Geological Society of Glasgow Excursion Itineraries

Isle of Arran
DRUMADOON AND THE TORMORE DYKES

Version 1.0

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Registered Scottish Charity No. SC007013

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The Tormore shore near An Cumhann. Permian Lamlash Beds crop out in the foreground. In the distance the skyline is dominated by Beinn Bharrain (721 m) on the western side of the Northern Granite. Schistose grits, slates and phyllites of the Southern Highland Group of the Dalradian Supergroup crop out on the shoulder between Beinn Bharrain and the shore line.

This is a minor revision of Excursion 13: Drumadoon and the Tormore Dykes. pp. 163–169, published originally in:
J.G. MacDonald & A. Herriot (eds), 1983. *Macgregor's Excursion Guide to the Geology of Arran*. 3rd edition. Geological Society of Glasgow.

Drumadoon and the Tormore Dykes

The object of this excursion is the examination of the composite dykes and other intrusions which abound on this stretch of shore. It can be carried out by public transport from the main centres on the east side of the island. If private transport is used it will be found more convenient to arrange for collection at the appropriate terminal point, especially if another excursion is to be made on the same day. The Tormore shore is reached by the track that leads westward from the main road at the old post office [Grid Ref. NR 8950 3245]. The route follows the raised beach southwards past the houses.

As an alternative, for those who wish to restrict their visit to an examination Judd's dykes, and the localities between King's Cave and Cleiteadh nan Sgarbh, cars can be left at the car park beside the Blackwaterfoot to Machrie road (A841) on the east side of the forestry plantation [NR 8981 3148]. A path skirting the plantation on its north side leads to the shore close to An Cumhann (locality 3). Another path through the plantation reaches the shore at locality 5, south of King's Cave.

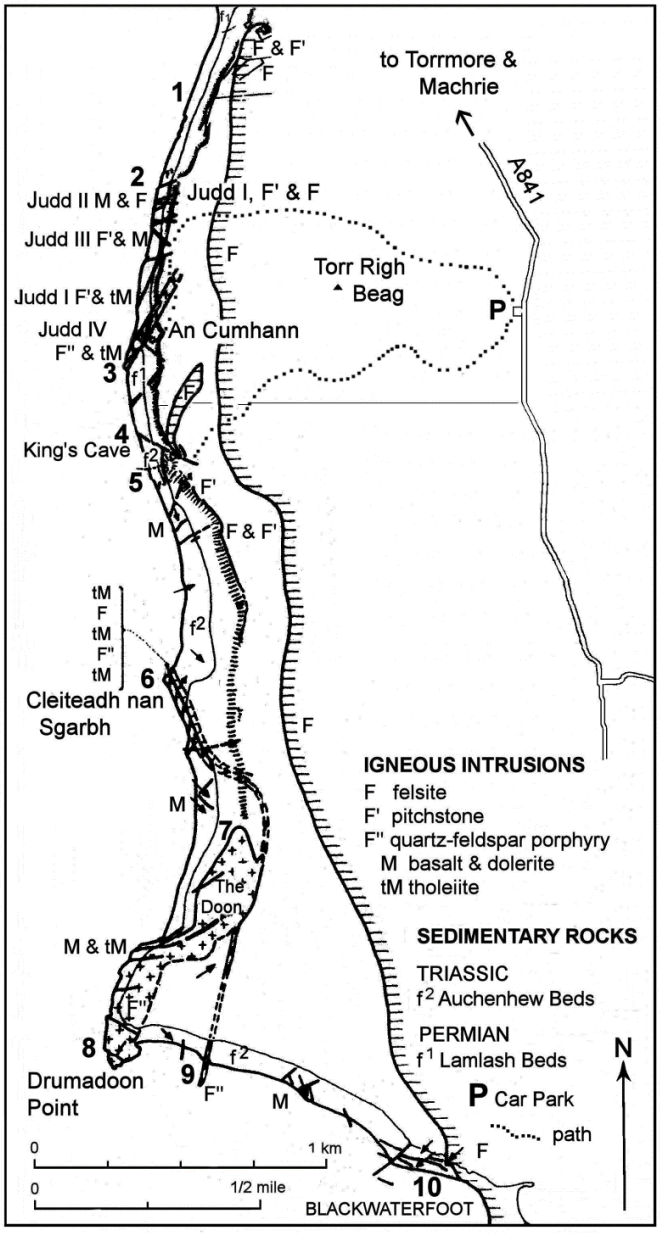

Fig. 1. Geological sketch map of the Drumadoon – Tormore area (after MacDonald & Heriott 1983)

1. The Tormore Shore. The foreshore and raised beach cliff are eroded in sandstones attributed to the Lamlash Beds in the upper part of the Permian succession of Arran. These sandstones are often strongly cross-laminated and carious weathering is locally striking. Irregular distribution of carbonate cementing material leads to hard, rough-weathering bands alternating with soft red sandstones and siltstones. Pseudomorphs after halite and dendritic gypsum are recognisable in places.

2. Judd's Dykes. Along this stretch of shore numerous dykes crop out including the composite dykes made famous by Judd (1893). The finer points of the petrography of these interesting intrusions must be studied in the laboratory but the constituent rock types are sufficiently diverse to enable adequate field determinations to be made. These types include felsite, quartz-feldspar-porphyry (quartz-porphyry of the 1:50 000 BGS map), pitchstone, and dolerite. The Roman numerals used by Judd to identify the dykes that he described are appended in Figure 1. The most northerly pitchstone was not considered to be composite by Judd but it encloses some areas of felsite; it forms a conspicuous feature on the foreshore, about 5 m thick at high water mark but is variable in thickness and dip. The intrusion trends ENE–WSW and is composed mainly of dark-green pitchstone.

Judd's dyke No I. This N–S trending, dark green pitchstone dyke crops out south of the most northerly pitchstone but the relationship of the two is unclear. It is about 4.5 m thick. It disappears beneath boulders and raised beach sediments but reappears south of dyke III where it dips to the east. Southwards its trend swings towards the SSW and the dip gradually decreases. By the development of felsic modifications and the presence of thin, generally rotted marginal tholeiite the intrusion becomes composite. Flow-banding is strikingly displayed, especially in dislodged blocks on the shore.

Judd's dyke No. II. A central 4.5m thick, east–west trending, quartz-felsite is bounded by sphere-oidally-weathering tholeiites 1.2m and 1.8 m thick on the north and south margins respectively. Judd records the felsites passing in places into "pitchstone-porphyry or 'vitrophyric' rock" which is stated to occur "as a band varying in width from 150 to 600 mm, sometimes forming part of the quartz-felsite mass and at other time intersecting the masses of andesite" (i.e. tholeiite). Some 55 m S of dyke II, two dykes intersect; they have irregular trends that diverge as they head for the raised beach cliff.

Judd's dyke No. III. This NW–SE trending dyke consists of pitchstone, 1.2–1.8m thick, with an olivine-dolerite on its north side. The dolerite differs in composition from the tholeiites usually found in association with the pitchstone and felsites of the composite intrusions, so Judd No. III might not be composite in the normal sense but the result of the fortuitous intrusions of two totally unrelated magmas. Judd No 1 reappears just south of this.

3. An Cumhann. *Judd's dyke No IV*, a 27m wide composite dyke, completes forms a prominent feature that stands high above the shore line and blocks the passage along the beach platform except at low tide. Otherwise it can be crossed by ascending a poorly defined path over the top on the shoreward side. The bulk of the dyke is composed of quartz-feldspar-porphyry with abundant large phenocrysts of white-weathering orthoclase feldspar and smaller glassy ones of quartz set in an aphanitic grey groundmass. The marginal tholeiites on both sides, although basaltic in composition, contain scattered xenocrysts of orthoclase similar in appearance to those in the centre of the intrusion.

4. King's Cave. South of An Cumhann the cliff at the head of the raised beach rises to a greater height. It has been hollowed out by wave action when sea level stood higher during early Post-Glacial times. The largest cave, known as King's Cave (Fig. 2) is entered by a gate in an iron railing. The gate is normally left open. It gets its name from the legend that King Robert the Bruce hid in it when he was in Arran. There is historical evidence that he passed through Arran on his journey from the Island of Rathlin to Ayrshire in 1307, but no written record exists of his visiting this site.

The cave was formed by the erosion of two upwardly converging joints in the Permian sandstone. When wave action undermined the cliff the unsupported rock between the joints collapsed and the resulting debris was washed away. Little of archaeological significance has been found here. Some carvings high on the left hand side inside the entrance are of doubtful antiquity and in other places the rocks have been defaced by modern graffiti.

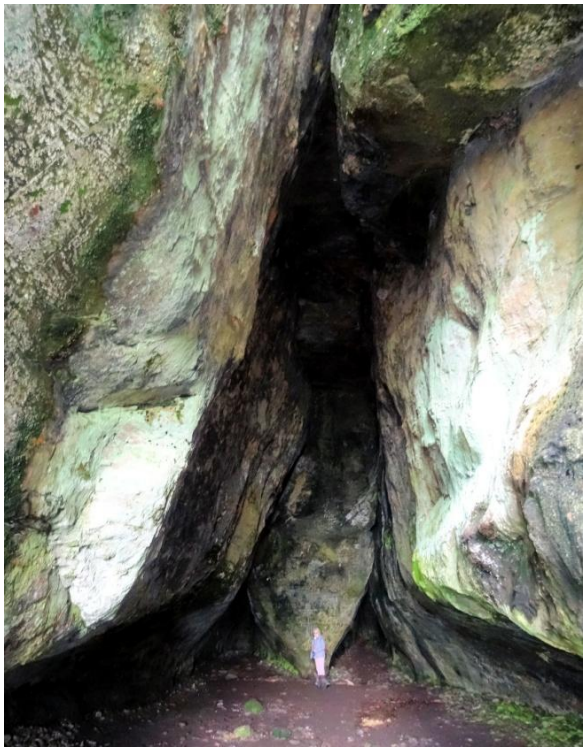

Fig. 2. King's Cave. The figure is ~1.6 m high.

5. Signpost for Blackwaterfoot. A short distance south of King's Cave, at a recess in the cliff, a short climb leads to a branch in the path. A signpost indicates the route south towards Blackwaterfoot and the path to the King's Cave car park. The view of the north side of the recess (Fig. 3) shows

sandstones intruded by a thick felsite sill, mostly deeply weathered to red and yellow 'sandy' material. Above the sill there are more sedimentary rocks capped by a sill of pitchstone. Pitchstone crops out at several points in the recess and most readily at the base of the conspicuous knoll on its south side. Partially devitrified pitchstone occurs in a low cliff below the footpath.

Fig. 3. View north from the path to King's Cave car park. Felsite and pitch-stone sills are intruded into sandstone of the Permian Lamlash Beds a short distance south of King's Cave.

The above recess has been considered to mark the line of a NW–SE running fault coinciding with the junction of the Permian Lamlash Beds to the north with the Triassic Auchenhew Beds to the south (Tomkeief 1961). It is certainly clear that there is a change in lithology; the sedimentary rocks to the south are finer grained with a high proportion of marls. The path continues along the raised beach for about 800m towards Cleiteadh nan Sgarbh. Auchenhew Beds crop out sporadically along the shore.

6. Cleiteadh nan Sgarbh. The promontory here is formed by a NNW trending composite dyke complex, similar in some respects to An Cumhann (locality 3). The widest member is a quartz-feldspar porphyry 15.5 m thick flanked on either side by ~0.6 m thick basaltic intrusions (Fig. 4). The quartz-feldspar porphyry is darkened at its margins and the marginal basalts contain xenocrysts of orthoclase feldspar, similar to, but less abundant than those in the porphyry. On the east side a 9 m thick felsite dyke is in contact with the eastern marginal basalt. The felsite is flow banded parallel to its western side and has weathered to shades of bright-red and yellow which make it look deceptively like sandstone in places. The intrusive complex is inclined to the east and at the top of the beach its heading changes towards the southeast as it crosses the raised beach. It crops out in the cliff to the north (to the left) of the Drumadoon sill.

Fig. 4. View from Cleiteadh nan Sgarbh towards the Drumadoon Sill.

A – felsite;
B – quartz-feldspar porphyry

7. Drumadoon. Follow the track from locality 6 from the foot of the raised beach cliff up the slope to the north end of the Drumadoon Sill. Then continue along the top of the talus slope where marly

sedimentary rocks below the sill can be examined as can the basal rocks of the intrusion. At the base of the sill is a sheet of tholeiite, about 1.2 m in thickness thinning to about 0.8m at the south end of the cliff. Above that rises the main quartz-feldspar porphyry with its columnar jointing which has inspired the local name 'Organ Rock'. Near its base the porphyry is darkened and is rich in xenoliths of tholeiite which have a tendency to weather out. Fallen blocks of xenolithic porphyry litter the talus slope and the adjacent shore. Fragments of a thin upper marginal tholeiite have been reported (Tyrell 1928, 200) supporting the view that the Drumadoon sill was intruded during the same episode as the composite dykes. [Research carried out since the publication of the 1983 edition of the Macgregor Guide (Meade *et al*. 2009) throws new light on the nature and of the Arran composite intrusions.]

8. Drumadoon Point. West of the Drumadoon the composite sill steps down to shore level, possibly as the effect of an EW oriented fault. The same relationships between the main quartz-feldspar-porphyry and the margin tholeiite occur here and at Drumadoon Point the eastern margin of the intrusion can be examined. At the Point the marginal tholeiite dips to the east. Note also the presence of an igneous breccia with a matrix of yellowish porphyry, a thin composite dyke and a number of basaltic dykes that cut the main sill.

9. Composite dyke. Here a NNE-trending quartz-feldspar-porphyry dyke with a darkened eastern margin cuts the shoreline. Its projected line runs to the north of the eastern margin of Drumadoon suggesting that it may have been the feeder to the sill. It resembles the dyke at Cleiteadh nan Sgarbh (locality 6) and that at An Cumhann (locality 3). This raises the possibility that all three dykes and the Drumadoon sill are connected and were intruded at the same time. This locality is situated close to the north-western end of Blackwaterfoot Golf Course which is laid out on coastal sand dunes. Care should be taken to keep clear of fairways and maintain a good lookout for unexpected wayward golf balls whizzing towards you.

10. Blackwaterfoot. The beach margining the golf course is cut in several places by basic dykes. On the shore, south of the Golf Club House, the dip of the country rock marls and sandstones increases to about 50° against the Blackwaterfoot–Torr Righ Mor felsite. At the contact the felsite is flow banded; east of this flat lying joints give a roughly 'stratified' and, in places, a rippled appearance. Elsewhere columnar joints are well developed, as seen at the Blackwater Bridge beside the harbour. Dykes which trend in the same direction as the felsites have irregular courses, "as though they were influenced by the proximity of the felsites or found it difficult to penetrate it." (Tyrell 1928, 222 & fig. 32). South of the Club House the remains of two sea-stacks stand in front of the raised beach sea cliff. Farther to the SE the cliff shows a patch of the Auchenhew Beds, with columnar felsites to the west. Felsite on its E side has joints disposed in an asymmetric arch; this feature was noted and figured by Bryce (1872). The stacks and arch are situated in private grounds.

REFERENCES

Bryce, J. 1872. *The Geology of Arran & the other Clyde Islands* (4th Edit.), Collins, Glasgow & London

Judd, J.W. 1893. On composite dykes in Arran. *Quart. J. geol. Soc. London*, **131**, 331.

MacDonald, J.G. & Heriott, A. 1983. *Macgregor's Excursion Guide to the Geology of Arran, 3rd edit.* Geol. Soc. Glasgow.

Meade, F.C., Chew, D.M., Troll, V.R., Ellam, R.M. & Page 2009. Magma Ascent along a Major Terrane Boundary: Crustal Contamination and Magma Mixing at the Drumadoon Intrusive Complex, Isle of Arran, Scotland. *Journal of Petrology*, **50**, 2345 –2374.

Tomkieff, S.I. 1961. Isle of Arran, No. 32 in Excursion Guide Series, *Geologists' Association*

Tyrell, G.W. 1928. *The Geology of Arran*. Memoir of the Geological Survey GB, HMSO Edinburgh.