## SRUC Oatridge Farm and Campus

Oatridge is part of the specialist landbased college Scotland's Rural College (SRUC) offering a wide range of courses including agriculture, animal care, engineering, environment and conservation, equine studies, horticulture, and landscaping. At its centre is Oatridge Farm, which includes commercially run beef, sheep, pig and arable enterprises. The farm is used for practical tuition, and as a resource for the provision of real time physical, financial and technical data.

Oatridge Farm extends to 289 hectares. Originally comprising three steadings, Oatridge, East Broadlaw and Hanging Side, all activities are now centred on Oatridge.

### *Landscape*

The majority of the farm lies at a height of between 135 and 180 metres above sea level, whilst Binny Craig, an igneous outcrop almost central to the farm, rises to 219 metres.

The soils within the college boundaries are complex and varied, deriving from a series of exposed soft Carboniferous mudstones and sandstones, giving rise to sandy clay loams, which have impermeable subsoils requiring artificial drainage. Rainfall averages 940 mm (37 ins) per annum and the growing temperature of 6°C is not generally reached until late April.

As described elsewhere in the leaflet, the landforms seen within the LGS and the surrounding area have been shaped largely by glaciation, with crag-and-tail forms dominating the landscape, with an obvious west to east grain to the land. The hilly terrain reflects the underlying geology of mixed hard (igneous) and soft (sedimentary) rock types.

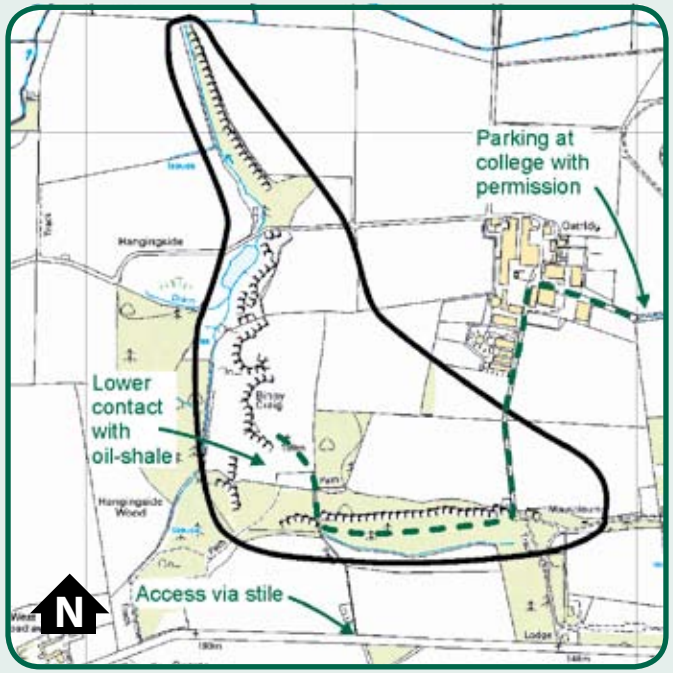
### *What is a LGS?*

A LGS is a Local Geodiversity Site. It is a landscape, landform or rock feature identified by the local goeconservation group as having particular value for education and tourism; for academic research; for the history of science; or for its aesthetic appearance. With the permission of the landowner, LGS are identified to the local council.

*What are its planning implications?* There are no statutory restrictions on the site but when planning proposals are considered the councils will be aware of the value of the LGS.

Contact: ***Lothian and Borders Geoconservation Group***
***www.edinburghgeolsoc.org***
email: ***lbgeoconservation@edinburghgeolsoc.org***

## Location and access




Public access to Binny Craig is by a footpath from the minor road near East Broadwood [NT 043 731].

With prior permission, access may also be gained via SRUC Oatridge Campus (Ecclesmachan, EH52 6HN; tel 01506 864800) where parking is normally available in the evening and at weekends [NT 045 736].

The site is precipitous in parts and slippery underfoot. Please take care, especially whilst walking on rocks or steep slopes. Help us to protect this interesting site by staying on the footpaths, where they are provided, and ensure that the vegetation and geological exposures are not damaged.

Thank you.

***Spring 2017***

*Lothian and Borders GeoConservation*
*A committee of the Edinburgh Geological Society, a charity registered in Scotland No SC008011.*
*It is a member of the Scottish Geodiversity Forum and GeoConservation UK.*

# Binny Craig
## Bathgate Hills

*Geology and wildlife*

**westlothian**.gov.uk West Lothian Council

Binny Craig is a prominent landmark in West Lothian, situated in the grounds of the SRUC Oatridge Campus of Scotland's Rural College (SRUC). It is a spectacular example of a ***'crag-and-tail'*** landform, a legacy from the last ice age, with its '*crag'* of hard rock facing west, and a sloping *'tail'* of sedimentary rock and fertile farm land to the east. Binny Craig and the surrounding terrain exhibit many features of an ice-sculptured landscape of ***drumlins***, ice-cut channels and glacial spillways. On a clear day a magnificent panorama can been seen from its summit. One can see the full width of Scotland's Midland Valley, from the Southern Upland Lammermuir Hills and Culter Fell in the south-east and south to the Highland hills such as Ben Ledi in the north-west. (Open the leaflet to see details of the panoramic view).

Binny Craig is a stepped sill of ***dolerite*** rock sandwiched between layers of ***Carboniferous sedimentary strata***. When broken, the rock emits a bituminous odour derived from oil-shales in the strata. The dolerite is an unusual form of quartz-dolerite known as the Binny Craig type. The sill dips at 25° to the east and the step forms the striking cliff to the west.

A full description of Binny Craig is given by J.W. Lunn in the *Transactions of the Edinburgh Geological Society for 1926*, pages 74 to 79.

*An explanation of geological terms used (highlighted in **bold** print) is given in the glossary overleaf.*

## Natural history at Binny Craig

SRUC Oatridge Campus estate is made up largely of agricultural land, but also contains woodland areas, ponds, water courses, and a golf course; all of these provide valuable habitats for wildlife. Habitats within Binny Craig Local Geodiversity Site (LGS) include: steep crags, agricultural grassland, old hedgerows and the aptly named *'Crow Wood'* (a mixed, planted woodland, that supports a rookery).

Some of the mammals you might catch sight of within the LGS include badgers (which like to forage in woodlands and grasslands), foxes, brown hares (often seen racing across open fields), stoats and weasels. You might even catch a glimpse of a red squirrel, probably part of a colony re-introduced at Beecraigs Country Park.

Many species of birds can be found on this site, including: kestrels, buzzards, sparrowhawks, merlin and perigrine falcon.

The range of habitats within the site support a variety of plants, including wildflowers such as red campion (found in woodlands, hedge banks and growing in base-rich soils), ragged robin (indicative of wet conditions), few-flowered leek and white varieties of the north American pink purslane and Climbing Corydalis is a plant of interest found in the Binny Craig area. Wood sage is a common British plant found in a range of habitats including dry woods, grasslands, heaths and dunes. It is indicative of former woodland cover where none continues to exist.

Gorse is a common shrub found on the site, with its coconut scented flowers it provides excellent cover for nesting birds and is managed, in places, to provide conservation areas within the estate.

Native species of trees present on the site include; oak, elm, elder, willow, scots pine, blackthorn, hawthorn and rowan. These all provide food and shelter for a wide range of native plants and animals, and help to maintain and improve the biodiversity of the site.

Within Crow Wood, there is a small group of four pines not native to Scotland. They are thought to date back to the opening of Binny House, probably ordered from a tree nursery to stock part of the woodland, and may have come from as far away as Bosnia (represented by the Bosnian Pine).

## Geology of Binny Craig

Binny Craig is formed from an **igneous** sill of **quartz-dolerite** intruded into the once commercially valuable sedimentary rocks of the West Lothian Oil Shale formation. Oil shales are found in strata which also include **marls**, sandstones, mudstones and limestones. They were deposited in the **Carbonifereous**, some 330 million years ago, in shallow lakes, which were occasionally inundated by the sea.

Subsequent earth movements contorted the **strata** into a series of folds, and **faults** cut the strata and displaced blocks of the country rock both vertically and horizontally. The Binny Craig **igneous** rock was probably intruded initially as a near vertical dyke injected into a weakness in the earth's crust that ran along the west side of the hill. Part of the intrusion spread between layers of the **sedimentary strata** to form a **sill**, which now caps the hill. Subsequent uplift and erosion has exposed the sill and its feeder **dyke** step. These features, and good examples of the contact between the **igneous dolerite** and the oil shale **strata**, can be seen at this LGS site.

During the glacial period, ending some 12,000 years ago, glaciers moved from the west through the Midland Valley. The ice scoured and sculpted the landscape by grinding and eroding the softer rocks leaving the more resistant harder rock exposed as prominent high ground. When the glaciers retreated, melt waters formed glacial lakes and cut drainage channels (spillways), which can still be seen today as dry gullies and over-deepened streambeds. Many of these features can be seen at Binny Craig and in the surrounding area. The most notable feature is the dominant ***'crag and tail'*** landform of Binny Craig, Tar Hill to the east, and also West Broadlaw to the south. The ice advancing from the west met the hard resistant rocks that form these outcrops and was forced to rise up over them. The ice gouged out a hollow immediately to the west of Binny Craig, thrust up over Binny Craig to form the steep cliff face, and then smoothed lower gradient tail to the east. The ice exploited lines of weakness (faults) to cut out the five 'notches' or colls along the top of the sill outcrop.

### *Lomond Hills*

Beyond the eastern limb of the Cleish Hills, formed from Carboniferous igneous rocks, the East and West Lomond Hills and the Hill of Beath mark volcanic vents, as does *The Binns*, home of former West Lothian MP, Tam Dalyell. The Shell Mossmorran Petrochemical Plant and the Rosyth Dockyard are two major industrial developments. Beyond SRUC Oatridge Campus lies the oval Tar Hill volcanic vent. The oil-shale bings dominate the middle distance around old mining villages, such as Winchburgh and Broxburn. The famous rail and road bridges span the Forth, where it narrows at Queensferry. To the east, Edinburgh lies on, and is surrounded by, low igneous hills; Corstorphine Hill is a thick dolerite sill. Arthur's Seat and Berwick Law are sites of Carboniferous volcanoes.

### *Pentland Hills*

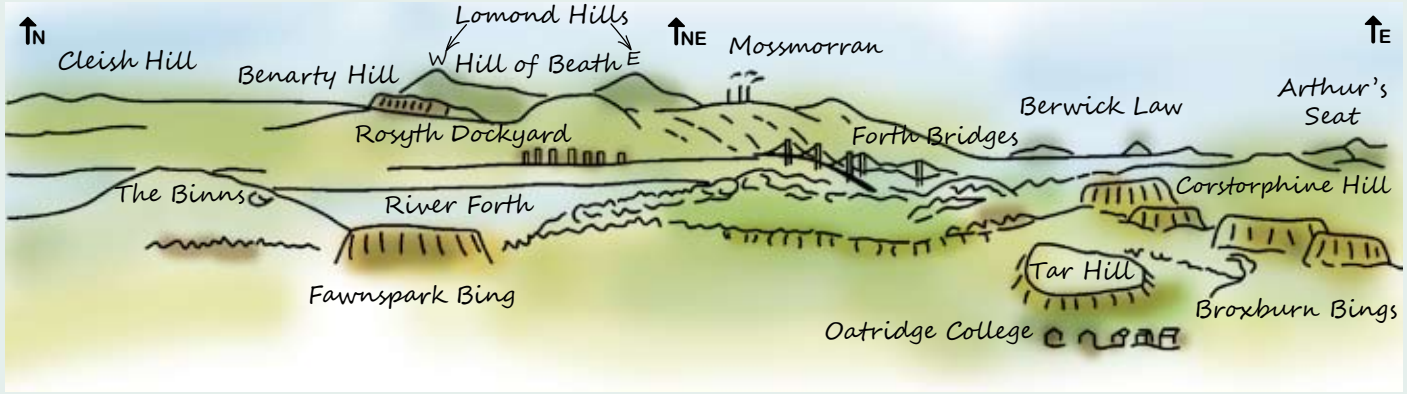
To the east, the Braid Hills are the northern end of the rounded Pentland Hills, which dominate the horizon towards the south-east. The Pentlands are formed from Lower Devonian lavas and tuffs, and intrusive rocks such as the Black Hill microgranite **laccolith**. In the far distance to the south, beyond the Southern Upland Fault, are folded Silurian and Ordovician sandstones and mudstones of the Lammermuir Hills. Dalmahoy Hill and Kaimes Hill lie on the most prominent ridges formed by dolerite sills, quarried nearer Edinburgh. Population centres have moved from mining villages, such as Broxburn and Uphall, to Livingston. The old mining villages in the area are typically marked by prominent oil-shale bings.

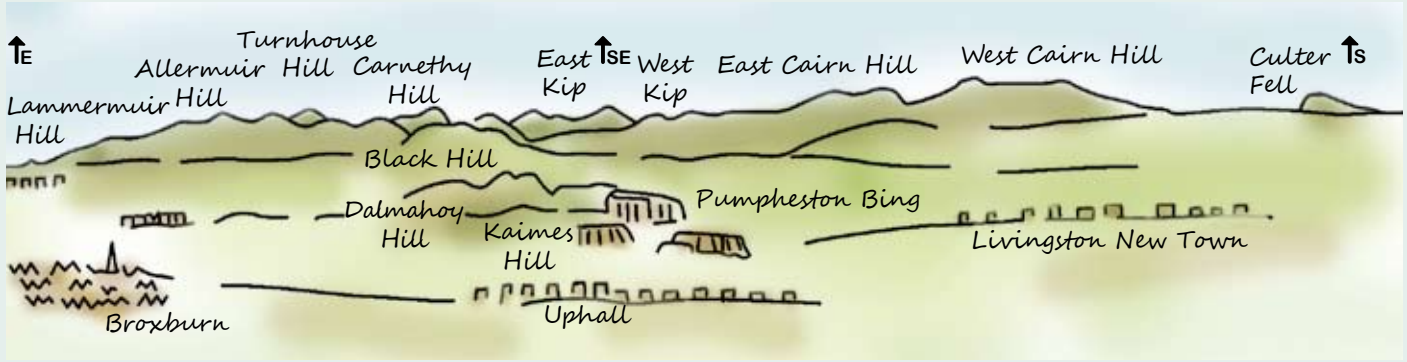
### *Bathgate Hills*

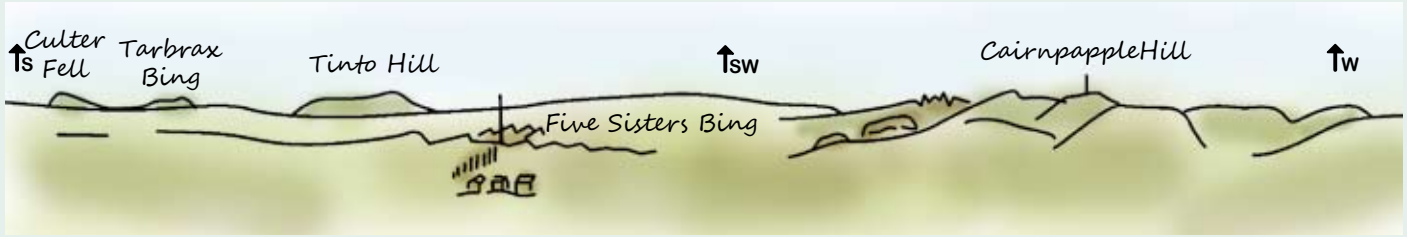
The gentle topography to the south and south-west allows glimpses of Culter Fell, one of the higher of the Southern Upland hills, and Tinto Hill, a large Lower Devonian microgranite intrusion near Lanark. Tarbrax bing is the most southerly of the oil-shale bings. The 'Five Sisters' bing near West Lothian lies in the middle distance.

### *Ochil Hills*

Lower Devonian lavas form the Ochil Hills across the Forth. Dalradian rocks form the Highland 'Bens' beyond. The single chimney marks the coal-fired power station at Longannet, site of Scotland's last deep coal mine, now flooded and closed. The BP Petrochemical Complex at Grangemouth, which processes North Sea Oil, is the natural successor to the Scottish oil-shale industry. The west-to-east flowing glaciation of past ice ages has moulded the landscape in the foreground into drumlinoid ridges and crag-and-tail features.




### *The Midland Valley of Scotland*

Binny Craig, lies near the centre of Scotland's Midland Valley. The Midland Valley is geologically bounded by two of Scotland's great faults: the Highland Boundary Fault from Stonehaven to the Isle of Bute, and the Southern Upland Fault from Dunbar to Ballantrae. To the north-west lie the ancient Highland rocks and to the south-east the younger Silurian and Ordovician rocks. The Midland Valley is filled with Devonian (Old Red Sandstone) and Carboniferous sedimentary and igneous rocks. It is the igneous rocks which form most of the upstanding features; Lower Devonian andesitic lavas in the Pentland Hills and Ochils, Carboniferous basaltic lavas in the Bathgate Hills and Arthur's Seat, and intrusive laccoliths and sills such as Binny Craig itself. Sedimentary rocks are softer, more easily eroded and are covered by glacial deposits, which show a strong west to east grain in the area. The West Lothian Oil-shale field (Lower Carboniferous) occupies the low ground to the east, marked by the massive red bings (spoil heaps) of spent oil-shale, from near the Forth to Tarbrax in the south. Along the length of the valley, from coast-to-coast across Scotland, the mountains of Arran may be seen in the distance to the south-west and Berwick Law to the north-east.

### *Story of the rocks*

Some 330 million years ago, in the Carboniferous Period, the area that now forms West Lothian was a shallow lake. On occasions the area was inundated by the sea. At that time, Scotland lay in the tropics just south of the equator, part of the ancient continent known as Laurasia. In shallow tropical waters, sediments were laid down from algae mats in stagnant pools and decaying vegetation in coal swamps. Rivers poured in sand, silt and mud, and periodically, the sea invaded the stagnant waters and swamps to give clear water in which corals thrived to form limestone reefs, and chalky mud deposits accumulated. In time, these sediments hardened to form layers of mudstone, siltstone, sandstone and limestone - these types of rock can all be found in the strata that outcrop in West Lothian today.

During the Carbonifereous Period volcanoes were very active in the area, and successive lava flows and ash falls built up to form areas of land and islands in shallow lakes. Molten rock was also injected underground as hot magma, which either cut through the layers of strata vertically or was forced horizontally between the layers. The magma cooled to form dykes or sills of hard crystalline rock .

Over the years, continental drift moved that part of the Earth's crust northwards to its present position, and earth movements eventually uplifted the rocks in the Midland Valley to form dry land. Wind, rain and especially ice movement during the ice age weathered and wore down the landscape to its present level to give the land forms we see at the present time. Many of these processes still continue today - see if you can find some examples of these ongoing weathering and erosion processes in the Binny Craig Local Geodiversity Site during your visit.

Countryside of West Lothian leading to Binny Craig

## Glossary

**Andesite:** fine-grained volcanic rock consisting chiefly of plagioclase feldspar, pyroxene and amphibole, and/or biotite mica. It is named after the Andes mountains, and is associated with explosive eruptions.

**Basalt:** dark-coloured, fine-grained basic volcanic rock essentially composed of plagioclase feldspar and pyroxene, with or without olivine. The most abundant lava type.

**Calcareous:** containing calcium carbonate, e.g. chalk, limestone.

**Carboniferous:** the geological period between 360 and 300 million years ago associated with formation of great coal deposits.

**Continental Drift:** the concept that continents have undergone large-scale horizontal movement during periods of geological time.

**Crag-and-tail:** a streamlined ridge or hill resulting from glaciation, consisting of a knob ('the crag') of resistant rock, and an elongated 'tail' of softer bedrock on its lee side.

**Devonian:** the geological period between 410 and 360 million years ago. The Devonian, the 'Old Red Sandstone', had extensive areas of continental and desert conditions, and also widespread regions of marine deposits.

**Dip:** the angle of tilted rock strata. Dip slope refers to the slope of the land surface overlying the tilted strata.

**Dolerite:** medium-grained intrusive igneous rock of basaltic composition, frequently occurring in sills and dykes. A special variety containing quartz is called Quartz-Dolerite.

**Drumlin:** an elongated elliptical hill formed by glaciation under ice sheets. The long axis of the landform usually indicates the direction of ice flow.

**Dyke:** a sheet of intrusive igneous rock that cuts across the strata of the host rock. Dykes are typically vertical or steeply dipping.

**Faults:** fractures in the rocks of the earth along which opposite sides have been moved vertically or horizontally or a combination of both. Often caused by earthquakes.

**Microgranite:** light-coloured, fine-grained, igneous rock composed chiefly of quartz and feldspar

**Igneous:** a rock solidified from molten rock material (magma), which was generated deep within the earth.

**Laccolith:** a dome-like body of intrusive igneous rock. It arches the overlying rocks and has a floor that is more or less flat.

**Lava:** molten rock (magma) that issues from openings at the earth's surface or on the ocean floor, e.g. from craters or along the flanks of volcanoes, or cracks not associated with volcanic cones.

**Magma:** molten rock generated deep within the earth's crust or upper mantle; the source of igneous rocks.

**Marl:** a calcarious clay sedimentary deposit.

**Ordovician:** the geological period of time between 505 and 440 million years ago.

**Quartz:** crystalline silica, often forming hexagonal crystals.

**Quartz-Dolerite:** a variety of dolerite rock that contains quartz as the dominant accessory mineral.

**Pyroclastic:** pertaining to fragmental rock formed by volcanic explosion or aerial ejection from a volcanic vent.

**Sedimentary:** a rock formed by the consolidation of sediment that has settled out of water, ice or air and accumulated on the earth's surface, either on dry land or under water. Sedimentary rock is typically layered or bedded into strata that can vary greatly in thickness.

**Sill:** a sheet of igneous rock intruded between layers of the surrounding rock such that its boundaries are conformable with the adjacent strata in contact with it. The strata at these boundaries are usually baked and hardened by the heat of the injected magma.

**Silurian:** the geological period of time between 440 and 410 million years ago.

**Strata:** a layered arrangement of rock.

**Tuff:** a pyroclastic rock mainly composed of volcanic ash, with fragments less than 2mm in size.

**Volcanic vent:** an opening in the earth's surface through which volcanic materials are extruded.