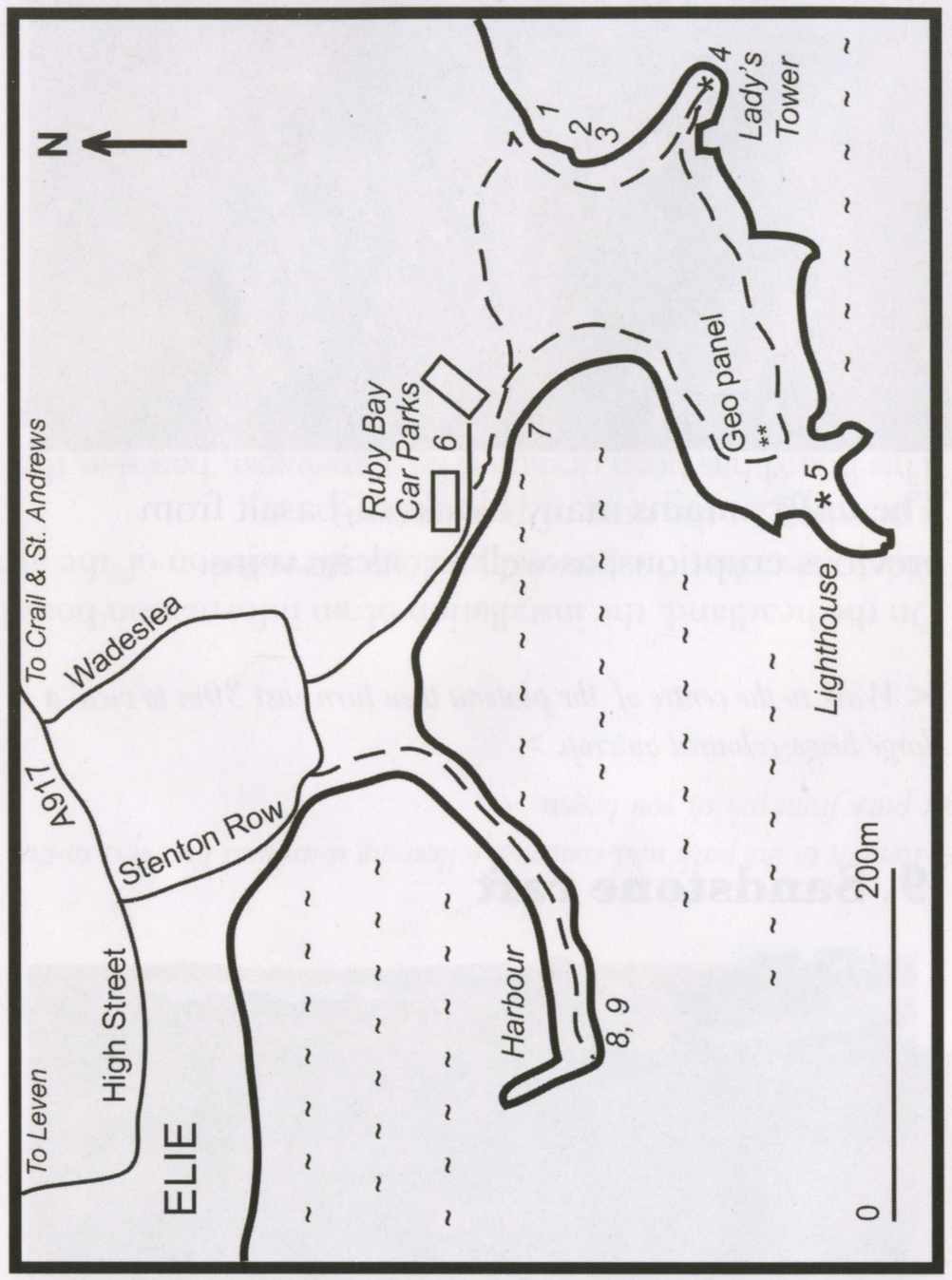
LOCATION MAP



** Geo panel: Interpretation board describes the geological history of the area (University of Southampton)

SAFETY INFORMATION

This trail (one-way) is about 1km long.

It requires a low tide.

Wear clothing and footware appropriate for the terrain and prevailing weather conditons.

TRAVEL INFORMATION

By bus:

Stagecoach service 95 serves Elie from St. Andrews and from Anstruther and Leven.

Stagecoach service X60 connects St. Andrews and Edinburgh via Anstruther and Elie.

By road:

Elie lies on the A917 St.Andrews to Leven road.

There is free car parking at Ruby Bay car park.

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

T: 01334 828623
W: http://earthsci.st-andrews.ac.uk/outreach

Scottish Charity No. SC 032509

Fife RIGS/LGS

RIGS were Regionally Important Geological (and Geomorphological) Sites, but are now known as Local Geodiversity Sites (LGS).

Fife LGS is concerned with identifying and assessing important sites and notifying the statutory planning authority of these sites. Fife RIGS was incorporated into geoHeritage Fife in 2005.

GLOSSARY

Basalt: A fine-grained dark igneous rock
Dolerite: A coarser grained variety of basalt
Dyke: Magma injected into pre-existing rocks
Igneous: Molten rock generated at high temperatures
Limestone: A rock made mostly of calcium carbonate and formed under water
Magma: Molten rock
Sandstone: A rock formed by the accumulation of sand grains, mostly quartz
Shale: A fine-grained sedimentary rock formed mostly of mud
Tuff: Ash erupted by a volcano

Geological Trail of Elie

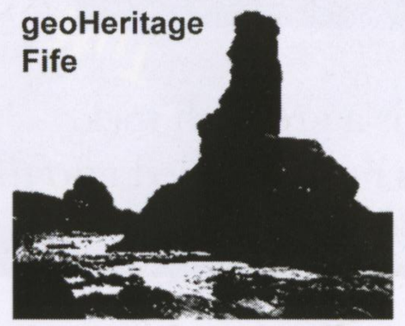
© Richard Bates

Examine the sedimentary and volcanic rocks that underlie Elie

330 million years old local rocks

Rocks folded by tectonic forces 305 million years ago

Walk through the remnants of an extinct volcano 298 million years old



Geological setting

Around 330 million years ago, Scotland lay near the Equator. River sands, estuarine muds and marine lime were deposited in large river deltas, forming **sandstone**, **shale** and **limestone**.
Coal formed from the decay of tropical forests.
Later violent volcanic activity punched through these rocks, which had also been folded by crustal compression.
Erosion has now revealed the underground volcanic "plumbing", known as a volcanic neck.
Thus the rocks seen on this trail were once deep underground.

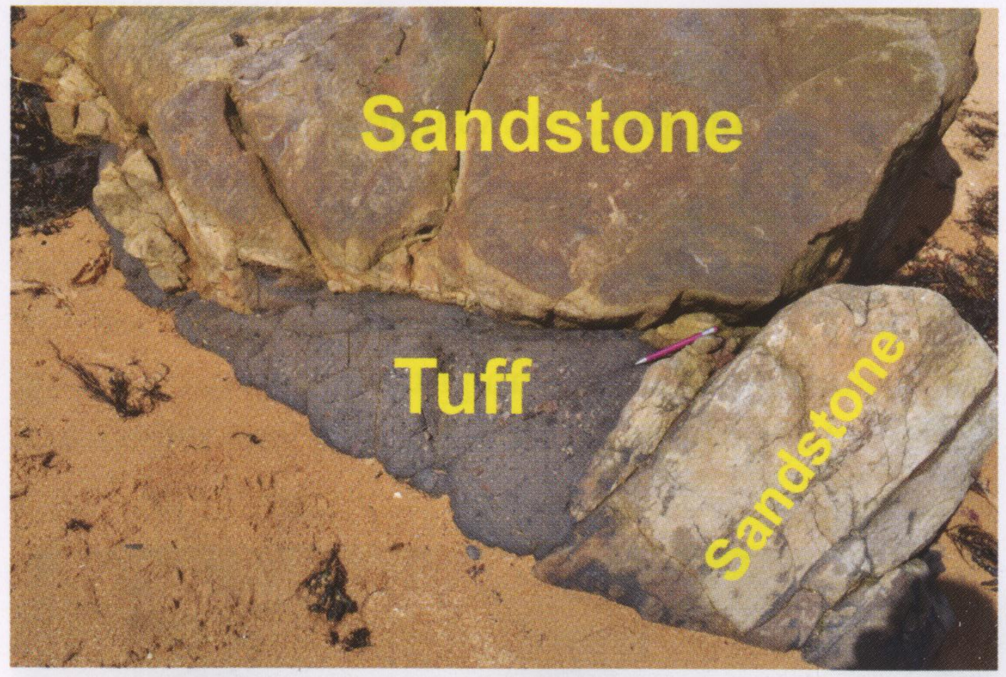
< From Ruby Bay car park take the Fife Coastal Path to the east, away from Elie Harbour. Follow the coastal path signs to take the left fork at the first set of concrete blocks, and then left at the next junction. 10m along this path look down to the shore below the seat. >

1. Folded Sandstones

Looking down at the beach, to the left you can see dramatic folding of layers of sandstone. This folding resulted from crustal plate movements 305 million years ago which created continental Europe.
To the right are greenish-grey rocks with no layering. This is volcanic ash, now compacted to form **tuff**.
At this point you are standing on the contact zone of a volcanic neck.

< Follow the coastal path with the sea on your right, until you reach the next signpost for the Fife Coastal Path. Here take the right-hand path cutting through the dunes to the beach. Once on the beach walk 20m to the right. >

2. Volcanic Ash Deposits



Scale = Pencil (8cm)

Here tuff has intruded the local sandstone as ash from a volcano that erupted 298 million years ago. Fragments of sandstone and shiny black coal in the tuff were ripped from the outer edges of the pipe during eruption.

<From this point, look seaward towards an exposure of curved sandstone.>

The sandstone here forms a dome which was probably caused by magma rising up and deforming the overlying layers. Dark volcanic rock lies inside the dome.

< From Locality 2 walk 25m to the south-west, towards the rocky cliff and grassy slope at the edge of the beach, as shown below.>

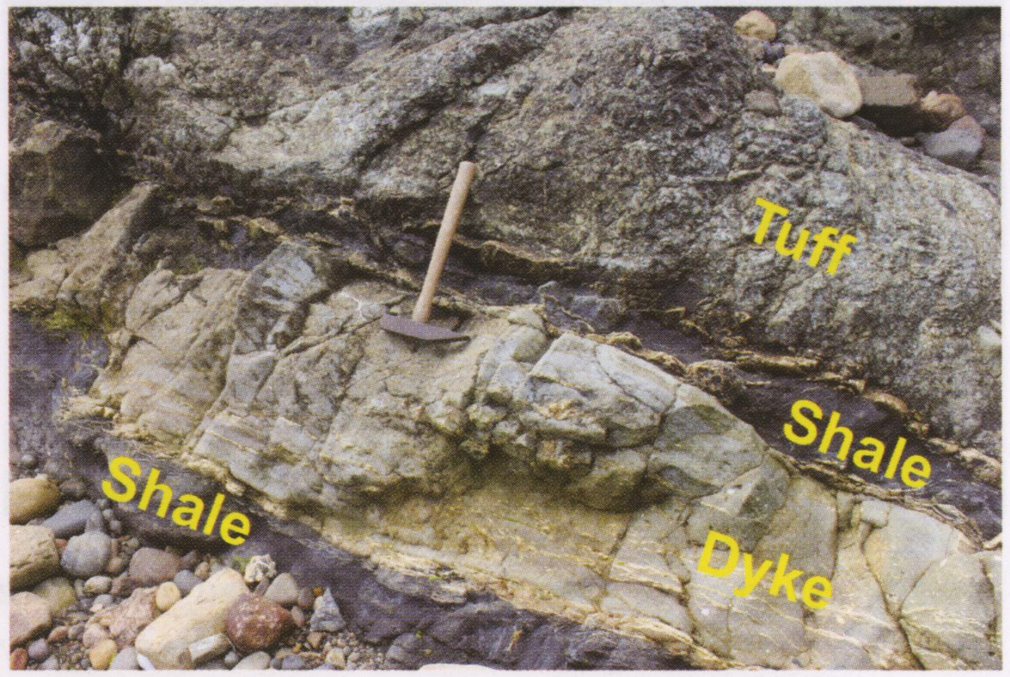
<On the way to the cliff, notice large boulders of dark rock on the beach. >

Scale = Pen (7cm)

Look at the blocks scattered around the beach.
The dark coloured blocks are **dolerite**, identified by their very dark grey colour and pits on the surface. The pits represent holes left where some crystals were corroded out. These blocks were probably brought here by moving glaciers about 10,000 years ago. Similar rock occurs nearby to the west at Chapel Ness and Kincraig.

< Continue to the rock cliff that marks the edge of the beach. >

3. Dyke and Shale



Scale = Hammer shaft (30cm)

On the cliff is the contact zone between the host sedimentary rocks and the volcano. Layers of shale have been intruded by basalt forming a dyke. Tuff lies above the shale beds.

< Retrace your steps to regain the Coastal Path, walk west and take the left-hand path to the Lady's Tower. >

4. Stones and Volcanoes

The Lady's Tower is built on an exposure of coarse tuff. The Tower itself is built mostly of rounded boulders of sandstone and dark basalt from the beach. Pale brown boulders with many round pits are limestones which have been drilled by a clam-like sea creature called a piddock. The limestone blocks also contain fossils of crinoids, seen as small white rings and tube-like stems.

Lady's Tower

Limestone with piddock holes

Scale: =Pencil (14 cm)

Crinoid stems in limestone

Scale: =Pencil (14 cm)

Looking through the southerly window of the Lady's Tower, on a clear day you can see both the Bass Rock (1) and North Berwick Law (2) in the distance.

Bass Rock (1) is a volcanic plug of Lower Carboniferous age (360-320 million years ago). It was more resistant to erosion than the surrounding rocks, which have been eroded to below sea level.

North Berwick Law (2) is another volcanic plug formed around 335 million years ago. During the Ice Age about 20,000 years ago, ice eroded the surrounding softer material, leaving the harder rock plug protruding.

From this point, looking west, black tuff forms the rocky beach which represents the centre of the volcanic neck.

< Return to the coastal path, taking the left fork towards the lighthouse. Just before the steps up to the lighthouse, turn left to the sandy bay. >

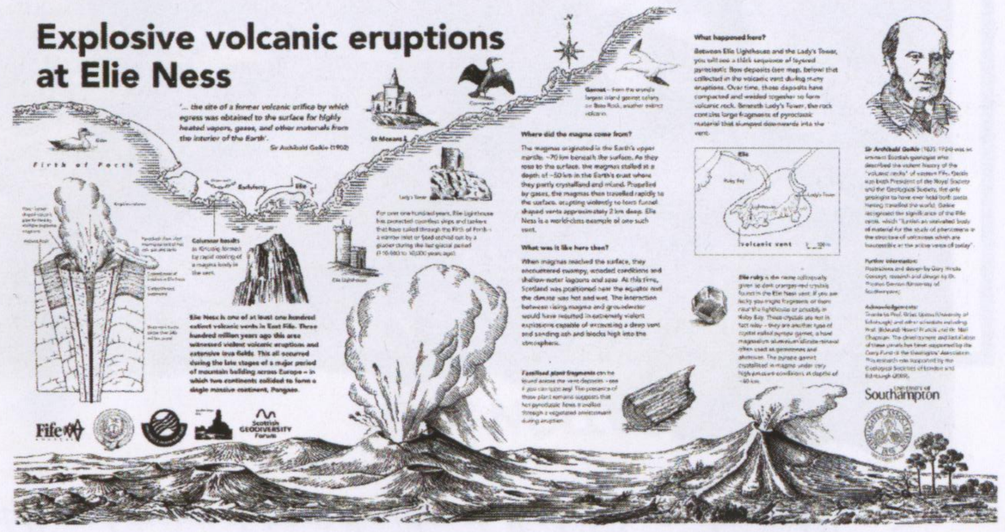
5. Calcite Veins

The tuff in this area is cut by calcite (calcium carbonate) veins, which are up to 3cm wide. These veins formed by fluids intruding the ash layers after they cooled.

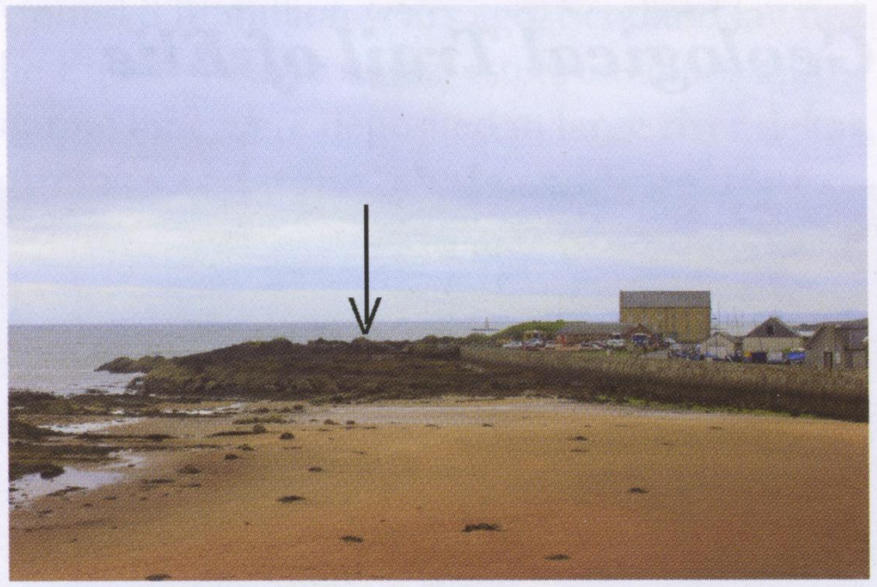
Scale = Pen (7cm)

< Return to the path and continue following it around the Ness to the car park from which you began. >

On the headland, the installation of an information board which describes the general geological evolution of the area, is pending (at the time of publication).
This board has been designed by a geologist, based at the University of Southampton, who has worked on the rocks around Elie.



6. Wave-Cut Platform



Returning to the car park, look west to the former granary house at the harbour. On the left side of the harbour is a large plateau of rocks. This is known as a wave-cut platform, formed between high and low water marks, due to sea level falling after the last ice age.

< From the information board in the car park go down the ramp and turn left towards the sandy beach on the east. Walk down to the sandy beach. >

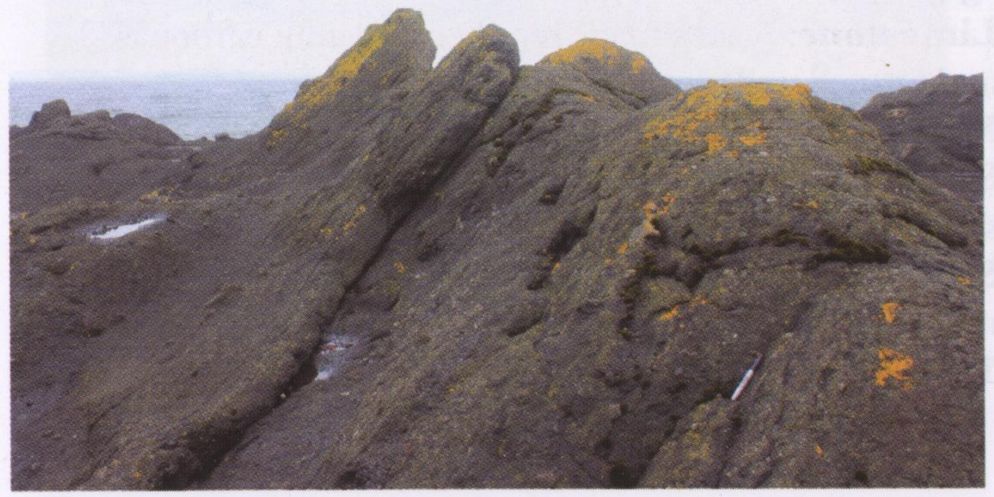
7. Dolerite

On each side of the ramp is a greenish rock. This is dolerite, an igneous rock intruded into the crust in a molten state. The green colour comes from the mineral chlorite. The rock is coarse grained near to the beach, indicating slow cooling deep underground. This rock is also cut by veins of tuff, which suggests it was affected by the Elie Ness neck.

< Return to the car park entrance by the height barrier and go left. At the bottom of Admiralty Lane turn left along the harbour road towards the old granary building. Take the slipway on the left side of the building, on to the wave-cut platform mentioned in Locality 6. >

8. Concentrically Dipping Tuff

Looking around the wave cut platform, concentrically-dipping layers can be seen in the tuff which forms this dark coloured landscape.
Here we are inside a volcanic neck which was collapsing inwards on itself. Each layer of ash represents a volcanic eruption, showing that there were multiple eruptions.

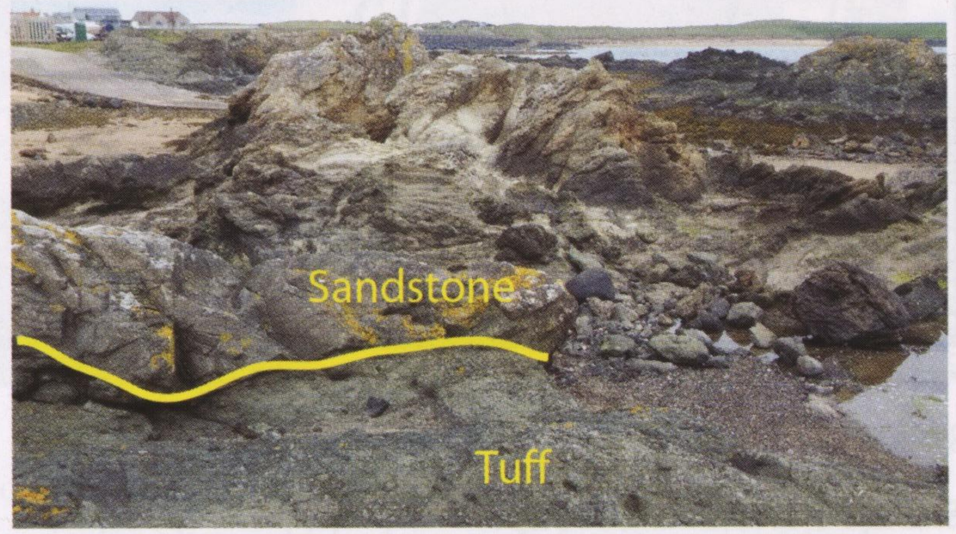


Steeply-dipping layers of tuff.

The tuff contains many blocks of basalt from previous eruptions, as well as calcite veins.

< Walk to the centre of the plateau then turn east 30m to view a large beige-coloured outcrop. >

9. Sandstone raft



A large block of sandstone (the lighter coloured rock) is here welded to the tuff below (the dark grey rock). As the volcanic cauldron collapsed, lumps of the surrounding rock fell inside it and became embedded in the tuff.
The sandstone raft was part of the Carboniferous sedimentary rocks through which the volcano erupted. The steep dip of the surrounding tuffs suggests the sandstone block fell into the centre of the volcano.

<Return to the car park, or your starting point.>