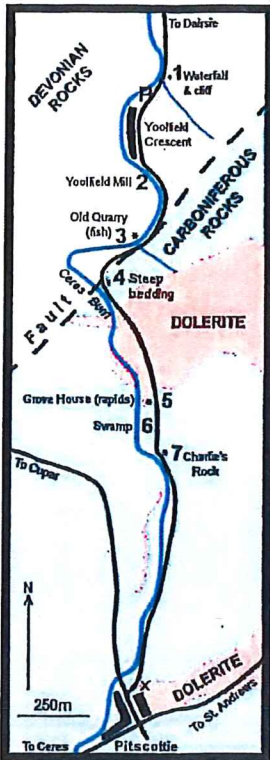


Locality Map



Geological Information © British Geological Survey

Locality marked by * and/or number.

SAFETY INFORMATION: While most of this trail uses footpaths, some sections require walking on, or crossing, a public road and road verges. **BE VIGILANT FOR TRAFFIC.** Wear a high-visibility vest. Waterproof clothing and stout footwear are recommended. **DO NOT HAMMER OR REMOVE ROCKS.**

geoHeritage Fife

was set up in 2000 to:

- * publicise Fife's geological heritage
- * provide educational resources in geology
- * promote geotourism

If you would like to assist with these aims, consider joining the group by contacting:
geoHeritage Fife
01334 828623

Scottish Charity No. SC 032509

Fife RIGS

RIGS are Regionally Important Geological (and Geomorphological) Sites.

The scheme was devised to encourage local involvement in the identification, designation and monitoring of sites of local and national educational and scientific importance. Fife RIGS is concerned with notifying Fife Council planning authority about these sites.

Fife RIGS was incorporated into geoHeritage Fife in December 2005.

Mike Browne (Chair, UKRIGS)
0131 667 1000



geoHeritage Fife/RIGS in Dura Den

Dura Den Geological Trail



Explore the local geological and industrial heritage. See rocks formed between 370 and 325 million years ago when Scotland lay near the equator. After the last Ice Age 16000 years ago, the land rose in response to the receding glaciers and rivers cut deep gorges into the rocks. A local flax-spinning industry grew around the fast-flowing river which powered the water mills.



© J. McManus, R. A. Batchelor & M.A.E. Browne 2007

Locality 1

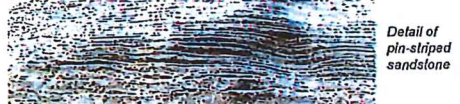
Cars and minibuses can be parked in the public car park opposite Kemback Church Hall [NO 416151]. From the car park, turn left and cross the road to the golden sandstone cliff just left of the waterfall.



Here sandstones of Upper Devonian age (370 million years old) display a feature known as cross-bedding (centre of photo, left), in which some sandstone layers lie at an angle relative to the horizontal layers above (highlighted by black lines).

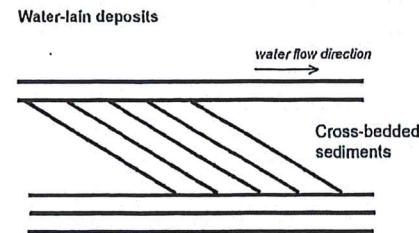
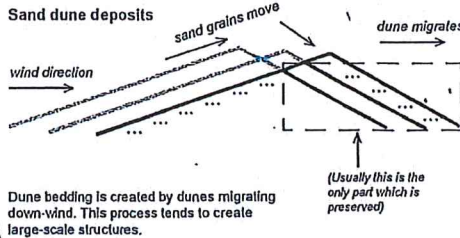
The coin rests on rippled sands which contain some layers of mud, and are interpreted as tidal flats. The horizontal black line marked * points to a line of oval shapes which represent a cross-section through sand ripples.

Large scale cross-bedding can be seen in the top half of the cliff (above the stone seat) and represents sand dunes. The thin layers (or pin-stripes) are typical of wind-blown sand deposits.



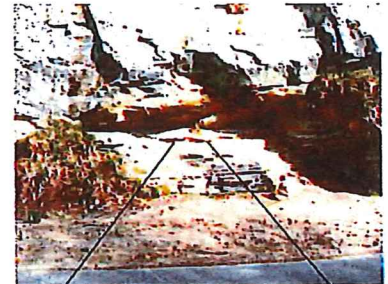
Detail of pin-striped sandstone

The change from tidal flats below to sand dunes above suggests that the local climate at that time was becoming more arid or that coastal dunes encroached into an estuary.



Water-lain cross-bedding tends to form smaller scale structures.

<Walk about 20m north (to the left) of the first cliff and look closely at the rock exposed in the next cliff.>



View of cliff to north



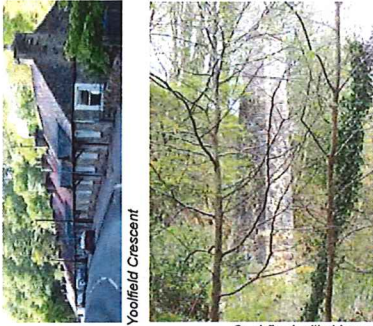
Contorted bedding in sandstone

The layers in the rocks here are contorted and show evidence of having slumped after deposition. This could have been caused by (a) rising groundwater during floods, (b) the weight of overlying sediments squeezing out water in the underlying sands, or (c) by the effect of an earthquake, which would have shaken the water out of the sands.

<Walk southwards past the car park and towards the row of cottages.>

Locality 2

<Walk south past the row of terraced cottages called Yoolfield Crescent, a bridge and a detached cottage.>



Coal-fired mill chimney

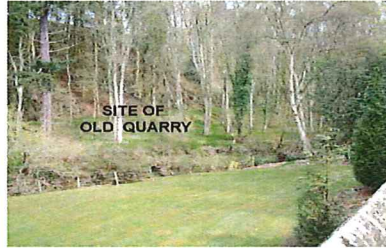
The Yool family built Yoolfield and Pitscottie Mills as a flax-spinning enterprise between 1827 and 1839, harnessing the power of the river in the gorge. Water was diverted into a mill-lade to drive a waterwheel which measured 39 feet (12m) in diameter and 10 feet (3m) in width.

The mill worked until about 1926 and over 200 people were employed in the valley, many of them accommodated in nearby Yoolfield Crescent, the row of terraced cottages in the valley. The valley had its own gas supply, school and shop. The spun flax supplied the linen industry of Ceres, much of North Fife and also Dundee. Ceres was a big centre of weaving in the 19th century with 700-900 people employed in the industry. The emergence of the jute industry in Dundee eventually killed off the local flax-spinning industry.

Stone from the mill was salvaged by the University of St. Andrews for an extension to College Gate, its administrative buildings on North Street. The chimney illustrated above was part of a late coal-fired mill.

Locality 3

<Walk along the road, past a "bend" road sign, where the river diverges from the road, then on for 60 paces to a metal picket gate. Look across the lawns to the far river bank.>



Across the river is the site of an old quarry cut into Upper Devonian sandstones. In 1836, well-preserved fossil fish were discovered here by the local quarrymen, who informed the naturalist Rev. John Anderson. He published a book about the fish in 1859. The fish probably died in small pools which dried up some 370 million years ago. The quarry became unsafe and was filled in 1910.



A cluster of fossil fish "Holoptychius" found in Dura Den in the 19th century. Each fish measures about 30cm (1 foot).

The genus "Holoptychius" was on the ascendancy at this time. This lineage was destined to evolve into the first land vertebrates and hence the indirect ancestors of mammals and eventually humans. Example of these fossils can be seen at the Bell-Pettigrew Museum, University of St. Andrews.

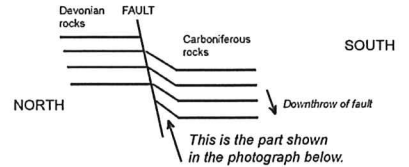
<Walk southwards along the road to just past the white bungalow on the corner.>

Locality 4

<About 30 paces south of the end of the white bungalow at the sharp bend in the road, stop at the first wooden fence post and look across the road.> DO NOT LOITER ON THE BLIND BEND OF THE ROAD.

The rocks here are poorly exposed but on the east side of the road, rocks of Carboniferous age (325 million years old) have been brought against the older Upper Devonian rocks (370 million years old) by the action of a fault, or fracture, in the Earth's crust.

The result of the movement has dragged the younger rocks down, tilting them southwards due to the drag effect of the fault. The rocks on the southern side of the fault have dropped down by about 300 metres.



Professor John McManus points out the inclined strata.

Locality 5

<The best place to view the rapids during the winter months is from the roadside just before the entrance to "The Mill Lade" and "The Old Mill" houses.>



<In summer, the rapids may be viewed downstream from the end of the weir bridge just past Grove House. DO NOT CROSS THE WEIR BRIDGE - IT IS IN A POOR STATE OF REPAIR>

DOLERITE is an igneous rock which, in a molten state, squeezed into the layers of sedimentary rocks. Because it is more resistant to erosion than the surrounding sedimentary rocks, it has formed a ridge in the river which gives rise to the rapids.

<It is not easy to get close to the dolerite outcrop here but this stone can be seen at a good outcrop (photo on right) in Pitscottie village, on the left hand side of the road, in a small recess from the pavement, (marked 'x' before the road T-junction (about 30m on the map).



Access courtesy of Mr & Mrs Auchterlonie

Farther along the road, you can see where water-generated electricity was produced. Between "The Coach House" and "Grove House" an iron pipe can be seen entering the old turbine house, which supplied electricity to "Grove House". The inlet can be seen just beyond the weir.



Iron pipe which fed water to a turbine inside the stone hut.

Locality 6



The weir served to divert water to generators at the big house, and to Blebo Mills downstream. The interruption of the river flow by the weir has resulted in the creation of a boggy area, now colonised by water-loving plants such as willow trees, yellow iris (flag) and horsetails.

<Continue south past Grove House for about 300 metres to the end of the pavement. Here pale grey cliffs occur on the left side of the road.> PROCEED ALONG THE GRASSY BANK. BEWARE OF TRAFFIC.

Locality 7



DO NOT CROSS THE ROAD. VIEW THE CLIFF FROM THE RIVER-SIDE BANK.

This cliff is made of Lower Carboniferous sandstone. The sands were laid down in migrating river channels; a cross-section of one can be seen in the middle of the cliff as a saucer-shaped dislocation in the rock (marked by the curved black line).

Below this line in the cliff face you will see rounded nodules set in the sandstone. The nodules possibly originated as an iron sulphide mineral called MARCASITE, but which has since altered to LIMONITE - a form of rust. Concentric layers in the nodules suggest that the spheres formed by chemical activity around some organic fragments, now long since lost.



<Retrace your steps back to the car park>