Irish Geological Association

GEOLOGY OF OLD BAWN AND BOHERNABREENA

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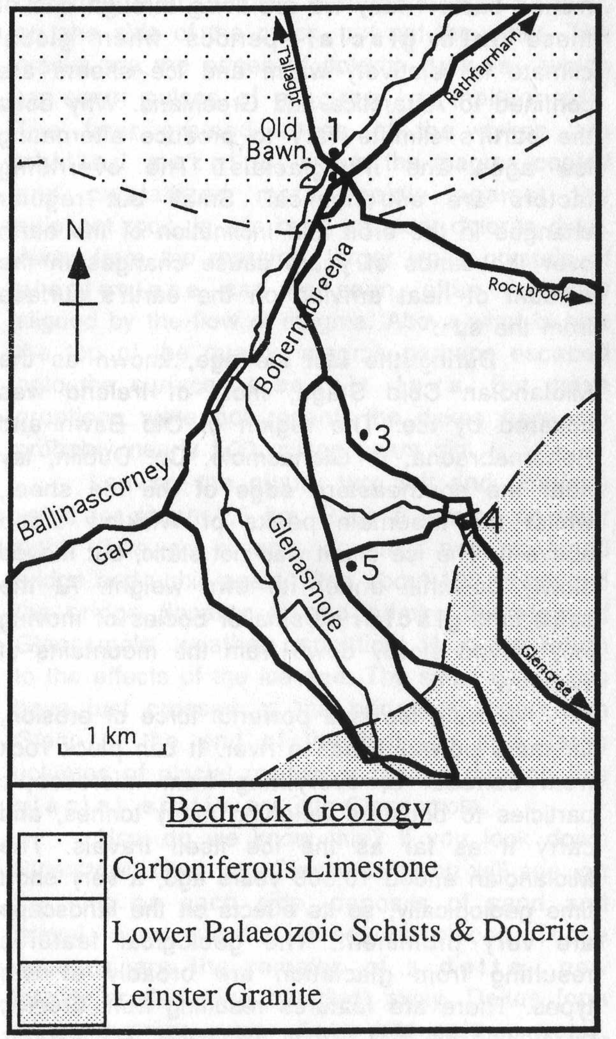

THE ICE AGES IN IRELAND

The land surface of Ireland, with its mountains, valleys, plains, lakes, headlands and bays shows enormous variety. Surprisingly, a single force shaped much of it: ice. Over the past 2 million years, the **Pleistocene Epoch**, global climate changed many times. Large areas of the northern hemisphere were repeatedly covered by **ice sheets** up to a few kilometres thick. These periods of extensive glaciation, the **ice ages**, alternated with periods when the ice melted back. Today we are living through one of these **interglacial** periods when global climate is relatively warm and ice sheets are confined to Antarctica and Greenland. Why does the earth's climate vary to produce alternating ice ages and interglacials? The overriding factors are astronomical. Small but regular changes in the orbit and inclination of the earth over thousands of years cause changes in the amount of heat arriving on the earth's surface from the sun.

During the last ice age, known as the Midlandian Cold Stage, most of Ireland was covered by ice. The region of Old Bawn and Bohernabreena, in Glenasmole, Co. Dublin, lay near the southeastern edge of the ice sheet, whilst the mountain peaks of Wicklow stood above it. The ice sheet was not static, but moved slowly downhill under its own weight. At the same time **glaciers**, smaller bodies of moving ice, moved slowly down from the mountains of Wicklow.

Moving ice is a powerful force of erosion, far more powerful than a river. It can pluck rock from beneath it, everything from microscopic particles to boulders weighing many tonnes, and carry it as far as the ice itself travels. The Midlandian ended 10,000 years ago, a very short time geologically, so its effects on the landscape are very prominent. The geological features resulting from glaciation are broadly of two types. There are features resulting from erosion by moving ice and glacial meltwater, and various deposits of sediment dumped when the ice melted. Both **erosional** and **depositional** features can be seen in this area.

OLD BAWN

The trip begins at the River Dodder in Old Bawn, about 1.5 km south of the centre of Tallaght, Co. Dublin. Walk into Dodder Valley Park, through the entrance on Old Bawn Road nearest to Old Bawn Bridge. Follow the path towards the River Dodder and where the path turns to the left, walk through the small trees on the bank to the river's edge (locality 1 - see map). The opposite bank of the river forms a cliff about 5 m high made of **boulder clay**, also known as **till**. It is a sediment consisting of rock particles of all sizes. Looking across the river you can clearly see boulders and pebbles set in a finer matrix, which includes sand and microscopic material. The boulder clay has not been buried beneath later sediments and compressed to a rock; it remains **unconsolidated** like soil.

The key to understanding boulder clay is the random mixture of rock particles of all sizes. When sediments are deposited from water they are **sorted** into layers (**beds**) within which the particles vary relatively little in size. In contrast, glaciers carry particles of all sizes and when the ice melts they fall to the ground, leaving an **unsorted** deposit - boulder clay. The boulder clay has subsequently been exposed due to erosion by the River Dodder.

Return to the path and continue along it parallel to the river. You will see, through the trees, that much of the far bank has been landscaped to a smooth slope, as has the bank you are walking on. Notice the large boulders lining much of the river's course. These have been put here to prevent erosion of the soft boulder clay which forms both banks.

Where the path swings to the left and uphill, follow it until you can see the top surface of the opposite river bank. Notice that this top surface, about 5 m above the river, is almost flat. Beyond it is a housing estate built on a higher level. These two level surfaces are natural. They are **river terraces** and represent the **flood plain** of the Dodder at earlier times in its life. The higher level represents the first flood plain, probably formed as the last ice age was ending. Large amounts of glacial meltwater from the mountains fed a much larger river than today. The melting of the huge weight of ice caused the earth's crust to rise higher above sea level, a process called **isostatic rebound**. This caused the Dodder to cut down more deeply through the boulder clay and produce a flood plain at a lower level (the lower terrace). Later still it cut down to the present level.

Now return to the park entrance, turn left along Old Bawn Road, cross the bridge and take the path on your right immediately before the car park of Bridget Burke's (locality 2). Walk just past the car park wall and look out to the southwest along the valley of the Dodder. Here there has been little interference with the river banks and terraces. The car park and pub are built on the 5 m terrace and a lower terrace lies at the base of a small cliff.

BOHERNABREENA AND BEYOND

From Bridget Burke's, walk or drive away from the river to the roundabout, turn right on to the Bohernabreena Road and continue for 500 m. Then fork left to pass the pitch and putt course on your right. If you are walking, pause to look at the course, which uses remnants of terraces to produce a multilevel design. Continue up the road, past Bohernabreena church and up the steep hill past the council tiphead. Where the road divides, take the left fork and continue about 1 km to Friarstown quarry (locality 3). This small, disused quarry is set back about 100 m to the left of the road. It is not signposted and you will have to climb a small fence to get in.

Here we take a break from the ice age and look at the far older **bedrock**, which in this quarry is **dolerite**. A hard, **igneous** rock, hence the quarry here for roadstone, dolerite consists mainly of millimetre sized crystals which catch the light on a sunny day. Most of the rock is weathered to a brown colour and you will have to find a fresh rock surface, darker and bluish grey, to see the crystals.

Stand back from the quarry face and you will see vertical cracks running through the rock from top to bottom. Now examine the rock close to these vertical cracks. In a few places, if you look closely, you can see that the dolerite becomes finer grained, with a smoother surface, on one side of the crack, but not the other. The cracks are the edges of dolerite **dykes**, which represent pulses of **magma**, or molten rock. The finer grained edges of the dykes are **chilled margins**, where the magma cooled and crystallized more rapidly against the adjacent rock, in this case an older dolerite dyke. Away from the margins, larger white crystals of **plagioclase** can be seen, often vertically aligned by the flow of magma. Above what is now the top of the quarry, magma perhaps escaped onto the surface as **basalt lava**. But these eruptions were not recent; the dykes here are probably nearly 500 million years old.

Leaving the quarry turn left and continue uphill for about 1.5 km. Pass a turning on your right, then go steeply downhill over a small bridge and uphill again. Stop about 100 m beyond the bridge (locality 4) and admire the view of Glenasmole, weather permitting! Here we return to the effects of the ice age. The small valley you have just crossed at the bridge is Piperstown Glen. At the end of the last ice age, large volumes of glacial meltwater poured through this **glacial spillway** into Glenasmole.

How do we know this? If you look down Piperstown Glen into Glenasmole you will see, on the hills on each side, deposits of sand and gravel, once quarried in several places. These deposits are the remains of a **delta**, now largely eroded (and quarried) away. Deltas form where running water flows into calmer water, loses momentum and deposits the larger, heavier particles it has been carrying. An active example of this process is the River Nile which deposits a delta where it reaches the Mediterranean Sea. But look how high above the floor of Glenasmole these deltaic deposits lie. Sediment is deposited in a delta at the level where the river runs into calmer water, so Glenasmole was full of calm water to this level - a lake.

Look back towards Old Bawn at the northern end of Glenasmole. There is nothing there to hold back a lake. The answer? For a short time, as the last ice age ended, the northern end of Glenasmole was dammed by a wall of ice, the southern edge of the huge ice sheet covering most of Ireland. Later, further melting of the ice allowed the lake to drain away. Looking westwards to the far side of Glenasmole, a road runs through a nick in the mountainside. This is Ballinascorney Gap, another glacial spillway. When glacial Lake Glenasmole was at its deepest, water spilled out westwards, cutting the channel of Ballinascorney Gap 300 m above sea level!

Now retrace your steps downhill, cross the bridge and take the first turn on the left. Follow the road for about 1.5 km, almost to its end, where you will find the entrance to the disused Piperstown quarry on your left (locality 5). Here the deltaic deposits of Piperstown Glen were quarried. Inside the quarry you can see what remains of these deposits. The deltaic sediments are unconsolidated, like the boulder clay at Old Bawn, but consist mainly of sand and gravel. Beds of differing grain size can be seen. These features result from the sorting of particles which occurs when they are carried and deposited by water, rather than ice. Bedrock is exposed beneath the sand and gravel: **schists** (metamorphosed sediments) intruded by dolerite dykes like those at Friarstown quarry.

From the entrance to Piperstown quarry, turn left and then immediately right and follow the road back to Bohernabreena and Old Bawn.