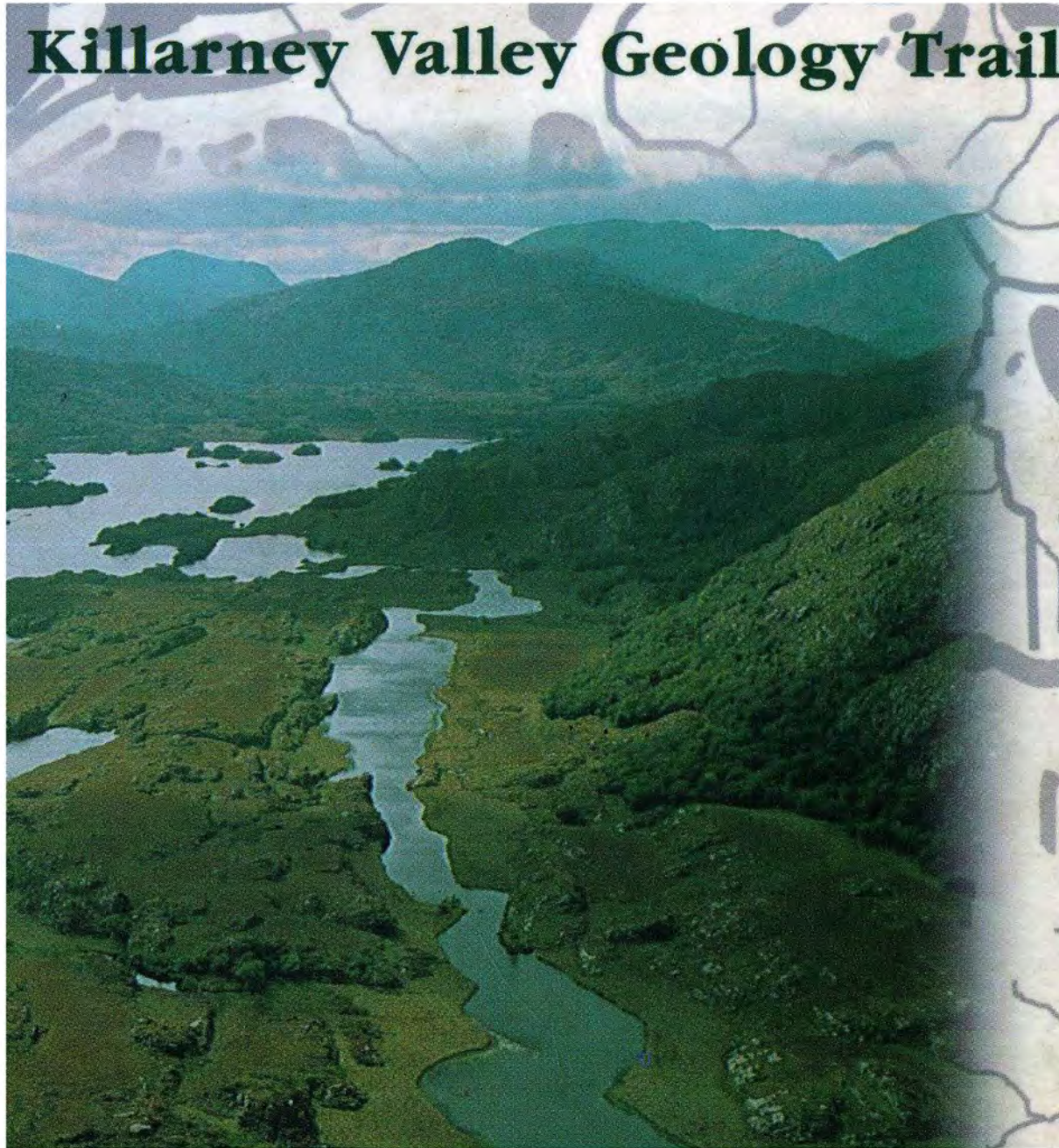


Killarney Valley Geology Trail





PRODUCED ON THE ORDNANCE SURVEY OF IRELAND BY PERMISSION OF THE GOVERNMENT (PERMIT NO 4041)

THE KILLARNEY VALLEY GEOLOGY TRAIL

Many of the geological and landscape features of Killarney National Park can best be appreciated by exploring on foot, and indeed, many aspects of the geology of the area are explained in the various nature trail booklets. However, it is also possible to see geological features from the road side and this section explains some of these which can be seen along the Kenmare - Killarney main road. The trip visits nine sites on the drive between Moll's Gap and Killarney and these are best appreciated by driving towards Killarney, since this route follows the course of the ice flow during the last glacial period.

Please be careful while driving along this route and while parking and leaving your car at the various sites as the road is narrow and has a heavy traffic flow.

A look at the geological map will show you that the Old Red Sandstone of Devonian age (395 - 345 million years old) occurs in the south and west of the Park while the younger Carboniferous Limestone (345 - 295 million years old) occurs to the north around Killarney.

The other important aspect of the geology of the National Park is the

glaciation that occurred between 2 million and 16,000 years ago. Ice has shaped the landscape, eroding the bed-rock in many places and depositing the eroded material, known to geologists as "glacial till", as moraines or mounds of mixed gravel and stones in other areas.

On this trip you will see the sandstone and limestone bed-rock and also the effects of the glaciation of the area. Try to imagine the scale of the time needed for the rocks to form. Try also to imagine the depth of the ice that passed over the present landscape and the time needed for the glaciers to erode the hard sandstone.



SITE 1 - MOLL'S GAP

Grid Ref. V861775



Moll's Gap is a pass on the watershed of the Iveragh Peninsula and has fine views to the north of the Macgillicuddy's Reeks. The pass gets its name from Moll Kissane who ran a small pub or s**í**bín here during the construction of the Killarney - Kenmare Road in the 1820's. The older name in Irish is C**é**im an Daimh meaning the gap of the ox.

The rocks at Moll's Gap are part of a group of rocks known as Old Red Sandstone. Notice that the rock is composed of grains less than one millimetre in diameter. These

grains are of the mineral quartz (silicon dioxide) and were rounded in the bed of a large meandering river before being laid down in layers on the flood plain of that river over 350 million years ago. The sandstone here, despite its name, is green in colour because the quartz grains were coated and cemented together by chlorite, a soft green mineral. However, most of the sandstones around Killarney are red in colour because the mineral coating cementing the quartz grains together was iron oxide.

Rainwater and sunlight tend to break down or leach out the chlorite or iron oxide so that the weathered surface of the rock becomes a nondescript brown colour and the difference in colour between the red and green sandstones is therefore obscured. Only on freshly broken surfaces can the true colour of the rock be seen. The quarry on the Sneem road about 200 m. from the shop shows this very well.

During the last cold period of the Ice Age, about 25,000 years ago, an icecap, called the Templenoe Icecap, formed just to the west of Kenmare. Ice spread outwards from this icecap in all directions and as it progressed northwards, it came up against the watershed of the Iveragh Peninsula where you are now! It banked up against this obstacle and eventually flowed out over the lowest points, in this case Moll's Gap. Where ice crosses a barrier in one place like this is known as a "glacial breach". As more snow fell on the Icecap, the ice flow over Moll's Gap and other glacial breaches became thicker and started to pass to the north. Notice how the bed-rock around the car-park is rounded and smoothed. This is because the base of the ice-flow was studded with boulders and this had an effect like sandpaper on the rocks over which the ice passed.

The Gap of Dunloe, which you can see from this point, is a spectacular example of a glacial breach. The U-shaped profile of the Gap was caused by the erosion of the crossing point by the passing ice. It is estimated that the depth of the ice crossing the Gap of Dunloe was at one time more than 500 m. thick. If you try to picture this you will see that most of the landscape at the time of maximum ice flow was covered by ice. Nevertheless, some of the higher mountain peaks would have stood up as "nunataks" above the ice surface. You can see that the high peaks of Macgillycuddy's Reeks were not eroded and made smooth by the action of the ice but instead present a jagged outline. This is due to the freeze-thaw shattering of the rocks which occurred during the period of glaciation. Some of this shattered rock can be seen today in the sheets of rock fragments lying near the summits of these mountains.

However, Macgillycuddy's Reeks prevented the main passage of the ice to the north so that the ice flowed in a northeasterly direction along the valley in front of you towards Killarney.

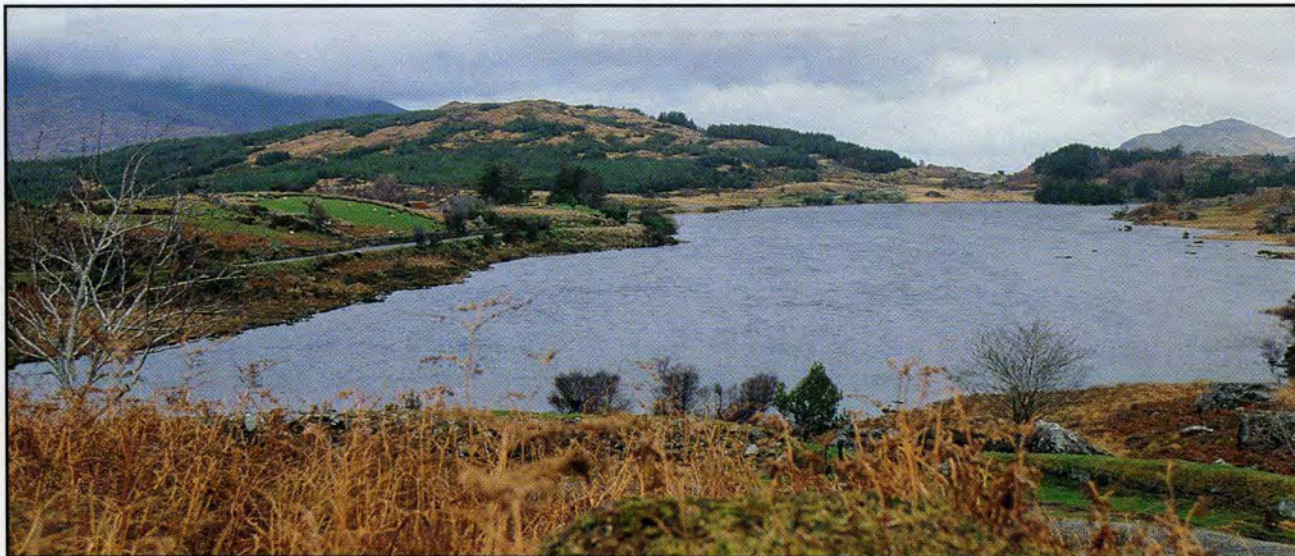
DRIVING BETWEEN MOLL'S GAP AND LOOSCAUNAGH

Set the trip meter on your car at Moll's Gap so that you can more easily find the parking places for the other stops. If you are a passenger on the trip between these first two stops you will have good views of the Owenreagh River (Abhainn Garbh - rough river) in the valley below. The bog on the side of the river closest to you is called Eirk Bog (Adharc - a sharp peak) but in spite of its Irish name, it has a slightly domed form. Eirk bog is a classical example of a bog type intermediate between a raised bog and a blanket bog. It probably formed because of the lack of drainage in the glaciated valley bottom but now its surface layers depend on rainfall rather than the ground water for nutrients. Part of the bog is protected as a National Nature Reserve.

The stopping point for the next site is at 3 Km. (1.85 miles) where you get your first full look at the small lake as you approach from Moll's Gap. Park your car off the road on your left.

SITE 2 - LOOSCAUNAGH LOUGH

Grid Ref. V885795



In Irish the lake is called Loch Lúscánach; the meaning of which is uncertain. You can see that the lake is dammed by a long mound that runs parallel to the road ahead. This is a lateral moraine that formed on the side of the large glacier when eroded material was pushed aside by the ice flowing from Moll's Gap down towards Killarney. Follow with your eye the curve of the moraine along the edge of the lake and around to where you stand. Another moraine extends up the valley towards Moll's Gap. The dumping of all this glacial till as a lateral moraine resulted in the formation of a hollow in which the lake has formed.

Patches of moraine are better drained and more fertile than the bog-covered sandstone bed-rock around and are usually covered in short grass grazed by sheep. In many, the remains of pre-famine potato

ridges can be clearly seen. If you look along the shore of the lake on the other side from the road, at the far end you can see an example of just such a well-drained moraine patch. If the light is right you will be able to see the potato ridges or lazy beds. The last potatoes sown in these ridges were probably abandoned at the time of the Famine when the crop was killed by potato blight.

Along side your car, you will see in the small cutting some of the glacial till. It is composed of a mixture of sand, gravel and stones. This material was loose when it was deposited but has compacted in the last 10-20,000 years. The till here is composed of sandstone debris which is poor in nutrients and forms an acid soil. In the midlands of Ireland the till is commonly composed of limestone debris making for a more fertile soil.

DRIVING BETWEEN LOOSCAUNAGH AND LADIES' VIEW.

As you drive north towards the next stop, you will see the stream draining the lake as the road approaches closest to the lake. At this point you begin to leave the moraine and gain height onto the bare sandstone. This is the boundary of Killarney National Park and from here nearly to the town of Killarney the road will run through the Park. At 6.1 Km. (3.8 miles) there is a large lay-by on a right hand bend. Walk from here to the viewing point.

SITE 3 - LADIES VIEW

Grid Ref. V905807



Ladies' View takes its name from Queen Victoria's Ladies-in-Waiting who made an excursion to this spot during the Royal Visit to Killarney in 1861. This famous viewing area is a good place to see the scale of the last glaciation of the area. The Killarney Valley opens out before you and is a continuation of the valley you saw as you left Moll's Gap.

Looking to your left you can see the Black Valley nestling in the shadow of Macgillicuddy's Reeks. To your right, towards Killarney, the flat valley floor contains the Upper Lake, studded with rocky islands. Almost all that you can see in this direction is within the National Park. The valley and the smoothed, rounded topography of the mountain slopes are the



product of the massive ice tongue from the Templenoe Icecap which pushed north and eastward towards Torc and the Eagles' Nest. Notice again how the exposed rock surfaces were smoothed and rounded by the ice.

Glaciated areas tend to have a "nap" or texture due to the passage of the ice. From the display panel, you can see to the left good examples of Roches Moutonnées. This is perhaps best translated from the French as "rocks shaped like breaking waves". The upstream side of the abraded rock outcrops tends to be smooth and streamlined, whereas the downstream sides are rough and commonly almost vertical, like the breaking crest of a wave. The ice sheet flowing down the valley produced a smooth surface on the left hand ends of the hillocks whereas the rougher right hand ends were shaped by the ice plucking lumps

of rocks free as it flowed over the rock surface. Such roche moutonnée shapes can be seen all along the valley and over half way up the valley sides. This type of formation gives us a good indication of the direction of ice flow.

The relatively flat area on which you are standing is littered with large boulders. These are glacial erratics; boulders that were carried along by the ice and dumped here when the ice started to melt about 16,000 years ago. If South Kerry was composed of different types of rock, we would be able to gain some interesting information on the pattern of ice movement by studying the distribution of glacial erratics. Unfortunately, South Kerry's rocks are too homogeneous in composition and appearance and it is difficult to say where exactly these erratics have come from.

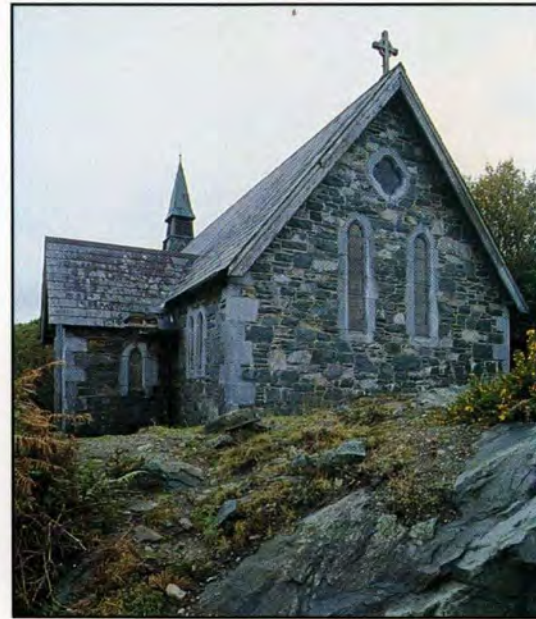
DRIVING BETWEEN LADIES VIEW AND THE UPPER LAKE

A short distance below Ladies' View you will see on the right of the road the remains of the castellated Royal Irish Constabulary barracks, built to protect the property of the Earls of Kenmare. A little further on is Derrycunihy Church, built in the 19th Century, reputedly to the design of Pugin. This served the people of the Black Valley who used to walk the 6 km.(almost 4 miles) around the shores of the Upper Lake each Sunday to hear Mass. Here, as you cross the Galway's River which below the road forms the Derrycunihy Cascade, you enter the Oak woods of Derrycunihy. The Killarney Valley contains the largest stands of native oakwoods left in the country.

Further on, the Upper Lake comes into view. This is the uppermost and smallest of the three lakes of Killarney. At 10.6 Km. (6.65 miles), pull in on the left 1 Km. (0.6 miles) beyond a short tunnel.



Mulgrave Barracks.



Derrycunihy Church.

SITE 4 - UPPER LAKE

Grid Ref. V926825

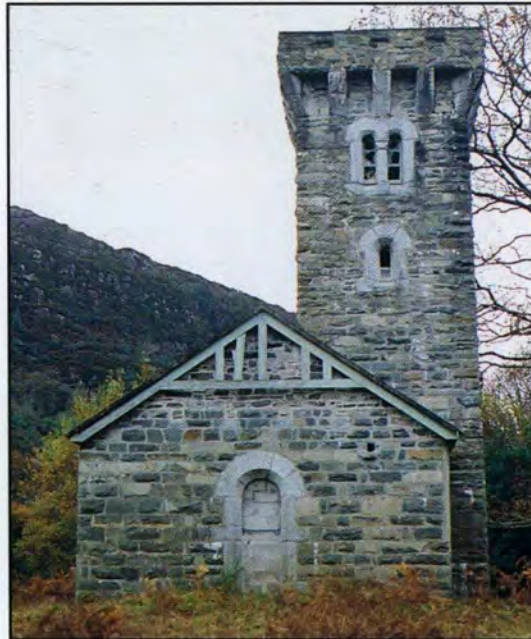


Immediately alongside you, between the lake and the parking area, is a very good example of a roche moutonnée. This outcrop of sandstone has been smoothed and rounded on its upstream side and on top by the gravel and boulders carried along at the base of the glacier while on the downstream side to your right the ice plucked loose sections of the outcrop away and created a steep profile. The ice passing over this rock may have been 800 m thick so that the force exerted on the rocks lying at the base of the glacier was considerable.

If you walk along the track to the left of the outcrop, you will find a good view of the Upper Lake. Notice how the rock surfaces on the shores of the lake are smooth and tend to slope gently to your left while abruptly to the right indicating the direction of the ice flow from left to right. To your left, on the shores of the lake is a small cliff. This is unlikely to have been cut into the sandstone by the waves generated in a small lake like this one and is therefore probably a product of glacial erosion.

DRIVING BETWEEN THE UPPER LAKE AND THE FIVE MILE BRIDGE

As you leave this stop, you pass alongside the cliffs of Cromaglan. Before the present road was built, the Lakes were used far more for communication and transport. It is said that people living on the hills above used to lower barrels of butter down these cliffs for transport by boat to Killarney. Immediately after crossing the bridge over the Crinnagh River which was the boundary between the Kenmare and Muckcross estates, you will see on your right, the ruins of the Tower Lodge. The tower was used by gamekeepers as a lookout point for poachers. As you pass along the straight section of road, you will see on your left the remains of turf banks from which peat was cut for fuel. Peat is no longer saved here since this would be against the conservation principles of the National Park. Continue until you cross a small bridge on a left hand bend at 12.5 Km. (7.8 miles). Stop here at the parking place near the lake.



Tower Lodge.



Old peat cuttings.

SITE 5 - THE FIVE MILE BRIDGE

Grid Ref. V936839



Walk down the small track to the lake edge. The hill on the far side of the Long Range River is called the Eagles' Nest and Golden Eagles nested here until late in the last century. The shape of the Eagles' Nest sloping gradually to the left but with very steep slopes on the right shows that this is a large scale example of the roche moutonnée structure.

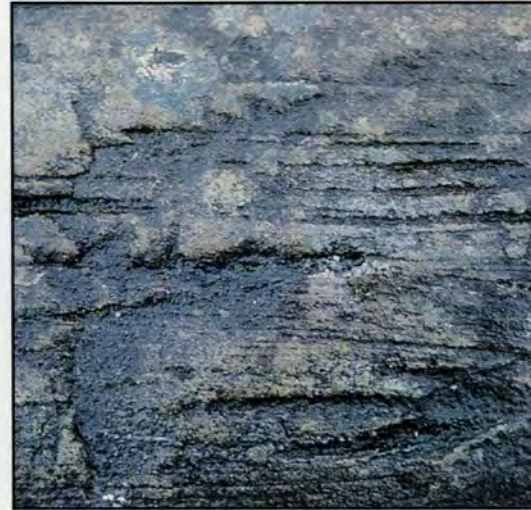
The valley behind the Eagles' Nest is called Glaishin na Marbh which translates as

the Little Stream of the Dead. Oral tradition has it that at one time there was a graveyard in this valley. Notice how the woodland is broken into small patches. The lack of a continuous tree cover is primarily due to the felling of the natural forests by man, particularly since the end of the 16th century. Subsequent overgrazing has prevented the regeneration of the forest so that today only scattered patches of natural woodland remain. The stripping of the protective tree cover has left the thin

nutrient-deficient soils exposed to the weather and these soils have either been washed away, exposing the underlying rock or have become waterlogged and have developed into blanket bog.

See how the bed-rock on the shore is very deeply scratched and scored. These scratches are known to geologists as “glacial striae” and it is easy to see how rocks and stones embedded in the glacier would score the outcrops of rocks over which they passed. If you run your hand along the rock surfaces here you will notice that it is easier to move your hand in one direction rather than in the other. The easier direction where you step down over any irregularities is the direction of ice movement. This is a smaller

scale example of the roche moutonnée effect.



Glacial striae.

DRIVING BETWEEN THE FIVE MILE BRIDGE AND DINIS CAR PARK

As you leave the car park, notice the almost sheer north face of Torc mountain. Between the road and this steep escarpment are some lower hills and silhouetted along the skyline of these are some isolated rocks. These are erratic boulders of sandstone deposited by the retreating ice.

On both sides of the road you will see the evergreen foliage of *Rhododendron ponticum*, an introduced and strongly invasive shrub which in May and June has showy purple blossoms. The heavy canopy of these dense, impenetrable thickets shades out the ground vegetation preventing oakwood regeneration. It is the long-term Park policy, therefore, to remove *Rhododendron ponticum* from all areas of the Park. At 14.5 Km. (9.05 miles) there is a large lay-by on the left of the road. Park here to see the view across Muckcross Lake.

SITE 6 - DINIS CAR PARK

Grid Ref. V950846



Here you are close to the boundary between the sandstones of South Kerry and the limestones and shales of the north of the county. The limestone is separated from the sandstone by fault lines, part of the Armorican Front which extends from the tip of the Iveragh Peninsula to Youghal. This line represents the edge of the Armorican mountain folding that included the Kerry/Cork mountains and extended into southern England and mainland Europe. Behind you, the north scarp face of Torc mountain is very close to the Millstreet to Muckross Fault line and its steepness is due

in part to it being a fault plane. On the southern side of the fault the Old Red Sandstone was raised up by as much as 3000 metres relative to the limestone to the north. (See pages 10-11).

In places the fault line has a break in it and, where the rocks are not affected by faulting, the rock strata remain in the same sequence they had when they were deposited. The Muckross Peninsula lies in a break in the fault line and is one of the few places in this area that shows a complete unfaulted transition between the Old Red

Sandstone and the Carboniferous Limestones. However, as a result of the Armorican mountain building episode, these strata now lie vertically rather than horizontally, that is at right angles to their plane of deposition.

Follow the shoreline of the Muckross Peninsula from right to left with your eye. You will see grey Carboniferous Limestone cliffs at the right hand end of the Peninsula. When the lake level is low, you will be able to see a line of caves since limestone is readily dissolved by water especially if the water is slightly acidic. As the limestone is undercut in this way, it will eventually collapse into the water to form cliffs. At a certain point along the Peninsula, you will see that the cliffs disappear and the

vegetation extends down to the water's edge since the sandstone is far more resistant to erosion and consequently caves and cliffs have not developed. This is the point of transition from the limestone to the sandstone and is one of the few places in the Killarney area where this transition can be seen.

Looking north you can see in the distance the rounded hills of the shales that are the next part of the geological history of Kerry. These lie on top of the limestone of the Lower Carboniferous and form what geologists call the Upper (or younger) Carboniferous rocks. Many of the rounded hills of North Kerry are composed of these sediments.

DRIVING BETWEEN DINIS AND MUCKROSS

On the trip from Dinis to Muckross you will be driving along the edge of Muckross Lake with the looming bulk of Torc Mountain to your right. The deepest spot (70m.) in Killarney's Lakes is near here and is part of the Millstreet to Muckross fault line. At 16.2 Km. (10.1 miles) the car park for Torc Waterfall is to your right. The waterfall cascades over part of the steep slopes that occur along the fault line. Torc Waterfall, about 200m. from the car park, is a spectacular sight particularly after heavy rainfall and is certainly the best known of the falls in the National Park.

Having passed Torc Waterfall, you see again Muckross Lake on your left with part of the demesne grasslands in the foreground. This area was cleared of rocks, mostly sandstone erratics, in the middle of the 18th Century by Thomas Herbert, then owner of the Muckross Estate.

SITE 7 - MUCKROSS HOUSE ENTRANCE

Grid Ref. V975861



At 17.8 Km. (11.15 miles) turn left at the entrance to Muckross House. Park here to see a good example of a swallow hole on the Killarney side of the entrance. Water rises from the limestone beneath the moraines on the other side of the main road, is piped under the road, and immediately goes underground here. Limestone is very susceptible to dissolution by rainwater which is slightly acidic from interaction with the carbon dioxide in the air. Water dissolves

away the limestone making underground passages into which surface water flows. In limestone areas like the Burren in County Clare there are very few surface streams and where they do occur they flow over glacial till. This is what has happened at this stop except that the stream flows above ground for only a few metres!

Continue on towards Muckross House and leave your car in the car park.

SITE 8 - MUCKROSS HOUSE

Grid Ref. V967862



Muckross House was built in the 1840's by the Herbert family. The house is constructed of Bath Stone, which is easy to work and carve and was specially imported from England. Bath Stone, laid down in the Jurassic Period, is an oolitic limestone, so-called because it is composed of small spheres of lime (oolites) that are cemented together.

Walk past the front door of the House and continue on to the Upper Terrace. The crazy paving of the terrace is largely of slabs of "Killarney Marble", a metamorphic rock, predominantly pink in colour, flecked with white. Pressure and heat resulting from the rock faulting during the Armorican mountain building period have turned the limestone white and traces of shale and chert in the strata pink. You are looking down on the almost enclosed waters of Dundag Bay, part of the Muckross Lake with the small limestone cliffs of Dundag Point to the left overshadowed by Torc Mountain. The woodland on the right hand side of the bay is the start of the Muckross Peninsula, which divides Muckross Lake from Lough Leane. The names Muckross (Muice- pigs; Ros - a promontory) and Torc (Torc - a wild boar) derive from the occurrence here in ancient times of wild pigs although the wild pig is long extinct in Ireland.

Straight ahead of you, you can see the gap between Torc and the Eagle's Nest through and over which the glacier flowed during the Ice Age. To your right are the peaks of the Purple and Tomies mountains which form the western shore of Lough Leane, also known as the Lower Lake.

SITE 8A - DUNDAG

Grid Ref. V965857

If you would like a longer walk, you can follow the road down to the Old Boathouse Nature Trail and the viewing stand at Dundag Point. Follow the Nature Trail through the woodland and about 20 m. from the Boathouse on the left is a moss-covered erratic boulder of sandstone. The bed-rock here is limestone and this sandstone boulder has been transported by the ice from the south across the geological boundary between these two rock types and left here when the ice melted.

As you walk down onto the beach at Dundag look to your right to see some interesting caves. A little way further along the shore are some smooth, wave washed outcrops. In these are fossils of crinoids or sea lilies. The sea lily is an animal related to sea urchins and starfish which was very common in the Carboniferous Period when these limestones were deposited. Nowadays crinoids are not so common and live on the deeper parts of coral reefs in tropical waters. The white cylinders, which are fossilised here, are parts of the stalk of the crinoid and are composed of calcite, a pure crystalline form of lime or calcium carbonate.

There are also veins of calcite here. During the Armorican mountain building period about 295 million years ago, the sedimentary Old Red Sandstone and Carboniferous Limestone were deformed by the collision of two continents. This caused the rock strata to fold and even rupture. Pressure and heat built up in the folding and rupturing dissolved materials present in the rocks. As cracks opened up, they were filled with the dissolved material which solidified to form what are called "veins". In limestone the veins are of lime crystals (calcite) but in sandstone the veins are of quartz. The deformation responsible for the mountain-building also damaged the fossils in the rock and these are not as well preserved as those in limestones that occur

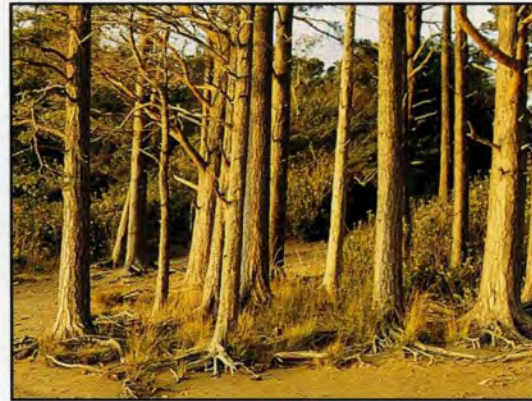


Calcite veins.

further to the north, for example around Tralee.

Notice the fine quartz sand on the beach here. As Muckross Lake is small it is unlikely that the sand was produced by the crashing of large waves onto the beach. Instead it is likely that the sand is of glacial origin, produced by the grinding of the glacier on the rocks over which it passed. This sand may then have been washed and carried along by the rivers of meltwater that emerged from beneath the glaciers and deposited in this area. When the ice finally melted, the lake assumed its present level and the gentle action of the waves further washed and built the sand up along the

shore. This deposit extends some way off the shore and provides a pleasant place to swim on a summer day. Turn left on the roadway to return to Muckross House.



Pine Trees growing on the beach at Dundag.

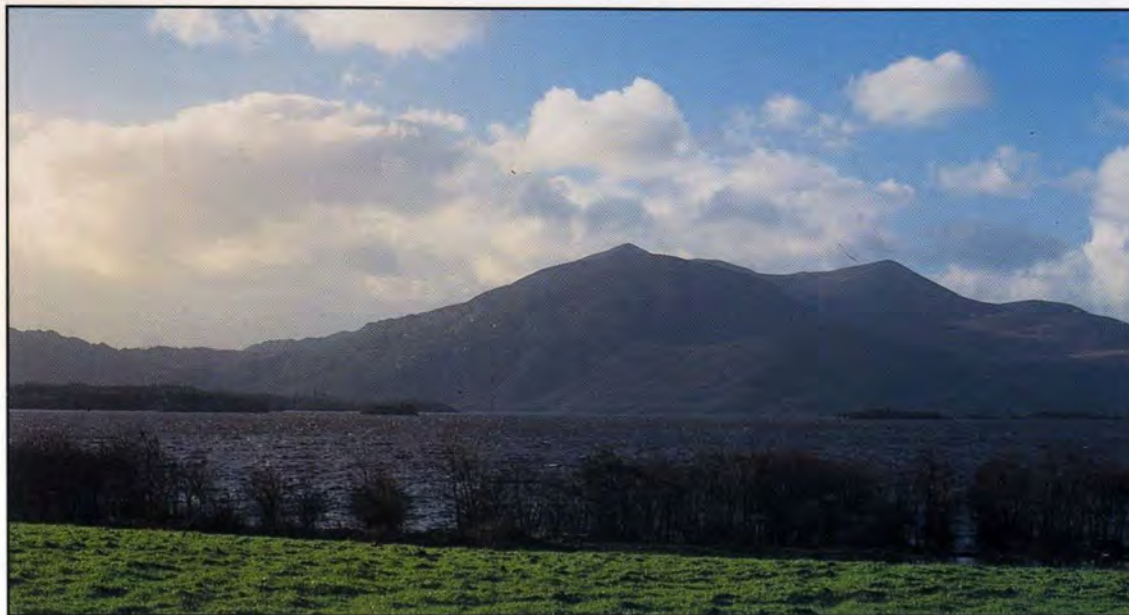
DRIVING FROM MUCKROSS TO THE MAIN GATES

Having returned to your car, turn left at the exit from Muckross House onto the main road to continue your journey towards Killarney. Immediately on your right you will see the imposing farmyard buildings of the old Muckross Estate, now used as the service buildings for the National Park. After you have passed the Muckross Park Hotel look out in the woods on your left for the ruins of the old smelter. These date back to when iron was smelted here in the 18th century. The preparation of the charcoal, used in the smelting process, was one of the principal causes of the clear felling of the native oak forests at that time.

On the hill on the right of the road, just after the Muckross Post Office, you will see the Celtic Cross erected over the grave of Henry Arthur Herbert for whom Muckross House was built in 1843.

SITE 9 - THE MAIN GATES

Grid Ref. V977878



On the left, at 21.5 Km. (13.4 miles) are the imposing main gates of the old Muckross Estate. This was the principal entrance to Muckross House when the Estate was privately owned. Leave your car in the car park and walk into the Estate. The fine view from here includes Lough Leane (the Lower Lake) in the foreground and behind it, the mountains of Tomies, Purple Mountain and Shehy with behind them, Macgillycuddy's Reeks. All of these mountains are of Old Red Sandstone while

the floor of Lough Leane is mainly of Carboniferous Limestone. This limestone can be seen in the small islands of the lake. The craggy shape of these islands is again due to the erosion of the limestone by rain and lake water. The nearest of the islands is Friar's Island, so named because it is the nearest island to Muckross Abbey.

The low hill that underlies the gate and roadway is one of a series of concentric crescents of moraines deposited as the ice

flow which had spread out on the lowlands began to melt about 16,000 years ago. As the last of the ice disappeared, the ground between the mountains and the moraines became filled with melt water which rose until it found a low point in the ring of moraines over which to flow towards the sea. This low point lies at the northwestern end of the lake. Lough Leane is therefore dammed by these moraines to the east, north and northwest. The Muckross Peninsula forms the southern shore while the mountains of Shehy and Tomies form most of the western shore. Such moraine-dammed lakes are very common in Ireland; the Gap

of Dunloe holds some very good smaller examples and the Macgillycuddy's Reeks have several excellent corrie lakes.

This is the end of the trail but for other fine views of the landscape of Killarney why not visit the view point in Knockreer,(Grid Ref. V9539145) at the edge of town, or Aghadoe.(Grid Ref. V934927)? Both of these locations are to the north and provide spectacular views south towards the Lakes and the mountains. If you would like to see other geological features, all of the nature trails include sites of interest.

