily of mineral grains (or *clasts*) that originated following the weathering and erosion of pre-existing rocks. In addition to these clasts, there are biogenic components (i.e. shells and burrows that were produced by marine animals), and chemical components (which result from the precipitation of non-organic minerals).

The composition, shape and size of clasts in sedimentary rocks tell geologists how (and where) the rock formed. When the clasts are overwhelmingly made up of say, well-rounded quartz grains, we may conclude that:

- The grains have been in a weathering/transportation phase for a while (quartz is a tough **detrital mineral** and wears down slowly). Perfectly spherical quartz grains are likely to have been in a system for a very long time.
- The **source rock** would have contained quartz (such as granite, quartzite or quartz sandstone).



Figure 4: Grain shape and sorting are indicators of provenance. **a:** uniform rounded and spherical aeolian quartz sand, **b:** glacial outwash sand with mixed rock fragments. Average grain diameter *c.* 1.0mm.

If the clasts are coarse (i.e. comprised of large grains of minerals and/or rock fragments), the transport distance from “source” is likely to have been less than in deposits where clasts are fine (e.g. muds and clays).

Further, in marine deposits, if the mineral grains are uniform in size, we may conclude that some degree of sorting has occurred prior to deposition. Sorting is a term applied when particles have remained in a fluvial, marine or aeolian system for sufficient time to separate out coarse from fine particles.

Task 2: Examine a sample of the beach sand at Ricketts’ Point (a hand lens will help). Are the grains rounded or sharply angular? Now examine the Beaumaris Sandstone and the Red Bluff Sands (the latter outcrops on cliffs some 80 metres to the North of the Beaumaris Yacht Club).

Is the grain shape and “size range” of the rock in the cliff face similar to that of the sand on the beach?

Carbonate-rich sedimentary rocks include limestones and marls. A marl is primarily a very fine-grained carbonate rock. It accumulates in quiet conditions (often deeper water) when erosion from adjacent land masses is minimal.



Figure 5: A limestone with skeletal remains of molluscs and barnacles. As this limestone is coarse grained, with little clastic material, it is classified as a coquina.

Task 2 answer: Note similarities (and differences) in the rock fabric. The beach sands are, in large part, derived from the cliffs above, **but** unlike the lithified rock, the beach sand is not cemented. (See Figure 6).

Coarse limestones are more likely to accumulate in shallower waters, where they comprise the skeletal remains of animals such as molluscs and corals with calcareous shells. When a limestone is entirely made up of relatively unbroken shells, it is known as a *coquina*.



Figure 6: Beach sand and sandstone: The top image shows some of the coarser beach sediments that typically accumulate at Ricketts' Point. Although the eye quickly notices shell fragments, these are not the dominant sediment. Most of the grains are sand-size detrital quartz, derived from weathering of the adjacent cliff-face. Below is the Red Bluff Sands, a poorly indurated rock in the cliff. Note the more angular quartz grains. [coin diameter 23 mm].

Layering in sedimentary rocks:

Sedimentary rocks are generally deposited as beds; typically, each bed represents a single event, such as when sediment settles from a slurry of suspended grains or clasts. You should be able to find similar grain sizes and dispositions in the beach sand to that observed in the Red Bluff Sands; from this you may deduce

that this particular sandstone formed in conditions not unlike present-day Ricketts' Point – i.e. in relatively shallow water on and near beaches.

Task 3: What conditions are required to convert sediment grains into rock.

- Where are these conditions likely to develop?
- Does this require burial beneath the sea?
- These rocks are now at, or above sea level. Why is this so?

Note: **Tectonism** is the process during which rocks are buried or uplifted. Periods of uplift are called orogenies.

Uniformitarianism:

To understand how geological processes operate, geologists utilize the scientific principle known as uniformitarianism, wherein *present processes are seen to reflect those that have occurred in the past*. Present day processes include the patterns produced by water flowing over loose sandy sediment. The friction and fluid movement force the grains to roll or bounce, organizing them into repeating, wave-like ridges and troughs that are called ripple marks.



Figure 7: Beach processes. a: Surface features on the Beaumaris Sandstone exposed centrally at Ricketts' Point. b: Modern ripple marks at Ricketts' Point.

Task 4: Were the structures in Figure 7a produced by water flow? i.e. Are they fossilized ripples, comparable to the present-day ripples shown in 7b?

What evidence can you provide for your answer?

However, loose sediments on the beach do not comprise rock. They must undergo what is known as lithification, a process in which sediment grains are both variously compressed and cemented, and volatiles such as water are released.

The rocks at Ricketts' Point are variably cemented by goethite, a ferric oxyhydroxide that was preferentially deposited in fissures and porous sands. Goethite is more resistant to weathering than the rest of the Beaumaris Sandstone, and because of this, the harder ferruginous horizons are classified as “moderately well indurated”.



Figure 8: Ferruginous (iron-rich) layers are a feature of the Beaumaris Sandstone that is exposed in the intertidal zone. The mineral responsible is the yellowish to dark brown iron oxy-hydroxide **goethite** – with the chemical formula FeO.OH .

Weathering and Erosion:

Nature is in a constant state of flux: The earlier image of rocks exposed at Ricketts' Point represents a cliff section and, for the most part, is not greatly vegetated. From this we can deduce that the site is **actively eroding**. Rocks along this coast are being broken down by wind, rain and heat from the sun. This process is known as **weathering**. Weathering alone does not make a cliff, for if there were no sediment transportation systems operating, the debris that

Task 3 answer: Sediment grains are lithified in two ways – by cementing them together and/or compressing them. Common cements include quartz (SiO_2); calcite (CaCO_3) and goethite. If the sandstone effervesces when a weak acid is dropped on it, calcite (or aragonite) is present.

Compaction occurs when sediment is buried beneath more sediment. Cementation can be caused by mineral-rich ground waters passing through the sediment.

These marine deposited rocks are above sea level because they have been uplifted.

accumulated at the base of the cliff would soon mantle the underlying rock, and in doing so eventually slow weathering down to almost zero.

Task 4 answer: In figure 7b, the ripples are real and were exposed in the mid intertidal zone below the café. However, the structures in 7a were produced by tracked vehicles cutting into relatively soft rock during the construction of the adjacent stormwater outlet. A close analysis will show that these patterns differ from natural ripples as they cut into each other, often at sharp angles. These tracks are exposed some 50 metres to the south of the café.

At the toe of the cliff, impact and erosion by waves at high tide, especially in storms, undermines the cliff, leaving the higher layers susceptible to collapse.

Task 5: What happens after rocks are weathered?

What processes operate to prevent sediments building up *in situ* (i.e. at the place of origin)?

Note: In some regions of Australia, where there is low topography, sediment does build up, and if there is little or no rain or ground water, the process of weathering drops to almost zero. [Note also the importance of the Earth's atmosphere in **surface processes**].



Figure 9: Coastal erosion in Port Phillip. A seemingly peaceful beach can rapidly be degraded during storms. The above depicts erosion at Mount Martha on 9th September 2025.

Erosion also occurs when loose grains are washed down the cliff, briefly accumulating on the beach, where they are picked up by waves and transported along the coast. Eventually these new sediments will come to rest in quieter (generally deeper) waters, and if left alone, will ultimately become the sedimentary rocks of the future. In time, and in turn, these will be uplifted, weathered and eroded to form new rocks.



Figure 10. Destructive wave action: In June 2014, storms coinciding with high tides caused havoc along Bayside beaches. Large slabs of basalt, some weighing several tonnes were thrown for more than two metres by the waves. This site is along the sea wall between Blackrock and Ricketts' Point.



Figure 11. The same section of the coastal promenade that is shown in Figure 10 – after repairs. Maintenance can be expected to be ongoing. Photographed following a further storm on 6th June 2026.



Figure 12. When rocks are more cemented than the surrounding rock, they will be more resistant to erosion. Cement is delivered to sediment via groundwater, groundwater flow in this case was most likely released subsurface – as a cold-water seep in a marine setting prior to uplift of the Beaumaris Sandstone.

Deformation of rocks:

Except in unusual situations such as lava flows, when rocks deform, they do so beneath the surface. When sedimentary rocks are exposed at ground level, they may simply have had the overburden eroded. However, in most cases we can conclude that they have been subjected to tectonic activities such as faulting and folding, or simply “uplifted” due to pressures within the earth’s crust.

Although there is a large, gentle monocline intersecting the coast near Ricketts’ point, faults are not obvious features on the beach. This is because past uplift has been moderately gentle and uniform. Some of the rocks on the shore platform at Ricketts’ Point appear to be folded – almost in a circle. Observation will show that this is due to weathering and exposure of the gently warped sub-horizontal bedding that is typical of the area. When lithified sediment is placed under compression or extension rocks either fracture (Figure 13) or fold (Figure 14).

Task 5 answer: Weathering reduces rocks to sediments. The sediments may remain where they formed, forming a soil (or regolith). However, they are generally **eroded** – i.e. transported and deposited elsewhere.

The processes of erosion include æolian (wind), fluvial (rivers) glacial (ice) and simply gravity.



Figure 13: Well lithified rocks deform by faulting. In this sketch, deformation has been compressional. Here, the lower sedimentary layers are rich in clay and are thus more plastic. Under compressive stress, they have folded. However, the overlying sandstone is more brittle and has ruptured forming a reverse (or compressional) fault. Note the geological hammer (upper central) for scale.

Task 6: Examine the moderately large, circular structures exposed on the upper shore platform at central Ricketts' Point. Are they evidence of highly folded strata?

Is there any reason why they may not be folded rock (as in Figure 14)?



Figure 14: These rocks, exposed at Point Addis on Victoria's Surf Coast, were still relatively "plastic" when under compression. Because of this, they have not faulted, even though the fold is rather angular.

Folding can be very much more dramatic however, Figure 14 shows what happens when very soft, “plastic” sediments are sufficiently lithified to retain their **bedding** (i.e. evidence of layers) but are still soft enough to be easily folded.



Figure 15. Deformation of rocks exposed on the upper shore platform at central Ricketts’ Point. These appear to be highly folded. However, the bedding in the immediate vicinity is close to horizontal.

The rocks in Figures 13, 14 and 21 are not found at Ricketts’ Point – they are included here as they graphically illustrate the deformation of rock by natural forces. Faulting and folding are only some of the many ways in which rocks can be modified. Although igneous rocks do not occur at Ricketts’ Point, they are

often associated with sediments, e.g. igneous intrusion into sediments at Cape Conran has resulted in both complex folding and the growth of new minerals (Figure 21).

Task 6 answer: The sedimentary rocks in Figure 15 are certainly deformed, but they are not truly folded. The exposed pattern demonstrates that the beds were gently deformed whilst still very plastic. The likely cause of this being loading and differential compaction.

Curious circular structures are exposed on the foreshore at Ricketts' Point (Figure 15); superficially it looks like the bedding has been dramatically folded, even in some cases to be sub-vertical. However, a careful analysis of how these strata fit in with the rocks adjacent indicates that the “domes and basins” are an integral part of an overall structure that is essentially sub-horizontal. If you follow a series of these deformed bedding planes, you should find that they join up with near-horizontal layers.

The cause of this localised deformation can involve mechanisms as varied as thermal subsidence, sediment loading, lithospheric flexure, and differential compaction, which gently warp originally flat strata into broad, shallow, bowl-and-dome-like features.

Nonetheless, there is some folding present – the best of which lies just outside the sanctuary. The Beaumaris Monocline, which is exposed at the northern edge of Mentone Beach (Figure 16) is the major structural feature of the area.

What lies beneath:

Geological mapping is a relatively new science. It was as recent as 1815 that the English geologist William Smith (1769-1839) created the first nation-wide geological map. A key observation made by Smith was that certain rock layers had uniform characteristics and could be correlated over considerable distances. These uniform layers were termed **strata**.

Smith described how the orientation of outcropping strata could be used to determine what lay beneath the surface. He also recognized that a particular stratum could be identified in another area by the fossils that it contained, and that the fossils present in a sequence of strata were not arranged in a haphazard manner, but were found in a regular, consistent order; he called this faunal succession.

Much has changed over the last two centuries and subsurface geology can be assessed in many ways; one, as proposed by Smith, being a careful analysis, following mapping, of the structural relationships of outcrops. Modern mapping now benefits from remote sensing, such as LiDAR (Figure 17), that uses pulsed lasers to measure distances and create highly accurate 3D maps. The process involves firing a laser at an outcrop and calculating the exact time it takes for the light to bounce back to the sensor.



Figure 16: This gentle fold is the Beaumaris Monocline, which is exposed at the north end of Mentone Beach (immediately to the south of the Ricketts’ Point Sanctuary). These rocks were still relatively plastic when under compression. A monocline is a “half fold” where only one side of the strata is down-warped or folded.

The southern boundary of the Ricketts’ Point Marine Sanctuary is marked by a sinistral fault, which is a northwestern extension of the Beaumaris Monocline. This fault is classified as “sinistral” because movement on the opposite side of the fault (from where an observer stands) has moved to the left. Sinistral movement is anticlockwise.

Most of the other faults in Figure 17 are dextral – movement being to the right, and thus clockwise. Reconstructing how this occurred suggests that the outcropping strata (i.e. the layered, or bedded rocks) may have been in a zone of localized rotation between two larger blocks. As noted, rocks deform either by fracturing along fault lines, or by bending (and in some cases flowing). The rocks that are exposed in the sanctuary are relatively plastic, and so have folded.

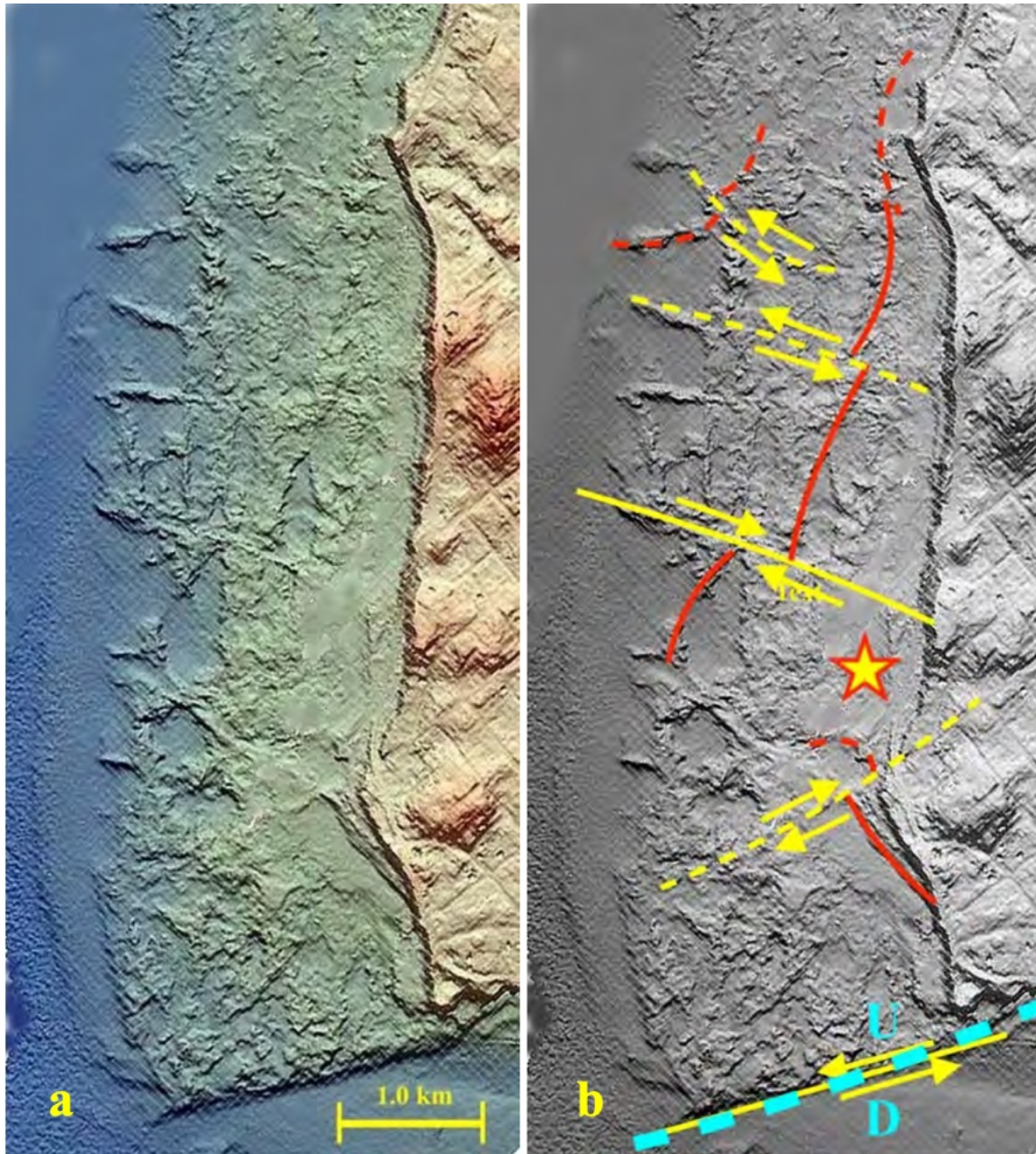


Figure 17: a: LiDAR image of Ricketts' Point. **b:** Structural relationships. Yellow lines are faults; red lines represent displacement of strata. Dotted lines show less clearly defined movement of strata. The region is bounded by a strong sinistral fault and a monocline (dashed blue) at the southern end. Movement has been sinistral except for the central part (starred) where it is dextral. This is interpreted as resulting from local rotation of beds. (from Buckeridge et al., 2024). Colour image: Depart of Energy, Environment and Climate Action, Victoria.

However remote sensing can never be 100% certain: to know what is beneath the exposed rock, especially metres below, it is necessary to sample this by exploratory drilling. Exploratory drilling involves the extraction of either broken rock fragments from a known depth, or complete rock core recovery. Providing the orientation of the core is known, a series of cores provides a very sophisticated picture of what lies beneath.



Figure 18: Subsurface investigation: Drilling and extracting core samples from below the surface at Ricketts’ Point in June 2026. The lower image shows a core sample taken from about 2 metres down.

The core in Figure 18 shows that there is a surprisingly high proportion of clay in the Beaumaris Sandstone. The rock in the core retrieved from *circa* 2.0 metres below the surface was soft and friable: it is poorly cemented (i.e. weakly lithified). This seems to counter observations of the adjacent rocks – on the shore platform, which when handled, appear to be relatively hard – i.e. they are significantly more lithified.

When rocks are exposed, they undergo weathering. In general, this process results in rocks being degraded, transported as sediment and generally

Task 7: How can “rock layers” extracted some 1-2 metres below the surface appear to be less lithified than the **same rock type** that is exposed on the surface?

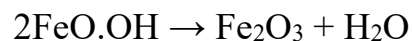
redeposited as new sedimentary strata elsewhere. This cycle has been in operation on this planet since the first sediments were deposited some 4 billion years ago.



Figure 19. Reddish colours that demonstrate formation of iron oxide (haematite) on the shore platform at Ricketts' Point after dehydration of ferruginous minerals.

Task 7 answer: Dehydration of mineral(s) that bind the sand grains occurs when the rock is exposed to oxygen. The result is a harder and more penetrating cement (see a more complete explanation in the red box on page 30).

However, weathering can also harden rocks due to the oxidation of minerals. This explains how the tracks made by bulldozers and excavators (Figure 7a on page 12) were made, and importantly why they are still there: the excavators removed the harder surface layers of the Beaumaris Sandstone and in doing so, formed indentations in the newly exposed softer rock. However, these exposed beds quickly hardened, one of the processes being conversion (by dehydration) of hydrated iron minerals to haematite:



Mobilization of hydrated iron minerals also fills in voids between sand grains, further cementing the sandstone.

Structural relationships

Except in areas when there has been significant tectonic activity, the rocks at the top of a sequence are the youngest. An exception to this is when strata have been heavily folded and faulted to become **overturned** or **inverted**. Whether or not

strata have been overturned can be determined by the fossils contained within the beds, as many fossils are known to have well defined age ranges. But structures can also indicate whether overturning has occurred.

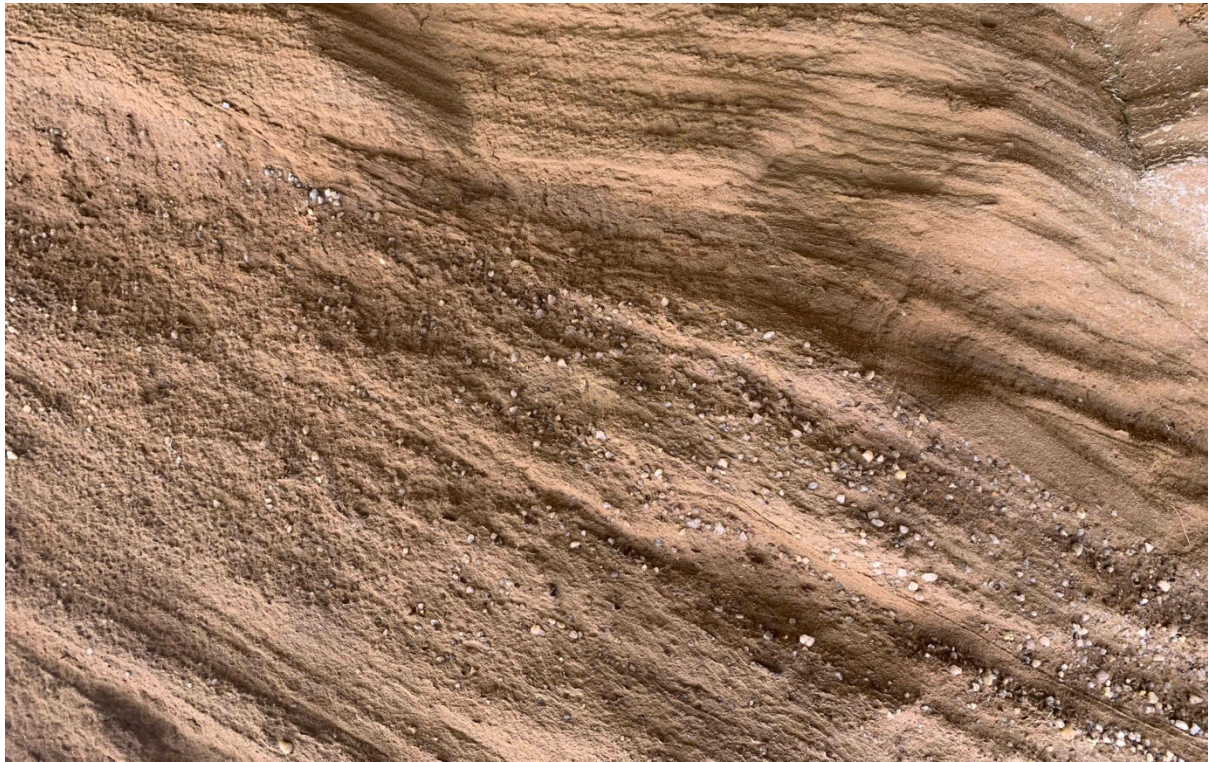


Figure 20. Cross-cutting strata exposed on the Beaumaris Monocline.

Task 8: Are the strata in Figure 20 **inverted** or are they preserved in the same sequence as they were when deposited? i.e. Are the lowest beds in this image the oldest beds?

What evidence is there to support your conclusion?

Metasediments:

With sufficient pressure and/or temperature, rocks will remelt to form magma – which in turn will cool to form igneous rock. However, when sedimentary rocks are exposed to moderately high temperatures and pressures, changes may still occur – even if total melting does not happen. New crystals may grow, and structures form. However, if hints of their original sedimentary layering (bedding) or unique mineral compositions are retained, these rocks are termed metasediments.

Metasediments are present at Ricketts' Point, but they are not exposed. Using William Smith's methodology of correlation, combined with sampling rocks via coring, it can be deduced that they will be much like the metasediments exposed in other parts of Victoria, such as Cape Conran, East Gippsland (Figure 21).



Figure 21: Structures in metasedimentary rocks: Folding in rocks outcropping at Cape Conran, eastern Victoria. These rocks are more than 400 million years old and are similar to the rocks that are known to underlie the much younger sedimentary rocks at Ricketts' Point.

Task 8 answer: The strata in Figure 20 are not inverted. In the mid right, the lower beds have been cut by the upper beds – there was a brief period of erosion between the two depositional events. Importantly, beds cannot be “cut” by another series of strata **unless they exist**. (Note: If the image was turned upside down, and it represented the exposure, the sequence would be inverted).

Preservation of past life:

Palaeontology is the scientific study of prehistoric life, the evolution of this life and the environment that once supported it. It is perhaps the most integrative of all the sciences, using geology, biology, chemistry, physics and mathematics to unravel ancient environments and the nature and biological relationships of the organisms that inhabited them.

The term “fossil” comes from the Latin *fodere* (= to dig) and as such was first used to describe anything excavated. Today, the word is reserved for either the preservation of organic remains, or evidence of past organic activity.

The most common animal fossils are mineralized shells, bones and teeth of marine organisms. These remains commonly retain their original mineralogy, e.g. for many molluscs this is either calcite or aragonite – both being forms of



Figure 22: Fossils *in situ* on the shore platform at Ricketts' Point. The fossil to the left is *Monostychia*, an echinoderm (c. 70 mm in diameter). The only part of the original animal that remains is an incomplete calcareous shell (or test).

calcium carbonate (CaCO_3). The teeth of vertebrates such as sharks are also common at sites near Ricketts' Point (see teeth of *Carcharodon* in Figure 23, the largest being *circa* 60 mm long), these are made of hydrated calcium phosphate or hydroxyapatite $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$.



Figure 23: Teeth of *Carcharodon hastalis* (Agassiz, 1843) – an extinct species of mackerel shark that grew up to 7 metres long. In the early 20th Century, these were very common at Ricketts' Point. Average length of teeth in image c.50mm.

Apatite is a harder and tougher mineral than calcite, and because of this is more resistant to weathering and erosion. Although teeth have a similar chemical composition to the bones of vertebrates, teeth are much denser and are often the only vertebrate remains preserved in a deposit.

The teeth in the Beaumaris Sandstone occur near the base of the sequence, where they accumulated during periods of very low sedimentation rates. There are few bones present in these horizons (note that sharks are cartilaginous and have no bones). On rare occasions however, bones have been found nearby from fish, whales, turtles, seals, dugongs, marsupials, birds and crocodiles.

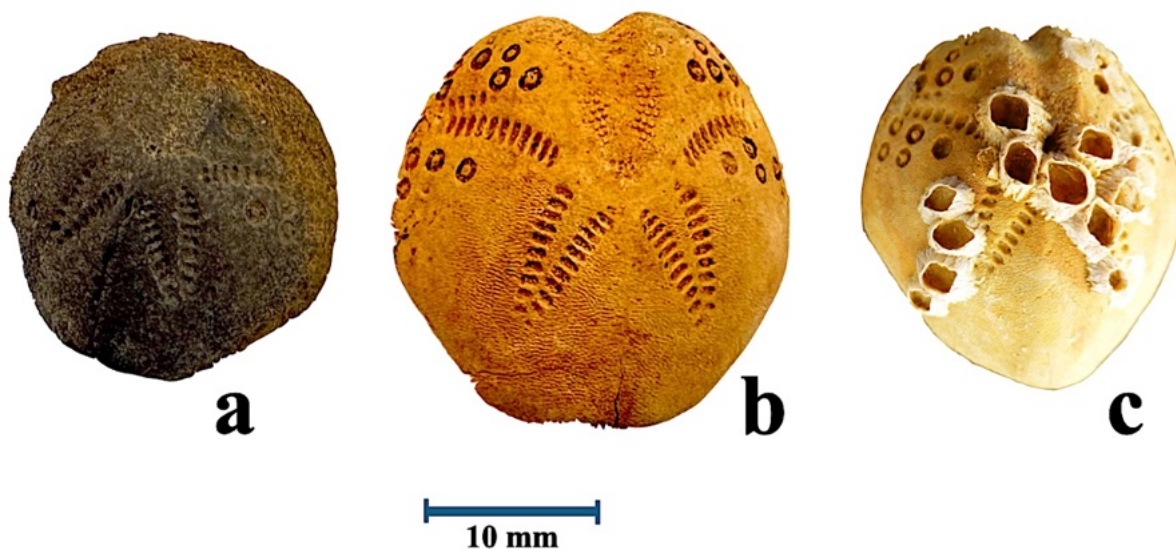


Figure 24: These three fossils are the remains of the echinoderm *Lovenia woodsii* (Etheridge, 1875), a heart urchin that was first described from the Beaumaris Sandstone. In a, any original calcite has been dissolved away and is replaced by goethite. In b, the shell has absorbed a small amount of some iron minerals, giving it an orange appearance. Apart from this it remains much the same as it was when the animal died. In c, *Lovenia* has been encrusted with the barnacle *Zullobalanus australiae victoriae* (Buckeridge, 1983).

Task 9: *Lovenia woodsii* lived circa 12 cm below the sediment-water interface.

Explain why it has barnacles growing on it when barnacles live in open water.

Another important group of fossils are derived from plants: In some situations, sufficient plant material accumulates to produce coal. There are no coal measures (i.e. beds of coal) at Ricketts' Point, but there are certainly remains

of plants. The structure below is about four metres long and is exposed at low tide a short distance north of the Beaumaris Yacht Club. The plants fossilized at Ricketts' Point and at many sites along the beach are preserved as **casts**. They were transported down rivers and streams some five million years ago – probably following storms.



Figure 25: The cast of a tree trunk preserved on the wave-cut platform at Ricketts' Point. (Diameter of coin 41 mm).

Upon reaching the coast, they became waterlogged, and sank into the sediment, where they were slowly consumed by worms, molluscs and micro-organisms (Figure 26). However, they were sufficiently heavy to make an impression in the sediment, which was at that time in the process of becoming rock. Although no trace of the original material that made the tree remains, it is still present as a moulded impression. Identification of the species is difficult, but the fossils near the yacht club are large and for much of their length apparently unbranched, suggesting that they may have been *Eucalyptus*.

Task 9 answer: After *Lovenia* died it was brought to the sediment surface, possibly during a storm. Whilst on the surface it became a suitable (i.e. firm and stable) substrate for *Zullobalanus*, which colonized the upper surface.

Figures 25-27 illustrate how, during the process of rock-formation (or lithification), the original skeletal mineral of organisms is sometimes replaced.



Figure 26: Detail of part of the cast of a tree trunk in Figure 24, showing preserved borings of marine “teredo-like” worms. (Diameter of coin 41 mm).

At Ricketts’ Point, impregnation of shell, bone or plant tissue is primarily by ferruginous minerals, particularly goethite ($\text{FeO}\cdot\text{OH}$).



Figure 27: These tubular structures are interpreted as having been a colony of polychaete worms. When living, these worms had a thin shell made of calcium carbonate (CaCO_3) and/or chitin. After burial, this was replaced by goethite. This image is much as it would have appeared when living. It has not been transported and is thus a biocoenosis. (Diameter of coin 23 mm).

Task 10: Goethite is the most distinctive mineral that cements rocks at Ricketts' Point. But what is the source of the iron-rich minerals in the groundwater that were oxidized to form goethite (and haematite)?

A group of fossils may represent a “life assemblage” (or biocoenosis), meaning that they preserve the ecosystem in which they lived. Observations that can help identify a biocoenosis include instances when both shells of a delicate bivalve mollusc are preserved together.

A biocoenosis commonly represents rapid *in situ* burial of organisms. In most cases however, shells disarticulate on death and are transported separately, accumulating in lower energy environments, thus coming to rest as thanatocoenoses or “death assemblages”. This is typical of the fossils within the Beaumaris Sandstone and the Fyansford Formation.

On rare occasions, bones of vertebrates are preserved in much the same arrangement as they were when the animal died. An example of this from Ricketts' Point includes a series of whale vertebrae, exposed on the shore platform near the old Keefer's boatshed site, (Figure 28).



Figure 28: A series of aligned whale vertebrae exposed near the old Keefer's boatshed site. After death of the whale, these bones were gently buried before ocean currents or biological processes could disassociate them. The thin bony plates between vertebra indicate that the vertebrae were not fully formed. This whale was probably a juvenile. (Diameter of coin 25 mm).

Small organisms, such as protozoans (Foraminifera) are often a major component of sedimentary rocks. *Amphistegina* (Figure 29a) illustrates a relatively large, benthic (bottom dwelling) protozoan that has survived through being selectively mineralized. In the Beaumaris Sandstone, these are very uncommon, as most have simply been dissolved away by weakly acidic groundwaters during the rock formation.

Figure 29 illustrates some of the more common invertebrate macrofossils that have been recovered from lower horizons within the Beaumaris Sandstone.

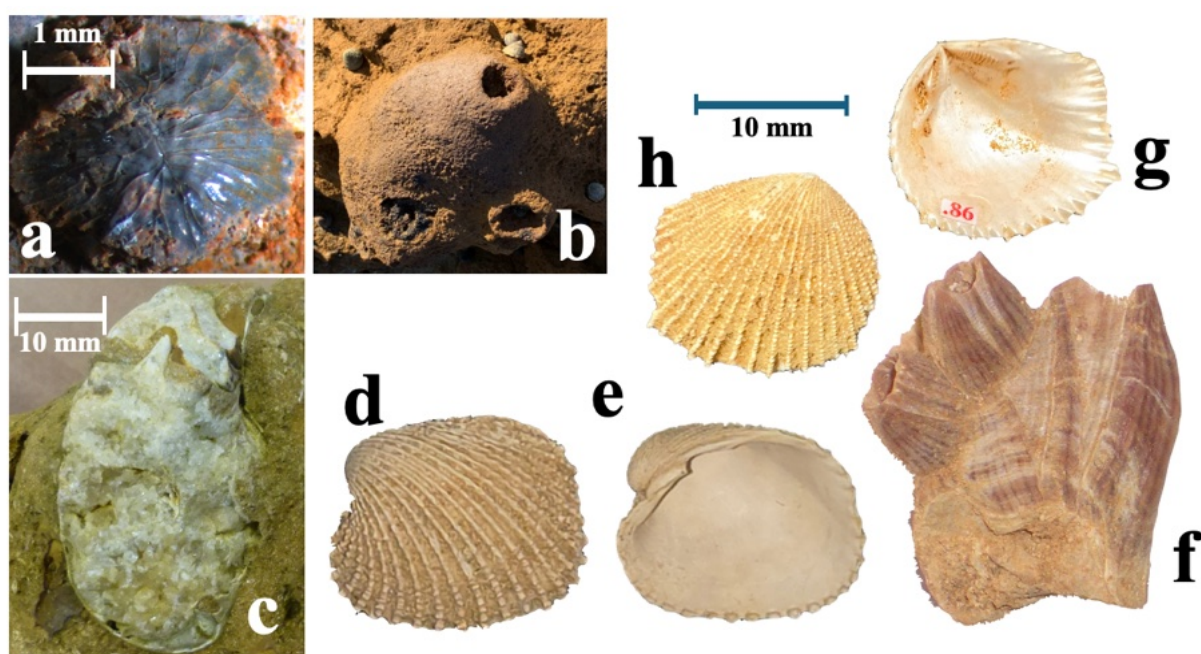


Figure 29: Palaeontology: Invertebrate fossils from Ricketts' Point. a. *Amphistegina* (a protozoan); b. a petrosid sponge; c. *Aturia coxi* Miller, 1947 (a cephalopod); d. *Glans kalimnae* Crespin, 1959 (exterior of bivalve shell); e. *Glans kalimnae* Crespin, 1959 (interior of bivalve shell); f. *Austromegabalanus victoriensis* Buckeridge, 1983 (a barnacle); g. *Neotrigonia acuticostata* (McCoy, 1866) (interior of bivalve shell); h. *Neotrigonia acuticostata* (McCoy, 1866) (exterior of bivalve shell). Scale, except for a and c, is common to all specimens.

Figure 29b is identified as a petrosid (or stone sponge) that has also been selectively mineralized. Petrosids are demosponges and comprise some 80% of all living sponges. Most are made of an organic protein called spongin, plus needle-like mineral structures called siliceous spicules.

The two species of bivalves in Figure 29 show two very distinct hinge lines (where each side of the shell would have interlocked). *Glans* is heterodont and has long smooth interlocking grooves, whereas *Neotrigonia* is schizodont, and possesses very delicate feather-like interlocking structures. *Aturia coxi* is an extinct, coiled nautilus that has a wide distribution – including the Miocene of Japan to Western Australia and New Zealand. *Austromegabalanus victoriensis* is endemic to Victoria; it was first described from the Beaumaris Sandstone – Ricketts’ Point is thus the **type locality** of this species.

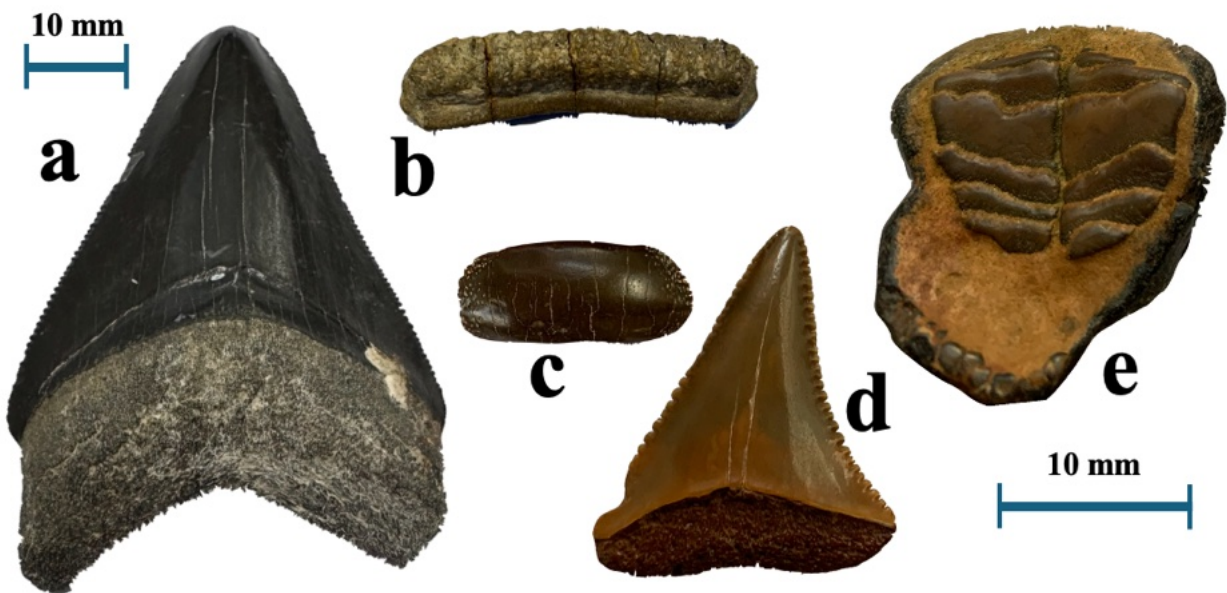


Figure 30: Palaeontology: A selection of vertebrate fossils from Ricketts’ Point. a. *Otodus megalodon* (Agassiz, 1843) (a shark); b. *Myliobatus altus* Davis, 1888 (an eagle ray); c. *Heterodontus portusjacksoni* (Meyer, 1793) (a shark); d. *Carcharodon carcharias* (Linneaus, 1758) (a shark); e. *Diodon formosus* Chapman & Pritchard, 1907 (a toadfish). Scale, except for a, is common to all specimens.

Task: Examine the teeth in figures 23 and 30. Compare the shape with function – the flat plate-like teeth of *Myliobatus* and *Heterodontus* reflect their diet of benthic invertebrates. In contrast, the triangular, serrated teeth of apex predators such as *Otodus* and *Carcharodon carcharias* were designed to slice through the flesh of large prey, including seals, dolphins and large whales. The smooth-edged teeth of *Cacharodon hastalis* however were better designed to impale soft-bodied prey such as squids and schooling fish.

The vertebrate remains illustrated in Figure 30 are a random selection, demonstrating some of the variations in tooth shape. The extinct *Otodus megalodon* is the most well-known of these; it had a global distribution and was the largest predatory fish that has ever lived, it is estimated that it may have grown up to 24 metres long, weighing some 90 tonnes. *Myliobatus altus* (Figure 30b) has long, specialized teeth to crush its food – typically benthic bivalves and echinoderms; similarly, *Heterodontus portusjacksoni*, or the Port Jackson shark, has flat and blunt back teeth (Figure 30c) to grind the shells of invertebrates upon which it feeds. The toadfish (Figure 30e), also known as a pufferfish, was a bony fish (a teleost), and probably lacked scales. Pufferfish have a global distribution.



Figure 31: These tubular structures are the most abundant large fossils at Ricketts' Point. They are generally sub-horizontal, but they can branch and some have vertical components. (Diameter of coin 23 mm).

Ichnofossils:

In addition to shells and bones, fossils may also preserve past activities of organisms, such as footsteps, feeding trails and burrows. These are often the only indication that soft-bodied organisms, such as annelids and anemones, lived in the sediment. Collectively, these tracks, trails and burrows are known as trace fossils or *ichnofossils*.

Task 11: What are the structures that are illustrated in Figure 31? Are they likely to be organic or inorganic? Justify your answer. What could have formed them?

The most obvious macrofossils in the Beaumaris Sandstone are long, branching tubular structures, up to three metres long and 55 mm in diameter.

Figure 31 shows a typical example although it does not show branching, which is common. It also shows that the structures are hollow and that the outer surface of the tube is nodular.

Until 2015, the structures in Figure 31 were interpreted as the fossilized remains of *Banksia* trees, and there was official signage testifying to this at the Black Rock Beach carpark (see Figure 32). However, this interpretation was mistaken, these *Banksia*-like fossils have nothing to do with plants. Indeed, they are not even terrestrial: rather they are the ferruginous burrows of crustaceans that lived in the shallow waters of a proto-Balcombe Bay some 5-6 million years ago. The burrows may look a little like the branches of *Banksia serrata*, but appearance is only part of the assessment of any fossil.

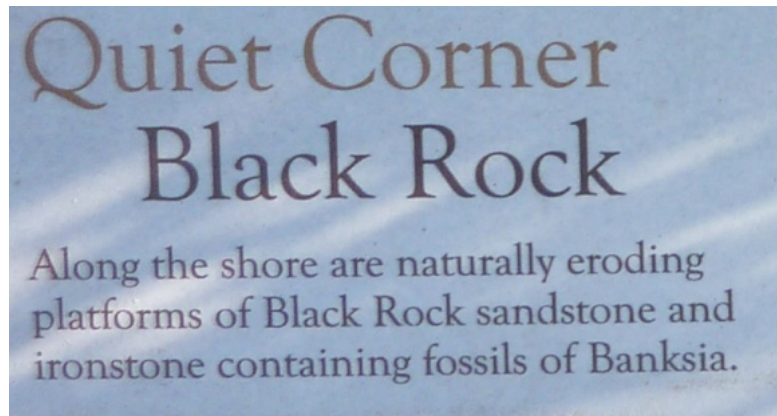


Figure 32: Detail from the city council’s explanation of the fossil illustrated in Figure 31.



Figure 33: An exuvia of *Thalassina anomala* (Herbst, 1804) from Pleistocene concretions at Gunn Point, Darwin NT. This “mud lobster” makes burrows that are very like the *Ophiomorpha beaumarisensis* at Ricketts’ Point. (Length of the exuvia (moult) is *c.* 95 mm).

A careful assessment of the disposition, association and overall morphology of these tubes leads to the recognition that they are neither skeletal nor carbonaceous



Figure 34: Typical exposure of *Ophiomorpha beaumarisensis* burrows at Ricketts' Point. (Coin diameter 23 mm).

remains. Instead, they are more correctly classified as ichnofossils (or trace fossils) and represent the past activities of mud lobsters that built subsurface burrows for communication and protection. The large, complex and most abundant burrows in the Beaumaris Sandstone have been formally named *Ophiomorpha beaumarisensis* (Figure 34).

Task 10 answer: Goethite forms from ferrihydrite ($\text{Fe}_5\text{HO}_8 \cdot 4\text{H}_2\text{O}$), which is technically insoluble in water. However, ferrihydrite represents the **most soluble** form among all iron oxides.

Importantly ferrihydrite is highly soluble in acidic environments – and carbon dioxide in the air contributes significantly to this solubility.

The ultimate source of iron is weathering of basaltic ash, erupted from local volcanoes.

Task 12: Why are the *Ophiomorpha* burrows so prominent?

Why do they not simply weather and erode at the same rate as the enclosing rock in which they are preserved?

Ophiomorpha burrows can be up to three metres long and 50 mm in diameter. They are characterized by a nodular surface (Figures 31, 34).

There are many smaller burrows exposed on the shore platform too; these are also produced by invertebrates such as crabs or annelids, but most of these have smooth exteriors (Figure 35). However not all non-skeletal organic structures in the Beaumaris Sandstone are burrows. Near the old Keefer's boatshed site are some very unusual (and rare) fossils of soft-bodied anemones (Figure 36). Conditions that permit preservation of these animals, which have been named *Bergaueria* were very quiescent conditions, with rapid burial of the anemones by fine grained sediment.



Figure 35: Palaeontology: There are numerous smaller diameter ichnofossils at Ricketts' Point. These burrows may have been produced by worms, echinoderms and/or crustaceans. The larger, central specimen in this image has distinctive bulges. Although the purpose of these is unknown, but they could well have been “brood chambers” for juveniles. (Coin diameter 23 mm).

Task 11 answer: The tubular fossils in the Beaumaris Sandstone were made by crustaceans. They were formally described in 2012 as the trace fossil *Ophiomorpha beaumarisensis* Ter & Buckeridge. Similar burrows occur in association with body fossils in concretions at Darwin and were made by thalassinoid crustaceans (Figure 33).



Figure 36: Soft-bodied marine organisms are preserved only when very special depositional conditions are met: a quiet, “quiescent” environment that experiences a rapid burial event by fine sediment. Under these conditions, a stratum outcropping near the Keefer’s boatshed site has preserved sea anemones. These remains are known as *Bergaueria* and surprisingly have a fossil record that extends back some hundreds of millions of years. (Coin diameter 20.5 mm).

Task 12 answer: The mud lobsters that produced the *Ophiomorpha* burrows needed to reinforce the walls – preventing them from collapsing when the burrow was occupied. They did this by using their appendages to compact clay-rich sediment into small, rounded balls which were pushed into the tunnel walls. These walls were preferentially mineralized by ferruginous solutions in groundwater, which transitioned to goethite on exposure.

Fossil Casts:

Casts are the remains of fossils from which all the original skeletal or “hard” material has been lost. The process typically begins with organisms such as molluscs that possess a shell with a semi-enclosed internal body cavity. At Ricketts’ Point it also includes the impressions of tree trunks (Figures 25, 26).

Upon death, this cavity is infilled by fine sediment, which in turn is mineralized. Later, or contemporaneously with this mineralization phase, the shell of the animal has been dissolved away, exposing the inner “cast” (Figure 37). Although the coiling and general shape of fossils in Figure 37 are easily

identified as gastropods, they do nonetheless represent the moulded inner surface of the animal's body chamber, so features that characterized the original shell, such as external spines and ribbing are lost.



Figure 37: Fossil horizon in the Beaumaris Sandstone: The above is a richly fossiliferous layer of gastropods. This abundance is relatively rare except near the Beaumaris Motor Yacht Club. This site has been exposed at low tide and with the fossils are living specimens of *Bembicium melanostoma* (greenish brown snails). None of the gastropod fossils (dark brown here) have retained their original shell; all the calcite or aragonite has been leached away by weakly acidic groundwater. Upon death of the animal, the interior of the shells became infilled with sediment; this sediment has subsequently been preferentially cemented by the iron-rich mineral goethite.

Task 13: Why are fossils abundant in some horizons, but not in others?

Is it possible for igneous rocks to preserve fossils?

The Law of Superposition:

As noted on pages 19-20, William Smith recognized that the arrangement of sedimentary rocks was not haphazard, and because of this, could be used to correlate strata over great distances, even when the strata were, for the most part, not exposed.

Smith's observations led to recognition that in any undisturbed sequence of sedimentary rocks, the oldest beds are at the bottom, and the layers become progressively younger toward the top. Many fossils are known to have very well

confirmed time ranges between first occurrence and extinction. As such, these “index fossils” are not only useful in recognising similar strata, but in dating when these strata were deposited. The basic rule is that the age of any fossiliferous rock is determined by the age of the youngest fossil in it.

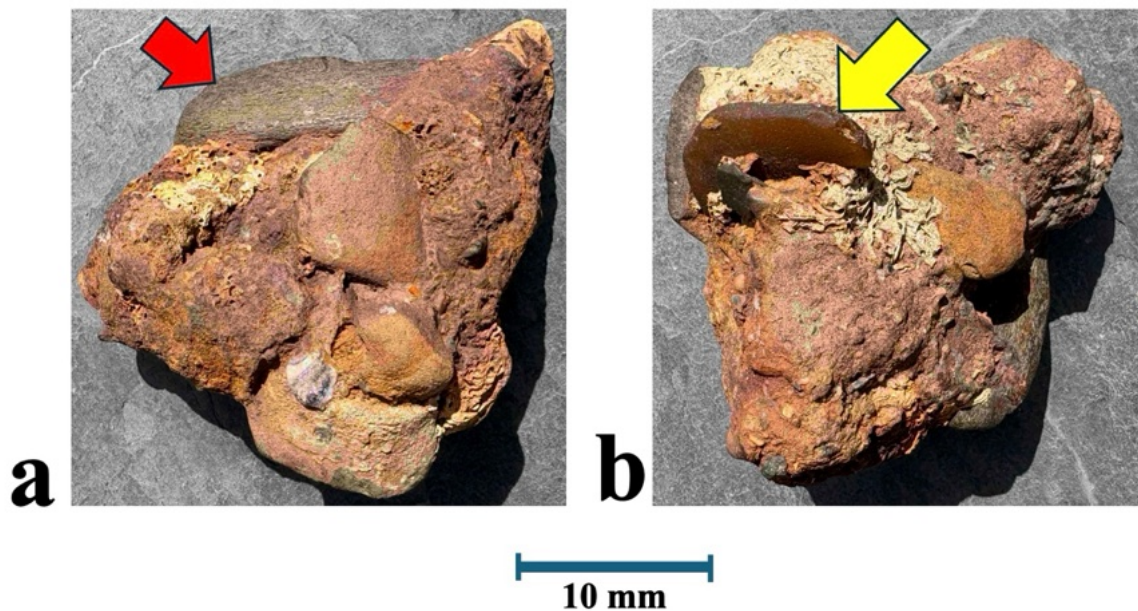


Figure 38: A rock specimen collected on the shore platform at Ricketts' Point that contains a 5.6-million-year-old fragment of a whale's rib (red arrow) and on the other side, a well-worn fragment of a Victoria Bitter beer bottle (yellow arrow).

Dating of rocks:

The dating of rocks is undertaken in two ways:

- **Absolute Dating:** This is particularly effective with unweathered igneous rock. Isotopes of radioactive "parent atoms" in rocks decay into stable "daughter atoms" at a constant, known rate. This rate is called the half-life of the parent atoms. By measuring the ratio of parent-to-daughter atoms it is possible to calculate exactly how many half-lives have passed. Some elements, such as ^{235}U (uranium-235) with a decay rate of 704,000,000 years, can be used to date rocks that are billions of years old – the end point is the lead isotope ^{207}Pb . ^{14}C (carbon-14), which decays to ^{14}N , has a half-life of only 5730 years, and can be used to date organic remains up to about 35,000 years old.
- **Relative Dating:** This is widely used in sedimentary rocks, where direct use of isotopes is not possible. Age is determined through

superposition, cross-cutting relationships (see page 24) and index fossils.

Task 14: Examine the image of the rock in Figure 38.

If the whale bone is 5.6 million years old, when did the rock form?

Abundance of fossils:

If you are fortunate, you will find some highly fossiliferous horizons. The Fyansford Formation is, on the whole, more fossiliferous than the Beaumaris Sandstone, but it only outcrops near the Beaumaris Motor Yacht Squadron. From this you may conclude that not all sedimentary rocks are fossiliferous.

Fossils can occur in two ways: *in situ* – or **autochthonous**, where there has been no transport of the remains since death. This is particularly the case with ichnofossils. **Allochthonous** deposits are produced from fossils that have been transported from outside the depositional environment, e.g. by underwater avalanches (turbidites).

Pseudo-fossils

Not everything that looks like a fossil has an organic origin. Some are inorganic, with structures produced by chemical processes. One of the most common of these, (Figure 39), is sufficiently “organic-like” to be classified as dendrites (from Greek δένδρον = tree). At Ricketts’ Point colourful banding formed by chemicals is common. This formed when ferruginous-rich water moved through permeable rock. These are known as *Liesegang* rings (Figure 40).



Figure 39: Dendrites of manganese dioxide that crystallized when mineral-rich solutions seeped through a rock fissure.



Figure 40: Liesegang rings. These form when water travels through the rock and deposits ferruginous minerals in zones. The process depletes minerals from one zone, with dissolved ions diffusing further, before precipitating again, creating distinct, alternating bands.

Task 13 answer: Organisms are not distributed evenly. Most organisms, especially soft bodied ones, do not get preserved when they die.

Possession of a skeleton does not ensure fossilization, as bones and teeth may be crushed beyond recognition, or simply dissolved. Becoming a macrofossil is rather like winning a lottery with one prize and millions of tickets.

Task 15: Does the fossil record provide a complete record of the organisms lived in an area? (i.e. from which one can make a comprehensive reconstruction of the palaeoecology).

If there is any bias, what is the reason for it?

The future of the Ricketts' Point Sanctuary:



Figure 41: Erosion of the poorly lithified Red Bluff Sands, exposed in central Ricketts' Point. This occurs after relatively light rainfall.

Natural processes:

More visually dramatic storm damage has been illustrated above (pages 14-15), but environmental change is inexorable. Much is subtle, including what appears as very minor erosion (Figure 41), but even though humans may well believe (or wish) otherwise, nature is in a continuous state of flux.

Although the impact of storms can be considerable (Figure 42), damage varies considerably – depending not only on their severity, but on the time of year in which they occur. Damage to the cliff face is mitigated by the build-up of sand; but when sand has been previously scoured away, damage is accentuated and cliff erosion accelerates.



Figure 42: Erosion of the algal build-up at central Ricketts' Point. **a:** The accumulation of subtidal algae on 17th October 2025 following gradual build up, over many years, was over a metre deep. **b:** The same site, at a similar tide level, on 8th June 2026 after a major storm event had removed *circa* 170 cubic metres of algae in an hour.

Human activities:

Unfortunately, some overzealous fossil collectors have excavated rock to extract fossils from the sanctuary. In some cases, pneumatic tools have been used. In the process of doing this, they have damaged the fragile geology and have almost certainly destroyed valuable fossils. It is illegal to do this – collecting fossils or any other natural materials from the Ricketts' Point Marine Sanctuary is legally prevented and strictly prohibited under Australia's National Parks Act 1975, operating alongside the National Parks (Marine National Parks and Marine Sanctuaries) Act 2002.

Task 14 answer: The age of any rock or stratum is defined by the age of the youngest component.

In this example, the youngest easily datable component is the fragment of beer bottle. If it is Victoria Bitter, the oldest it can be is 1854, the year the brewery was founded by Thomas Aikken.

Providing it is done scientifically (with careful recording of the locality, the geology and associated fauna *and* with minimal excavation), collecting is permitted, but it should be done with care and with the **permission** of the Bayside City Council and Parks Victoria.

Fossil collecting is great fun, especially for children, as it gives them an understanding of deep history. Sometimes collectors may find rare, and palaeontologically important fossils. It is important that these are not lost to science. If you believe that you have found something special, get in touch with Museums Victoria. In this way, we can preserve this unique record of the Earth's history for future generations.

Task 15 answer: Organisms that possess shells (and are thus the most likely to be preserved), are often only a small fraction of the organisms that make up an ecosystem. Fossils of soft tissue are very rare, they occur in the Burgess Shale (500-million-year-old rocks in Canada) and in the Ediacara Formation – about 570 million years old, in South Australia (the latter has some of the earliest multicellular organisms known). These very special lithologies are known as *Lagerstätten* (= mother loads).

New rock formation:

Not all natural processes are destructive, as you have seen in Figure 38, some rocks formed only a century or so ago. Concrete, made with Portland Cement technically fulfills the criteria of a “rock”, even though a hardened sample may only be a few weeks old.

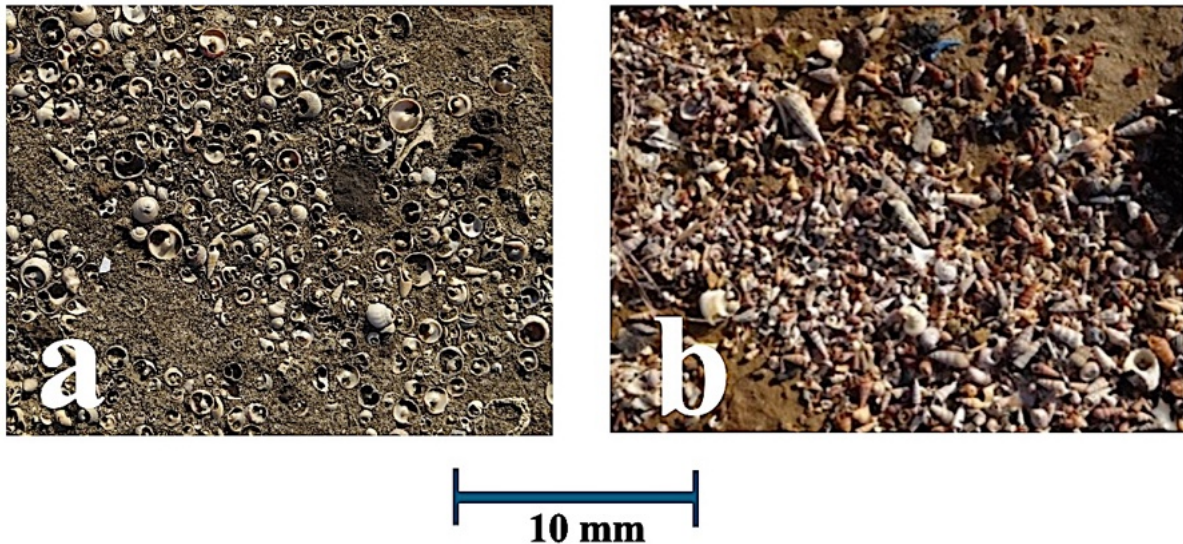


Figure 43: Nature is not static. In central Ricketts’ Point new horizons are forming at the present time. Mollusc shells on the beach are being cemented by carbonate-rich waters leaching out from rocks beneath the road. a: The new, richly fossiliferous, limestone veneer; b: Existing beach sediment, containing similar shells to those being incorporated in the new rock.

Irrespective of human influence, rocks are continuously forming naturally, although this is generally unseen: the process of lithogenesis (rock-formation), which includes higher pressures and temperatures than are normally expected on the surface. However, loose sediments on or near the surface can be lithified by groundwater-borne cement – and this can be observed at the uppermost intertidal zone at the southern edge of the Ricketts’ Point car park, where shell and sand accumulations are being cemented by calcareous cement, forming a thin veneer of shelly arenite (Figure 43).

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I also thank my family, especially my wife June, and grandsons Benedict and Rafael. Without their support and interest in the sanctuary, this book would not have been written.

There is some variation in the spelling of Ricketts' Point – specifically whether there is an apostrophe in Ricketts'. In many publications concerning the sanctuary, and for local businesses such as the tea house at the point, the spelling has been **Rickett's**. However, the Point is named after a prominent local pioneer and early fisherman, Captain Thomas Ricketts, who settled in the Beaumaris area during the mid 19th century. Although Australian geographic naming authorities remove apostrophes from official place names to “simplify map reading and databases” it is retained herein as **Ricketts'** – acknowledging the origin, but not ownership.

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<i>Zullobalanus</i>	27

Notes

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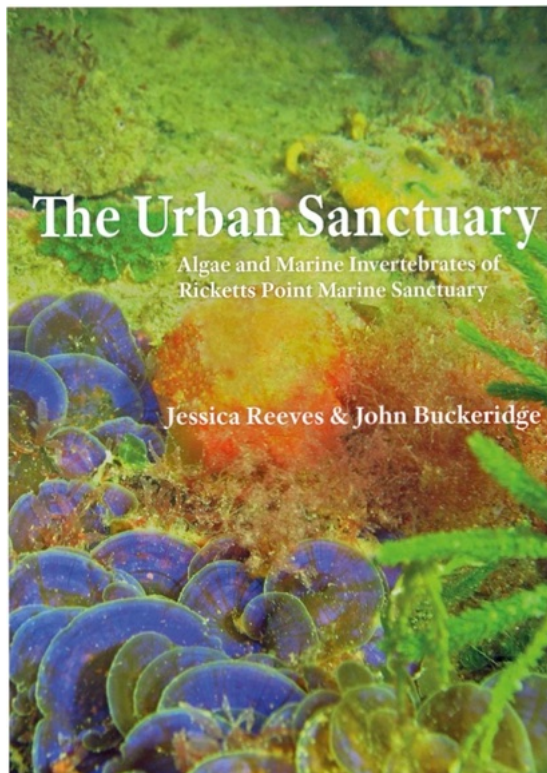
Notes



Associated Resources

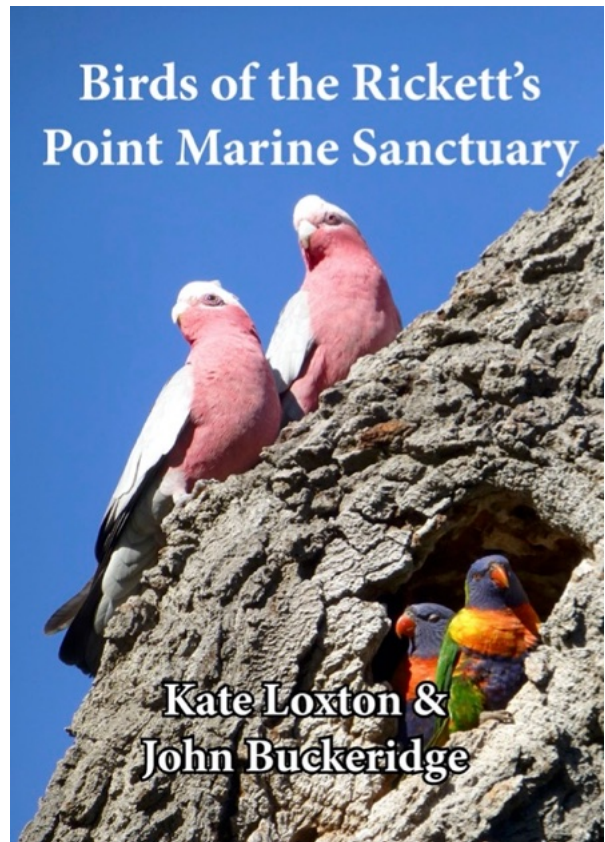
The Urban Sanctuary Series

The following six titles, written to provide a comprehensive outline of selected biological and geological components of the Ricketts' Point Marine Sanctuary, Melbourne, VIC are available either as printed and bound books, or as free, downloadable PDF files from the International Union of Biological Sciences (Paris) website (<https://iubs.org/publications/>) and the Marine Education, Science & Community (Melbourne) website (<https://mesac.org.au/newsletters-mesac/>).

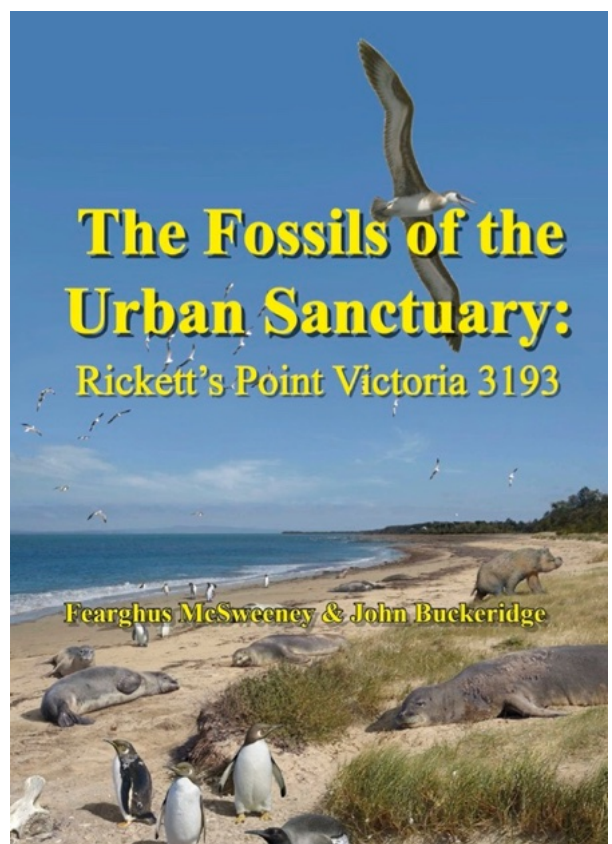


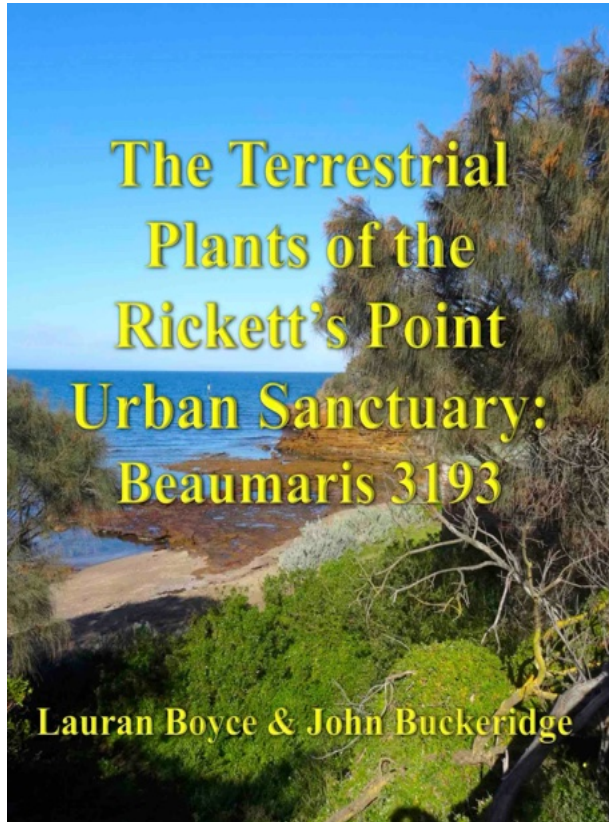
The Urban Sanctuary, Reeves & Buckeridge, (2012). This, the first book in the series deals with the marine algae, marine plants and marine invertebrates that live in the sanctuary. All species are photographed, listed systematically and provided with a description that focuses on key features. An assessment of their habitat and abundance within the sanctuary is given.

Birds of the Ricketts' Point Marine Sanctuary, Loxton & Buckeridge, (2016). The second book in the series deals with the aquatic and terrestrial birds that live in, and immediately adjacent to, the sanctuary. All species are photographed, listed systematically and provided with a description that focusses on key features. An assessment of their habitat, breeding patterns and abundance within the sanctuary is given.



The Fossils of the Urban Sanctuary, McSweeney & Buckeridge, (2016). The third book in the series deals with the animals and plants that are preserved as fossils within the sanctuary. All species are photographed, listed systematically and provided with a description that focusses on key features. Keys to assist with the recognition of taxa are provided.



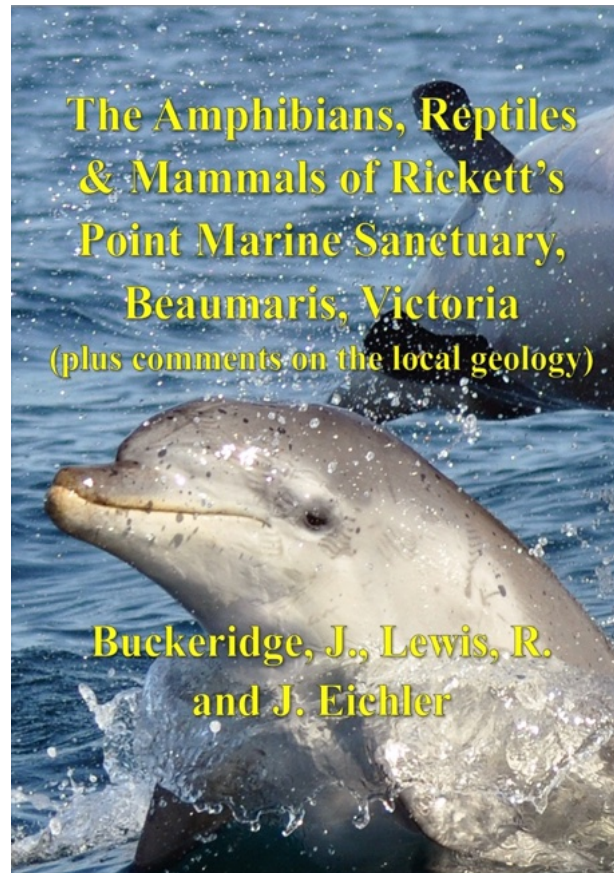


The Terrestrial Plants of the Rickett's Point Urban Sanctuary, Boyce & Buckeridge, (2018). The fourth book in the series deals with the plants that live in the zones immediately adjacent to the sanctuary. All species are photographed, listed systematically and provided with a description that focusses on key features. An assessment of their habitat and abundance within the sanctuary is given.



The Common Insects & Spiders of Rickett's Point Marine Sanctuary, Hakam, Eichler & Buckeridge, (2023). The fifth book in the series deals with the insects and spiders that live in the sanctuary. All species are photographed and listed systematically and provided with a description that focusses on key features. Keys of insect and arachnid morphology are included and an assessment of their habitat and abundance within the sanctuary is given.

The Amphibians, Reptiles & Mammals of the Rickett's Point Marine Sanctuary, Buckeridge, Lewis & Eichler (2024). The sixth book in the series deals with the vertebrates that live in and adjacent to the sanctuary. It also provides a brief overview of the local geology, some of which is included in the current volume. However, it does not include fish, as these are well covered in many other texts*. All species are photographed, listed systematically and provided with a description that focusses on key features. An assessment of their habitat and abundance within the sanctuary is given.



*A useful, well-illustrated text that includes fish is G. J. Edgar (2008), *Australian Marine Life. The plants and animals of temperate waters*. (Second edition). Publisher, Reed New Holland, Sydney. 624 pp.

Selected Films & Videos

A series of videos have been produced to promote general interest in the sanctuary and to encourage those who visit the site to both embrace the wonderment of the natural environment and to develop an ethos of natural conservation: *Pour comprendre la nature, il faut l'aimer, et pour l'aimer, il faut être initié à son langage, à ses voix secretes*¹



Fossicking for fossils

With Ray Lewis

<https://youtu.be/hkSoHMCITSQ>



Forming Fossils #2 Bayside

With Professor John Buckeridge

<https://youtu.be/Xt80nyjWBqs>



Our Beaumaris Fossil Heritage

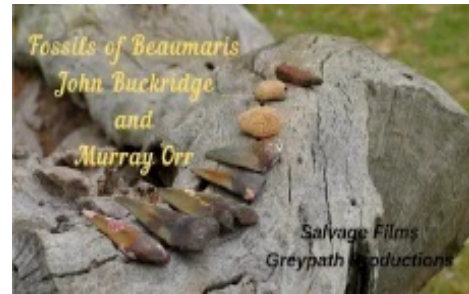
<https://youtu.be/rszJRhCcClc>

¹ This phrase, “To understand nature, one must love it, and to love it, one must be initiated into its language... to its secret voices” encapsulates the guiding principles of nature conservation. It was coined by French writer and historian, Jules Claretie in *La libre parole* (1868).

Fossils of Beaumaris

John Buckeridge & Murray Orr

<https://youtu.be/gB4hYHyZONk>



A journey through the mists of time

<https://youtu.be/d87398t7BQI>



Winter Solstice Walk 2024

<https://youtu.be/IOBIIJGssjA>



Winter Solstice Walk 2023

https://youtu.be/VQ_S_1__bZ8



Reef & Foreshore Birds

Part 1 (Ray Lewis)

<https://youtu.be/ADgR8dooNi4>



Reef & Foreshore Birds

Part 2 (Ray Lewis)

<https://youtu.be/eeQSb94QagM>



John S^t James Stewart BUCKERIDGE has lived 300 metres from Ricketts' Point for more than 20 years. He is Professor Emeritus in Earth & Oceanic Systems at RMIT University, Melbourne and honorarprofessor at Wismar University, Germany. He is a member of the Hungarian Academy of Sciences, Past President of the International Union of Biological Sciences (Paris), Past President of the Australasian Association of Palaeontologists, President Emeritus of the International Society of Zoological Sciences (Beijing) and past Executive Board Member of the International Council for Science (Paris). He has described more than 100 new species, including a number from Ricketts' Point.



Back cover image: Cliff erosion at the southern end of the sanctuary.



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