EXCURSION 1: PORTRANE

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How to get there: By car (car park is in centre of excursion area at Irish grid ref. O 261504), by bus 33B from Eden Quay or Swords, or by train to Donabate, and 33C bus, or walk 3km.
Geological horizon: Ordovician - Silurian and Quaternary.
What to see: Remnants of an Ordovician volcanic island, with younger slumped fossiliferous limestones, black slates, thrust fault, Silurian sediments, Quaternary caves and till.
Duration: about half a day but can be varied.
Warning: Much of the section is only accessible at low tide especially at Priest's Chamber. Some scrambling may be necessary.

Whether driving or walking from Portrane follow the road from the village to the headland car park. From here two loops cover the main interest. One goes north, the other south. The northern excursion starts back 400m along the road at a sharp bend. Descend to the foreshore here and follow to the right round the headland back to the toilet block and steps to the beach from the car park.

Stop 1. The hard dark greenish rocks here are all andesite. This volcanic rock was erupted in the Ordovician period as an island in the sea, roughly centred on Lambay Island, which is mostly made up of various volcanic rocks. A large ocean called Iapetus separated SE Ireland and Britain from NW Ireland and the N. American continent. As the continents drifted together oceanic crust was forced down (subducted) beneath the continental crust. Some of this crust then melted and formed an arc of volcanoes from Kildare through Lambay to the English Lake District. Just before the headland is reached, near a broken wall, some dykes of porphyry are obvious. These are volcanic lavas injected into fractures at a late stage. They are clearly identified by the lighter coloured larger crystals (phenocrysts) of feldspar which crystallised out at a lower temperatures than the surrounding minerals. Sections of this rich in jasper are red coloured. Larger intrusions of the 'Lambay Porphyry' are found near the southern Martello Tower and were formerly quarried for building stone on Lambay.

Stop 2. Having passed on to the headland, an abrupt break occurs at the last outcrop of resistant andesite. Beyond this is a beach with rocks exposed

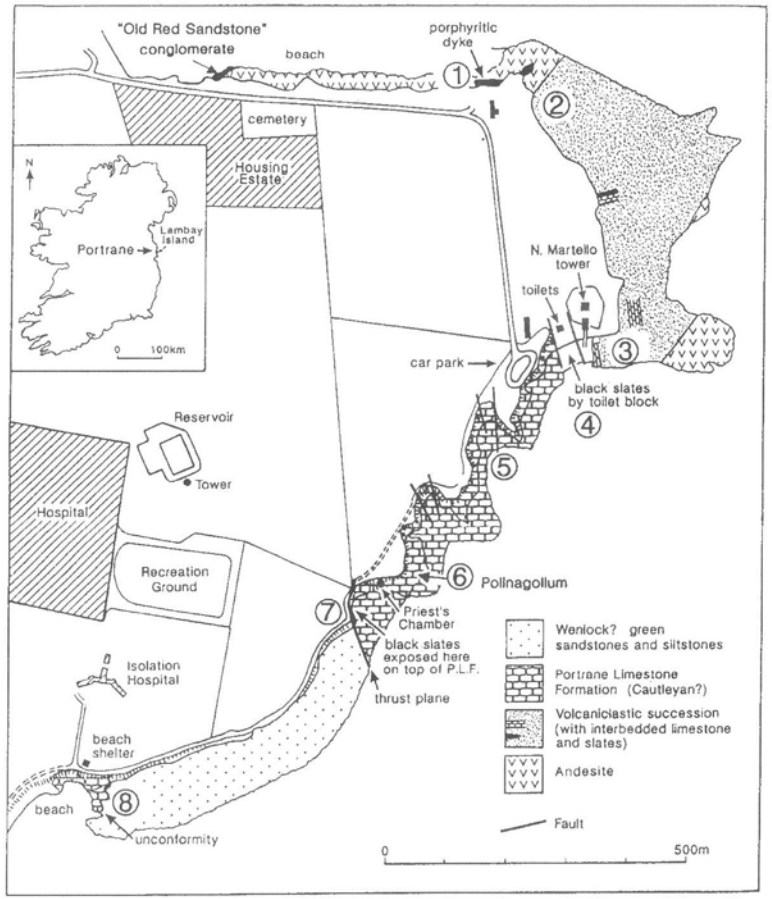

Figure 3. The geology of the Portrane area.

only at low tide. Between here and the Martello Tower the majority of rocks can be termed volcaniclastics - they are volcanic material which has been modified by sedimentary processes. Much is volcanic ash erupted violently into air which has then fallen or washed into the sea. As well as volcanic ash, large blocks of earlier formed rocks may be caught in the eruption and deposited, forming a conglomerate. See if you can see blocks of limestone, andesite and other rocks. The explosive power of the volcano is shown by the size of some blocks, the largest is more than 1m in diameter. These rocks are bedded (they form strata), dipping southwards at around 30-40°, showing they have been modified by currents during deposition. However, towards the Martello Tower, they are also folded and faulted, but not easily seen by the untrained eye.

Stop 3. Standing on the rocks immediately beneath the garden wall of the Martello Tower some pale grey bedded limestones are obvious, and also on the edge of the beach parallel to the slipway. These formed in the shallow waters at the same time as the volcanic rocks were being erupted. White veins of quartz reveal the presence of faulting, which displaces some beds by many metres. Out towards Lambay, the rocky headland is again made by andesites.

Stop 4. At the back of the beach alongside the toilet block is a small outcrop of black slates. Some poorly preserved graptolites have been found in this block. It is a fault bounded block but the actual faults are obscured. To the west are muddy limestones, but these are best seen in the next section of the walk. Return via the car park to the next small beach, south of the car park.

Stop 5. Two small faults are a weakness exploited by the sea to form this beach. The rocks around you are the Portrane Limestone Formation (PLF). On the west side, broad open folds can be seen in the thin bedded limestones with interbedded dark mudstones. To the east are some smaller scale slump folds through one or several beds. Commonest in the thinly bedded PLF, they may have been triggered by earthquakes, but perhaps just by steep slopes in the sea bed around the Lambay volcano. Here and in the rest of the PLF fossils of corals, brachiopods and others are relatively common. Because the shells are silicified (altered to silica) they are less easily weathered than the limestone and stick out from the rock.

Stop 6. Pollnagollum is one of several caves in the PLF that are not formed by marine erosion. Evidence such as passage morphology, scalloping on the walls (formed by water flowing in one direction) and roof pendants in bedding plane caves left by meandering streams show these caves are

karstic or solutional in origin. Careful descent into the unroofed bit of this cave shows some of these features. The large size shows the caves must have formed when the hydrology was very different from today. One cause may have been glacial meltwater streams during the Quaternary. At the edge of the cliff path above the cave is a thin glacial till on an ice-scratched (striated) limestone surface.

Stop 7. This section can be viewed from the cliff top but is better from the beach, either by a tricky scramble or by descending elsewhere but only at low tide. More caves including Priest's Chamber can be examined here, but the main interest is the junction with the next rock type. This is a greenish rock; well bedded unfossiliferous siltstones with a slaty cleavage in the finer grained beds, probably of Silurian age. These are emplaced on top of the slumped PLF by a thrust, a shallow angled fault. It runs from sea level up below the highest cliff from left to right facing the cliffs. If you go close, on the beach, a thin white quartz vein shows the thrust plane exactly. It actually rides on top of a metre or so of black shales which acted almost like a lubricant to the movement.

Stop 8. Round off your trip either by going on along about 400 m of the Silurian rocks till you meet limestones again. Can you spot the unconformity, where erosion of the limestone has occurred before the siltstones were deposited? Across the beach are outcrops of the andesites and porphyry. Lastly, as you leave Portrane, stop at the last rock outcrops on the beach edge to your right. Conglomerate of Lower Carboniferous age ('Old Red Sandstone') is evident. Can you recognise what the clasts are made of?