THE GEOLOGY OF
DALKEY AND KILLINEY
A walking guide

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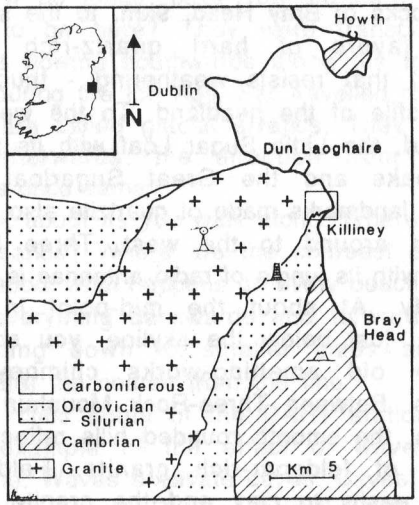

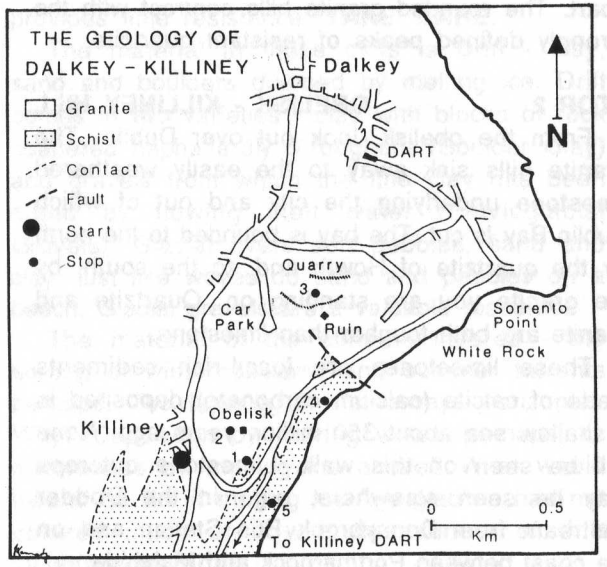

Note: Stop 4 is best seen at least 2 hours from high tide. There are many steps up and down.

This walk starts in Killiney Village (Nat. Grid Ref. O 258 254 - Ordnance Survey 1: 20,000 Street Map of Dublin. Allow 4 hours.

Enter Killiney Park by the entrance opposite the bus stop. Climb the steps. Turn right at the top and walk to the point overlooking the beach.

STOP 1 THE VIEW

The rocks of Bray Head, 9km. to the south, include layers of hard quartz-rich rock (quartzite) that resists weathering - thus the ribbed profile of the headland. To the west of Bray Head, the Little Sugar Loaf with its three small peaks and the Great Sugarloaf are prominent landmarks made of quartzite also.

Further around to the west, Three Rock Mountain with its jungle of radio antennae is easy to identify. At about the mid-point in the panorama, just below the skyline, you should spot the old smelting-works chimney at Ballycorus. Between Three-Rock Mountain and Ballycorus, the smooth rounded hills reflect the presence of feldspar-rich granite. Feldspar weathers easily to clay and the granite falls apart. The rounded granite hills contrast with the strongly defined peaks of resistant quartzite.

STOP 2 OBELISK - KILLINEY HILL

From the obelisk, look out over Dublin. The granite hills sink away to the easily weathered limestone underlying the city and out of which Dublin Bay is cut. The bay is bounded to the north by the quartzite of Howth and, to the south, by the granite you are standing on. Quartzite and granite are both tougher than limestone.

These limestones are fossil-rich sediments made of calcite (calcium carbonate) deposited in a shallow sea about 350 million years ago. None will be seen on this walk. Limestone outcrops may be seen elsewhere, e.g., in the Dodder upstream from Donnybrook Bus Station and on the coast between Portmarnock and Malahide.

Granite crops out close-by to the west of the obelisk. This granite, examined close-up on a clean surface, is seen to contain grey, glassy quartz, white feldspar, dark biotite mica and silvery muscovite mica. Except for some larger rectangular feldspar crystals, individual mineral grains are typically a few millimetres in size.

The thin and very fine-grained stripes are aplite veins. Aplite lacks biotite - hence the pale colour. Wander about these outcrops to find some pegmatite veins. Pegmatite and aplite have essentially the same composition. However, in the very coarse-grained pegmatite, feldspar, quartz and muscovite are easily seen.

Aplites and pegmatites are the final dregs of liquid left over when most of the original molten granite had solidified. The veins are cracks that formed in nearly solid granite and which were filled by these remaining fluids. The granite magma, which had formed at depth, moved upwards, lost heat, crystallized and came to a stop where you are now about 400 million years ago and 5-10 Km. below ground as it was then. Imagine it!

These outcrops have a streamlined shape that is not just chance. They are 'roches moutonnées' - outcrops shaped by the passage of an overriding Ice-Age glacier. They have smooth tops and ragged seaward terminations. On top of the largest outcrop, striations (scratches) on an aplite vein show the direction of ice movement.

STOP 3 DALKEY QUARRY

Take the most easterly path through the trees towards the car-park. Cross the car park and continue past the main entrance on to the picnic site . Find a half-hidden track leading into the large quarry. **TAKE CARE**. Keep to the paths. Do not distract any rock climbers hanging on.

The granite used to build Dun Laoghaire harbour was quarried here. Aplite veins and joints (fractures) are many. Regular joint patterns in granite aid the making of blocks for building. The joints post-date the development of the aplite/pegmatite veins. How might this be demonstrated? Some of the joints probably date from when the quarry was worked (1817-1859) - forming only when exposed granite relaxed and stretched. These quarries once gave work to some 400 men.

STOP 4 KILLINEY BEACH - NORTH

Climb the balustraded steps, turn left and continue on around to a paved road. Turn right along the footpath. Take the first steps down to the road. Cross the road (**TAKE CARE**) and descend to the beach over the railway footbridge.

North of the shelter, the rock is mica schist - a metamorphic rock containing numerous tiny, parallel, mica crystals. Because each mica has a sheet-like shape, a schist tends to split like a pack of cards. Pressure from the nearby intruding granite made the micas grow like this.

Face these rocks with your back to the mass of aplite topped with concrete. The surface to the right of the thin aplite vein is but one of many showing myriads of matchstick-like andalusite crystals - often in small radiating clusters and dark against the surrounding mica. A good eye may also see some small (1-2mm), round, brown, garnets. Once sandy muds on the Iapetus Ocean floor, these rocks are garnet-andalusite rocks now because they were baked and metamorphosed when the granite intruded. The brown staining is rust (limonite).

The contact between granite and schist is on the hillside above. Walk 50m north to a small mine. **DO NOT ENTER.** In the last century, lead taken from many similar mines sited on this contact, e.g., at Glendalough in Co. Wicklow, was smelted at Ballycorus not far away from here.

STOP 5 KILLINEY BEACH - SOUTH

If the tide is in, return to the road. Go south to Killiney DART station and, using the underpass, on to the beach. If the tide is out, you may walk along the beach but **WATCH OUT FOR SLIPPERY GRANITE BOULDERS**.

On the beach, most of the pebbles are of local rocks - granite and schist and quartzite. You

might recognize some of them and flint from ?N. Ireland. Others from distant places need, perhaps, an expert eye, e.g., volcanic rock from Lambay Island, Old Red Sandstone from ?Donabate and a distinctive, blue-speckled, fine-grained granite from Ailsa Craig in the Firth of Clyde - frequently found on east coast beaches.

How do these rocks from northern sources come to be here? They were transported in glaciers flowing southwards along the Irish Sea basin during the Ice Age. Far travelled rocks like these are called glacial erratics. They identify, long afterwards, the direction from whence glaciers once came

Look about as you walk along. Where are the finest sands? Where are the coarsest pebbles? Think about what happens on every beach. Waves drive everything backwards and forwards, grind everything down to smaller sizes and sort (separate) the coarse from the fine.

The cliffs south of the DART station are a good example of the effect of waves on a coastline. Waves excavate caves. Caves collapse and cliffs result. Poorly consolidated material provides little resistance. **TAKE CARE**.

The material in these cliffs is Drift - clay, sand and boulders dumped by melting ice. Drift comes in two varieties - clay with blocks of rock scattered haphazardly throughout (Boulder Clay) and gravels from which the fine clay has been sifted by flowing melt water (Fluvioglacial Gravels). Glacial rivers sort pebbles, sand and clay, just like waves do sand and pebbles on a beach. Glacial gravels are a valuable resource.

The material in the cliffs is layered - the sorting of winter streams and summer torrents perhaps. The layering is not always horizontal. Why? Deposition by moving water, perhaps, or disturbance by moving ice above? What would Ireland be like if melting Ice-Age glaciers had not covered much of it with this veneer of drift 10,000 years ago?

On leaving the beach, turn right to return to Killiney village - 1.5km away by the road.

THE CALEDONIAN OROGENY

The Caledonian Orogeny - strange words to name an event from the distant past which is recorded in the rocks of Ireland - a majestic collision of two continents 500-400 million years ago. Rocks were crushed. Rocks melted at depth and the molten magmas were squeezed upward to form large subterranian intrusions of granite or, where these magmas reached the surface, curving arcs of belching volcanoes. The history of these events was first gleaned from the rocks of Scotland (Caledonia).

The word orogeny means a mountain building episode. Mountain chains like the Alps result from continental collision. The Caledonian mountains have been long since removed by the never-ending processes of surface erosion. Only deeply-eroded remnants remain, e.g. the mountains of Wicklow, and western Ireland. The Leinster Granite is just one example of many granite intrusions that cored this old mountain chain and which are now unroofed. Heat from the cooling granites caused new minerals, e.g., andalusite and garnet, to grow in many of the rocks into which the magmas were emplaced and, as a result, aureoles of metamorphic rock surrounding the granites formed. All these things happened along the entire length of the Caledonian Mountain Chain from Scandinavia through Scotland and Ireland to eastern North America.

The line along which the colliding continents merged may be traced across Ireland from near Drogheda to the Shannon Estuary. It is very difficult to see. That two ancient continents are indeed welded together along this line is shown by the fossils entombed in the rocks on each side. These fossils are the remains of distinct marine animal populations that evolved independently on the margins of two continents separated by the barrier of a deep ocean - the Iapetus Ocean. Orogeny involves not only the uplifting of mountains but the loss of oceans and the making of granite. All are linked to the continuous wandering of the continents.