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## ELC\_2: Burn Hope ('Fairy Glen')

### Site information

**Location and Summary Description:** The site is situated 9 km south-east of Dunbar, within an upland area comprising the north-eastern margin of the Lammermuir Hills, 4 km west of the small hamlet of Oldhamstocks. Burn Hope lies immediately to the west of the Aikengall Windfarm. The site itself is a ~450 m long section along a narrow stream gorge, centred around 'Fairy Castle' and is known locally as 'Fairy Glen'. Low cliffs along this scenic gorge expose conglomerates and sandstones of the Lower Devonian Great Conglomerate Formation.

#### National Grid reference:

Mid-point: [NT 70105 69941]

West end: [NT 69824 69951]

East end: [NT 70284 69947]

**Site type:** Natural Section; Natural Exposure; Natural Landform

**Site ownership:** Not known

**Current use:** Open Country

**Field surveyors:** Hugh Barron and Rachael Ellen

**Current geological designations:** None

**Date visited:** 25th September 2014

**Other designations:** Lammermuir Deans Biological SSSI; part of East Lammermuir Deans Nature Reserve, within Lammerlaw AGLV, Innerwick Ancient Woodland Site

### Site map

(Figure 7) Burn Hope ('Fairy Glen') Location Map. The exact area of bedrock exposure is likely to vary over time due to erosion and changes in vegetation. The landform area covers the glacial meltwater channel along which the bedrock at the site is exposed, and is therefore included within the Site Boundary. Northern parts of the site have been designated geologically significant as they provide good viewpoints across the site from the rim of the gully.

### Site description

#### Background and site area

The site borders that of the Aikengall Community Windfarm, which lies immediately to the west. An extension to this wind farm was granted in 2013, and at the time of site visit, construction warnings were in place along the access road, which may affect access to the site in the short term. The site comprises a naturally formed glacial meltwater channel.

#### Sedimentary rocks

A 20 m section through the Great Conglomerate Formation (Lower Devonian in age) is excellently exposed at the site, particularly on the south-facing cliffs. The cliffs are composed mostly of loosely bedded red-brown conglomerates and subordinate sandstones formed from sediment deposited by high energy streams in a series of alluvial fans at the margin

of a mountain range (ELC\_2\_P1). The conglomerate beds are up to 4 m thick, containing cobble to boulder grade (<45 cm in size) clasts of volcanic rock, quartzite and greywacke (ELC\_2\_P2). The cobble grade clasts (<64 mm) are typically sub-rounded, elongate and flat, and display a weak to well-developed imbrication in parts of the section indicating that they were deposited by rivers flowing to the east-south-east (ELC\_2\_P3). The conglomerate is interbedded with thin red sandstones and green, thinly laminated silty sandstones up to 5 cm thick, with rare desiccation cracks indicating periodic drying out of the wet sediment occurred during deposition.

### **Volcanic rocks**

A 50 cm wide basalt dyke (the so-called 'Fairy Castle') with sparse vesicles is exposed at the site (ELC\_2\_P4), cropping out as a conspicuous rock wall in the east of the site. The dyke has baked and hardened the adjacent conglomerate (ELC\_2\_P5).

### **Quaternary deposits and landforms**

There are good examples of small talus fans forming from natural erosion of the conglomerate cliffs (ELC\_2\_P6). The small fans are comparable in morphology to the much larger fans from which the Great Conglomerate originated. Imbricated river gravels in the bed of Burn Hope also provide a modern analogue for the development of flow-alignment in fluvial sediments that may be compared with the imbrication of clasts in the Great Conglomerate. Natural erosion by glacial meltwater has formed a deep gorge cutting the sequence. Post-glacial weathering of the partially carbonate-cemented conglomerate has resulted in a 'badlands' landscape, featuring boulder capped residual pillars and picturesque isolated rock stacks. The scenic nature of these pillars and stacks has historically earned the exposure the name of 'Fairy Glen' and 'Fairy Castle' (ELC\_2\_P7).

### **Access and additional information**

The site is accessed by a minor road and a short stretch of rough gravelled track. Car parking (is available off-road adjacent to the Aikengall Windfarm substation. Burn Hope is accessed south of the car park, via a small bridge, leading onto a path over open moorland. The descent into the valley of Burn Hope is steep and may be difficult when wet; care should be taken when accessing the site. Although the cliffs are not high, active erosion is ongoing with small clasts falling out of the conglomerate on a regular basis, forming small talus cones at the base of the cliffs. The basalt dyke is accessed by crossing a fence with wooden slats at the confluence of Bladdering Cleugh with Burn Hope.

## **Stratigraphy and rock types**

**Age:** Early Devonian

**Group:** Reston Group

**Formation:** Great Conglomerate Formation

**Rock type:** Conglomerate and subordinate sandstone, interbedded

**Age:** Carboniferous to Early Permian

**Rock type:** Basalt

Suite: Midland Valley Carboniferous to Early Permian Alkaline Basic Dyke Suite

### **Assessment of site: access and safety**

**Road access and parking** Road access past Thurston Mains to Wester Aikengall, then along to the Aikengall Windfarm substation. Cars can be parked off-road here, leaving access to the substation clear.

**Safety of access** A small path leads from the parking area across a small bridge, through moorland to a laddered stile crossing a fence. This leads to a view point over Burn Hope, the base of which can be accessed with care down some steep but naturally stepped ground. Care should be taken on surfaces with loose material. Stout footwear is recommended. The site can get very windy and therefore care should be taken whilst walking along the top of the cliffs to access the floor of the gorge.

**Safety of exposure** The low cliffs are continually eroding, particularly in high winds and rain, and so care should be exercised at the base of the cliffs.

**Access** Access by footpath and open country. The extension of the Aikengall Windfarm may impose temporary restrictions on road and pedestrian access.

**Current condition** The rocks are well exposed.

**Current conflicting activities** Extension of Aikengall Windfarm may impose on road access in the short term.

**Restricting conditions** Activities related to Aikengall Windfarm may impose restrictions on access.

**Nature of exposure** Gorge cut by fluvial and glaciofluvial processes, with natural cliff exposures.

## Assessment of site: culture, heritage & economic value

**Historic, archaeological & literary associations** No known association

**Aesthetic landscape** Picturesque, peaceful stream gorge in upland region of Lammermuir Hills.

**History of earth sciences** No known association

**Economic geology** No known association

## Assessment of site: geoscientific merit

	Rarity	Quality	Literature/collections	Primary interest
<b>Lithostratigraphy</b>	Regional	Good	Browne et al., 2002; Davies et al., 1986; Stone et al., 2012	X
<b>Sedimentology</b>	Local	Good	Browne et al., 2002; Davies et al., 1986; Stone et al., 2012	
<b>Igneous/mineral/metamorphic geology</b>	Local	Moderately good		
<b>Structural geology</b>				
<b>Palaeontology</b>				
<b>Geomorphology</b>	National	Excellent		X

## Site geoscientific value

The site comprises a sequence of conglomerates and subordinate sandstones, allowing interpretation of the depositional environment during the Lower Devonian. Whilst numerous outcrops of Lower Devonian conglomerates exist across Scotland, few belong to the Great Conglomerate Formation. The rocks are also unusually weathered to a 'badlands' topography, a weathering phenomenon relatively rare in the UK.

Burn Hope provides an excellent example of 'badlands' geomorphology with national significance. It also provides a good example of Lower Devonian fluvial sedimentology with regional stratigraphic significance.

## **Assessment of site: current site usage**

**Community** Due to its relative remoteness and hidden nature, the site is likely rarely visited by the public, although it forms part of the East Lammermuir Deans Nature Reserve.

**Education** The site presents the best natural exposure of the Great Conglomerate Formation in East Lothian. This site may be a good locality for educational fieldwork relating to the Lower Devonian in Scotland. A leaflet with a map of a geo-trail detailing the geology and geomorphology would complement the Nature Reserve well. An on-site interpretation board overlooking the site from the viewpoint beyond the stile may also be appropriate.

## **Assessment of site: fragility and potential use of the site**

**Fragility** Geohazard, weathering/erosion, natural overgrowth.

**Potential use** Research, higher/further education, school education, on-site interpretation

## **Geodiversity summary**

The site comprises good exposures of Devonian sedimentary rocks in a unique geomorphological setting. The site area is accessible, but its rural location means that it is likely to appeal to local interest and educational groups. The geodiversity value of the site may be enhanced by the provision of additional information on the geology on site or on-line that is suitable for teaching purposes.

## **Site photos**

(ELC\_2\_P1) Loosely bedded, massive, slightly imbricated conglomerate beds dominate the 10 m high cliffs of the Burn Hope site. Clast sizes vary across the site – in this photo, clasts up to 45 cm are found, whereas to the east of the site smaller clasts are seen. The different sizes of clasts is indicative of differing energies in the fluvial-terrestrial environment that supplied this sediment, where large rivers and alluvial fans drained broadly towards the south-west during Lower Devonian times. Photo looking north west © BGS, NERC.

(ELC\_2\_P2) Detail of the matrix-supported nature of the conglomerate. Note most of the smaller clasts are flat and elongate. The reddened nature of the rocks is indicative of deposition in a semi-arid environment. © BGS, NERC.

(ELC\_2\_P3) Imbrication of clasts within the conglomerate can be seen just below the camera case, orientated top left to bottom right with respect to the photo. The imbrication here is truncated by a thin (5 cm) layer of green silty sandstone. © BGS, NERC.

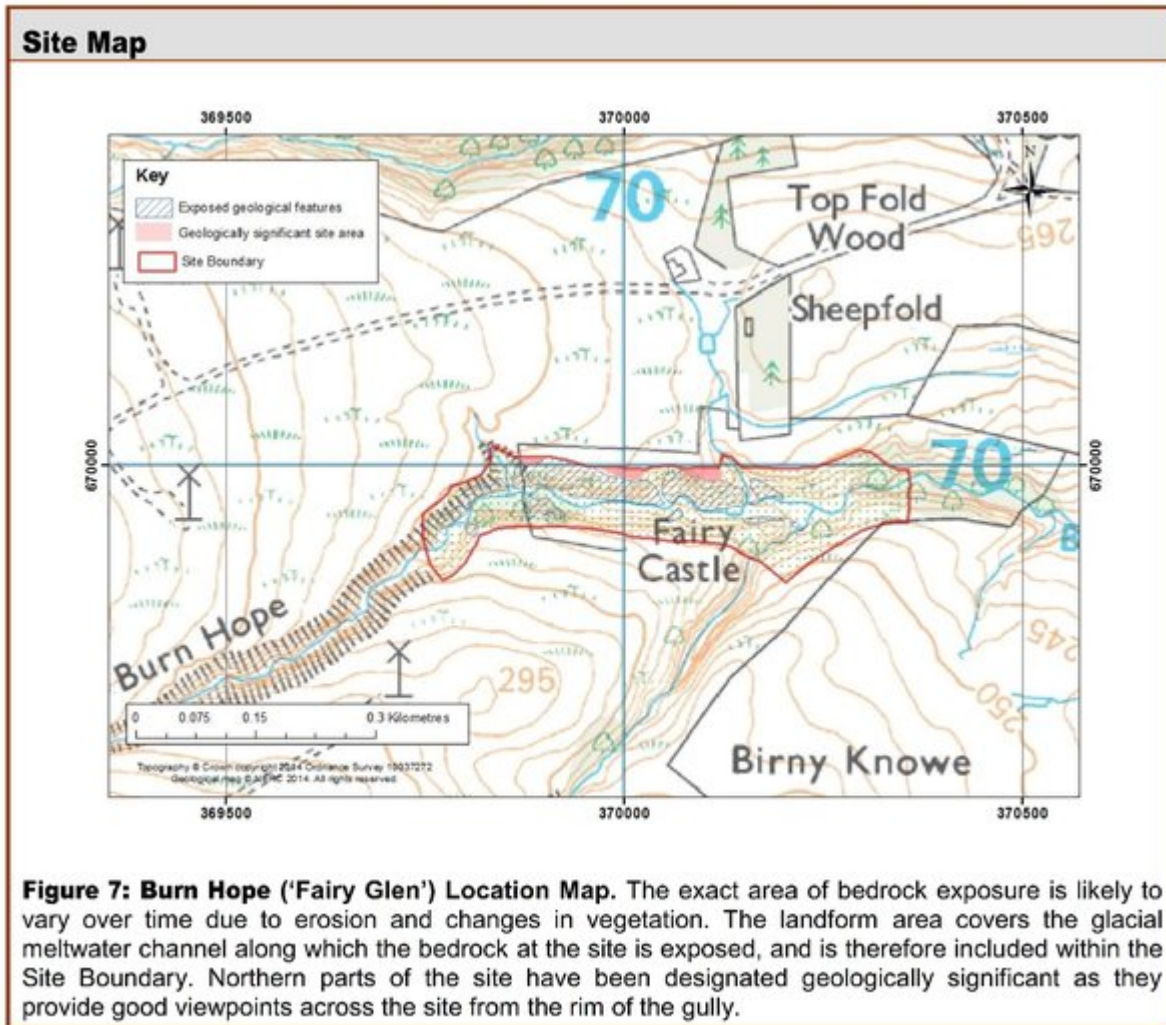
(ELC\_2\_P4) The basalt dyke cutting the sequence at Burn Hope contains small vesicles and a set of fractures parallel to the edge of the dyke. © BGS, NERC.

(ELC\_2\_P5) The dyke forms a proud standing rock wall ('Fairy Castle') at the southern end of the eastern margin of the site. The camera case here rests on the dyke itself, and the higher rock to the left of the dyke is the hardened, baked conglomerate. Photo looking north. © BGS, NERC.

(ELC\_2\_P6) Talus fans are commonly found forming at the base of these 20 m high cliffs, and are actively, but slowly, growing. The talus fans mimick, albeit on a much smaller scale, the processes that would have formed the Great Conglomerate during the Lower Devonian, i.e. erosion of mountains and deposition in alluvial fans. Photo looking north, cliff height around 20 m. © BGS, NERC.

(ELC\_2\_P7) The gorge was formed by fluvial processes, which as well as leaving spectacular rock cliffs, has also left conspicuous rock spires. These erosional features are conical columns usually capped by a boulder (conglomerate clast) that shields the underlying softer rock from erosion. © BGS, NERC.

## References



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*(ELC\_2\_P4) The basalt dyke cutting the sequence at Burn Hope contains small vesicles and a set of fractures parallel to the edge of the dyke. © BGS, NERC.*



*(ELC\_2\_P5) The dyke forms a proud standing rock wall ('Fairy Castle') at the southern end of the eastern margin of the site. The camera case here rests on the dyke itself, and the higher rock to the left of the dyke is the hardened, baked*



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