Clachtoll

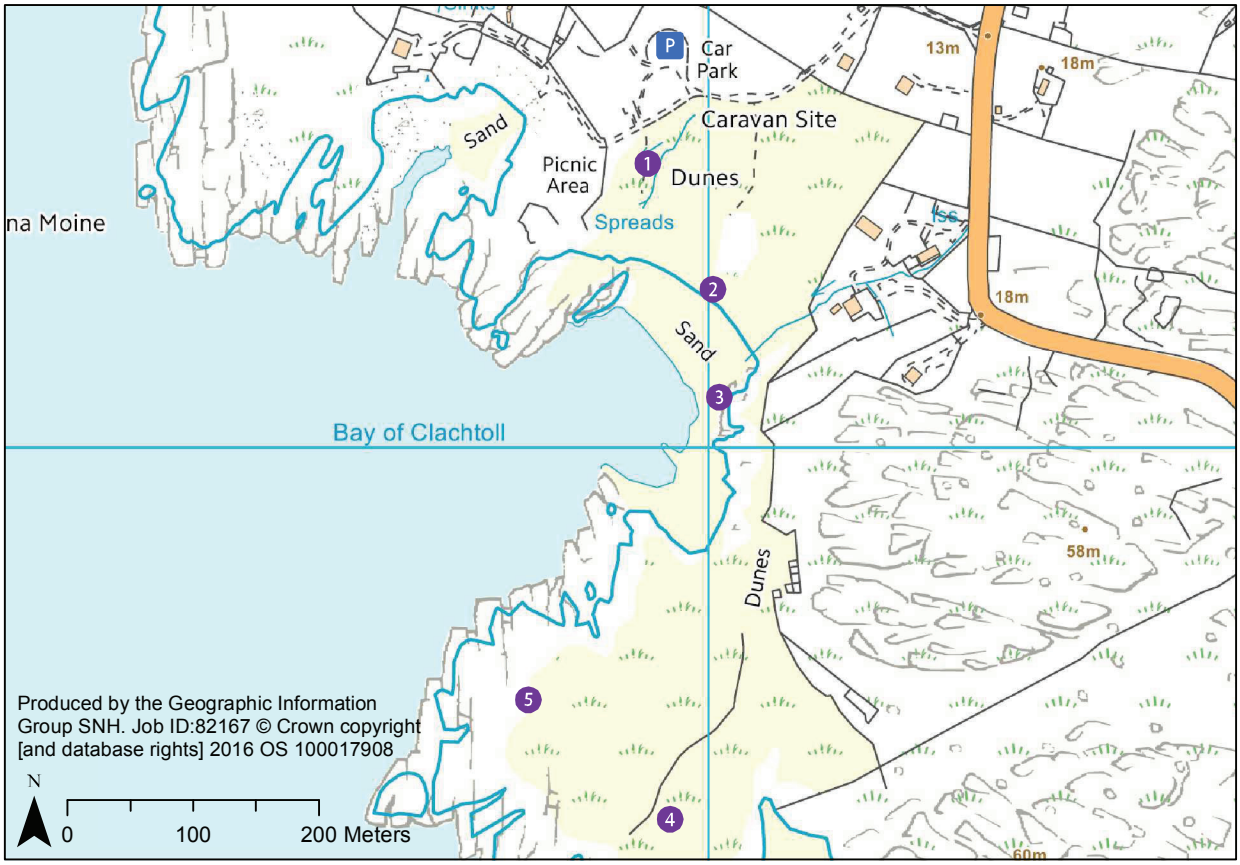
Teacher's Sheet



The purpose of this excursion is to build a picture of what the area was like 1.2 billion years ago as the first beds of the Torridonian Sandstone were being deposited during the Pre-Cambrian. These sedimentary rocks are older than most of the Torridonian Sandstone and belong to a distinct group called the Stoer Group.

The rocks found at this location are part of the lower section of the Stoer Group. The rock types present in this location are breccia, sandstone and mudstone, which were deposited on top of Lewisian gneiss.
The underlying Lewisian gneiss underwent a long period of erosion which formed a hilly landscape on which scree slopes formed. The area gradually became covered with river and lake deposits. Sediment from erosion of the gneiss was first deposited on the lowlands. Hilltops composed of gneiss protruded through the sediment. This hilly landscape resulted in a quite irregular unconformity between the gneiss and sandstone. There was no land vegetation when the sediments were being deposited but cyanobacteria (blue green algae) were growing in mats in shallow water on the fringes of lakes. Sometimes these cyanobacteria grew up in mounds. As they grew and multiplied they released oxygen into the atmosphere, which is how the first free oxygen was produced in our atmosphere.

These are land sediments deposited on the continent of Rodinia. They were formed by screes, rivers and lakes.



Location Map

Teacher's Notes

SUGGESTED STOPS	POINTS TO NOTE
Access:	Free parking is available by turning off the road at the campsite sign in Clachtoll and following the track round to the public car park where there are toilets and a rangers hut.
1	The first site provides an overview of the bay with Split Rock on the other side of the beach. Even at this distance the bedding planes are obvious, dipping about 20 degrees to the west. These Torridonian sandstone beds can be examined up close at site 1 near the slipway, which goes down. There are signs of cyanobacteria in these sandstones but not easy to find. Split rock is so called, because a local legend is that the separate block on the right (viewed from the north end of the beach) slipped down the bedding plane one night. Part of the magic of this site is to let students decide for themselves what happened.
2	Walk down the boardwalk to the main bay and around the tide line to a large outcrop in the middle of the bay. At the sea end of the outcrop is a good exposure, available to view at most tide states. Here the bedding planes are not as obvious as those in the sandstones viewed from location 1. The grain size is much finer which makes it a coarse mudstone. There are some joints in the mudstone but the most noticeable features are the short cracks produced during the original drying out of the sediment before it became solid rock. These are called desiccation cracks and indicate that the lake where the mud was deposited in periodically dried out. At Site five and the bay west of site 1 it is possible to see some classic mud cracks filled with sand.
3	To reach site 3 walk cross the rest of the beach and then climb up the sloping rock, passing a gate in the fence. There are several places around the cliffs here where the unconformity, the joining plane between the older Lewisian Gneiss and the deposited Torridonian sandstone, can be observed. The unconformity is clear and running roughly East -West between gneiss in situ to the south and breccia and then sandstone to the north. The foliation in the gneiss is very steep and where pieces of gneiss fell off the original hillside 1.2 billion years ago they slipped down and rotated parallel to the slope. You can even stand on the original hillside!! The dip on the Torridonian is quite steep here, as it wasn't deposited horizontally originally, being part of a scree slope. Folds and the general structure of the gneiss can be observed here as well. The gneiss is 3 billion years old so the unconformity represents nearly 2 billion missing years – getting on for half of the age of the Earth. You can put your finger on the unconformity, which represents this missing time. It may be possible to go around the rocks on the present beach to see more of the unconformity, but more likely you will need to go back to the gate and through it, follow the path round until a gully is reached which leads down to the beach on the same side of split rock close to site 3 on the map. The gulley is eroded by the sea along a fault plane. This fault has dropped down the rocks to the west. Go round to the right where the remnants of a breccia deposit dips steeply towards the sea, although most has been eroded off. The unconformity now runs North –South, it is very irregular as it represents a hill made from eroded gneiss that was buried by breccia and then river deposited sand. The fragments in the breccia are all from very locally derived gneiss. They are very angular and have just slid down the hillside that existed 1.2 billion years ago. Structures such as folding can be observed in the gneiss here as well.

4	Here you have a real feel for the three dimensional nature of the unconformity and can find small pockets of the scree still adhering to the old hillside. The gneiss can be further investigated as well. Some parts of the foliation are stretched very thin and some folded. Go back up the gulley and on to the grass area following roughly the line of the gulley and then branch slightly right before you descend onto the small beach at the corresponding gulley on the other shore. This marks the other end of the fault. A new house has been built on your left since the map was drawn. After walking for about 50 metres look across the bay and you will see an ancient valley infill of breccia/conglomerate. This consists of a mixture of angular and rounded blocks with a big range of sizes. Some of the boulders have come from the gneiss close by. It is possible to have a closer look by retracing your steps, crossing the line of the gulley and going as far right of the new house as possible and then down though a small gate and on round the cliff for 30 metres. You will find angular blocks of the local gneiss as well as fragments that have obviously been water carried as they have rounded off. There is also vein quartz and large blocks from a local Scourie Dyke which is quite soft and Ultramafic in composition. You crossed the dyke where a gulley is eroded out. This valley infill has been left by recent glacial erosion as it sits down in a hollow in the original hillside, dating from 1.2 billion years.
5	From the viewpoint for Site 4 walk North-West over some lazy beds, to the top of a slope and then down to site 5. It may be easiest to descend at the very north end where the slope is not as long. Here in thin mudstone beds, within thick sandstone beds are stromatolites of cyanobacteria. There are 5 or 6 separate horizons present and they show signs of desiccation as if the cyanobacteria were growing as mud settled and then dried out. **Please do not hammer or remove material from here.** Having visited all these sites the students should have enough evidence to try and reconstruct what the area looked like 1.2 billion years ago.