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# Corrie Shore, Isle of Arran

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Geological Society of Glasgow Excursion Itineraries

(Cover photograph): Clach a' Chait (Cat Stone) — The source of this glacial erratic is the Northern Granite intrusion that forms the mountainous area immediately to the west of Corrie. A number of these erratics, of various sizes, occur along the eastern shores and raised beaches of Arran.

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This is a major revision of Excursion 4: Corrie Shore, pp. 103–112, published originally in: J. G. MacDonald and A. Herriot (eds), 1983. Macgregor's Excursion Guide to the Geology of Arran. 3rd edition. Geological Society of Glasgow.

Access to unpublished data relating to the Corrie Limestone and the Coal Measures succession, held in the archives of the British Geological Survey, Edinburgh, is gratefully acknowledged.

## Corrie Shore

The main purpose of this excursion is to examine the Carboniferous rocks of Arran in an area where the rock succession is clearly displayed at the roadside. The excursion also offers an opportunity to examine the junctions of the Carboniferous strata with the underlying Upper Old Red Sandstone and the overlying Permian.

The localities are readily accessible along a 2 km shore section. The only diversion involves a steep climb to locality 8 to examine the Corrie Limestone. The shore section is largely accessible at any state of the tide but it is best to avoid high spring tides. The going is rough over rocky outcrops and boulder beaches the latter often being slippery, especially after stormy weather when they may be strewn with seaweed, so stout footwear is recommended, especially with ankle protection.

There is limited car parking at localities 1 and 13 and a larger car park on the south side of the Corrie Hotel. Refreshments may be obtainable at a few small tea rooms or the hotel bar.

## The geological setting

Corrie is situated to the east of the northern granite. The strata are generally inclined to the SE so the oldest rocks (Old Red Sandstone) occur in the north at locality 1 and they become progressively younger toward locality 12 (Permian). The outcrop pattern is broken up by a set of NNW trending normal faults. As a result of this the succession seen in the shore section is displaced and repeated inland where it crops out in stream sections, especially in the Leucheram Burn (Figure 1)

## The itinerary

### Locality 1 Clach a' Chait [NS 0208 4449]

At the roadside a huge erratic block of granite known locally as the Cat Stone (Clach a' Chait); is approximately 4.3 m in height, 5.5 m long and 2.75 m wide. About 50 m to the north a small parking area on the east side of the road provides access to the shore where red, cross-stratified and often coarse-grained sandstones crop out. These beds of Upper Old Red Sandstone, dip to the south-east at angles of between 24° and 30°. Sparsely pebbly horizons contain clasts mainly of vein quartz. Note that the dips steepen locally in the vicinity of small crush-lines or faults. Access to locality 2 is to the south along the shore.

### Locality 2 Conglomerate [NS 0218 4435]

A red conglomeratic horizon, 21 m or so thick, crops out here. It is poorly sorted and loosely packed, with a variety of clasts, notably of vein quartz (up to about 120 mm in length), quartzite, sandstone, and semi-pelitic chlorite-schist set in a sandy matrix. The proportion of clasts decreases upwards. It is followed southwards, in upward succession, by a series of red, cross-stratified sandstones, often showing on their upper surfaces irregular ridges which it has been suggested may represent in-filled mud-cracks.

### Locality 3 March of Achag [NS 0231 4418]

This locality can be reached by walking along the shore from locality 2, or from the road through a gap in the vegetation opposite the wooden bungalow at the north end of Corrie Village. Cross-bedded Upper Old Red Sandstone is succeeded by a thick upstanding bed of conglomerate (Figure 3) forming a small promontory. Comparisons can be made between this and the conglomerate at Locality 2. Note in particular the frequency of large pebbles, lenses of sandstone and red sandstone clasts. The rock types exposed in upward succession along the shore between locality 3 and the base of the Clyde Plateau Volcanic Formation at Locality 4 are listed overleaf (Table 1).

	<b>thickness</b>
(f) Pale-grey sandstone dipping southeast at 25° to 28°	~6 m
(e) Cornstone, pale-coloured, sandy, nodular	~0.75 m
Gap in succession	0.9 m
(d) Cornstone, nodules in red shaly matrix	~4.5 m
(c) Mudstones, red, with beds of pale-grey sandstone	~1.2 m
~~~~~ line of disturbance — possible fault	
~~~~~	
(b) Cornstone, pebbly, associated with calcareous sandstone	1 m
(a) Conglomerate, massive, reddish in colour, the top of the local Upper Old Red Sandstone succession	15 m

Gunn (1903, p.38) regarded bed (a) at locality 3 as the topmost member of the Upper Old Red Sandstone and the junction with the pebbly cornstone, bed (b) as "clearly an unconformable one." The cornstone horizons resemble the topmost part of the Kinnesswood Formation and the ~6 m of pale grey coloured sandstone above them resembles a similar formation that occurs on Bute ( Young and Caldwell 2011) that has been equated with the Clyde Sandstone Formation which on the mainland widely precedes the Clyde Plateau Volcanic Formation.

### Locality 4 Volcanic breccia [NS 02322 44141]

A sudden break in the sedimentary succession is marked here by rocks that bear witness to the onset of the volcanic episode that produced the Clyde Plateau Volcanic Formation. An unsorted mass of fragments of volcanic rock have a size range from close to 2m in length to fine grained ash. Individual blocks of highly vesicular lava display a degree of rounding indicative of transport in a highly energetic environment such as that encountered in pyroclastic flows produced by explosive volcanic activity.

### Locality 5 Clach an Fhionn [NS 02363 4402]

The lower part of the succession of the Clyde Plateau Volcanic Formation is encountered here. It consists of purplish porphyritic olivine basalt with phenocrysts of augite, olivine and occasionally plagioclase feldspar. The basalt is columnar and the flows have been tilted at about the same angle as the sedimentary rocks about and below. The columns have been spheroidally weathered (Figure 5) giving a false impression that they may have been pillow lavas erupted sub-aqueously. Note the large granite boulder known as Clach an Fhionn (the white rock) on the shore side of the road. It is a glacial erratic derived from the adjacent Northern Arran granite massif.

#### **Locality 6 Opposite Corrie Primary School [NS 02404 43824]**

The upper part of the lava succession, also consisting of olivine basalt, is generally fresh, unweathered and provides excellent specimens for making thin sections for examination under the microscope. Look for the slaggy, decomposed, amygdaloidal tops of individual flows. Thin ramifying veins of calcite are common near the top of the lava formation. Above the lavas a succession of beds of reddish sandstones and shales, includes a 460 mm thick bed of red limestone. These strata dip southeast at about 25°. Some of the beds contain small fragments of volcanic ash. They are succeeded by a 3.0–3.6 m thick purplish basalt lava flow, much veined by carbonates.

#### **Locality 7 [NS 0245 4364]**

A gap in the shore section above the last lava flow top at Locality 6 may represent 9–10.5m of soft, easily eroded beds. They are succeeded here by massive sandstone, pale grey in colour but with reddish staining locally. At one time these rocks were quarried along their outcrop both on shore and for some little distance inland. Above the sandstones soft reddish mudstones crop out sporadically.

#### **Locality 8 Limestone Quarry [NS 02253 43546]**

The Corrie Limestone is the basal member of the Lower Limestone Formation in Arran. This important marker horizon within the Lower Carboniferous succession of the Midland Valley of Scotland is found at many localities with a variety of names (e.g. the Hurllet Limestone in the Glasgow area). On the shore it was excavated to form the Old Corrie Harbour, and mined extensively inland along its outcrop for over 360m.

A path from the bend in the road at the harbour leads uphill to the entrances to day-holes (formerly called ingaun e'es), that gave access to the old underground workings (Figure 6). Good sections of limestone and the overlying beds crop out along the present rock face and at the mine entrances. Visitors should on no account attempt to penetrate the galleries as there is a serious danger of roof-falls. The limestone has been recorded as 6 m in thickness but includes only 3.6–4.3 m of good quality limestone. The Corrie Limestone is divided into separate beds, or posts, by partings of reddish calcareous shale on the upper surface of which are numerous shells of the large brachiopod *Gigantoproductus giganteus*. A layer packed with specimens of this species forms a striking feature on the roof of the old workings. The limestone is intruded by two thin dykes, one a little above the lime kilns, the other about 45 m higher up. Note also the series of white and pinkish sandstone in the cliff above the Corrie Limestone. These rocks also crop out on the shore at Locality 9, south of the Old Harbour.

#### **Locality 9 — Ferry Rock [NS 0258 4343]**

Rocks belonging to the Lower Limestone Formation crop out along the shore to the south of Corrie Old Harbour. They include thick posts of white sandstone some of which are fine-grained and exceptionally pure. The hard compact sandstone found at this locality was quarried (Figure 7) to supply large blocks for harbour construction in the Isle of Man. The projecting rock remaining after the excavations was later used as a jetty for small boats which were used to ferry passengers from passenger steamers; ferry operations ceased in 1939. The beds exposed above the sandstone here include a few seat earths interbedded with sandstones, shaley sandstones and shales which extend for a little way to the south. Although no trace of coal has been found faint impressions of coal forest vegetation are preserved on some of the bedding planes.

#### **Locality 10 — Index Limestone [NS 0257 4338]**

A reddish 600 mm thick limestone here has been tentatively correlated with the Index Limestone. Like the Corrie Limestone the Index Limestone is widespread throughout the Midland Valley and is of particular importance as it marks the top of the Limestone Coal Formation, a source of commercially workable coals. The limestone at this locality has yielded shelly fossils including brachiopods such as *Latiproductus latissimus*, small gastropods and a few bivalves. The strata extending southwards to the little bay in front of the Corrie Hotel contain several other marine limestones, ranging in thickness between 300 and 900 mm, separated by shales and occasional sandstone beds which together have been tentatively placed in the Upper Limestone Group. Due to lack of continuous exposure and the occurrence of minor faults or crush lines the estimated thickness of the Group at about 42 m must be regarded as approximate.

### **Locality 11 — Coal Measures [NS 0245 4324]**

This locality includes all the strata seen in the little Bay south of the Corrie Hotel as far as Locality 12. Results of research carried out during the revision of the stratigraphy of the Upper Carboniferous in Arran (Leitch 1942, pp. 141–154) place these rocks in the Upper Carboniferous, certainly in the Coal Measures although a 9 m thick, massive sandstone at the base may be equivalent to the upper part of the Passage Formation. The conglomerate at its base probably marks an unconformity of early Passage Formation age known on the mainland throughout much of Lanarkshire.

### **Locality 12 Carboniferous/Permian Unconformity [NS 0259 4308]**

Some 100 m or so south of the Corrie Hotel, a sudden change in lithology and sedimentary structures of the rocks cropping out on the foreshore, marks a major unconformity between the Upper Carboniferous strata and those of the succeeding Permian, Corrie Sandstone. The plane of unconformity has been described (Bailey 1926) as being marked by scattered, minute pebbles of vein-quartz and iron pan mixed with rounded quartz grains. The pattern of sedimentation in the Corrie Coal Measures comes to an abrupt end with the sandstone at the top of the succession. Highly irregular contortion of the bedding (Figure 8) indicates the deposit was deformed shortly after deposition, before the bed had been lithified. This type of soft sediment disturbance can be produced by slumping, or dewatering of wet sediment triggered by the weight of subsequent deposits in a deltaic environment.

The abrupt change in lithology above the unconformity (Figure 9) signals conditions of deposition in the Permian profoundly different from those in the Coal Measures. The red sandstones encountered here (Figure 10) are also markedly different from Upper Old Red Sandstone at Localities 1 to 3. Close examination of the beds shows that although there is some variation in grain size the composition of the grains is more uniform and there is a total lack of clasts coarser than sand grade. Also the cross bedding is on a much larger scale. Examination of the coarser sand grains with a hand lens reveals that they are well rounded and the surfaces have the 'frosted' appearance that results from transport by wind.

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## Figures

(Front cover)

(Cover photograph) Clach a' Chait (Cat Stone) — The source of this glacial erratic is the Northern Granite intrusion that forms the mountainous area immediately to the west of Corrie. A number of these erratics, of various sizes, occur along the eastern shores and raised beaches of Arran.

(Figure 1) Geological map of the Corrie area showing positions of localities mentioned in the text. This is a coloured version of part of fig. 9 of MacDonald and Heriott (1983) with some modifications.

(Figure 2) Diagrammatic cross-section and vertical sections (dates in millions of years) of the succession cropping out along the shore at Corrie. The three vertical sections, in the lower part of the figure, link the lithographic successions with the corresponding chronographic epochs of the Carboniferous Period. Key radiometric dates (Monaghan and Parish 2006) are in millions of years. The earliest epoch, the Tournasian, is represented only by a much attenuated part of the Icinnesswood Formation; the Ballagan formation is absent. More than half of the Westphalian is also missing and the overlying, topmost, Stephanian Epoch is totally unrepresented.

(Figure 3) The topmost beds of the Upper Old Red Sandstone (bed (a) in (Table 1)). Note the interbedded sandstone below the top conglomerate and the much finer grained beds at the base of the outcrop.

(Figure 4) Cornstone bed at Locality 3; top of the Upper Old Red Sandstone on lower left Locality 4. Volcanic breccia [NS 02322 44141]. A sudden break in the sedimentary

(Figure 5) The lower part of the Clyde Plateau Volcanic Formation (Locality 5).

(Figure 6) Post of limestone supporting the roof of the limestone mine at Locality 8. The roof of the mine is studded with *Gigantoproductus* shells.

(Figure 7) Ferry Rock (Locality 9), note the tool marks on the right where the white sandstone was quarried.

(Figure 8) Highly contorted bedding in the sandstone at the top of the Coal Measures succession.

(Figure 9) The Carboniferous–Permian unconformity. The smooth weathering large cross-bedded units of the Permian Corrie Sandstone on the right contrast with the disturbed bedding of the Carboniferous strata on the left (see also (Figure 8)).

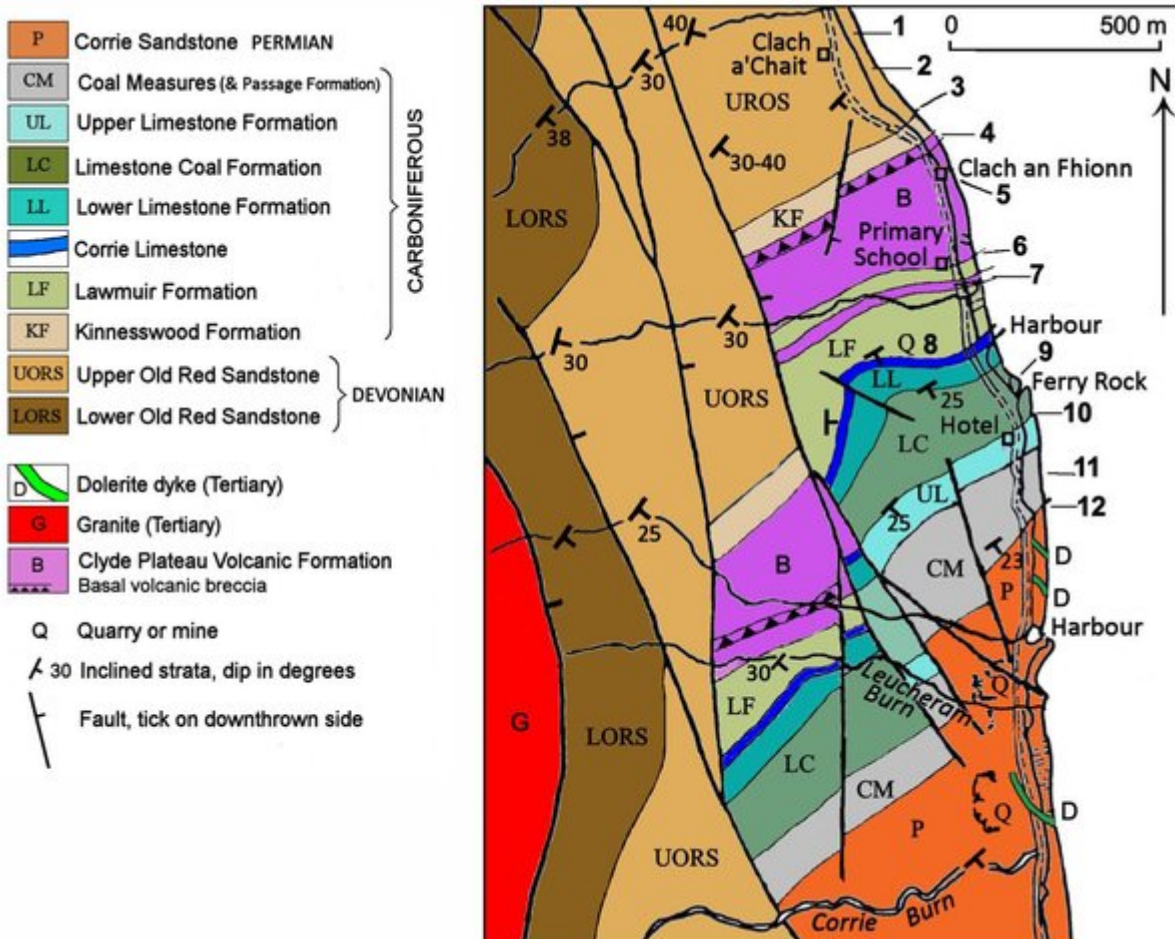
(Figure 10) Dune bedded Permian Corrie Sandstone south of the Carboniferous/Permian unconformity at Locality 12.

## Tables

(Table 1) Upward succession of strata cropping out on the shore between localities 3 and 4.



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*(Figure 5) The lower part of the Clyde Plateau Volcanic Formation (Locality 5)*



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# Isle of Arran CORRIE SHORE

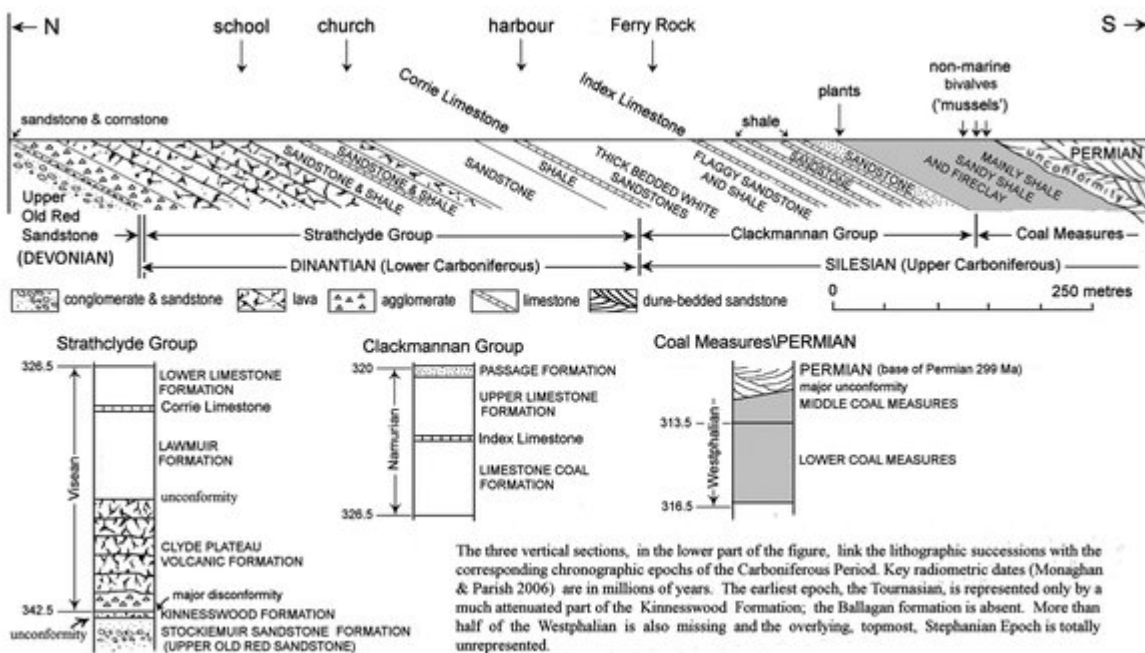
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(Front cover)



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