

FGS field trip to Aberdeen & the Grampians Sept 2009

Led by Don Milne & Graham Williams

On 31st August, Don Milne gave about 20 of us an overview of the geology of the Aberdeen area and we set out for the Stonehaven coast. We went to Garron Point where the metamorphosed Dalradian grits of Skatie Shore are in fault contact with the Highland Border Complex (serpentinised lava and shale) which extended along to Cowie village. The fault is the Highland Boundary fault (Figure 1, fault runs from top to bottom through notch in middle ground); a major fault separating the hard Precambrian Dalradian Group of the Highlands terrane from the softer, sedimentary Devonian Old Red Sandstone (ORS) of the Midland Valley area.



Fig 1: Highland Boundary Fault separating hard Dalradian rocks (RHS) from softer Old Red Sandstone rocks (LHS).



Fig 2: Conglomerates overlying lavas in Old Red Sandstone beds near Downie Point.

After lunch at Stonehaven, we went to the Tolbooth museum to see fossil exhibits, specifically *Pneumodesmus newmani*, a centimetre long fragment of a millipede arthropod found in Cowie sandstone, dated at 428Ma (Late Silurian). We then went to the coast between Downie Point and Castle Haven to view conglomerates interbedded with lavas (Figure 2). In places, the ORS conglomerate clasts are thought to include pebbles of Dalradian rocks.

Next day we had a longer drive up to Elgin, to Tynet Burn to see the Middle ORS fish bed localities east of Focharber (Figure 3). We had lunch in Elgin and saw ostriches in a field on the way (maybe too much Talisker?). We visited Elgin museum which had a wonderful display of Permian and Triassic reptilian fossils, e.g. *Stagonolepis robertsoni* and *Saltopus elginensis* (Britain's oldest dinosaur, but a drawing and model here as the only example is in the Natural History Museum) and fossil footprints. We then drove to the Permo-Triassic Hopeman aeolian beds (Figure 4) and the Stotfield chert.



Fig 3: Typical outcrop of Old Red Sandstone

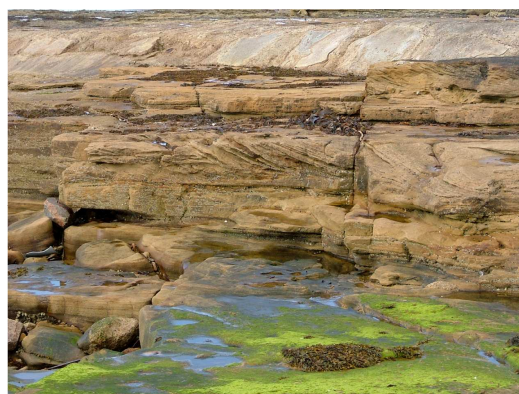


Fig 4: Hopeman aeolian beds of Permo-Trias age

On 2nd September, we drove to St Cyrus, where we saw lavas with a variety of textures interbedded with conglomerates of the Lower ORS (Crawton Volcanic Group) - the interbedded lava flows (basalts and andesites) are shown in Figure 5 and the last flow (Figure 6) showed white amygdales and vesicles (bottom RH corner of photograph), occasionally up to 10cm diameter. This Lower ORS sequence is in fault contact with Upper ORS sediments, which showed cycles of sedimentation – each cycle had conglomerates at its base, these passed up into cross-bedded and parallel-bedded sandstones of alluvial origin and then into red siltstones and marls with calcareous nodules of a fossil soil.

Excellent coastal features were seen including blow-holes and stacks and a small inlet in Fowlsheugh Bird Sanctuary previously used as a harbour. We progressed to Dunnottar castle where Joan and Mike described how the

small garrison held out against Cromwell for eight months to save the Scottish crown jewels (it also has connections with William Wallace and Mary Queen of Scots).



Fig 5: Devonian conglomerates overlying/interbedded with lavas, forming the Lower ORS, Crawton Volcanic Group.



Fig 6: Hammer points to the topmost lava with amygdaloid vesicles usually filled with calcite or quartz in bottom RH corner).

The next day we had a long and memorable drive over Tomintoul to Cromarty, with a short stop at Whisky Castle for souvenirs and at Carrbridge to visit some roches moutonnées before continuing on to the Great Glen Fault locality on Black Island and Hugh Miller's Museum (Hugh was an eminent geologist in the early 1800's as could be seen by the excellent fossils in the museum). Driving along the Cromarty Firth shore, large oil installations, rigs and equipment were visible across the water. We ran out of time and had to return through extremely heavy rain to complete a 300 mile round trip and just in time for dinner, on Sue William's birthday!

On the 4th we stopped at a quarry on the way to Rhynie and found some gabbro, then went on to see the famous Rhynie chert (originally deposited as sinter from hot springs, researched by Aberdeen University and described in detail at <http://www.abdn.ac.uk/rhynie/intro.htm>) in an ORS outlier. Graham produced some thin sections to view with a hand lens. We briefly stopped at the Glenfiddich distillery at Dufftown for a tour.

At Bin Quarry SSSI, Huntly, two members of the party were given permission to retrieve samples of igneous rocks from the quarry face where the exposed thickness is ~100m. The Huntly intrusion is a famous layered mafic and ultramafic igneous intrusion, and at Bin Quarry layering of the cumulate horizons dips steeply SE. The layers (cumulates) are exceptionally well-developed with small-scale (cm) variations from peridotite (pure olivine rock) to troctolite (plagioclase and olivine rock) and olivine-gabbro (plagioclase-augite-olivine). Some layers show grading into adjacent layers. The composition of these three mineral phases varies from one body/locality to another across the area, but the bodies are nonetheless considered to be fragments of a large stratiform intrusion that was disrupted much later by earth movements.

On the last day we stopped at a quarry to view metamorphic rocks then drove around Aberdeen to see the position of the Rubislaw granite quarry in the centre of the city. As most of the building stone used to build Aberdeen had been extracted here it was a huge flooded crater surrounded by a high fence. We then drove around Aberdeen looking at the different building stones. Driving along the coast another very large pit provides granite and metamorphics for road stone etc. We returned to the hotel at the end of another brilliant trip organised by Graham. I departed for Dundee for a couple of days with a boot full of rock!

Ian Hacker

Addendum - *Earth Heritage Magazine, 31, 2008-09: Recent finds of Devonian Fossil fish.*

Several small 19th Century quarries occur in the Den of Balruddery, east of Dundee. The quarrymen discovered remnants of fossil fish, a plant with spore capsules and a huge lobster and these were collected by the landowner and are now housed in the National Museum of Scotland. Quarrying ended in the late 1800's and since then no more fossil material had been collected until a team from Aberdeen University commenced re-examining these quarries in 1999 and 2004. New fish specimens (a zenaspid fish, cephalaspid fish and fin spines of an acanthodian fish) have been found.



Head of cephalaspid fish from Balruddery

volcanic eruptions generated ash layers and volcanic clasts are common in the sediments, indicating that sporadic violent volcanic activity affected this system.

The Balruddery Den is described as a river-fed lake within a semi-arid desert environment, which existed during the Lower Devonian, around 410Ma. This Lake Forfar stretched for 32 miles from Dundee to Montrose and was under the ever-present threat from active volcanoes. The lake formed suddenly (probably when a river was dammed by a lava flow or by tectonic movements associated with the volcanism). Few plants had evolved and the only land animals were arthropods. Predatory fish coexisted with crustaceans living in the rivers and lakes and varied in size from tiny to true giants. Successive

Barry Eade