Stop 3. Make your way carefully along the shore to the slight promontory about 200 m south of Bottle Quay (half way between it and the Martello tower). The bedrock below the boulder clay is no longer quartzite. It is layered green rock alternating between smooth, silky and easily split layers (mudrock), and more blocky layers (sandstone). These layers are known as beds or strata of rock, and are sloping towards the sea. They were originally deposited as horizontal layers of mud and sand which gathered on the floor of the Cambrian sea. A great thickness of mud and sand (and clean quartz sand) built up, and the lower layers became severely compressed by the weight of the upper layers. The layers became converted into solid rock - mudrock, sandstone and quartzite respectively. They also became tilted and, eventually, uncovered by upward movement of the earth's crust and removal of the upper layers by erosion. During these earth movements the sandstone beds tended to crack. The cracks pulled apart and the spaces later became filled with white quartz to form quartz veins. A layer of sandstone riddled by intersecting quartz veins may be seen near the head of the beach just beyond the promontory.

Look carefully at the boulder clay overlying the green bedrock at the promontory and just beyond it. Dark grey boulder clay at the bottom is separated from brown boulder clay above by a sloping layer of coarse pebbles and blocks. This intervening layer is associated with shells of limpets and small whelks and it is believed to be the remains of an ancient pebble beach. Again this evidence points to a time in the past when sea level was higher than it is today. Since the beach deposit is sandwiched between older and younger boulder clays, the high sea level stand seems to have occurred during the ice age after one ice-melting event, but before the last melting of ice, some 14,000 years ago.

EXCURSION 5: BLACKROCK

Patrick Wyse Jackson

How to get there: DART to Blackrock Station; Bus Nos. 6, 6a, 7, 7a, 8, 17, 45; Car parking close to railway station.
Geological horizon: Silurian - Devonian.
What to see: Explosion breccia in the Leinster granite. Use of granite and Carboniferous limestone for walls.
Duration: 1 hour.
Warning: Be careful of slippery rock surfaces.

This short trip will examine an unusual feature (a breccia) developed in the Leinster granite. In addition the walls in Blackrock Park are of interest.

Stop 1. The DART Station is a typical sturdy railway building, built in the 19th century. Have a look at the granite pillars that are by the entrance. They are probably quarried from Dalkey. They are unusual, as pillars of their size are more commonly of limestone. Walk to Blackrock Park by way of a path bounded by a high wall on your left and by the railway tracks on your right. Stop and have a close look at the wall. Are the blocks of stone irregular in shape or have they been 'squared' by the stone masons? The wall is built of the same type of stone that you have just seen at the Dart Station. This granite contains three major minerals - quartz (glassy), feldspar (white-cream), and mica (silver or black crystals). Draw a small piece of this stone taking care to show the arrangement of the different minerals. Are the crystals all the same size? Are they randomly distributed, or are there clumps of similar mineral types? In a note book describe in a few lines the rock - colour, size and arrangement of crystals.

Stop 2. Go into the Park, walk past the Bandstand on your right, and head to the walls on your left. These walls divide the park from the gardens of a number of large houses. One of these houses was frequently visited by John Wesley, the founder of Methodism, in the 1770s. Look closely at the walls. Are they built of the same stone used in the walls seen a few minutes ago? No! They are built of a grey stone called limestone. This limestone was deposited in a shallow sea during the Carboniferous period some 340 million years ago. You might be able to find some fossils in the rock. In addition you will probably be able to see some layering (called bedding, by geologists) in the rock - when sedimentary rocks are deposited they are

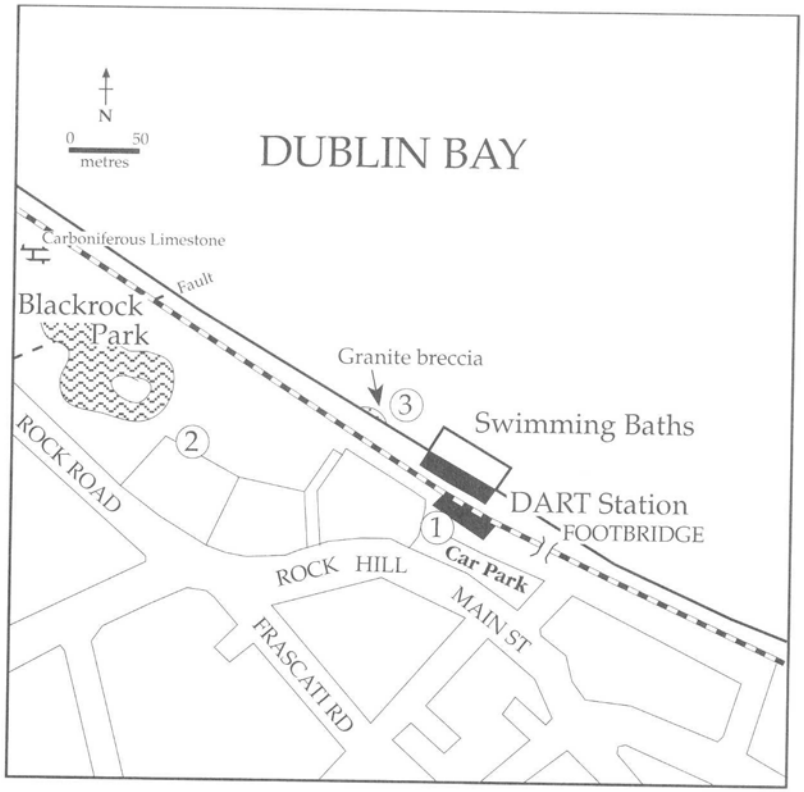

Figure 8. The geology of the Blackrock area.

stones the rock contains a large numbers of circular holes up to 1 cm in diameter. You may have seen similar features in some of the rocks at Howth. These holes were made by small shellfish called bivalves. These animals, which live in, which live in shallow water on the sea bed that is often sandy or muddy, prefer a firm stable place to live. The limestone cobbles provide a firm stable place to live (called a niche) and so the bivalves dissolve out hollows in the rock. Once the animal is inside the rock it continues to expand the hollow, and the bivalve reaches maturity. Unfortunately the animal cannot get out again as its shell is too large! You might be able to spot some traces of the shells inside the holes.

These dark limestone blocks used for building the wall came from the shoreline just north of the lake in the park. This is where the Leinster granite comes into contact with the Carboniferous limestone that is found

beneath most of Dublin city. Blackrock is so called because at this point the dark limestone contrasts with the pale granite found along the shore south from here to Killiney. The two rock types are very different ages and are faulted against each other. However, it is not possible to see this fault as it is covered by sand and other unconsolidated sediments.

Walk back to the DART station and cross the footbridge just south of the station. Turn left and walk northwestwards for 100 m along the path between the swimming baths and the railway tracks.

Stop 3. Granite outcrop. Exposed beside the sea is a small outcrop of pale granite, almost identical to that used in the walls near the DART station. This rock is most unusual. Please DO NOT remove any of it, as this outcrop is unique. Look closely at the stone. It appears to be broken up and recemented together. What shape are the pieces of granite? Are they rounded or angular? If they are rounded it would suggest that they were transported by water a long distance before being cemented together to form a conglomerate. The pieces are angular - the rock is a breccia - but not a sedimentary breccia. When the granite was emplaced some 400 odd million years ago, it slowly cooled down (taking 20 million years to do so). When it was nearly solid, a buildup of gas escaped from the mixture and as it did so, it shattered a small area of the solidifying granite. After all the gas had escaped, molten granite filled the cracks and cemented the angular pieces of granite together. This breccia is called an 'explosion breccia', and is rarely developed in the Leinster granite. You will see that the granite here and just south of the footbridge is quite cracked or jointed. These joints developed due to 'pressure release' as the rocks overlying the granite batholith were eroded away (if you press down on something from above and then stop doing so the body will move upwards). This happened to the granite, but as it was a rigid mass of rock, it cracked, thus releasing the pressure.

Return to the DART station, the bus stop, or your car via to footbridge over the railway line.