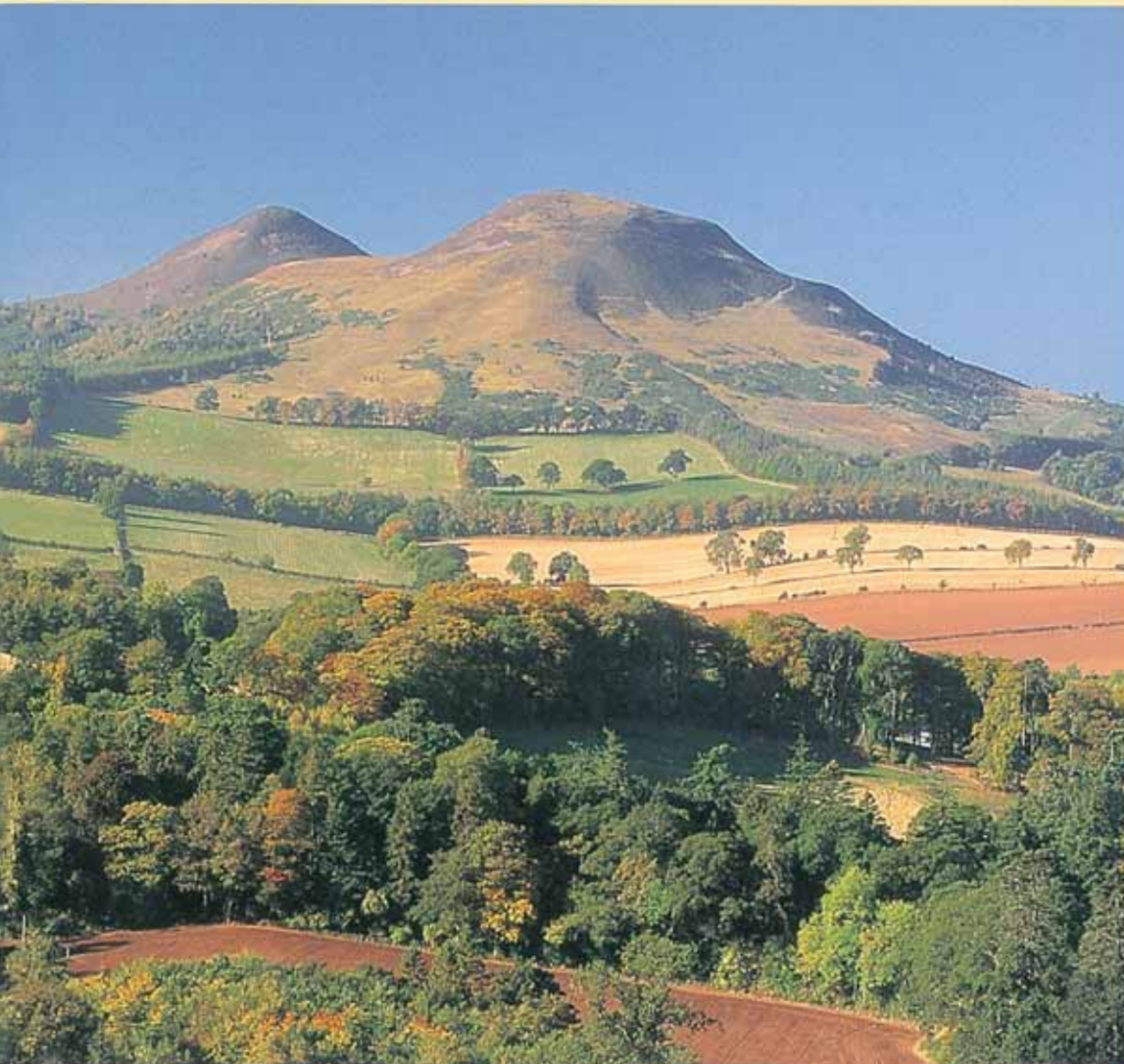


EAST LOTHIAN AND THE BORDERS

A LANDSCAPE FASHIONED BY GEOLOGY

SCOTTISH
NATURAL
HERITAGE



British
Geological
Survey



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North Berwick Law and the offshore islands: Fidra, the Lamb, Craigleith and the Bass Rock. Tantallon Castle can be seen to the far right.

South-east Scotland displays much of the country's scenic variety in one small region. The distinctive volcanic hills rising out of the glaciated East Lothian plain; the spectacular cliffs of the Berwickshire coast; the rounded Lammermuirs, made of rocks from the floor of a long disappeared ocean; the long narrow valleys of the Tweed and its tributaries and the gently rolling lowlands of the Merse to the rugged granite hills of the Cheviot along the English border are all part of that diversity. This booklet explains how this varied landscape was fashioned over 500 million years of geological time.

Volcanoes – worn down to their roots

Some 350 million years ago, East Lothian was a peaceful flat coastal plain, clothed by forests, dotted with lagoons and crossed by meandering rivers flowing into deltas at the edge of a sea to the north-east – much like the American Gulf Coast is today. From time to time, though, this peace and tranquillity was disturbed by the fire and explosion of erupting volcanoes.

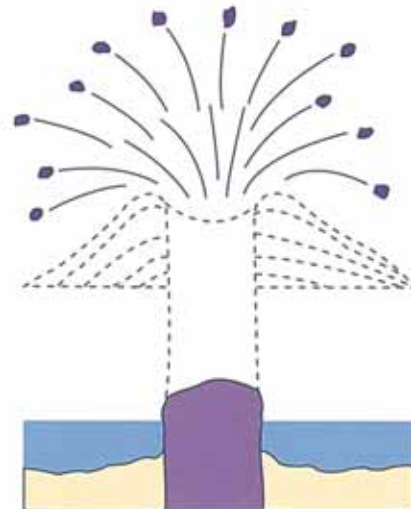
Volcanoes are formed when molten rock (called magma) forces its way from depth up a pipe (vent) to the surface. A volcano can be violent, throwing clouds of steam, ash, rock debris and bombs into the air, or less violent, with the flows of lava gradually building up a cone round about the crater. Some volcanoes erupt only one or two flows before becoming extinct, with the activity moving elsewhere. Other volcanoes produce many eruptions over a long time, building up a cone of lava flows separated by layers of ash. East Lothian must have presented quite a sight as volcanoes erupted near and far; near – at North Berwick Law, the Bass Rock, Tantallon and Dunbar, and far – at Arthur's Seat and the Lomond Hills.

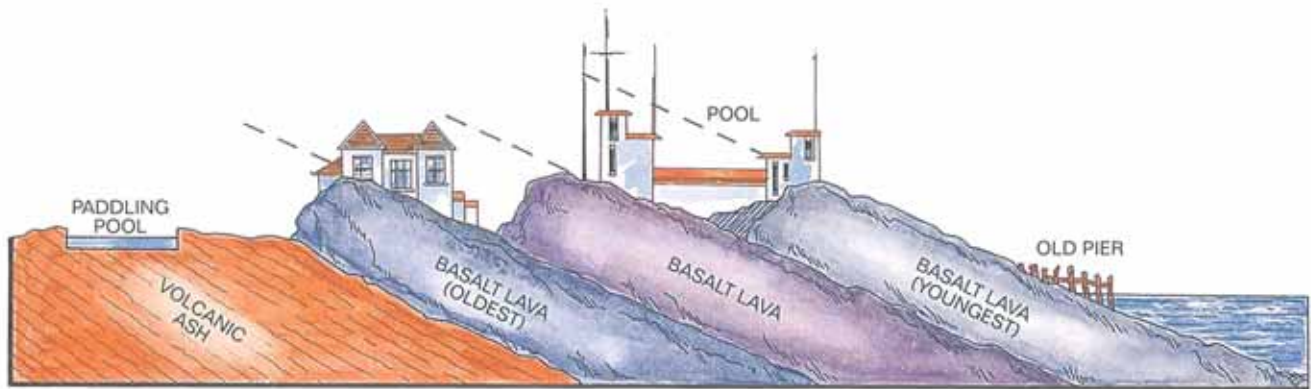


**The Bass Rock – the eroded root of a volcano (above).
Artist's impression (right).**

In the many millennia since the volcanoes were active they have been buried and then uncovered by erosion, so today it is only the remnants and roots of some of the volcanoes that are left. As volcanic rocks are harder and more resistant than the surrounding sedimentary strata, they form the main landscape features of the lowland areas of East Lothian.

North Berwick Law and the Bass Rock are the roots of two old volcanoes. The cones of lavas and ash have worn away, just leaving the columns of hard igneous rock – the last of the molten rock that cooled in the pipe, hence their almost circular shape. The Law has a conical shape, whereas the sea-washed sides of the Bass Rock have remained vertical.





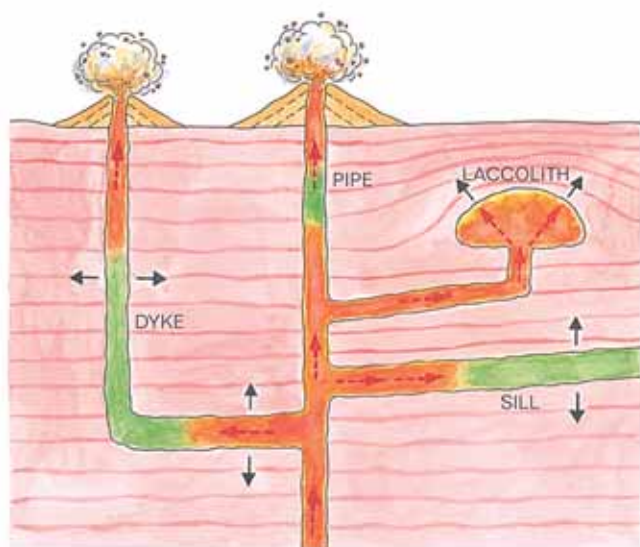
Lavas and ashes that erupted from a volcano can be seen on the foreshore at North Berwick.

Lavas and ashes that erupted from volcanoes such as the Law, can be seen on the foreshore and around the harbour at North Berwick. As the rocks have been tilted to the west by earth movements, different beds are exposed along the shore. The Paddling Pool has been cut in red volcanic ash which settled in water where the layers and the larger ash fragments can be seen. Then three lava flows erupted one after another.

Each flow is about 10m thick, consisting of a dark, structureless lower portion, grading upwards into a honeycomb rock, formed as gas escaped from the erupted lava flow. The lavas are formed of a crystalline rock, called basalt. Lava flows gave rise to the hills from North Berwick on the coast by way of Kingston and the Garleton Hills, Whitekirk Hill and East Linton to Whittingham.

Molten magma forms many shapes

When molten rock or magma forces its way through the Earth's crust, some reaches the surface and erupts from volcanoes as lava flows and ashes, known as extrusions. However, some magma is forced sideways along weaknesses in the strata, and cools down and solidifies before making it to the surface. This is called an intrusion, which is only seen when erosion has removed the overlying rock and uncovered it. Having cooled more slowly than a lava and not being exposed to weathering, intrusive rocks are generally even harder than lavas and so even more likely to form prominent features in the landscape. Because of the many ways in which the molten magma flowed, there are many different shapes of intrusions – some particularly well seen in East Lothian.



Volcanic 'plumbing' under East Lothian.

A dyke in Fairy Glen.

A dyke is a thin (usually only a metre or two) slab of vertical igneous rock. When the surrounding strata were stretched by earth movements, molten rock flowed into the cracks that these upheavals created. The heat of the molten rock baked the strata on either side of the dyke making it harder than normal. Dykes are common throughout the area. A fine example forms the Yellow Man on the North Berwick shore beside the East Links Golf Course. Another dyke cuts a red conglomerate in the Fairy Glen, near Oldhamstocks; the hardest rock here is actually the baked conglomerate, seen to the left of the dyke.



A sill is an intrusion formed where the molten rock forced its way sideways between the layers of strata, wedging them apart. There it solidified, baking the strata with which it came in contact. Because most



Fidra and the Lamb – a sill.

strata have been tilted, the sills are usually seen in cross-section, exposed by erosion. Many such sills can be seen along the shores of East Lothian, as the one which forms the twin points of Fairy Ness and Craigielaw Point, and also at Gullane Point, Hummel Rocks and Black Rocks.

The offshore islands of Fidra and the Lamb are parts of another sill. The strata above have been completely removed; the strata below are underwater.

Visitors may marvel at the spectacular columnar jointing of the Giant's Causeway in Ireland, or Fingal's Cave on Staffa, but many fine examples of this geological phenomenon can be seen in East Lothian. When molten rock cools slowly and solidifies, it shrinks and cracks. Normally the cracks are at right angles, but in ideal conditions, nature creates hexagonal columns.

You need go no further than Dunbar harbour to see a fine set of columns. Others can be seen on the shore between Yellowcraigs and Gullane opposite the tidal

**Lava columns
at Dunbar.**



slet of Eyebroughy. The island of the Lamb is entirely made of basalt columns, as is much of nearby Fidra.

Traprain Law is an unusual intrusion called a laccolith. Some magma is very thick, so it can only force its way a short distance sideways into a mushroom shape, arching up the strata above before solidifying.



Traprain Law – a laccolith.

Erosion of these softer sedimentary strata has laid bare the original shape of the intrusion we see today as Traprain Law. Joints in the quarry confirm that this is very much the original shape of the intrusion. Here also you can see flow structures in the magma, frozen into the rock, on the east side of the quarry.

The Borders had volcanoes too

At much the same time as all the volcanic action was taking place in East Lothian, volcanoes were erupting not far away to the south, around the Merse. Their remains still form many of the more prominent hills in the eastern Borders.

The lavas only form low hills around Kelso, but the many old volcanic necks and the intrusions can still be seen throughout the landscape.

Chief among these are the Eildon Hills (the Roman's *Trimontium*). These were a complex volcano, a bit like Arthur's Seat in Edinburgh, and nature has opened it up for us to see today. Each hill or knoll is hard igneous



Eildon Hills,

rock, mostly sills where the molten rock solidified underground, and agglomerate where the volcano tossed ash and blocks of lava into the air only for them to fall back into the crater.

Other notable hills on the site of volcanoes include Dunion Hill, Black Law and Peniel Heugh around Jedburgh; Rubers Law and Bonchester Hill towards Hawick; Bemersyde and nearby Black, Redpath (presently being quarried) and Brotherstone Hills; Sandy Knowes (on which Smailholm Tower stands) and various other prominent hills towards Hume, Westruther, Greenlaw and Duns. Spectacular, too, are the twin peaks of the Durrington Laws.

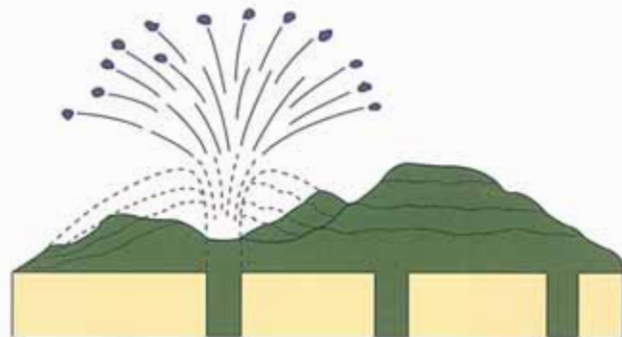


Diagram showing Eildon Hills volcano complex, drawn to give the same 'view' as the accompanying photograph.

Even older volcanoes – Cheviot and St Abb's



St Abb's Head.

These were not the first volcanoes in the region. Some 50 million years earlier volcanoes were active around St Abb's Head, and the lavas, ash and agglomerate from these form the spectacular cliffs around the lighthouse and nature reserve.

Further south a massive pile of lavas erupted along the border and now form the Cheviot Hills, including White Law, The Schill, Auchope Cairn and King's Seat. The Cheviot itself is actually part of a large granite mass that pushed up into the lavas; the granite hills can be recognised by the torr scenery. A mainly concealed granite under the Lammermuirs reaches the surface near the 'Whiteadder' Reservoir and at Cockburn Law.

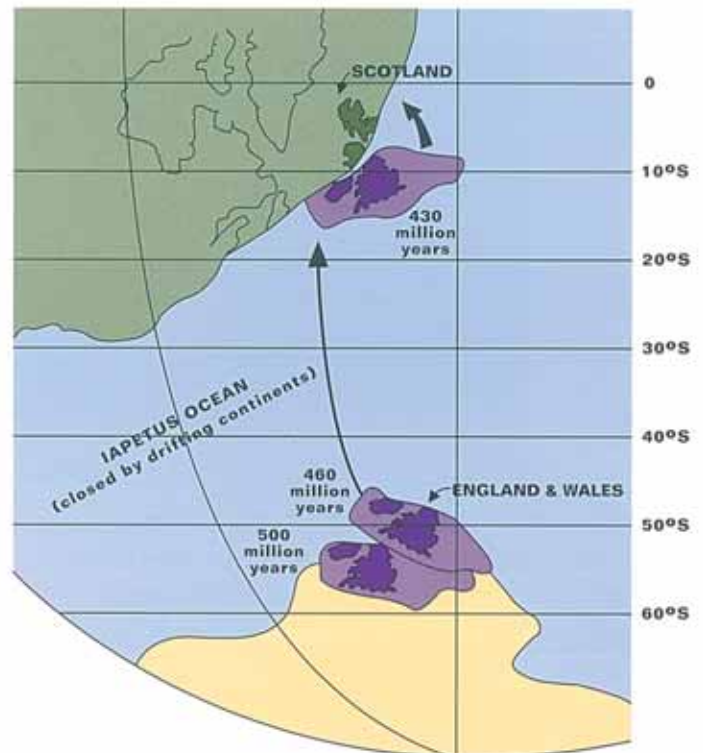
The Southern Uplands – mountains form when continents collide

The origins of the rocks that make up the range of rounded hills now known as the Southern Uplands go back in time to nearly 500 million years ago. Then the world was a very different place. Layers of sediment were accumulating in a deep ocean (known as Iapetus) which spanned the southern hemisphere. To its north lay a continent that was eventually to fragment into North America, Greenland and Scotland; to its south was another that was to form England, Wales, western Europe and Africa.

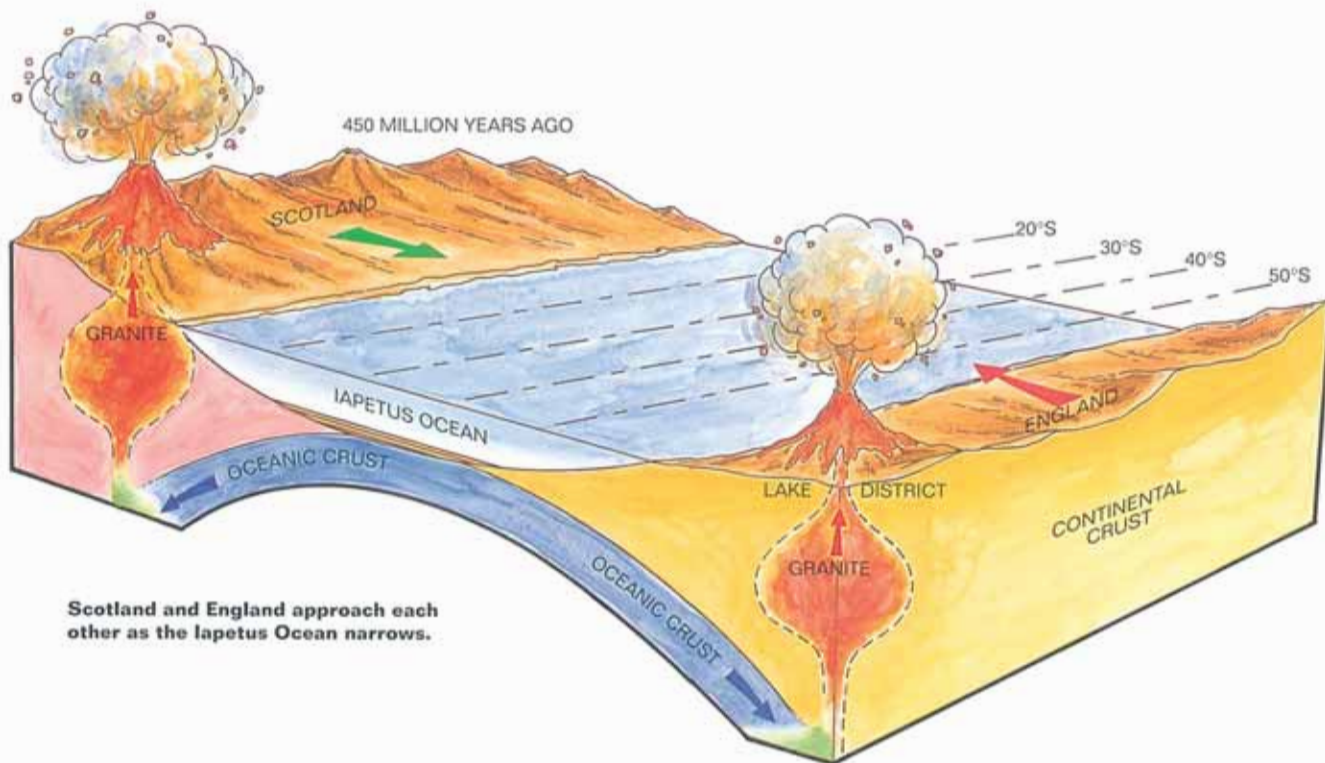
As the ocean floor subsided, thousands of layers of sand, silt and mud built up. Repeated massive influxes were triggered by earthquake shocks which set off large underwater avalanches, called turbidity flows, at the edge of the continents. Each flow gave rise to a distinctive deposit. As the coarser materials, pebbles and sand, settled out first they occur at the base, grading up to fine silt and then mud. The fine top of one flow is abruptly overlain by the coarse base of the next flow, commonly with marks where the sand-laden current scoured into the mud.

Around 460 million years ago, the continents started moving towards each other, squeezing the ocean and pushing the sea-floor sediments up to the surface. Some 40 million years later, the two continents collided; for the first time Scotland met England – and Scotland came out on top.

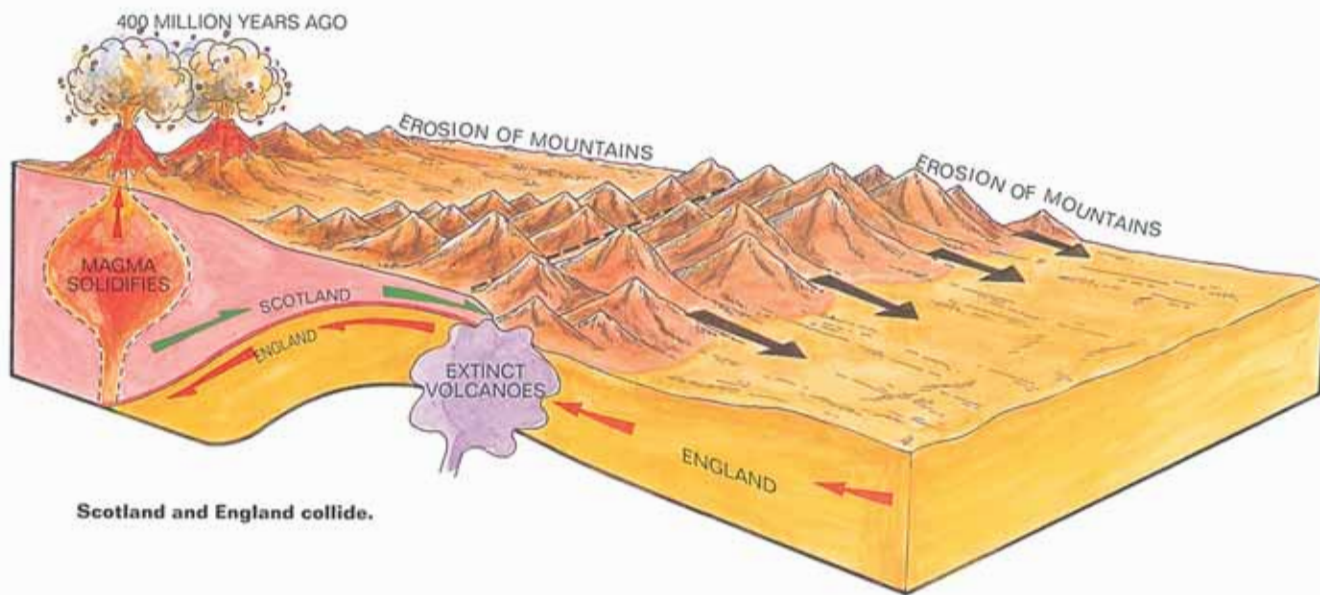
As the Scotland/America continent was thrust over the England/Europe continent, the ocean sediments were squeezed into folds, fractured as they were racked by earthquakes and hardened into rocks called greywackes (German for grey rock). They were pushed up as mountains, part of a range that stretched from the American Appalachians, through Greenland and Scotland, to Scandinavia.



Iapetus Ocean. Scotland and England collide.



Scotland and England approach each other as the Iapetus Ocean narrows.



Scotland and England collide.



Petticot Wick near St Abb's Head.

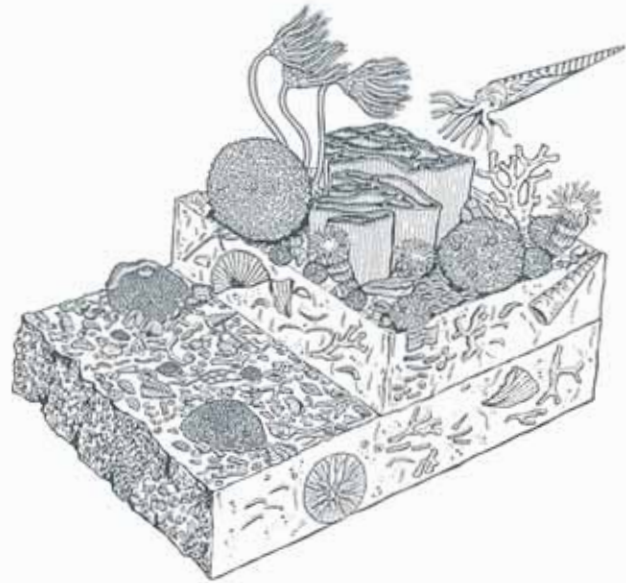
Over millions of years these mountains were raised and then worn down to give the rounded hills we know today as the Southern Uplands. The evidence of their past can today be seen within the rocks themselves, each layer of strata telling its own story. Along the Berwickshire coast the folded rocks are beautifully displayed.

Fossil remains of the earlier life that teemed in the ocean and along its margins are hard to find, although graptolites, an extinct type of floating invertebrate, can be locally quite common. These evolved particularly

rapidly into different forms and so they can be very useful for unravelling the relative ages of the folded layers of rocks. This was first demonstrated in 1878 by one of the early geologists, Charles Lapworth, as celebrated by a plaque on the wall of his lodgings, Birkhill Cottage on the Selkirk-Moffat road. He carried out his researches at nearby Dob's Linn, now recognised as an internationally important Site of Special Scientific Interest.

Sediments that were laid down along the coasts of the continents have fossils from the rich life that lived in shallower water and around coral reefs; trilobites, corals, various shell fish and other now-extinct sea creatures.

The Southern Uplands stand up as hills today because their rocks were baked hard when they were buried and heated during the mountain-building episode. However, they owe their distinctive rounded heather-covered shape with deeply incised valleys to more recent events.



Artist's impression of the sea floor during Silurian times. (Redrawn after McKerrow, 1978. *The Ecology of Fossils.*)

Heather moorland.



Hutton's Unconformity

– Siccar Point



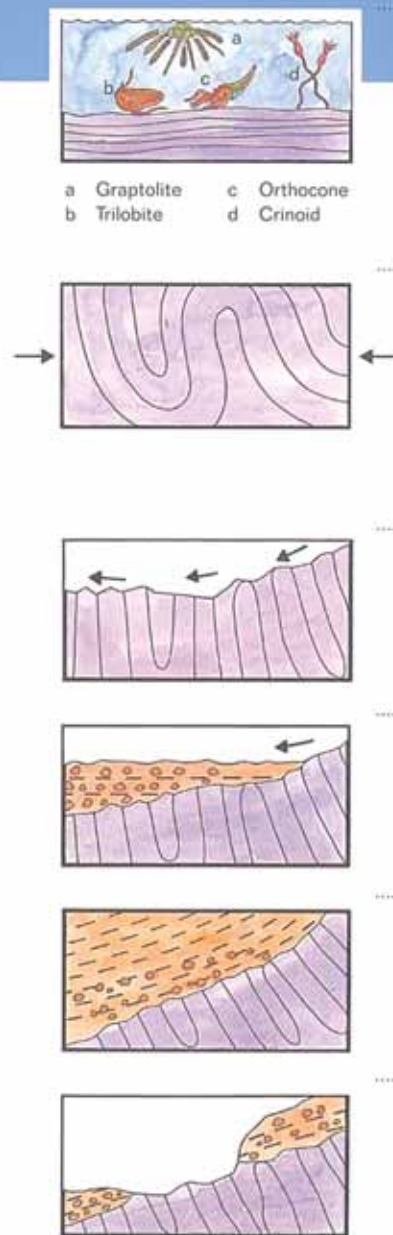
Siccar Point.

Siccar Point is a place of pilgrimage for geologists worldwide – here in 1788 James Hutton made one of the fundamental advances in geological understanding.

At that time geologists like Hutton were aware of the harder, folded rocks (which they called 'schistus') that formed the Lammermuirs and the cliffs of Berwickshire; they were also aware of the flatter lying sedimentary strata that formed the East Lothian coastal plain – but "where was the join?" they asked. Looking for an answer James Hutton with friends set sail from Dunglass and sailed east, studying the sea cliffs. At Siccar Point they found the answer at the locality known thereafter as 'Hutton's Unconformity'.

The junction between the two types of rock was laid bare by the action of the waves on the rock platform and cliffs. The 'schistus' beds were seen to stand vertically; they were cut off along an irregular surface; the red sandstones and conglomerates lay above them and were inclined gently seawards.

Here several chapters of the geological record could be seen in one place:



Chapter 1 The oldest rocks were laid down at the bottom of deep seas inhabited by surface floating animals such as graptolites. The sediments were buried and became rocks.

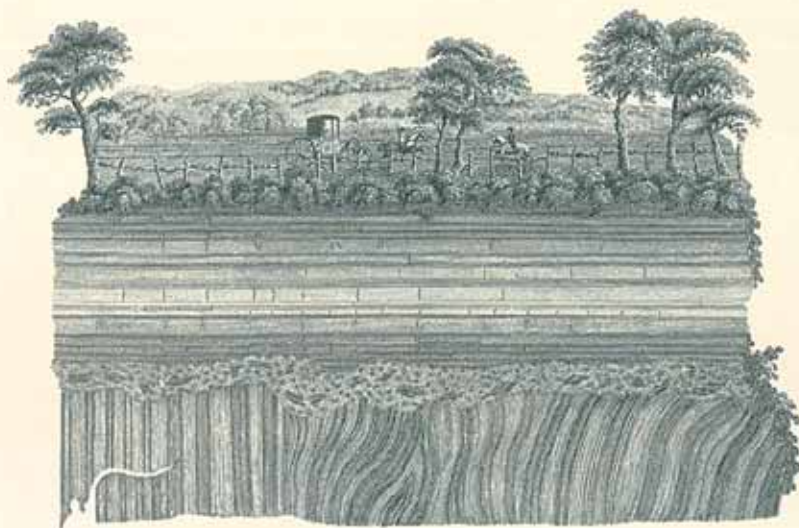
Chapter 2 Continents moving closed the sea and squeezed the rocks till the strata were almost vertical, heated them gently so they became hard and pushed them up to form mountains.

Chapter 3 The mountains were worn down by rain, flood, river, wind, trimming off the top of the strata.

Chapter 4 Torrents and flash floods carried boulders, gravels and sands, and deposited them in valleys and plains.

Chapter 5 More, but gentler, continental movement affected the rocks, tilting the newer strata to the north-east.

Chapter 6 Erosion wore down the mountains again to the position we see today.



Allar's Mill, near Jedburgh by John Clerk of Eldin.
(Reproduced with the kind permission of Sir John Clerk of Penicuik.)

So remember, although the landscape seems unchanging, a human lifespan is but a moment in geological time. Every day somewhere in the world, lavas are erupting, sills and dykes being intruded, faults are causing earthquakes, and all types of rocks being eroded and redeposited as sediments. Over geological time the landscape of Scotland has changed dramatically and will continue to change. Hutton's Unconformity gives us a glimpse of the forces that have been at work.

The same geological phenomenon had previously been noted by Hutton, but not fully understood, by the banks of the Jed Water at Allar's Mill near Jedburgh. Although now degraded and overgrown the section was beautifully illustrated in the drawing by Hutton's friend, the artist John Clerk of Eldin.



Fairy Glen,
Oldhamstocks.

Deserts and dunes that turned the land red

Around 390 million years ago, when Hutton's Unconformity was being formed, Laurentia, the continent of which Scotland was a part, lay in the southern tropics. The mountains that had built up were being worn down. The lowlands were an arid desert, like the Sahara today. There was no vegetation cover and flash floods caused rapid erosion. The result was coarse gravels of rounded boulders, cobbles and pebbles, which turned into the rock called conglomerate. The red colour is typical of rocks formed in deserts.

One of the best places to see this deposit is in the Lammermuir Hills above Oldhamstocks. The spectacular

valley of the Back Water has 'badlands' topography known locally as the Fairy Glen, displaying the conglomerate almost in the way it was originally formed.

The finer sand was blown about the desert plains as dunes. The sand grains became rounded and the beds formed typical dune bedding.

Red conglomerates and sandstones occur all the way round the Merse as at Jedburgh, and round the East Lothian and Dunbar basins. The fertile red soils of these areas pay testimony to the desert past.

Fossils – layer by layer

By 350 million years ago, Laurentia had drifted to near the equator, the desert had been replaced by a hot, damp, fly-infested tropical climate. The sea moved up and down, giving differing coastal conditions, each identified by the creatures that lived in it and became preserved as fossils. In swamp forests grew lush vegetation forming peat then coal. The tree roots occur in fossil soil below the coal. Flooding tropical seas killed the forest burying it with marine muds and coral reefs with rich marine life became limestone. The sea retreated leaving lagoons with shells and plant debris in muds and silts. Rivers filled the lagoons building sand

and silt deltas into the sea. On this new land coal forests grew; and so the cycle started all over again.

In East Lothian collect fossils at Barns Ness – White Sands – Catcraig, here limestones and shales are full of corals and shells. Pictures on the noticeboards help you to identify them. Also try Kilspindie, between Aberlady and Gosford, or Cove, or Burnmouth.

But remember, only collect one or two specimens from the loose material, as this is a limited resource and others will want to make the same discoveries as you have made.

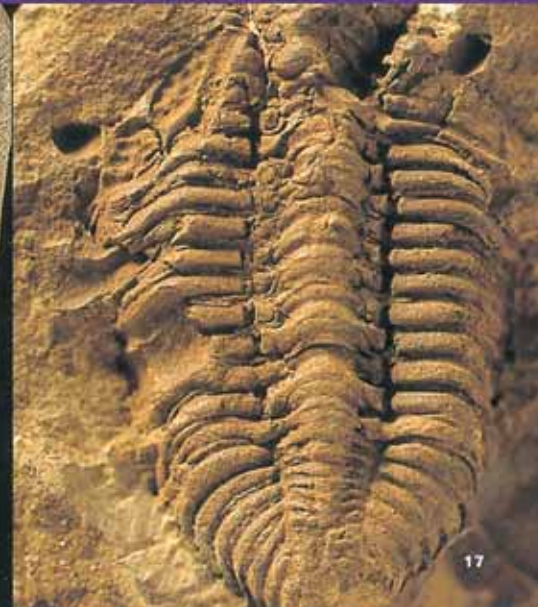
Corals.



Arms of a crinoid or 'sea lily'.



A trilobite.



Ice smoothes and moulds the landscape

During much of the last 2 million years, south-east Scotland was buried under an ice sheet many hundreds of metres thick. The ice sheet was not stationary but flowed from west to east across East Lothian and from south-west to north-east across the Borders.

North Berwick Law.



The moving ice carried boulders embedded in its base which scratched the bedrock underneath. These scratches or striae can be seen in many places but particularly good examples occur beside Fenton Tower at Kingston, near North Berwick.

Moving ice also moulds the landscape. Thus an east-west grain of ridges and hollows is very marked in parts of East Lothian. That is why the north-south roads in the county go up and down like a roller-coaster. Much of the Merse has similar ridges or is covered by oval mounds called drumlins forming the 'basket-of-eggs' landscape typical of glaciated areas.

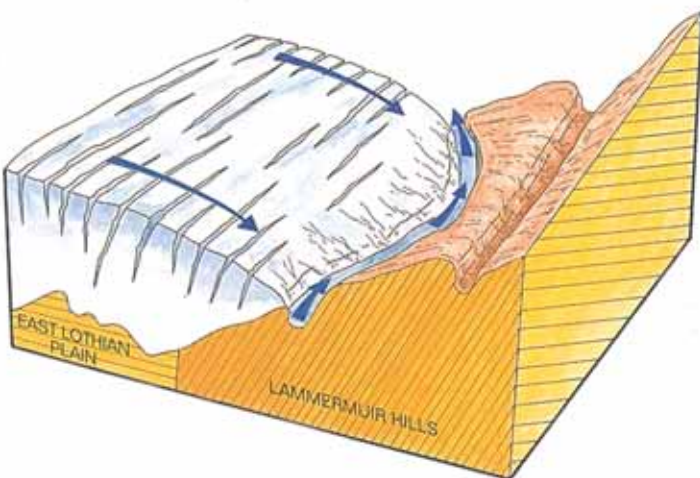
Crag-and-tail is a spectacular feature sculptured by ice. The Law at North Berwick is a fine example. The very hard rock of the volcanic plug resisted erosion much better than the softer sedimentary strata. The moving ice was forced over and round the obstruction, stripping away the softer rocks round the front (upstream) and the sides of the hard rock (forming the crag) while softer rocks, protected in the lee of the crag, formed the long ridge (tail). Almost every craggy volcanic hill in both East Lothian and the Borders has its 'tail' to the east.

Rivers carve valleys proportionate to their size. But some large valleys have only small streams and some valleys have no streams at all. These are called dry valleys.

When the ice was melting, towards the end of the ice age, the Lammermuir Hills emerged from the ice sheet as it retreated into the plain. Vast amounts of meltwater were produced and it escaped by the easiest route to lower ground or to the sea. This water eroded along the edge of the ice-sheet, down into the rock. As the ice retreated channels were abandoned and new ones cut at lower levels. Deep channels form dry valleys around Garvald, and all along the north side of the Lammermuirs and the Garletons. Similar valleys occur along the south slopes of the Lammermuirs, such as Raecleuch Head, and in many other places in the Borders, particularly Carlops.



Meltwater channel (above) and its formation (below).



Bedshiel esker.

Running water acts like a sieve and sorts sediment into different sizes. Thus the coarsest fragments form gravels which are only rolled a short distance along the river bed. The sand fraction forms banks, and the silts and clays are carried along in suspension to be deposited in lakes or the sea when the flow weakens.

The most vigorous water in recent times was the meltwater from the ice-caps. Hence there are deposits of sand and gravel where the edge of the ice stood, the same areas where meltwater carved out the dry valleys. The movement of the water can be seen in the internal structures preserved in the sands and gravel layers. Where meltwater flowed in tunnels under the ice it left sinuous ridges of gravel, called eskers, when the ice melted, as at Bedshiel, near Greenlaw.

Seas, rivers and lochs form the plains

The level of the sea and its twice daily tides may seem one of life's unchanging constants – not so. Within the not too distant past, sea levels have been quite different and indeed are likely to change in the future, as a result of global warming and the rise of the land as it recovers its equilibrium after the enormous weight of the ice has been lifted.

The coast of East Lothian and Berwickshire has been affected by fluctuating sea levels since the ice melted some 14,000 years ago. The record of this is clearly imprinted all round the coast. Some 5,000 years ago sea level was about 8 metres higher than at present and formed a raised beach. This is either a wide plain or a narrow terrace backed by an ancient cliff. Just like the present beach the raised beach is made of shelly sand, shingle or mud. Higher beaches relate to sea levels as they were 8,000 years ago or even earlier.

Along the coast, the sands and silts of the beaches are light enough to be readily carried along in the wind, particularly where exposed and dry in the intertidal zone. Blown sand forms dunes covered in rough grasses on the raised beach terraces. Notable dunes occur in the Gullane – Muirfield area, site of several golf courses,

where the sand was blown off the large intertidal estuary of Aberlady Bay. Dunes on the Belhaven Sands have reclaimed naturally the intertidal area and formed a new island in the last 100 years.

Rivers and streams carve out valleys. They carry stones, sand and mud downstream in a meandering channel. In times of flood the river overflows its banks, the flow slackens and its load of sediment is laid down in the valley bottom as a deposit called alluvium. This is why rivers have a flat strip along the bottom of their valleys (known as a haugh), commonly with natural embankments or levees next to the river where most sediment was dropped. Similarly many lochs have silted up to form flat hollows.

All the large rivers have associated alluvial plains, commonly giving the best agricultural land. They have also been chosen for settlements and as sites for large towns such as Haddington and most of the Border towns.

Unfortunately perhaps not exactly the best choice – nature still tries to deposit alluvium on the 'flood-plain' from time to time – as plaques on walls of many towns and villages attest.

Geology provides the playgrounds

Golf would never have happened were it not for the 'links' landscape which is so characteristic of the east coast of Scotland. These links are usually narrow strips of low raised beach with sand dunes blown over them. It would have been natural to have the tees on top of sand dunes, the greens on grassy hollows between dunes, the fairways on the flat 'machair' of the raised beach, and the bunkers being wind-blown sandy hollows. The narrow strip of raised beach also encouraged squeezing in 9 holes 'out', and 9 holes 'back'.

Rocky high ground which could not be cultivated lends itself for recreational use. The undulating heather-clad

Southern Upland hills, such as the Lammermuirs, and the lower craggy igneous rocks, such as North Berwick Law, are both popular walking areas. The Southern Upland Way traverses the area from east to west.

Flat areas formed by river alluvium and terraces or raised beaches along the coast form natural venues for bowls or cricket which require a level pitch. Most football and rugby grounds, too, are found along the river alluvium, their very name commonly indicating this, as Philiphaugh at Selkirk, Netherdale at Gala, and Riverside Park at Jed-Forest.

Jed-Forest rugby ground makes use of the flat alluvial plain of the Jed Water, and is sheltered by the red sandstone cliff (see p16).



Rock – industry's raw material

Man has exploited the mineral wealth of East Lothian and the Borders for at least 800 years.

Coal occurs in numerous seams in the coalfield basin from the sea at Musselburgh and Prestonpans inland to Tranent, Macmerry, Ormiston and Pathhead. Because of folding and faulting the seams come to the surface in numerous places.

Limestone, though bedded like coal, is not normally deep-mined. It was usually worked in small quarries and 'burned' with coal in limekilns, such as Catcraig near Dunbar, to produce agricultural lime used to 'sweeten' or reduce the acidity of the soil. Nowadays only the extensive quarry at Oxwellmains works limestone, where it is crushed, mixed with mudstone, and roasted in rotary kilns to produce cement for the building industry. Restoration has returned the land to agricultural use, but much of the original character of the land is lost as a result.

Oxwellmains Quarry – before.



Volcanic and intrusive rocks have been quarried at many sites as Whinstone for concrete aggregate and roadstone. Intrusions are harder and less weathered than lavas, so are more widely used.

In East Lothian almost every hill or 'law' has been quarried in the past. Even North Berwick Law had its quarry, later used as a refuse tip and almost fully restored. At Traprain Law the quarry was closed following public outcry before the characteristic outline was irreparably changed.

Many of the upstanding hills in the Borders, too, have been used, such as Dunion Hill at Jedburgh, and Redpath Hill not far from Scott's View. Fortunately, though, these can be worked in such a way not to affect the skyline.

Greywacke can be as hard as the volcanic rocks, so has frequently been quarried as 'whinstone' where there is no good igneous source.

Oxwellmains Quarry – after.



Building stones give local character to towns and villages

The traditional building stone used in each town or village in the East Lothian and Borders regions closely reflects the geology of the underlying rocks, simply because the local material would be the first choice of the stone masons.

In later years as improved transport made distant sources more accessible, the local stone was used increasingly with an imported dressed sandstone (ashlar) for the corners (quoins) and round doors and windows (jambs).

More recently, any stone used for building has been imported from the few quarries still active outside the region, all the local ones having closed.

Some buildings constructed over many centuries, such as the Lamp of the Lothian in Haddington, show several differing episodes in their walls. Smailholm Tower, near Kelso, has an attractive contrast between the rough black dolerite from the crags upon which it sits and the dressed red sandstone round the windows.



Smailholm Tower, near Kelso.

Where do I go to . . . ?

Collect fossils
Collect minerals
See a volcano
See lavas
Visit a famous site
See badlands
See columnar basalt
See the work of ice
Learn about lime-works
See red sandstones
See bedded strata
See 'dry valleys'
See folded rock layers
See a fault

EAST LOTHIAN

Barns Ness, Kilspindie
Traprain Law
North Berwick Law, Partan Craig
North Berwick Harbour
Siccar Point
'Fairy' Glen, Oldhamstocks
Dunbar Harbour, Fidra, Lamb, Cheese Bay
North Berwick Law, Kingston
Barns Ness
Dunbar
Barns Ness, Kilspindie
Garvald
Yellowcraig shore
St Baldreds, North Berwick shore

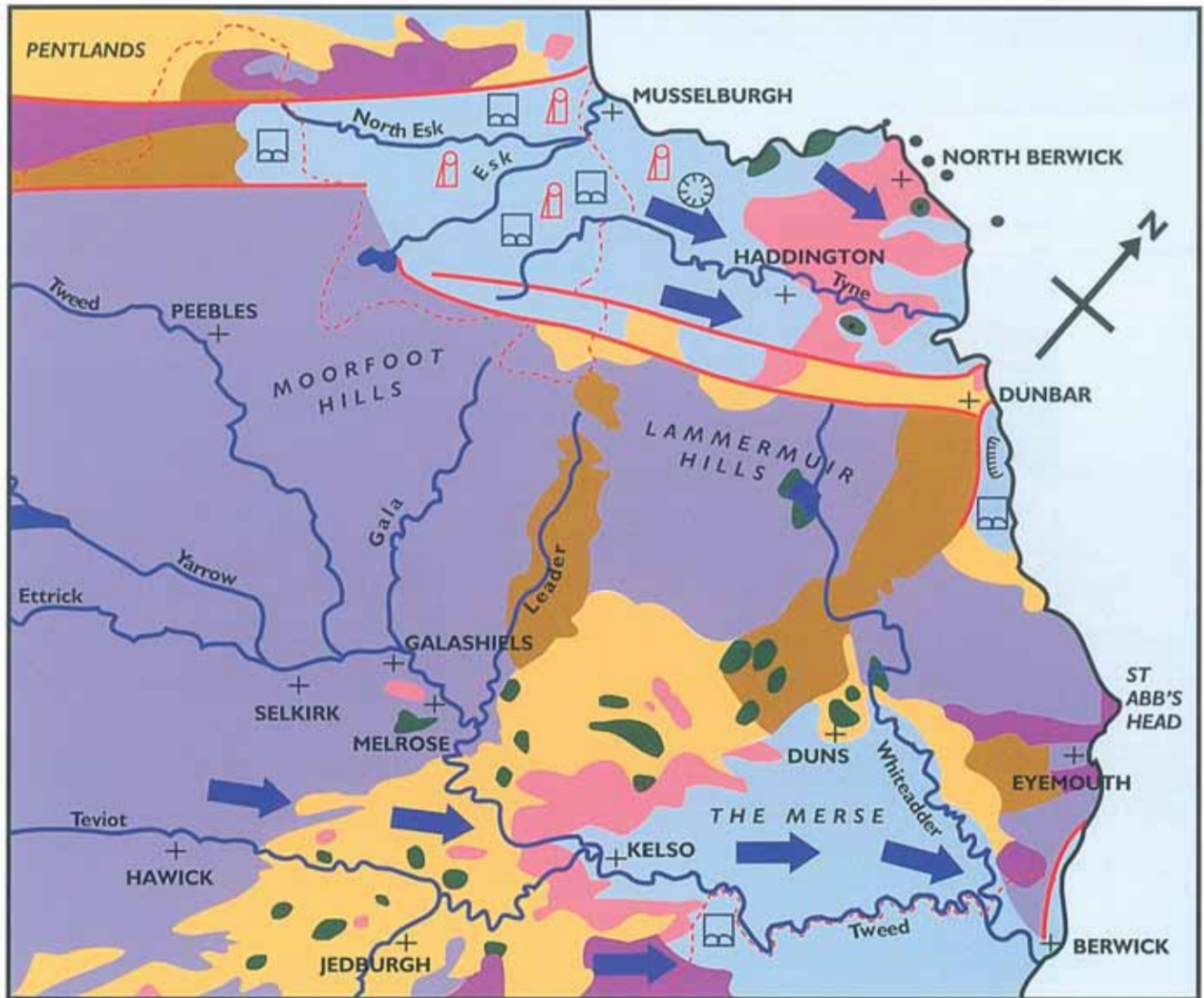
BORDERS

Cove, Burnmouth, Dob's Linn

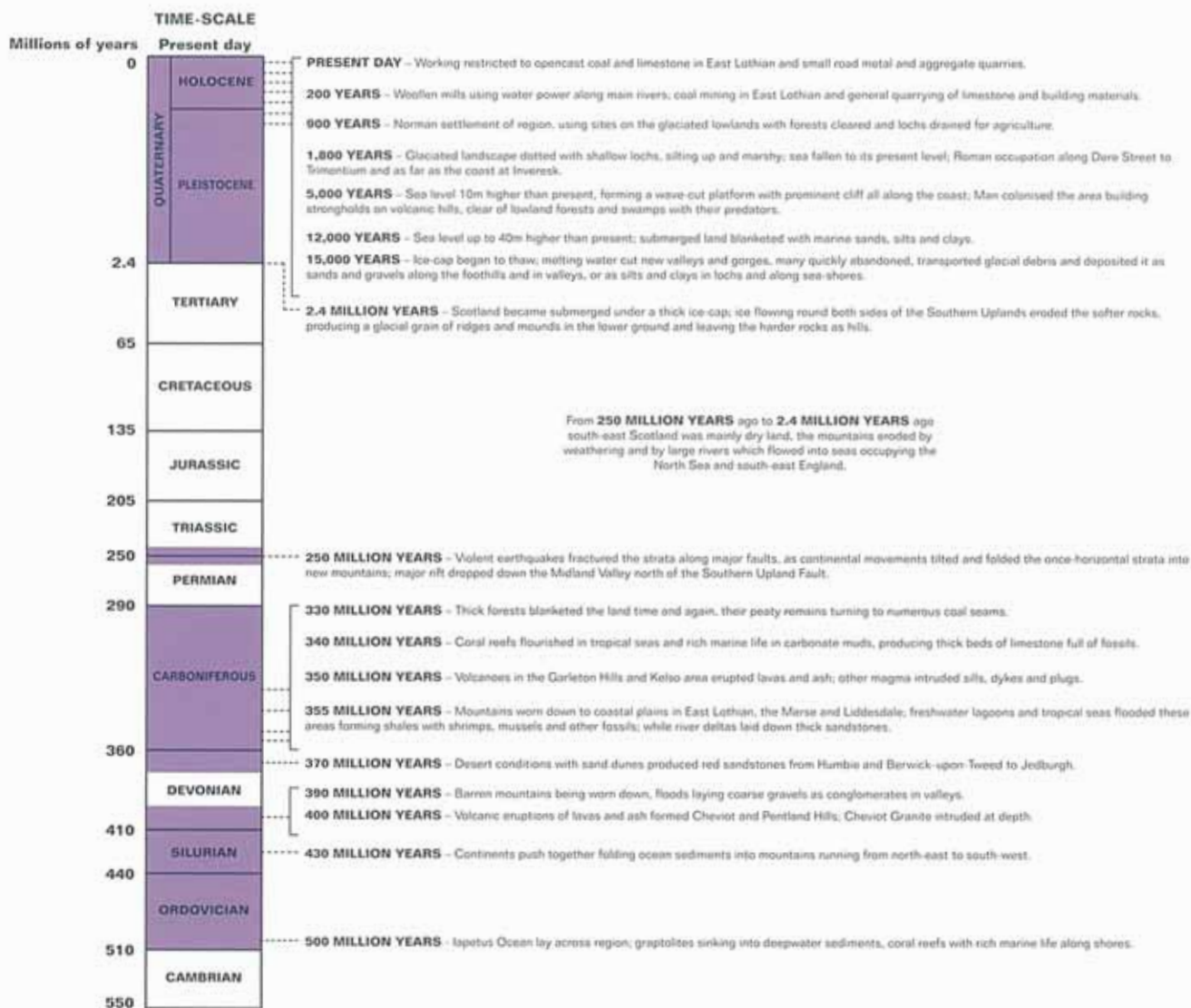
Eildons, Minto Hill
Kelso
Allar's Mill, Birkhill Cottage, Dob's Linn

The Merse, Bedshiel Esker

Jedburgh, Cove
Cove, Burnmouth
Raecleugh Head, Carlops
Berwickshire coast, Grantshouse
South-east of Eyemouth



Geological time-scale



Scottish Natural Heritage and the British Geological Survey

The need to conserve geological and landform features is, perhaps, less obvious than, for example, protecting a rare species of butterfly or an endangered wildlife habitat.

Geological and landform sites are often just as vulnerable to changes in land use.

Active steps must, therefore, be taken to ensure that such important features are safeguarded for the benefit of future generations. Around 20 Sites of Special Scientific Interest have been scheduled in East Lothian and the Scottish Borders to help conserve our geological and landform heritage. These sites are an irreplaceable scientific, educational and aesthetic resource. Conservation of such sites is the statutory responsibility of SNH, in partnership with landowners and local authorities.

Scottish Natural Heritage is a government body. It's aim is to help people to enjoy Scotland's natural heritage responsibly, understand it more fully and use it wisely so that it can be sustained for future generations.

**Scottish Natural Heritage, 12 Hope Terrace,
Edinburgh, EH9 2AS.**

The British Geological Survey maintains an up-to-date knowledge of the geology of the UK and its continental shelf. It carries out surveys and geological research.

The Scottish office of BGS is sited in Edinburgh. The office runs an advisory and information service, a geological library and has a well-stocked geological bookshop.

**British Geological Survey, Murchison House,
West Mains Road, Edinburgh, EH9 3LA.**

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