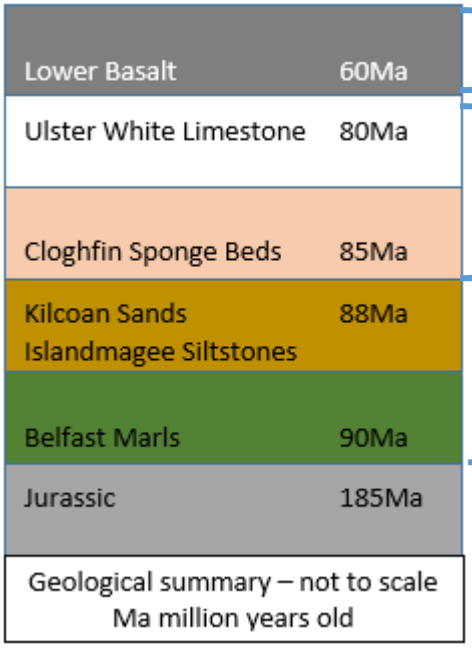
East Antrim U3A geology group report - Portmuck 10th May 2022

Ian Enlander group convenor

11 East Antrim members of the Geology Group turned out to hunt for fossils, enjoy the seaside and learn about the varied geology of Portmuck, Islandmagee.

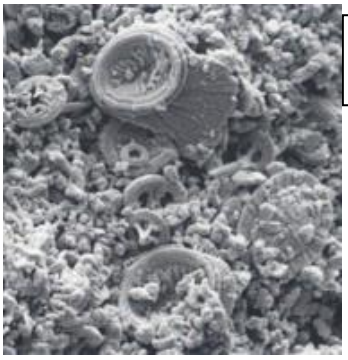


The shore along from the harbour hosts a small outcrop of Lower Jurassic rocks. Coastal processes have removed pieces of this so that fossils can be found on the beach. The bivalve Cardinia was the most common but an almost intact ammonite was also found – well done Teresa. There is a substantial time gap in the geology here between the 185 million year old Jurassic rocks and the 90 million year old Cretaceous age Hibernian Greensands. This 'gap' is known as an unconformity and represents a period when either no rocks were being formed in that particular area, or any rocks that were formed were subsequently eroded away. As this is the main period of dinosaur presence on the Earth, it helps explain why Ireland is so poor in dinosaur fossils.

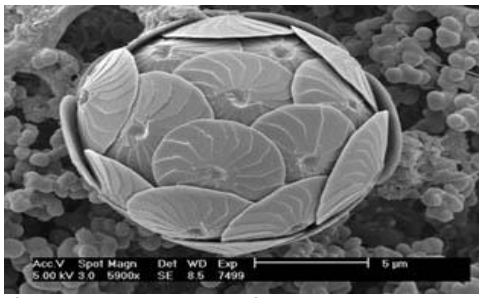
Our environment at this time (Jurassic and Cretaceous) was marine with progressively deepening water – another reason why 'dino remains' haven't been found *in situ*.

Portmuck has the best exposures of the Hibernian Greensands comprising a series of marls, siltstones and sandstones. They form the low cliffs to the west of the bay. The dark rocks (the Belfast Marls) are particularly rich in fossils.

These rocks give way to our familiar Cretaceous white limestone well displayed at Portmuck along the cliffs and on the shoreline opposite Isle of Muck. The chalk formed in a warm, deep ocean, the result of a progressive increase in global sea-levels. The reason for this global increase is unclear. The ocean was very productive, dominated by microscopic algae called coccolithophores. These algae formed protective plates made of calcium carbonate called coccoliths. When the plant died, the plates fell to the sea floor where enormous thicknesses accumulated, eventually forming the chalk we see today. The story of flint will be covered in the next trip report.



Cretaceous coccolith plate



Modern coccolithophore

A walk over the headland took us on to the chalk platform opposite Isle of Muck. Here the chalk has been thermally metamorphosed to marble. This relates to dykes (vertical) and thin sill-like (horizontal) intrusions of dolerite. Shattered flint nodules in the altered chalk could be seen, impacted by the alteration process.

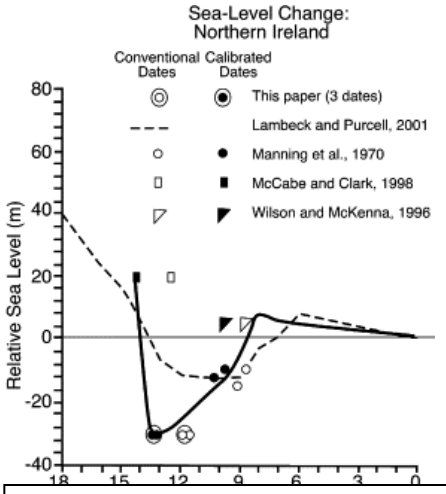
The larger dyke at the south end of the beach (close to the point where the electricity inter-connectors from Scotland come ashore) has also altered the adjoining chalk but more intensely producing a range of rare metamorphic minerals, formed by the interaction of the molten dolerite with the chalk. Lovely (small - <2mm in diameter) garnets can be found here.

Garnet at Portmuck

The lowest beds of the Cretaceous Ulster While Limestones (the Cloghfin Sponge Beds) could be seen at the southern end of the chalk/marble platform.

Cloghfin Sponge Beds at Portmuck

The association between the elevated platform and the cliffs and cave to the rear was discussed. These features date from periods when sea-level was higher than the level of the land. This situation has undoubtedly arisen many times during the Pleistocene (the past 2.6 million years characterised by periods of ice expansion and glaciation with intervening periods of warm conditions and ice retreat). As ice grew, global water levels decreased (more water locked up as ice on land masses) but the weight of ice forced land levels down. As ice melted and retreated, water was returned to the oceans, so sea levels rose again, but land levels, relieved of this weight, rebounded. These processes (increasing land and sea levels) were generally not in step resulting in periods when relative sea-level was higher or lower. The abandoned sea cliffs, caves and wave-cut platform result from coastal erosion at times of relative high sea-level. Similar 'elevated' sea cliffs can be seen on the Isle of Muck.

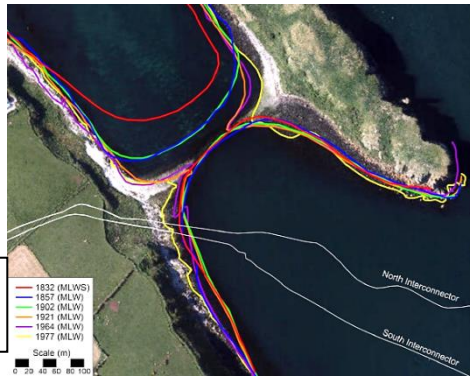


Generalised relative sea-level history for past 18000 years

Our final feature was the somewhat perplexing gravel ridge that runs between the east coast of Portmuck and the nearby Isle of Muck. This is often described as a tombolo but its presumed mode of formation is not typical of that type of coastal feature. The gravel barrier is formed of chalk, flint and basalt cobbles/pebbles clearly not being produced by coastal processes today. This is in fact reworked glacial deposits so no new material is being generated in the wider area that is then added to the barrier by wave action – which would have to be the case for it to be a tombolo.

Whatever its origins, historical maps and aerial photographs show that the feature has narrowed and reduced in height over the past 100+ years. It is mainly impacted by waves coming from the north which washes material into the water on its southern side. The gravel ridge is now only obvious at very low tides and may soon diminish to the point were just breaking waves mark its position.

Gravel ridge looking north-east to Isle of Muck



Former extent of the gravel ridge by year