GEOLOGICAL EXCURSION TO MYRTLE BEACH AND WASP HEAD

From Batemans Bay, head north on the Princes Highway for 9 km to Benandarah; turn right (east) on the Durras Road to South Durras. Follow the signs through the village to Murramarang Resort. Proceed past the entrance to Murramarang Resort on your left, and the carpark on your right, so you are now heading south. The track turns to dirt and there is soon a fork in the road: veer right, on to Coast Road, following the sign to North Head. After about 800 m you will pass the parking area for Emily Beach on your left. Keep going for about another 500 m to a turnoff to the left marked Myrtle Beach/Dark Beach. Follow this track to the parking area.

There are 2 walking tracks leading off the parking area - Dark Beach to the north and Myrtle Beach to the east. Follow the track to Myrtle Beach. After about 400 m there is a track junction - turn right and head downhill, then down the wooden steps on to the beach. Note this is a nudist beach, but you are at liberty to leave your clothes on if you prefer!

Walking track down to Myrtle Beach

Stop 1: south end of Myrtle Beach. Walk along the beach until you reach black rocks and a low cliff. These are black *carbonaceous shales* and *black chert* of the Ordovician Narooma Group; note the intense folding, and how the fold closures plunge steeply westwards (ie the fold closures themselves dip at 60 - 80 degrees from the horizontal, roughly westwards). There is a small cave at the base of the cliff with a fresh exposure of these rocks; note the very small scale folding and small scale faulting, and fine banding (ie very thin bedding) in these rocks. The pale grey bands are beds with little carbon content, vs the dark grey-black carbonaceous beds. Elsewhere here you may see how in places when the carbon weathers, it changes from dark grey to white as it is oxidised. Also note how much harder the chert is and how it stands out relative to the softer shale.

Interbedded carbonaceous shale and chert of the Narooma Group. The fold closures (where the beds bend around) are plunging away from the camera at about 80 degrees from the horizontal. The harder chert beds stand out between the softer carbonaceous shale beds.

Finely interbedded grey shale and black carbonaceous shale in the small cave. Look closely to see the fine bedding and very small offsets or micro-faults which offset the bedding.

Stop 2: centre of Myrtle Beach. Walk back to the wooden steps and then about 20 m past them to the the base of the cliff. Here is the *unconformity* surface between weathered carbonaceous shale of the Narooma Group, around 450 million years old, and the base of the Permian rocks of the Sydney Basin, deposited about 350 million years ago. So the unconformity represents a roughly 200 million year hiatus during which possibly 10 km of vertical thickness of rock was eroded off to form a gently undulating land surface, over which the Permian seas transgressed to form a thick sequence of sandstones with coal measures, which fill the Sydney Basin from here at its southernmost point, to the Hunter Valley and beyond.

If you look north along the base of the cliff you will see how the sandstones dip down beneath the sea as the sedimentary basin sequence thickens to the north and east, and the unconformity surface undulates. Also look up at the cliff face; there are large beds containing angular and unsorted clasts - mainly of Narooma Group rock types - which are jumbled in a matrix of sandstone. This type of rock is called a *sedimentary breccia*, and formed from rapid erosion and nearby deposition of rock material, such as from landslides into a river. Also look in the sand at the top of the beach for small pieces of pumice; the nearest possible origin for this is White Island in New Zealand.

	The unconformity between steeply dipping, weathered white-cream-grey carbonaceous shale of the 450 Ma Narooma Group below (Ordovician), and the almost horizontal grey-purple sandstone of the 250 Ma Wasp Head Formation (Permian) above.
	A sedimentary breccia with blocks of carbonaceous shale and chert in an iron-stained sandstone matrix.

Now head back to the wooden steps and the car park. Although not part of this excursion, if you have plenty of time you may like to follow the short track north from the carpark to Dark Beach. Here you will see the unconformity again, but this time the Narooma Group is made up of thick beds up to 3 m across of Narooma Chert, interbedded with grey-brown weathered shales. And the lowest part of the Permian sequence consists of a *basal conglomerate* about 6 m thick, which is overlain by sandstone.

Stop 3 OPTIONAL: Myrtle Beach Permian conglomerate and sandstone overlie Ordovician thickly bedded Narooma Group chert and weathered shale The heads of the people in the photo are in front of the unconformity surface.	

Now drive back towards South Durras. Just as you approach the resort complex, turn hard right and follow the track to Wasp Head. Beware of potholes. At the fork with the track heading left down to the beach, veer right and follow the track until the end. Park here and head east along one of several poorly marked paths. Take care, you will need to pick your way fairly carefully onto rocks which then form rough natural steps down to and along the wave platform. Once on the rocks, walk to the left and keep your eyes down - there is plenty to see!

Stop 4: **Wave platform on the southern side of Wasp Head.** There are many features to see here, all in sandstone of the Permian Wasp Head Formation. Slowly wander north towards Wasp Head; the field trip ends where a basalt dyke prominently cuts through the sandstone. Along the way, look for:

	Pick your way carefully along the rock ledges as you descend from the carpark and head left on to the main wave cut rock platform. Along the way you will see roughly concentric red-yellow banding in the sandstone which cuts across the bedding layers. This *Liesegang Banding* is caused by groundwater percolating through the rocks, taking iron into solution, transporting it, and then precipitating it in a process possibly dictated by the different levels of oxygen present in the rock.
	Iron and sililca are also taken into solution by groundwater, transported, and precipitated into *joints* (cracks). The silica and iron make the joints harder than the surrounding sandstone which is gradually weathered away, leaving the chocolate-brown iron-silica joints standing up to make a feature called *boxworks*.
	Another form of weathering involves salt water and spray seeping into porous rocks like sandstone, and then as the rock dries out the salts crystallise. Pressure exerted by the growing crystals, called the *power of crystallisation*, breaks the fabric of the rock apart, thus making it weaker and more susceptible to erosion. Hence a gradual process of surface pitting occurs, forming what is commonly called *honeycomb weathering*.
	As well as iron and silica being precipitated in joints from circulating groundwater, they were also precipitated in siltstone and mudstone beds in between the sandstone beds. These siltstone and mudstone beds are now dark brown flat areas, commonly associated with the boxwork areas. *Fossil remains* are preserved in this ironstone layer. They are hard to find and identify, but look for features that look like thumbmarks, which are the casts and moulds of shells similar to pippies.

Another fossil here is also rather enigmatic. Towards the top of the rock platform is a step-up in the rock, which is weathered into a horizontal recess about 2 feet or 1/2 metre high - it's characteristically blue/greyish. If you look closely here you will see narrow vertical pipe-like structures, commonly filled with slightly coarser material. These are *worm burrows*. The soft tissue of the animal is long gone, but the burrows in what was fine muddy sand leave a trace of the animal's existence. Hence this type of fossil is called a *trace fossil.*

On the rock platform, embedded in the sandstone, are several large, usually well rounded rocks which are too large to have been washed in along with the much finer grains of sand which make up the sandstone. They are *dropstones* - dropped from glaciers which were melting as they slowly drifted north from the polar seas into the newly forming Tasman Sea during the Permian period. Many of these boulders are felsic (quartz-rich) volcanic rocks which were carried hundreds of kilometres from their source area.

About 10 m before you reach the basalt dyke there is what looks like a rusty iron bar embedded in the rock. This is *fossilised wood*. It is very highly altered - replaced with iron and silica again - but we know it must have been from the genus Glossopteris, an early vascular plant similar in form to a giant tree fern, growing to something like a Norfolk Island Pine in appearance and size.

The last thing we look at is a vertical *basalt dyke* which traverses the rock platform roughly north-south. It intruded about 30 million years ago around the same age as the Coila Basalt, and is probably related to the basalt on Durras Mountain just north of Pebbly Beach. The orange edges of the basalt show where the basalt magma chilled quickly against the cool sandstone country rock into which it was being intruded; in this 'chilled margin' the grainsize is very fine as the crystals did not have time to grow as the magma quickly cooled. The grainsize is larger in the centre of the dyke because it was insulated by the surrounding rock and therefore the crystals had more time to grow as the magma solidified more slowly. Stand here and look south across the bay; there is a narrow notch in the sandstone cliff where the dyke was intruded, but the basalt has since been completely removed by erosion.

Stewart Needham
Tutor, 'Introduction to Geology'
Batemans Bay U3A
2012