

ANCIENT SITES

a geological journey

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all kinds of natural

The amazing gallery of formations and folds of sandstone, stiltstone, shale, granite and basalt along Eurobodalla's coast date back as far as 510 million years. The coastline itself was shaped around 90 to 70 million years ago when the Lord Howe Rise rifted away from what is now the south-east coast.

From the stunning sandstone at the edge of the Sydney Basin at Durras to dramatic chert and mudstone rocks, with their angular faults and folds, rising from the sea at Mystery Bay, all with Montague Island as the captivating backdrop.

A trip along Eurobodalla's coast and into the mountain wilderness is a journey through time you'll never forget.

MYRTLE BEACH: *Where two worlds collide*

A trip to Myrtle Beach is an opportunity to see two worlds collide. Discover the breathtaking sandstone cliffs of the Sydney Basin come to an end and rise up to meet the much older Wagonga Ordovician rocks of the Lachlan Fold Belt, which continue south. The point where two major geological units meet is called an unconformity, here clearly and strikingly revealed in the cliff face at the northern to middle section of the beach.

The sedimentary rock that forms the massive Sydney Basin, extends from Newcastle to beaches just south of Durras and inland, taking in the Blue Mountains. This rock was laid down during the Permian and Triassic periods, between 300 and 230 million years ago, while the older Wagonga Ordovician beds were created 500 to 450 million years ago. At Myrtle Beach look at the cliffs on the northern end of the beach—these sandstone cliffs are the southernmost exposed edge of the Sydney Basin, while the cliffs you see at the southern end of the beach, are from the Ordovician period.

How to get there: Take the South Durras turnoff 9.6 km north of Batemans Bay and follow it until you reach the Murramarang Resort carpark. Head south along the Old Coast Road for 1km until you get to the Dark Beach/Myrtle Beach turnoff where you turn left. Drive along this track for 450m to the main carpark to access both beaches.

The walk from the carpark to Myrtle Beach is about 400m. The start of the track faces you as you enter the carpark. This track heads part of the way east and is signposted—walk for 200m, take the first turn right (not signposted), walk a further 200m and descend the last part via the staircase. The closest public toilet is near Cookies Beach, next to the Murramarang Resort.

Check conditions at nationalparks.nsw.gov.au
or call 4476 0800



BENDEThERA:

Sparkling limestone in the mountains

White limestone in the creek bed that runs along the walking trail leading to the Bendethera Caves is easily seen and is lovely in its natural state. It's also a reminder that you're now walking through the largest karst (limestone) area in Deua National Park. The walking trail meanders and crosses Con Creek many times.

At about 3km into the walk, the hillside to the right is covered by the endemic Bendethera wattle. To the left of the trail, and with interpretive signs, are a number of dolines, which form circular bowl-shaped depressions in the limestone. Dolines are one of many weathering features, including caves, which form when rainwater dissolves limestone and the solution seeps away through the rock.

The limestone has been identified as forming in a shallow sea during the Silurian Period and is between 440 and 415 million years old. Limestone consists of calcium carbonate, the main gluing agent in cement. The limestone contains abundant fossils, the remains of shell marine animals. It predates the Great Dividing Range, which formed from 250 million years BP onward—possibly through uplifting over the ages and during the rifting of the Lord Howe Rise from the east coast 90 to 70 million years ago.

How to get there: The Bendethera Caves walking trail is 60km from Moruya. Take Campbell Street and Araluen Road to Womban Road (approximately 5km). Womban Road becomes Little Sugarloaf Road for approximately 30km then turn onto Bendethera Fire trail (4 wheel drive only due to steep terrain and three river crossings), then Bendethera Caves Track. The only public toilets are a few kilometres from the walking trail at a clearing near the river, at the old homestead site. The walking trail to the caves is an 8km return trip, and is very steep in its final stages. If accessing the caves take appropriate footwear, headgear and torches. The wattle and dolines are about 3km along the track and the walk there is moderately easy with numerous creek crossings.

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WASP HEAD, SOUTH DURRAS: *An incredible journey*

The golden colours of the sculpted sandstone cliffs, which form the exposed southern edge of the 280 million-year-old Sydney Basin, are a unique treat at Wasp Head. But the spectacle doesn't end with these beautiful cliffs. Out on the rock ledge of the head, both south and north, you will find the most fascinating rock formations and evidence of many millennia and life that has gone before. You'll need your camera as you encounter the honeycomb weathering of the eroded sandstone on the northern side of the head, that from afar looks like a discarded fisherman's net, or in some places an elaborate spider's web. On the southern side the display of ironstone box work—iron-rich sediment that has formed into a box-like pattern is spectacular and one of the highlights of Murramarang National Park.

You'll also see clusters of shellfish fossils embedded in the rocks, as is an old fault plane and igneous dike, with boulders of petrified magma, now basalt, clearly visible. Dropstones and pools of sedimentary conglomerate rock, carried to the area in melted water from west to east as the earth was emerging from an ancient ice age, are also visible and contribute to the richness of this site.

How to get there: Wasp Head is about 8.5km from the Princes Highway. Take the South Durras turnoff 9.6km north of Batemans Bay and follow it to the Murramarang Resort. Turn left immediately after the resort carpark, then turn left (no sign) and down to the back of Mill Beach. From here you can walk to the Wasp Head rock ledge and at low tide walk right around the head to the south. To access the southern side of Wasp Head turn left after the Murramarang Resort carpark and continue to Wasp Head carpark. This is a good access point during high tide when you won't be able to walk around the rock ledge. The closest toilets are at Cookies Beach, western side of the resort near the boat ramp.

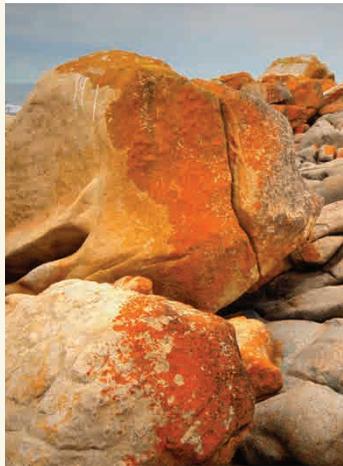
GUERRILLA BAY: *From the ancient Pacific*

Guerilla Bay is a hidden, sheltered and picturesque bay formed in some of the oldest rocks—dating back 510 million years—along Eurobodalla's coastline. These rock formations are layers of chert and slate and initially laid down in the ancient Pacific Ocean, before becoming part of the Gondwana continent, possibly during an interval of subduction.

A subduction zone is an area where tectonic plates converge, with one plate overlapping and overriding the other; they can sink to great depths in the Earth's mantle at a 25° to 90° angle. Through the high temperatures and pressures associated with this process, seabed sediment converts to rock. Although plate movement only occurs at a rate of centimetres per year, an active zone such as in Japan or New Zealand can cause tsunamis and earthquakes. Through plate movement, sediments and rocks can travel long distances to become part of landmasses.

Squeezed, bent and broken after they formed, these Guerilla Bay rocks consist of a mix of fragments called tectonic melange. Contained in these chert rocks are tooth-like microfossils (less than 1mm) from the gut of extinct eel-like animals, but a microscope is required to see these minute fossils.

How to get there: Guerilla Bay is 13km south of Batemans Bay and accessible from George Bass Drive. From George Bass Drive, turn east into Burri Point Rd, then first or second left to beach. There is a small carpark and a few picnic tables.



BINGIE BINGIE POINT:

Cool magma

Bingie Bingie Point is a site of intense interest to geologists because of the prolific and spectacular display of intrusive igneous rocks on the northern side of the point, at the north end of Bingie Beach. It is where a complex association of two igneous rock types exists—granite (Tuross Head tonalite) and gabbroic diorite (Bingie Bingie suite).

Intrusive rock bodies are masses of magma which have cooled

and crystallized below the earth's surface, as opposed to having formed from a volcanic eruption and then cooled on the surface. The Bingie Bingie Point rocks are part of the early Devonian granites of the Moruya batholith and are 415 to 390 million years old. A batholith is a body of rock—usually granite, that has formed in the earth's crust.

How to get there: Follow Princes Highway south of Moruya for 9km. Turn left onto Bingie Road, after 4.7km turn right to stay on Bingie Road. After 600m turn right and stay on Bingie Road for 1.9km to Bingie Bingie Point. There are no amenities.

SURF BEACH, NAROOMA:

Glasshouse rocks and pillow lava

Surf Beach, Narooma has two sites of geological significance and beauty at either end of the 1km sandy beach, looking out to Montague Island. At the southern end lie the imposing Glasshouse Rocks consisting of Narooma Chert, which is a mix of sedimentary chert and shale, and are part of the Cambrian/Ordovician Wagonga Group, dating back 510–440 million years. It's easy to see the aesthetic chevron folds in a number of the rocks, where the sedimentary layers have compressed into zig-zag patterns. Many geologists consider that these rocks came together as part of a subduction zone, with an ancient Pacific plate thrust under the eastern edge of the Gondwana plate.

At the northern end of Surf Beach, there is a display of igneous pillow lava, which formed through the lava flow of a submarine volcano or hot spot also in the ancient Pacific Ocean and made its way to the edge of the continent in the subduction process.

How to get there: Glasshouse Rocks: Glasshouse Rocks Road, South Narooma. Magnificent views of Glasshouse Rocks may be enjoyed from Narooma Golf Club and the rise above Surf Beach. Pillow lava: Surf Beach carpark, via Willcocks Avenue and Ballingalla Street, Narooma. Walk about 300m north from the carpark.



MYSTERY BAY: *Kink zone*

The bay and its dramatic rock outcrops arise from the sea and along the shoreline within a kink zone. These rocks are chert, black mudstone and slate and date back nearly 500 million years to the Ordovician period. The geological term, kink zone describes rocks that have been subjected to intense pressure during the moving of tectonic plates. A feature called foliation, which forms during movement at high pressure and enables further deformation, is apparent in the kinks and breaks in the angular brittle rocks, which makes these rocks look as if they could have been pieced together one by one. Kinks zones are widely developed but particularly evident in this area of Eurobodalla's coastline.

How to get there: Mystery Bay is 15km south of Narooma. Turn onto Mystery Bay Road from Princes Highway. As you enter Mystery Bay the carpark opposite Lamont Young Drive is a good place to access the display of kink zone rocks that lie at the northern end of the beach. There are toilets at the primitive camping ground site on the left as you come into Mystery Bay.

GULAGA: *Another world*

The forested ancient volcano that is Gulaga, also known as Mt Dromedary, can be seen from Tathra to Moruya and hides near its summit magnificent granite tors that are of great spiritual and cultural significance to the Yuin people of the south coast. There have been several volcanic eruptions from Gulaga, the first about 95 million years ago during the Cretaceous period when dinosaurs were still at the top of the food chain.

The volcano has had a significant impact on the surrounding environment with both Little Dromedary (Najanuka) to the east and Montague Island (Baranguba) formed through the volcano's activity. Gulaga, which is now about 800m above sea level, would have originally been close to two thousand metres higher, and its foothills would have extended to Tuross. The mountain that you see today is basically the inner core of the original volcano. The volcano has been dormant since the Cretaceous period—which ended 65 million years ago.

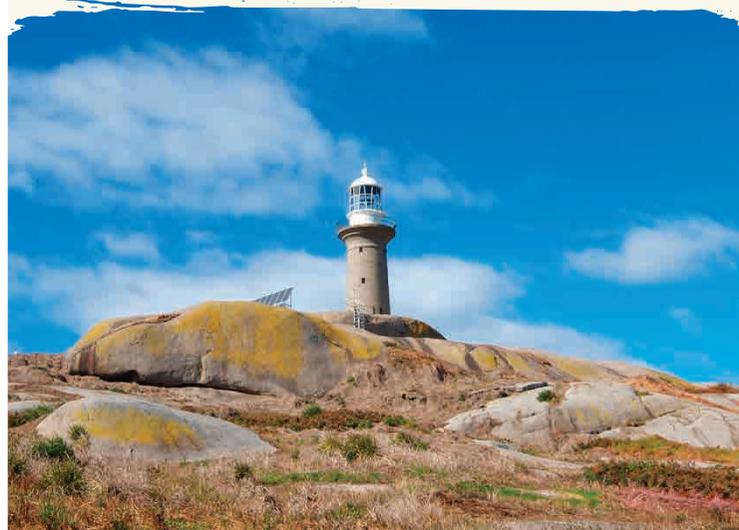
How to get there: Take the second turnoff to Tilba Tilba from the Princes Highway, approximately 18kms south of Narooma. The walk begins on the path behind La Galette (the old Pam's Store) at Tilba Tilba. The summit is approximately an 11km, 5hr return trip and steep in parts.

MONTAGUE ISLAND: *Jewel in the crown*

This incredible nature reserve is a seabird haven and is part of the Mt Dromedary Igneous Complex. The northern part of the island made of an andesite lava extrusion from a volcanic eruption on Gulaga, or Mt Dromedary as it is also called, about 95 million years ago in the Cretaceous period. The dark coloured rocks in the north contrast with the southern part of the island which has formed through intrusive igneous rocks. These rocks have cooled underneath the surface and exposed through erosion. These rocks formed through the activity of the ancient volcano and now take the shape of impressive sculptural tors that have been well-rounded and smoothed by weathering.

Until about nine thousand years ago the island was part of the mainland, connecting with Cape Dromedary, just south of Mystery Bay, by a sand spit. Montague Island is now 9km offshore from Narooma and of interest to not only geologists but lighthouse historians, nature lovers and eco-tourists. It holds extreme cultural significance to Yuin Aboriginal people.

How to get there: Tours are available from Narooma. Check eurobodalla.com.au for details. Overnight tours are managed by NSW National Parks at nationalparks.nsw.gov.au



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