AN UNREMARKABLE TRIO

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Scotland has an unrivalled wealth of geological sites, ranging in age from the earliest Pre-Cambrian through to the Quaternary and displaying features ranging from tectonics through geomorphology to fossil sites of great significance. This is the story of three geological sites that are unremarkable from a scenic and touristic point of view yet have their own importance in the history of geology.

The most northerly part of the coast of the Isle of Arran is composed of a low-lying boggy, grassy fringe backed by a cliff up to about 30 metres high. Walking from the village of Lochranza up the east side of the loch, the footpath around the most northerly point of the Isle, the Cock of Arran, takes a route close to the shore of the Sound of Bute through marshy ground dotted with rocks and boulders. At the back of the foreshore, where

Foreshore near Lochranza

the tidal range and storms has kept the rocks and shingle clear of vegetation, low-bedded red rocks crop out, frequently having been breached by the sea, and dipping about 30 degrees to the north west. In many places, this red rocky bedding can be seen to overlie another sequence, this time composed of greyish, thinly-bedded rock which dips almost vertically. At Newton Point, approximately ½ mile from the end of the road, this feature can be examined quite easily although the rocks are obscured by lichen and are rather eroded. It was here, in 1787 that James Hutton, in his determination to prove his theory of Plutonism, in which he proposed that '*No processes are to be employed that are not natural to the globe ; no action to be admitted except those of which we know the principle*' – which we know as the Principle of Uniformitarianism, found his first example of an angular unconformity. At Newton Point, vertical Dalradian schists are overlain by early Carboniferous red fine sandstones which dip at about 30 degrees. Hutton was not satisfied with the quality of the exposures on the Isle of Arran and subsequently discovered and described the angular unconformity at Siccar Point near Berwick on Tweed.

At Newton Point, the angular unconformity can seen particularly well where a small stream has cut through along the unconformity, causing the rocks on both sides to be relatively clear of vegetation, lichen and seaweeds. The photograph shows the stream running along

Hutton's Uncornformity—early carboniferous sandstones on Dalradian schist

the line of the unconformity which is highlighted by the black, wet rock which is the top of the Dalradian schists while the pale rocks to the upper right mark the Carboniferous red beds. The Isle of Arran has long been one of the classic areas of Scotland's geology and has been described and written about for over 150 years. It is visited by geologists of all disciplines and is much used as one of the classic teaching areas. It is a little surprising, therefore, that, although 'Hutton's Unconformity' is on a

signpost at the beginning of the footpath there is no sign or panel to describe the feature at Newton Point. The north coast of the Isle of Arran is unremarkable but has its place in the early history of geology and this is a missed chance to demonstrate a fundamental geological feature to the general public, as they walk past on the footpath around the Isle of Arran.

Walking down Main Street of the small Perthshire town of Comrie, you might be excused for thinking that you had been transported to a small township in the wild west of America, because, along the south side of the street can be seen a small but, judging by the queue, busy shop with a rather faded name above the window – 'Shakee Toon Bakery'. It is an unremarkable but nevertheless pretty little town, similar to many small Scottish towns and villages with white stone buildings, many of them being small and of single storeys, and businesses on both sides of the streets. On the south side of Comrie, the river Earn runs east beneath an old arched bridge and, close by the bridge, the white painted church stands on a hillock overlooking the river. About a quarter of a mile out of town to the west, a road turns off, immediately passing over a narrow, very humpbacked bridge. The signpost indicates it is the way to 'The Ross' and 'Earthquake House'. Odd name for a house! While most people would not give either 'Shakee Toon Bakery' or 'Earthquake House' a second thought, the more curious folk would possibly connect the two.

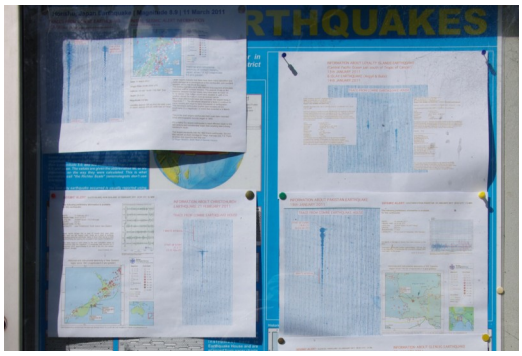
On a small hillock beneath a large conifer tree is a small stone building about 8 feet square, with a slate roof, a door on the west side and a full length window on the east side. Attached to the walls are some glass-fronted noticeboards containing sheets of paper. Let into the cement floor inside are two strips of wood at right angles with small wooden pegs, some of which are standing upright on the strips while others were lying on the floor. This is 'Earthquake House' – a small, unremarkable but significant contribution to the history of geology in Scotland and, more importantly, to the history and continuing monitoring of earthquakes worldwide. The wood strips and pegs were the first attempt made to detect earthquake activity.

Earthquake House, near Com-

Comrie sits about 2km north of the Highland Boundary Fault complex which cuts across Scotland from Stonehaven on the north-west coast, WSW to Loch Lomond, then to Bute and Arran on the west coast, separating the ancient hard rocks of the Highlands from the Devonian sandstones of the Central Valley of Scotland. The fault, which is actually a complex of faults, may dip in a northerly direction as the seismic records show that the epicentres of earthquakes which have affected Comrie were to the north of the town. However, it is also possible that a deep fault not visible at the surface, to the north of Comrie, is responsible for the earthquakes . The nickname of 'Shakee Toon' was acquired back in the 18th century after the inhabitants had experienced a period of 'shaking'. The first documented note of an earthquake was in 1597 when James Melville recorded one which was felt across Perthshire. The first recorded earthquake in Comrie was in 1788 and thereafter the local church ministers documented strange movements and noises to the end of the 18th century. One local person was of the opinion that the shocks were caused by the explosion of underground natural gas. It was only after the 'Great Earthquake' of 1839 that local people started to keep accurate records. In

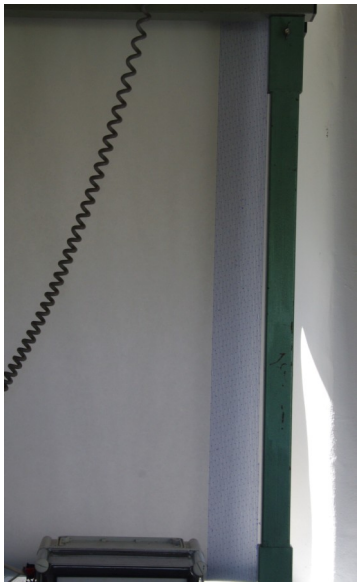
Seismograph in Earthquake House

1840, a number of the townsfolk got together and, in 1841, they constructed a simple detector in a shop in Dunira Street. In 1869, a simple seismograph was built at The Ross, a small hillock, about ½ a mile from the town followed, in 1874, by the building of



Traces of recent earthquakes

Earthquake House - this simple little building is the oldest seismic station in the world. However, the seismic activity decreased significantly after the house had been built and by the early 20th century, the building was in a poor way and continued to become derelict. In 1988, two centuries after the first recorded shock in Comrie, Earthquake House was rebuilt and modern seismograph equipment installed.



Close-up of seismic trace

Earthquake House is well supplied with notice boards that show records of recent local and worldwide earthquake traces, the most significant at the time of visiting being the magnitude 8.9 earthquake that devastated Japan on 11th March 2011. Also displayed are the records of the Christchurch, New Zealand, earthquake of 21st February 2011 at magnitude 6.3, south west Pakistan on 18th January 2011 at magnitude 7.2 and the Sumatra earthquake of 26th December 2004, magnitude 9.0 that was responsible for the 'Boxing Day' tsunami. Closer to home, and underlining that the UK, contrary to public perception, is seismically active, there are the records of earthquakes/ tremors which occurred on Islay in the inner Hebrides on 14th January 2011, at Glenuig, Scotland at magnitude 3.5 on 23rd January 2011 and the magnitude 5.2 event that caused damage in the Market Rasen area of Lincolnshire on 27th February 2004. As well as the records of quakes, there is a very clear description of the plate tectonics which cause them and the production of the different waves which the seismograph measures. Through a large window can be seen the seismograph and the traces that it had produced in the latest few days.

Chilled Margin of Permian sandstone

Comrie – an unremarkable small Scottish town with a similarly unremarkable feature which is of great importance in the history of geology and seismology. Like Hutton's Unconformity, this is a missed opportunity to bring the importance of geology to the wider public.

My school days (many years ago!) were notable for an unremarkable record in latin and history. The latin was so unremarkable that I was moved to the art class – seen as a soft option by many pupils but, to me, a liberation from a subject which I could neither comprehend, remember or enjoy. So it was that I moved to a subject where the teacher was passionate about his subject and was an accomplished teacher, and artist in his own right. (Perhaps it was the 'passion' that was lacking in the latin). I remember one lesson where we were drawing flowers and, thinking I had seen the subject correctly, drew a series

Corrie foreshore, Isle of Arran

of almost ruler-straight lines for the stalks. The teacher looked over my shoulder and quietly asked me to look at the stalks again and see if they were really that straight. Of course, I had not drawn what was there so, after a few words of discussion, he said 'Remember, there are no straight lines in nature'.

On the east coast of the Isle of Arran, large outcrops of red Permian aeolian sandstones run for many miles from the unremarkable little village of Corrie at the northern end down to almost the most southerly point of the Isle. With the tide well down, the rocks, boulders and sandy beach were well uncovered. Close to the road a small sandstone jetty had been built out into the sea with a number of large blocks of rock littering the harbour. In past years, Corrie had been an important source of limestone and these unwanted blocks had

Cross-bedded Permian sandstones on Corrie foreshore

been left when the business collapsed. Across the foreshore, the flat expanses of red sandstone were cut by darker, upstanding lines of rock extending in a variety of directions, but, in general, to the south east. Going onto the rocks, it was obvious that these darker, higher rock formations were Tertiary basalt dykes cutting the Permian sandstones and, because the dykes were much harder than the sandstone, were more prominent. It was while looking at the dykes that the little bit of advice from my art teacher came back to me 'Remember, there are no straight lines in nature' – there on that beach, many of the edges of the dykes were absolutely ruler straight, from where they became visible at the back of the foreshore to where they disappeared under the seaweed and the sea, a distance of many yards. The chilled margin of the sandstones were darkened but were as if cut by a knife along a straight edge. Some of the dykes were a few inches wide while one or two were up to 6 feet across. Others displayed gently curving edges but, nevertheless, were still surprisingly consistent in width.

Ruler-straight edge of basalt dyke in Permian sandstone

Large Tertiary basalt dyke

The Isle of Arran is famous for the exposures of volcanic rocks and in particular, the Tertiary basalt dykes that cut the rocks across the island and which originated from the Central Igneous Complex, a feature which dominates the mountainous middle of the island. On this unremarkable foreshore at Corrie, seeing one of the defining features of the north west of Scotland, the Tertiary volcanic dykes, I remembered what I had been told and was amazed that a natural occurrence such as the splitting of solid sandstone by molten lava had produced ruler straight lines. Remarkably, one of the rules of nature had been broken!

Gently curved contact of basalt dyke with Permian sandstones

These three, unremarkable, 'backwaters' of Scotland each tell a story and contribute important details to the history of geology in Scotland and across the world.