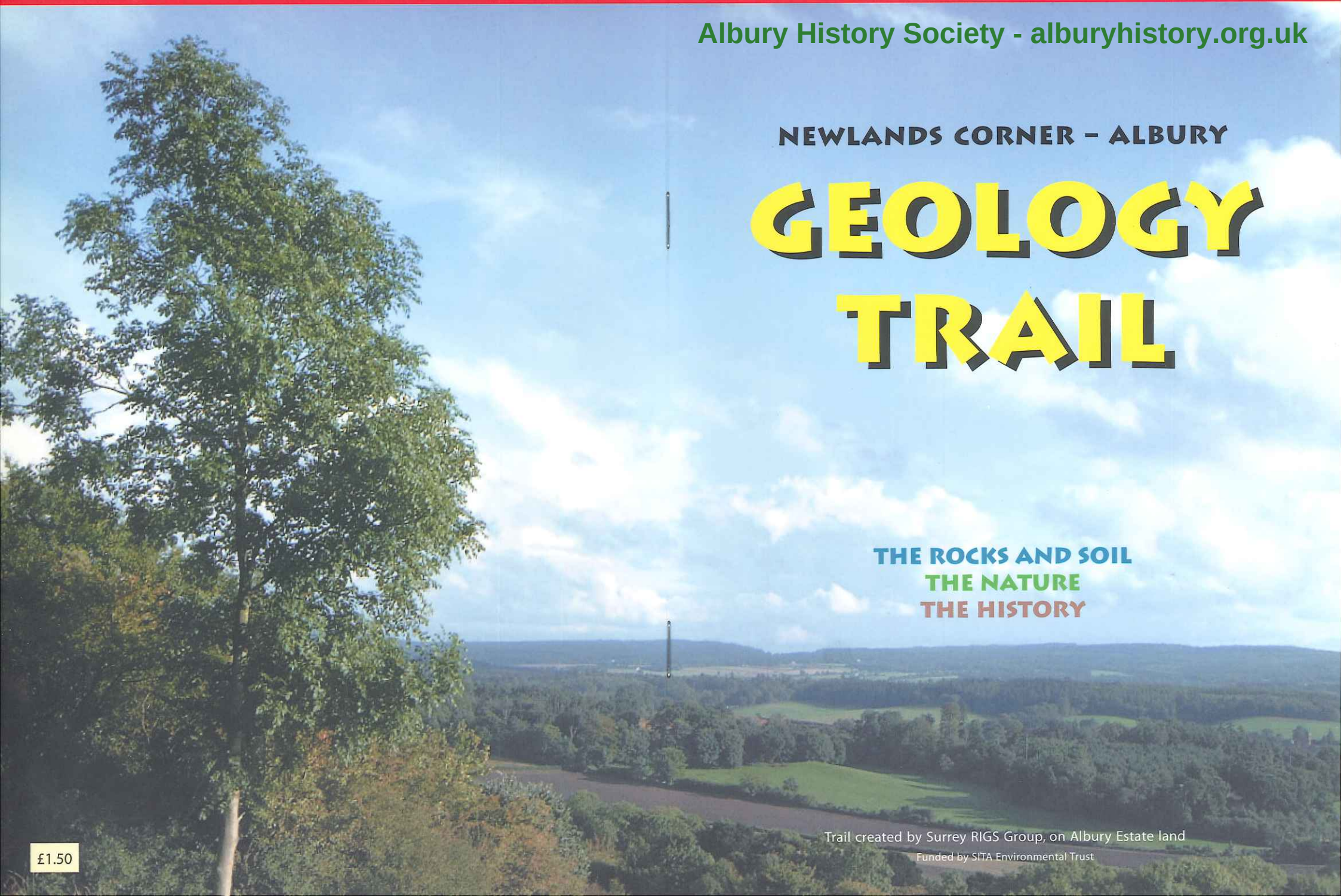
Walk on 120 million years of Surrey history!



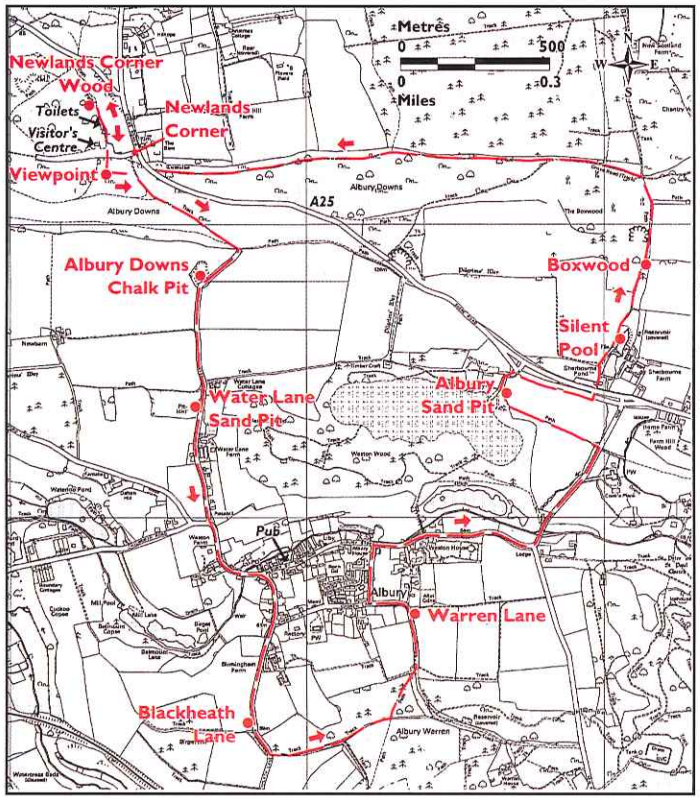
NEWLANDS CORNER – ALBURY

GEOLOGY TRAIL

THE ROCKS AND SOIL
THE NATURE
THE HISTORY

Trail created by Surrey RIGS Group, on Albury Estate land
Funded by SITA Environmental Trust

£1.50

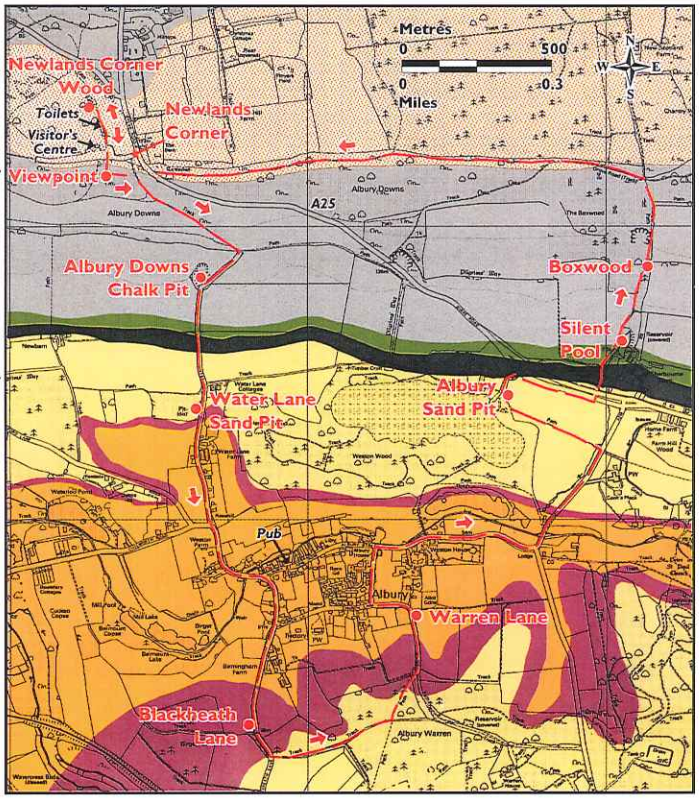


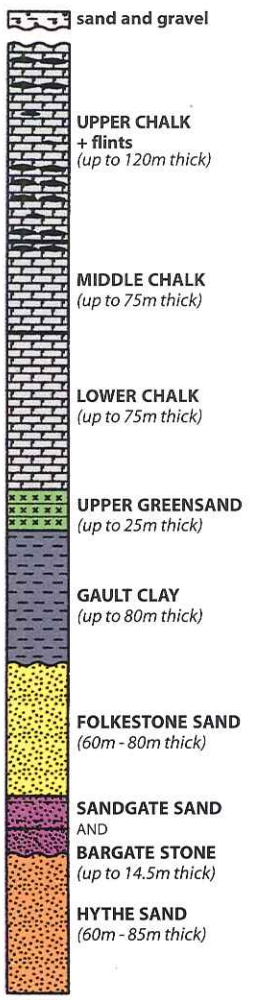
The Newlands Corner - Albury Geology Trail, 3 miles east of Guildford, is a circular walk of 5 miles (8 km), using quiet tracks and some minor roads. The route can be cut to 3 miles (5 km) by walking only to Albury village (where there is a convenient pub), then returning the way you have come.

The route is quite steep in parts and can be muddy and slippery after rain, so walking boots or stout shoes are recommended. Note that the only public toilets are in the Newlands Corner car park.

By following this Trail you will see more than just the landscape – you will see a wide variety of underlying rocks, the part they play in forming the landscape and how the plants and animals depend on each particular rock type. Different plants grow over different rocks, depending on whether they like lime-rich soil (chalk), 'acid' soil (sand and sandstone) or wet soil (clay). Once you know what to look for, you can tell which rocks lie under the soil – we will show you.

Humans also need the different rocks: clay for bricks, sand and sandstone for building, chalk for cement and agriculture. We will explain what use people have made of this land.





All directions for walking the Trail are on the centre pages of this booklet (pages 12 and 13).

STOP 1

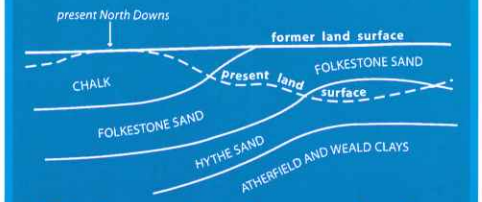
Newlands Corner Wood

Here, you are still on the North Downs ridge, so you would expect to be looking at chalk. But you're not. This is a dark yellow sand with a lot of gravel. The gravel contains flint pebbles (washed out of the Upper Chalk), but it also has other pebbles from the rocks below the Chalk. How did these other pebbles get on top of the ridge? Rivers don't flow uphill, so they can't have come from the valley to the south. So then, how do we explain it?

These pebbles must have been brought here from the rocks to the south (as there are none of these rocks to the north), and it happened before the erosion of the deep valley you saw from the car park. So there must have been a large hill to the south of here many thousands of years ago, and the pebbles were probably carried here by ancient rivers, as shown in the drawings.

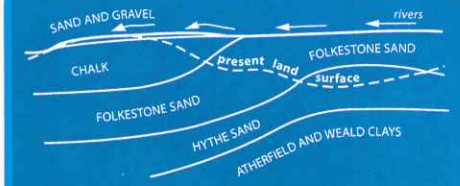
Further east, a similar sand and gravel contains sea shells, which are only about 2 million years old. At that time this area must have been down at sea-level; now it's 170 metres above sea-level. We tend to think that we live on solid, immovable land, but here is the proof that rocks can move (thankfully usually very, very slowly!).

2 MILLION YEARS AGO



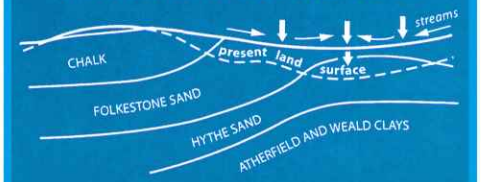
This shows where the ground surface may have been 2 million years ago, before the valley was created by river erosion.

1½ MILLION YEARS AGO



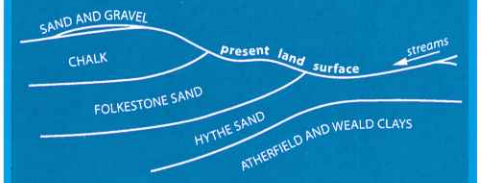
The streams and rivers on that land surface flowed north and brought down sand and gravel, dumping it around this location where you're standing.

1 MILLION YEARS AGO

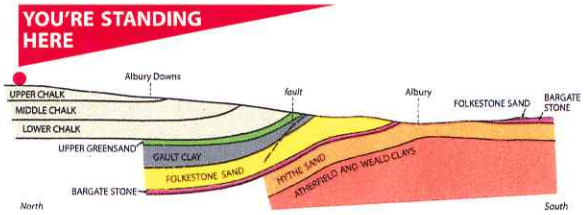


The rivers gradually wore away the land and turned west, eroding the weaker Folkestone and Hythe Sands.

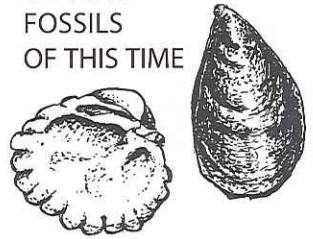
NOW



This is a section cut through the ground at the present day.



TYPICAL FOSSILS OF THIS TIME



Nature

In front of you, you will see Silver Birch and Oak with an undergrowth of bracken and bramble. You are looking at woodland which has grown up over disturbed soil, quarried for sand and gravel. Oak, Birch and bracken are more typical of acidic (sandy) soils rather than the dark evergreen Yew seen on the chalk slopes lower down the hill. This is known as secondary woodland because it has grown up on land that used to be grass downland.

The trees and shrubs in front of you have not been obviously planted by man but have regenerated after sand and gravel extraction and are semi-natural.

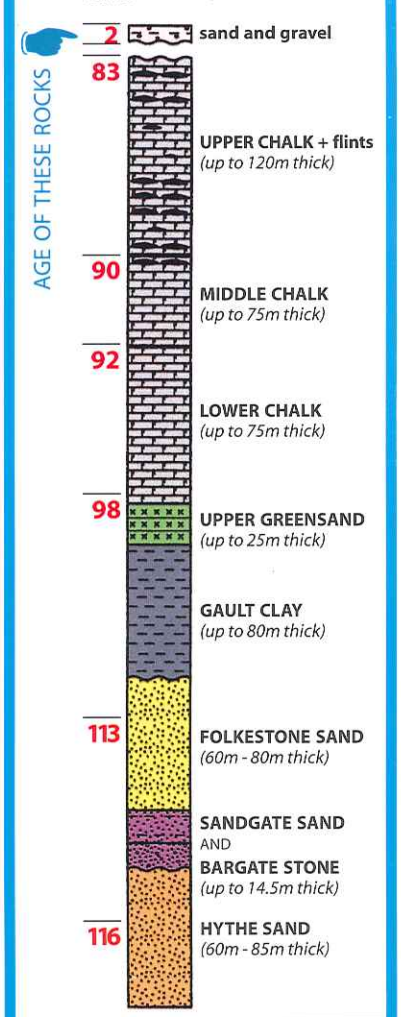
The whole area around you is part of the Merrow to Clandon Downs County Wildlife Site, chosen for its chalk downland and woodland.

History

These pits were dug into sand, gravel and boulders, which were mostly flint from the Upper Chalk. The material was used for surfacing the local roads, before the invention of tarmac. Stone Age man would also have used flint such as this for making stone tools.

There are signs of other pits here too. They were worked from before 1890 to at least 1923.

THE ROCK SEQUENCE



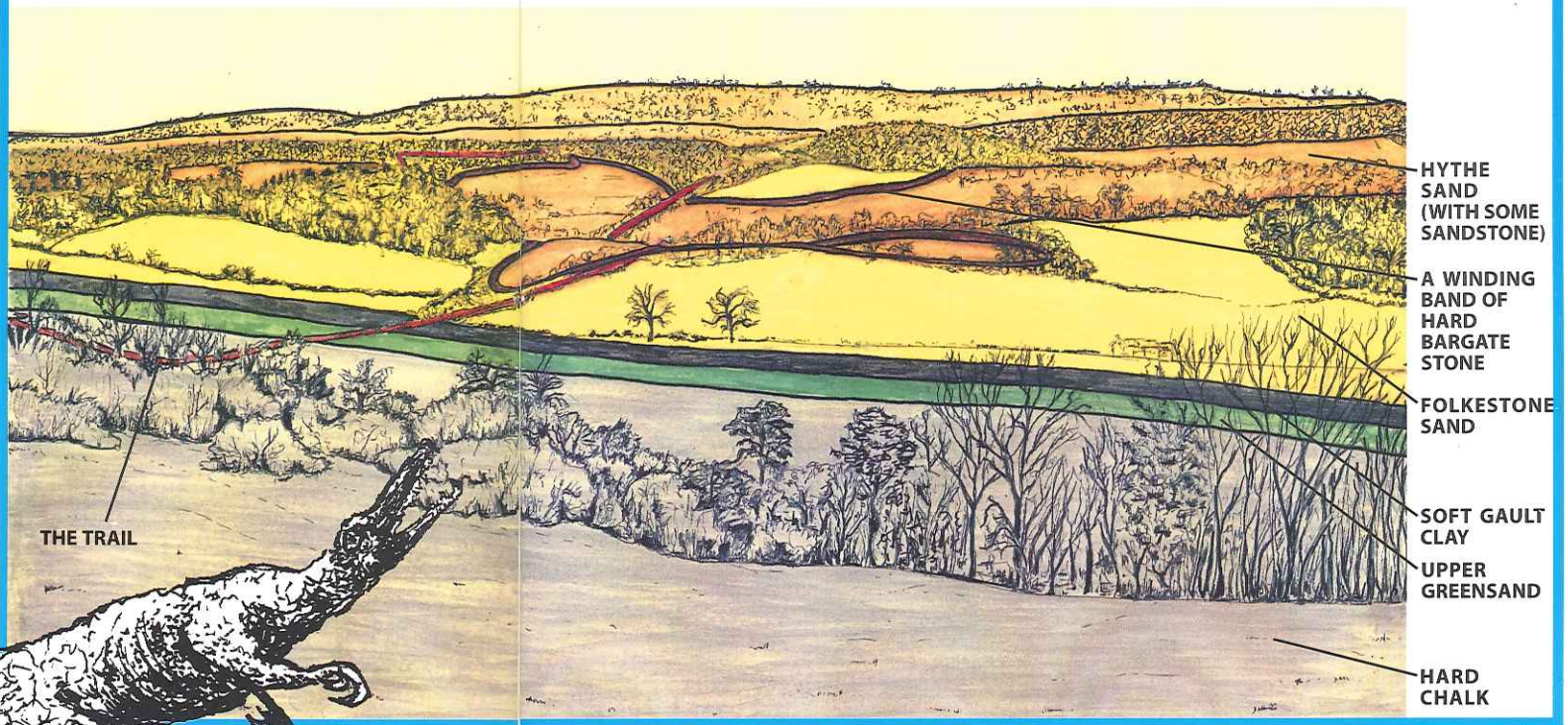
STOP 2

Viewpoint

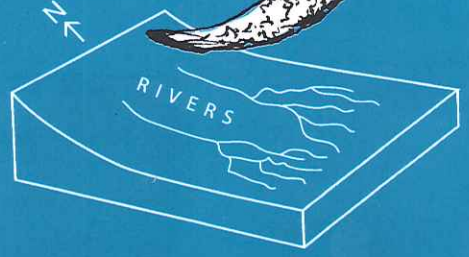
Look out over the view. You can see a valley just in front, and then the long slope up the opposite valley side to the dark tree-covered hills about two miles away in the middle distance. On a very clear day you can see the ridge of the South Downs in the far distance. This landscape of valleys and ridges is due mainly to the difference in the strength of the rock layers: some are easier to erode (wear away) than others.

The harder rocks are chalk (which you are standing on) and the layers of sand/ sandstone that form the tree-covered ridge. The weaker sand and clay form the valley. The rock layers are tilted quite steeply to the north and they have been eroded. How did all this happen? The drawings explain.

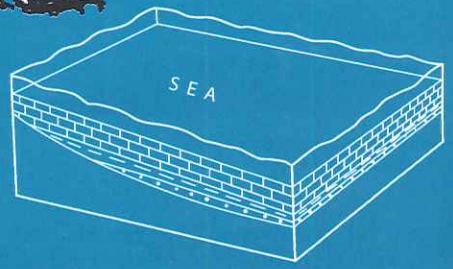
WHAT YOU SEE . . . AND WHAT'S UNDERNEATH



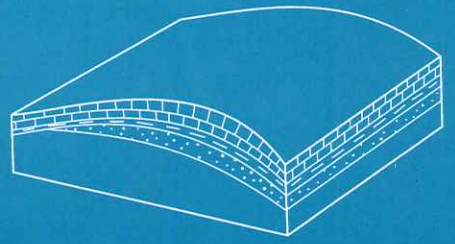
This is the fish-eating dinosaur found in Surrey. Nicknamed 'Claws', its scientific name is *Baryonyx walkeri*.



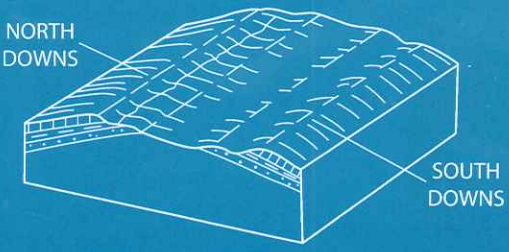
120 MILLION YEARS AGO this area was swampy land, with dinosaurs! In 1983, fossil remains of the dinosaur above were found 8½ miles south of here at Smokejacks Clay Pit.



Then the sea invaded as the land slowly subsided, and clays and sands were laid down on the sea-bed. 92 MILLION YEARS AGO, chalk was deposited, hundreds of metres thick.



After 24 MILLION YEARS and yet more layers of sand and clay, pressure within the earth's crust (due to Africa slowly advancing northwards into Europe) pushed against the rocks here, folding them upwards above sea level.



Since then a very long period of erosion cut off the top of the upward-folded rocks, and during the last 2 MILLION YEARS rivers eroded the valley in front of you, finally forming the landscape we see today.

STOP 3

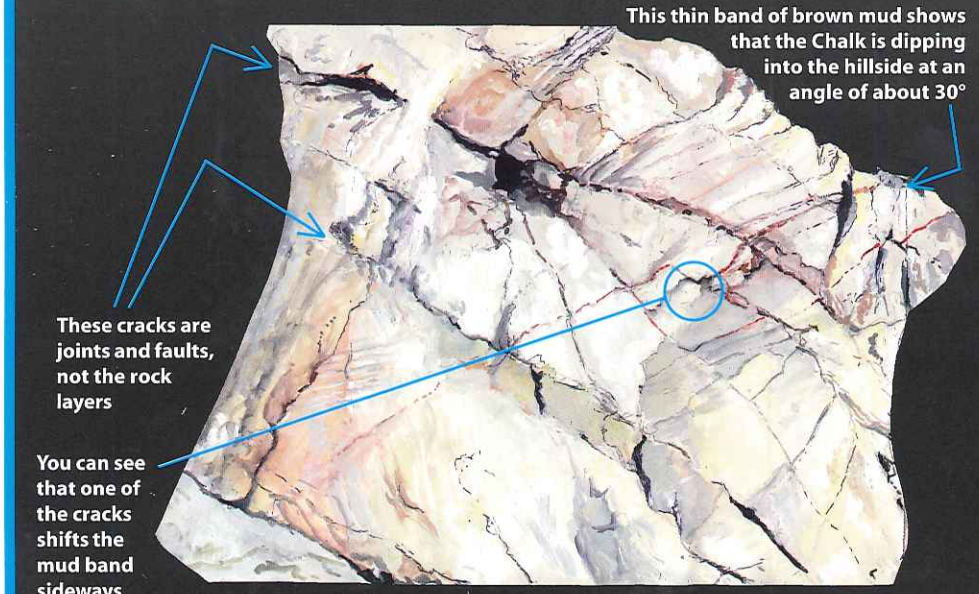
Albury Downs Chalk Pit

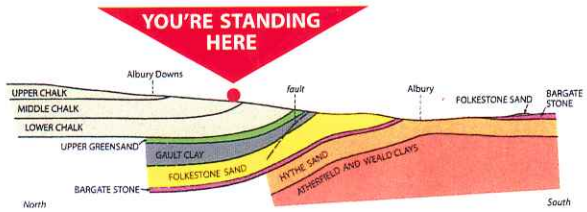
DO NOT CLIMB THIS CLIFF FACE, BECAUSE IT IS DANGEROUS.

The white rock in this pit is chalk. The chalk was laid down as a soft sediment on the bed of a warm shallow sea about 92 million years ago. At that time the nearest land was a long way away; no sand and only a little mud from the land reached here. So the chalk is pure and white (calcium carbonate). It is made from the tiny skeletons (a hundredth of a millimetre across!) of marine algae (plankton: food for fish) that floated in the warm sea and sank to the bottom when they died – see the picture below right. Other larger fossils, like shells, are found but are rare. You may see some broken ones if you look closely, but please do not hammer the rock to remove them – let other people look for them too.

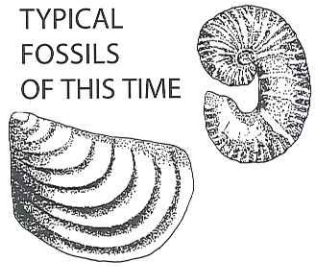
Chalk often has lines of dark flints, but not here. The flints occur mostly in the Upper Chalk (see 'The Rock Sequence' opposite), whereas this is Middle Chalk.

Look at the middle of the cliff face in front of you.
DO NOT CLIMB IT. Can you find the section represented here?





TYPICAL FOSSILS OF THIS TIME



Nature

The Chalk rock produces thin, lime rich soils, and these soils are colonised by chalk-loving plants (calcicoles). Only a limited number of plants like these conditions. Typical calcicoles include Yew, Dogwood, Buckthorn and, much more rarely, Juniper and Box. See the particularly large, old, dark evergreen Yew to your right.

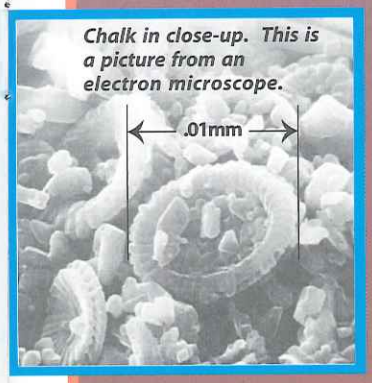
The climbers all over the bushes to the left are Clematis, which also like chalky soil and are a very good food source for many insects and birds.


Brimstone

The open downland that you crossed will be especially attractive in the summer when the many flowering plants feed a wide variety of butterflies and insects.

History

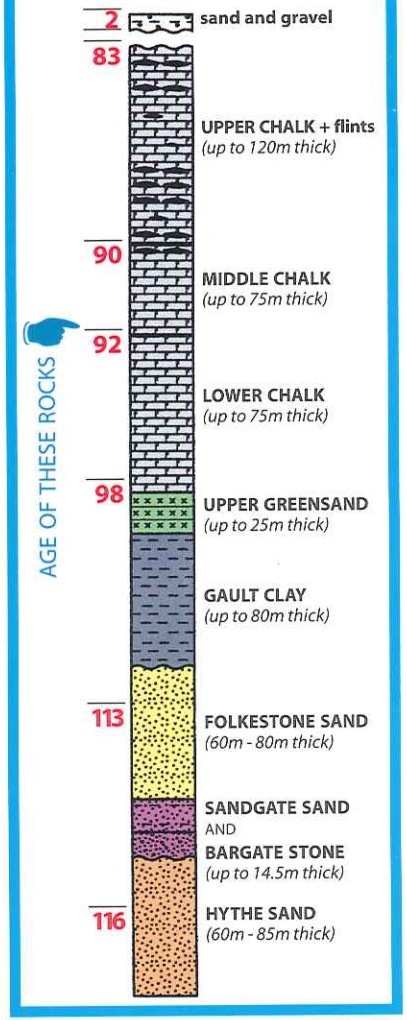
This is just one of many small chalk pits, opened up as needed by local farmers. Within this pit there used to be a lime kiln, which was in use until about 1940. By heating the chalk in the kiln it was converted into lime, for spreading on clayey fields to stop the clay being so 'sticky', making it easier to plough and to grow crops.



Chalk in close-up. This is a picture from an electron microscope.

This pit was once twice as deep as it is now: it was partially filled in the 1980s. Now it is used for the temporary storage of sewage sludge (hence the smell!), which is later spread on the fields.

THE ROCK SEQUENCE



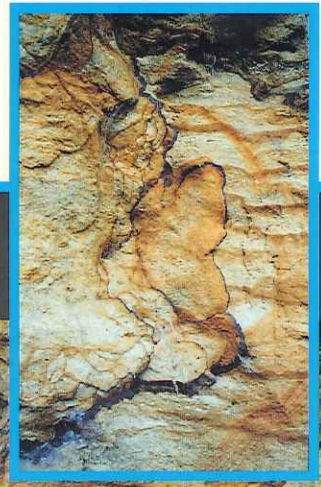
STOP 4

Water Lane Sand Pit

This is in the Folkestone Sand, which was laid down on the sea-bed about 114 million years ago. As you can see, the sand is quite clean, with no mud between the grains. There were shells on the sea-bed and fish in the sea, but they are very rarely found as fossils.

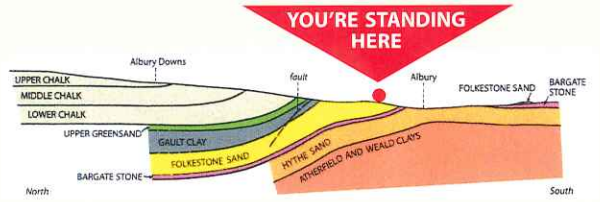
Up on the left-hand side of this pit, you can see that the sand is in thin layers, sloping down to the left. This is because the sand grains were dumped, not on a flat sea-bed, but on the sloping face of underwater 'sand-dunes'. They show us which way the sea currents were moving, all those millions of years ago: from right to left as you look at it (towards the south-east).

There are hard brown veins within the sand. They are due to iron oxide, which has filled the small spaces between the sand grains (just like cement). If you wish to examine a piece of this ironstone and feel how heavy it is, pick up a loose piece from the ground – please don't damage the cliff face.

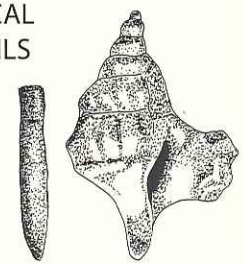


This is a photograph of the cliff face above you. WARNING: PARTS OF THE CLIFF FACE SOMETIMES COLLAPSE UNEXPECTEDLY.

The brown staining and wavy lines are due to iron oxide (rust!) coating the clear sand grains.



TYPICAL FOSSILS OF THIS TIME



History

This sand pit was dug some time before 1930, and has long been abandoned. The sand was probably used locally, as building sand (in the mortar between bricks, or in concrete). Some of the houses and walls you will pass have used slabs of the iron-cemented sand and ironstone, rather than bricks. Remember also to have a look for them when you're in Albury village later on.

Ironstone has been used to build this wall in Albury, with smaller fragments decorating the mortar.

Nature

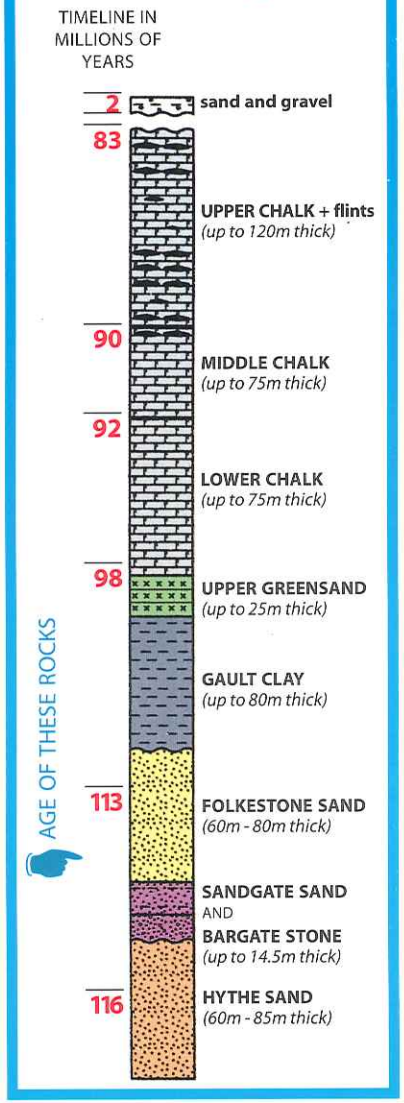
The underlying sandstone gives an acidic nature to the soil, which is shown by the plants in the area, particularly Pine, Broom, Holly (passed at the entrance) and Oak. A Pine plantation is around the rim.

The sand does not hold much water or nutrients for plants. As a result the soil is thin and crops are poor, so it is usually left as woodland.

Bee-killer wasp

If you look closely at the bank, which is exposed to direct sunlight, you will see many small holes. These have been made by burrowing hymen-optera – wasps, etc.

THE ROCK SEQUENCE



FOLLOW THE 'FOSSIL' TRAIL MARKERS

PLEASE RESPECT THE COUNTRY CODE THROUGHOUT YOUR WALK

The first stop on the Trail, **STOP 1 – Newlands Corner Wood –** *is behind you, 100m behind the toilets and Visitor Centre.*
It is on sand and gravel. (See information on page 4.)

STOP 2 – Viewpoint – on Chalk (page 6)
To get to Stop 2, return to the car park and walk downhill 200m to the Viewpoint board.

STOP 3 – Albury Downs Chalk Pit – on Chalk (page 8)
To get to Stop 3, walk to your left through the trees and past the bench. After 100m bear slightly uphill through the post-and-rail fence, then walk downhill on a chalk track. Turn right after 400m at the next trail marker.

STOP 4 – Water Lane Sand Pit – on Folkestone Sand (page 10)
To get to Stop 4, continue downhill for 400m, following the lane. After passing a track/road to the left, look for a sandpit on the right.

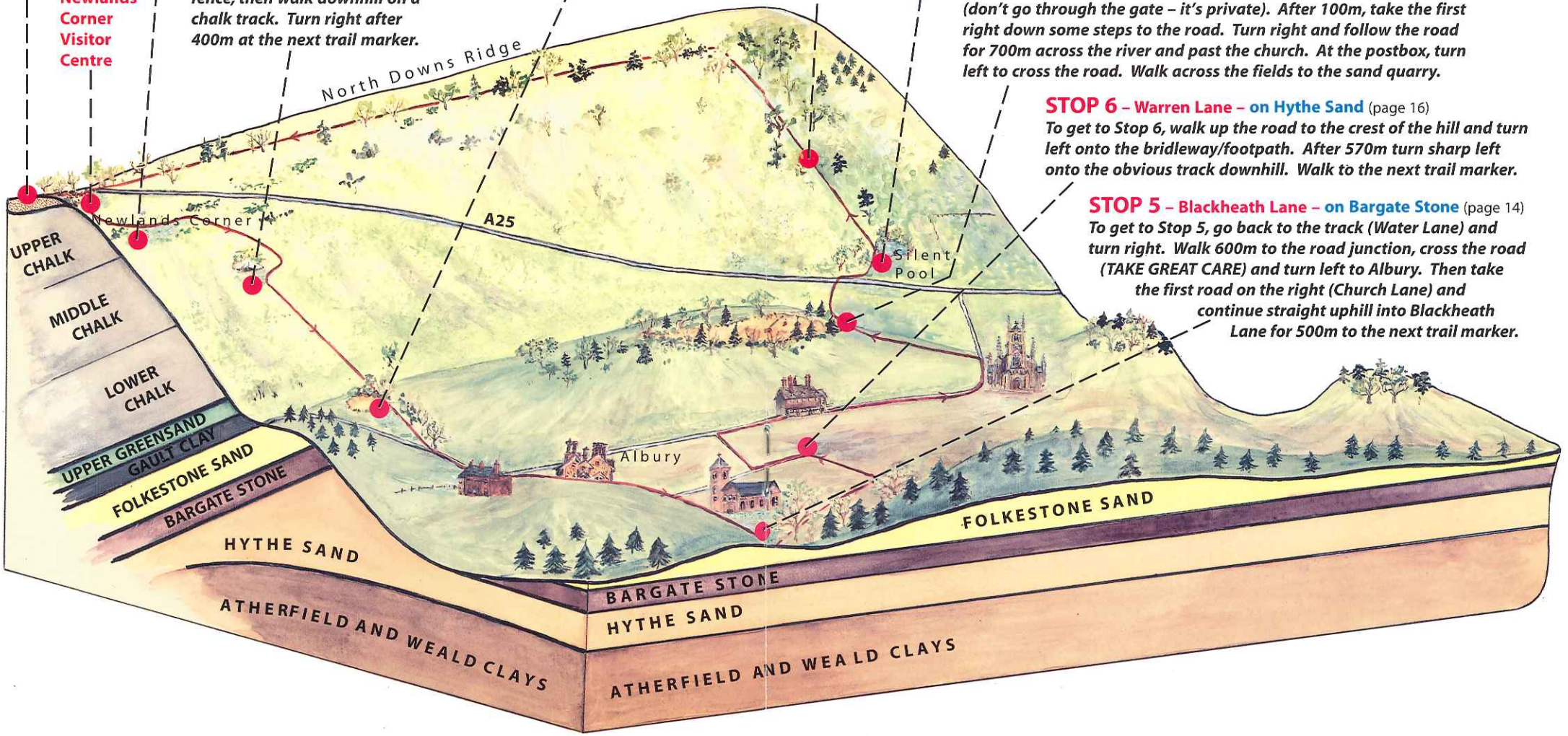
STOP 9 – The Boxwood area – on Chalk (page 20)
To get to Stop 9, from the upper pool take the footpath with steps uphill on the west (left) side onto the main footpath, and turn uphill.
This is the last stop on the Trail. *To return to the road and the car park, continue to the top of the hill, turn left and walk for 1.7km (just over a mile).*

STOP 8 – Silent Pool – on Chalk (page 20)
To get to Stop 8, turn right and follow the footpath for 300m until you are opposite Silent Pool. WITH GREAT CARE, cross the road to visit the Pool.

STOP 7 – Albury Sand Quarry – on Folkestone Sand (page 18)
To get to Stop 7, continue downhill, turning left with the path (don't go through the gate – it's private). After 100m, take the first right down some steps to the road. Turn right and follow the road for 700m across the river and past the church. At the postbox, turn left to cross the road. Walk across the fields to the sand quarry.

STOP 6 – Warren Lane – on Hythe Sand (page 16)
To get to Stop 6, walk up the road to the crest of the hill and turn left onto the bridleway/footpath. After 570m turn sharp left onto the obvious track downhill. Walk to the next trail marker.

STOP 5 – Blackheath Lane – on Bargate Stone (page 14)
To get to Stop 5, go back to the track (Water Lane) and turn right. Walk 600m to the road junction, cross the road (TAKE GREAT CARE) and turn left to Albury. Then take the first road on the right (Church Lane) and continue straight uphill into Blackheath Lane for 500m to the next trail marker.



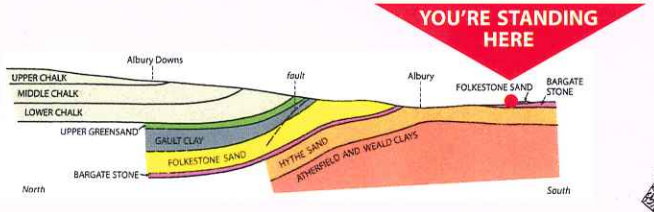
STOP 5

Blackheath Lane

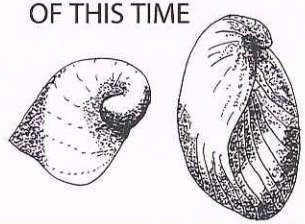
This is Bargate Stone. Downhill from here is dull brown sand, but this is real rock. Bargate Stone is a sandstone, which has been used for building houses and local churches. It is rock rather than sand because it has a natural lime cement. The lime content of the rock makes the soil fertile, and so it is farmed. Further uphill there are only trees on the Folkestone Sand, which gives an 'acid' and infertile soil.

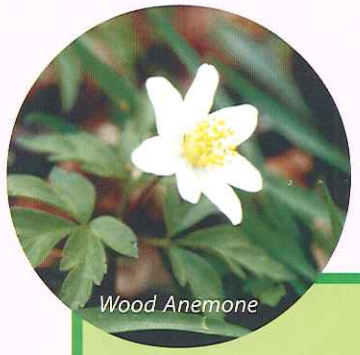
So why is this rock so interesting? Well, it was once part of an ancient delta. This area was on the sea-bed, but near the shore, with a river flowing off the land which was just north of present-day Guildford. On the land, an older limestone and its fossils were eroded by the river and then dumped out at sea, here. So part of the limestone was recycled, mixing its light yellow-brown grains ('ooids') with the sand on the sea-bed. The rest of the limestone formed the lime cement.

Unfortunately, fossils derived from this older limestone are extremely rare.



TYPICAL FOSSILS OF THIS TIME




Wood Anemone

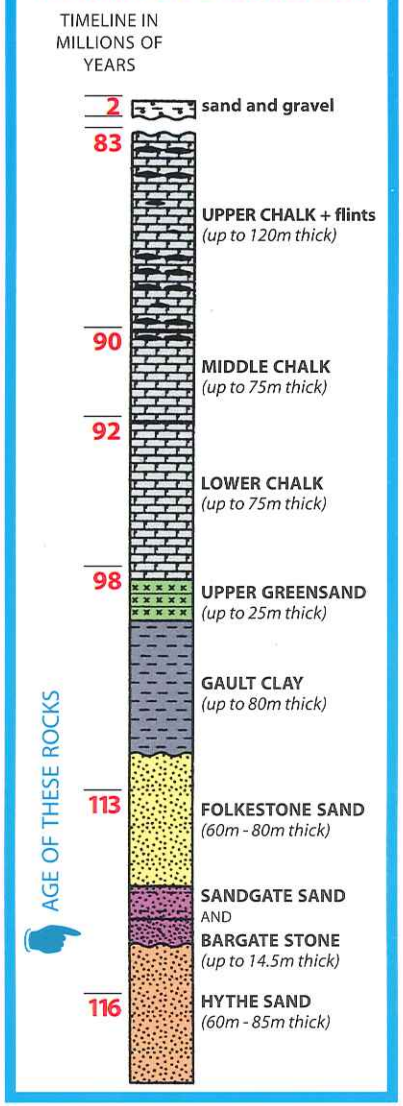
Nature

This rock breaks down to form a limy soil. Some of the plants that can be seen here are Wood Anemone and Arum Lily. These are in flower between March and May. The Hart's Tongue Fern provides more 'greenery', with its long wide leaves (they are not 'feathery' like the other ferns).

Further up the hill is woodland on a sandy soil. This has evergreen trees like Scots Pine, Larch and Western Hemlock, as well as natural Oak, Beech and Elm. Below the trees are typical dry-ground plants like Gorse, Bracken and Bluebell.


Hart's Tongue Fern

THE ROCK SEQUENCE



STOP 6

Warren Lane

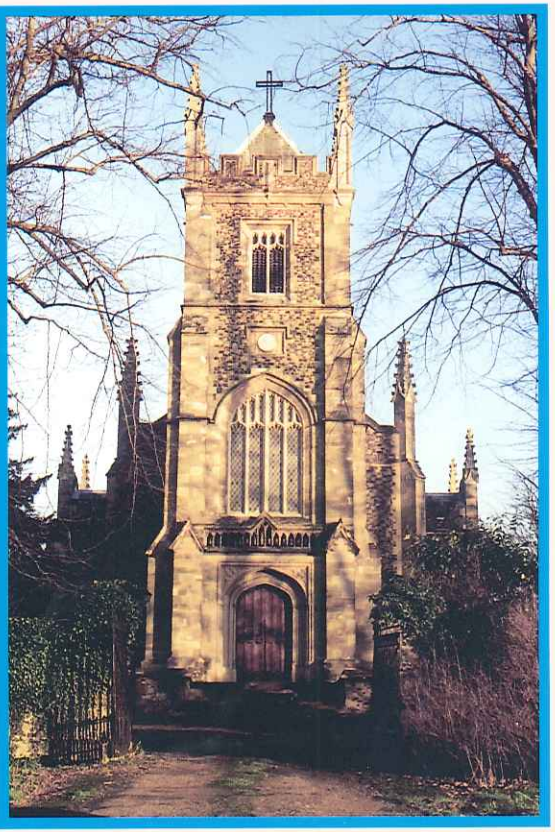
This is an exposure of the Hythe Sand, which is named after exposures of the same rock in Kent. It is a fine brown sand, with occasional hard nodules (of a mineral called chert, which is similar to flint). Some beds show many worm burrows: they are the small light-coloured circles, best seen in the dark grey layers. These darker layers contain many small dark green/black grains: they are made of a mineral called glauconite – see the picture opposite. This tells us that the sand was laid down on the sea-bed, and not on land or in a river.

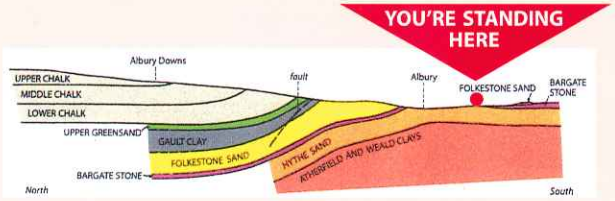
At the base of this exposure a thin pebble bed can be seen. This shows that the sea currents were occasionally stronger, perhaps due to a storm, but the greater amount of fine sand shows that usually conditions were fairly calm.

This is the Catholic Apostolic Church just east of Albury, which you will see further along the Trail. It is built from stone found in south-east England.

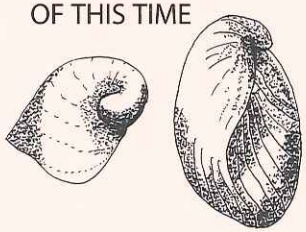
The light brown blocks on the sides of the tower come from the Hythe Sand, as exposed in the cliff face here, but they are obviously of harder material.

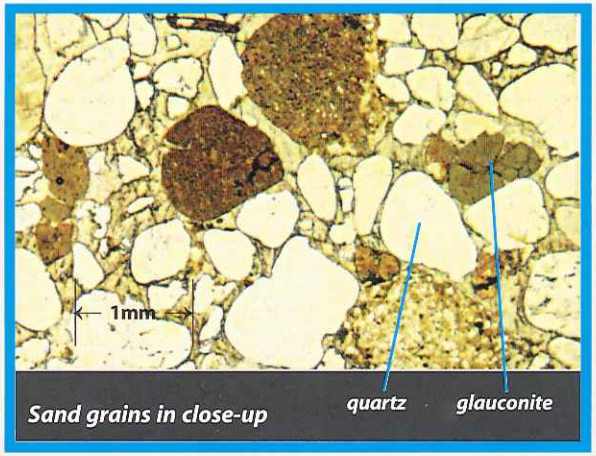
The smaller and darker blocks in the upper part of the tower are lumps of ironstone, taken from the Folkestone Sand (as we saw in Water Lane).





TYPICAL FOSSILS OF THIS TIME





Sand grains in close-up

Nature

The exposed sandstone face supports interesting communities of mosses and lichens. Larger plants include Foxglove, Elder, Beech and Oak. The exposed roots of a mature Oak play host to many species of plants and insects.

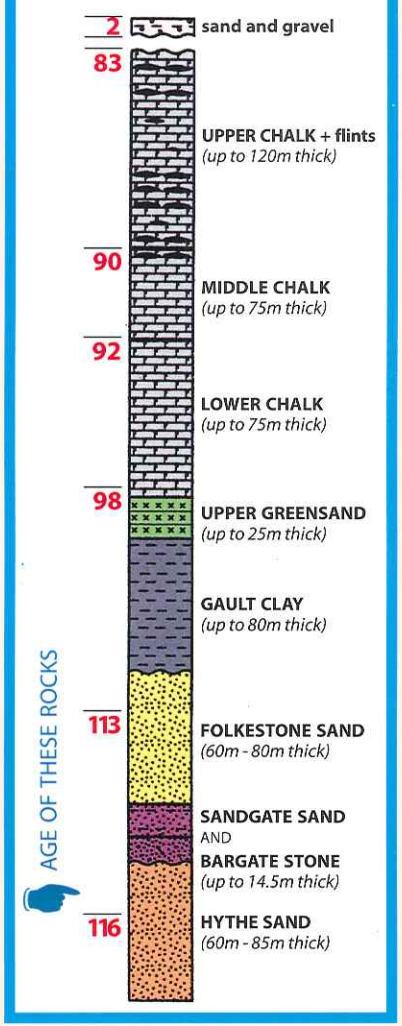
The sand grains here are smaller, and the soil will hold water and nutrients. So the natural vegetation has been cleared to provide fields.

Rabbits like sandy soil, and nearby Albury Warren was created in medieval times as a ready source of food.

Gorse

Foxglove

THE ROCK SEQUENCE



STOP 7

Albury Sand Quarry

This 'quarry' is in the Folkestone Sand, just like the smaller sand pit you saw in Water Lane. It is in clean yellow fine to medium sand, with only occasional thin clay layers. The sand again shows the current-bedding, up to 3m high, facing towards the south-east, while the beds themselves are tilted down (dip) towards the north at about 10°. No fossil shells have been found in this quarry, because they have long ago been dissolved by water moving through the sand.

The Folkestone Sand was laid down on the seabed about 113 million years ago. There was land close by, to the north. The current-bedding shows that the water was between 20m and 50m deep. At that time there lived in the sea many of the animals you can still find today: oysters, scallops, corals, starfish, sea-urchins, lobsters and fish. Land objects were also washed in: very, very rarely, one can find dinosaur bones and 'fossilised' wood.

(It is the tax on landfilling this pit that has paid for this Trail.)

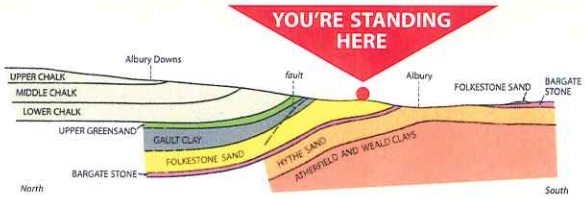
Extraction of Folkestone Sand in this pit, October 2001.

Nature

This sand quarry has been dug out of Weston Wood. This was once an ancient woodland that had existed for at least 400 years. Remnants of the original wood can be seen in the patches of Oak, Beech and Hazel over dense Bluebells (in spring) around the edge of the quarry.

You can see that many of the trees have been planted recently to maintain and extend the woodland and to act as a visual screen to the landfill. Behind the landfill is a plantation of Scots Pine and Larch and the non-native plant from the Himalayas, the Rhododendron.

Whilst the landfill area can never again be an ancient woodland, with careful management it can become a valuable area for nature conservation.



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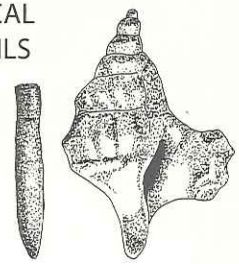
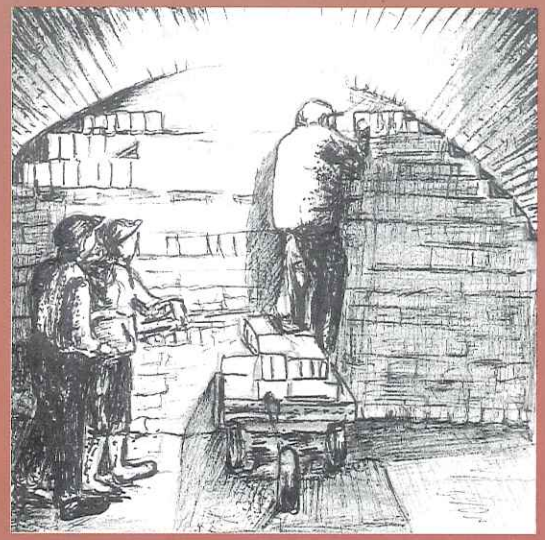


History

Sand has been dug at this pit since 1930. It's now (in 2001) at its maximum size – 800m long, 300m wide and up to 50m deep. The sand has been used as building sand (in bulk), and for road making (mixed in with the tarmac).

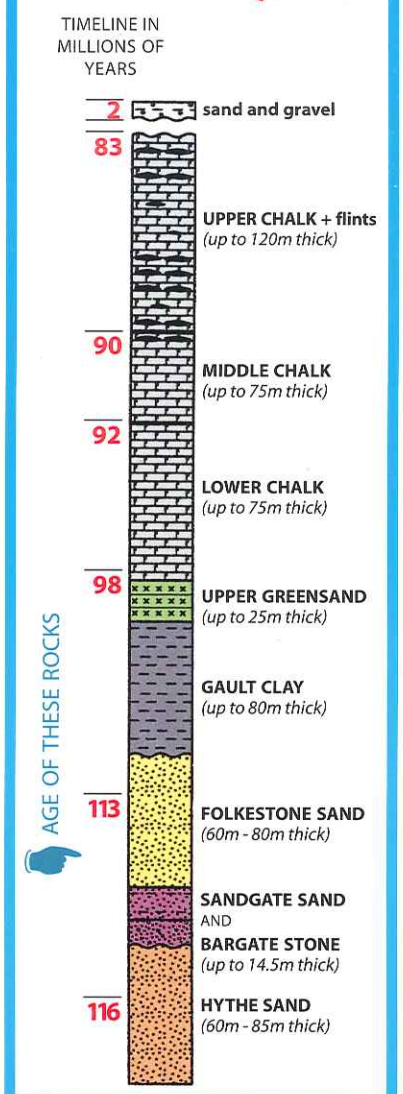
The 'big hole' is now a landfill, with completion due in 2025. The waste is in eight 'cells', each one well lined with clay and plastic to prevent water from the waste causing pollution.

Between this sand pit and the road was a brick works, with a pit alongside, working the Gault Clay. It was operating during the first half of the 1900s. The pit was about 5m deep, and fossils were easily found. It has since been completely filled, and the brickworks buildings have been demolished.



Packing a brick kiln. Surrey has many former clay pits and brickworks, but some still survive. Most brickworks now are highly mechanised, but some bricks and tiles are still being made by hand.

THE ROCK SEQUENCE



STOP 8

Silent Pool

Here you can study Surrey County Council's own information boards.

STOP 9

The Boxwood area

Look out over the fields in front of you, and try to match the view with the picture below. The rocks form 'strips' beneath the hillside. Also, the beds are tilted to the left (north), as in the drawing above. Use your imagination and try to picture the layers of rock beneath the grass and soil. With one glance you can sweep across 30 million years of Earth's history, still recorded in the rocks beneath your feet!

The fields in front of you are on the Chalk and they have thin, less fertile soils. At the foot of the slope the field is on the Gault Clay, which produces a soil that is thicker but poorly drained. Across the road is a wide area of sandy, less fertile soil. It has not been cleared for fields, but has been left as woodland.

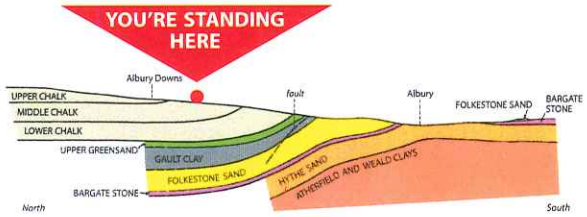
So you can see that there are links between the rocks, the soils and the uses that farmers make of the land.

Nature

In front of you the natural woodland has been cleared for fields. Further up the hill (beside the Trail) is the Box Wood. Box is a small-leaved, dark evergreen shrub that is found only on chalk. Given the rarity of chalk soils in Britain and Europe and the scarcity of Box, large areas of Box are often of European importance.

Whitebeam

Whitebeam (so named for the white, woolly underside of its leaves) and shrubs such as Privet and Buddleia are also common in this wood.



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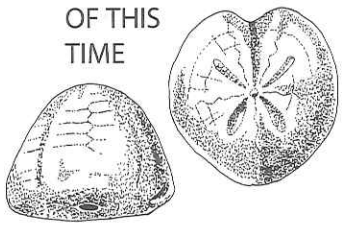


History

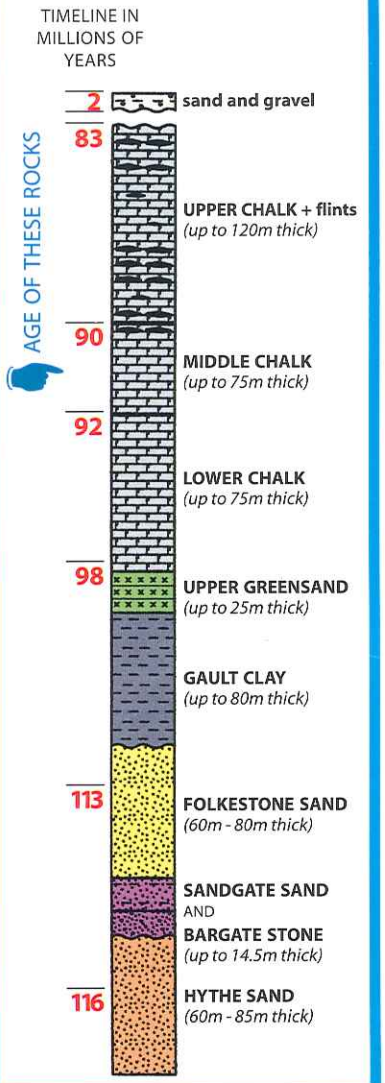
This location is also of historical interest. The obvious building here is known as a pillbox. It dates from about 1940, and was one of many thousands built at that time, especially across the south-east. It would have formed a small 'fort' or stronghold to resist attack if the country had been invaded.

The other, less obvious, building here is alongside the pillbox and is made of bricks. It was a lime kiln, used for converting the Chalk into lime to spread on sandy and clayey fields to provide vital minerals and make the soil easier to work. A fire is lit in the bottom of the kiln and chalk introduced above. As it burns, the chalk takes to be [illegible] lime.

These large kilns were usually built inside the chalk quarries to avoid the need for transport. At one time every farm would also have had a small lime kiln.

A typical lime kiln

THE ROCK SEQUENCE



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Surrey RIGS Group proposed the Geology Trail, wrote the text for the booklet and the signboard, and undertook their publishing and production. We thank all the members who contributed material, especially Margaret Hargrave for her superb illustrations.

Surrey Wildlife Trust and Surrey Industrial History Group also made significant contributions of pictures and text, and Paul Davies of the Natural History Museum supplied the excellent fossil drawings.

Finally, credit to our designer, Clare Windsor, for her faith and perseverance through to completion of the project.

Photograph credits

Cover and geology-related photos: Surrey RIGS/Iain Fletcher

5, Silver Birch: Surrey Wildlife Trust/Frank Blackburn

9, Brimstone Butterfly: Surrey Wildlife Trust/J M Tucker

11, Bee-killer Wasp: David Element

15, Wood Anemone: Surrey Wildlife Trust/Ken Potter

15, Hart's Tongue Fern, *17*, Gorse, Foxglove, *18*, Bluebells: Surrey Wildlife Trust

20, Whitebeam: Surrey Wildlife Trust/C W Ward

'RIGS' stands for Regionally Important Geological/Geomorphological Sites. There is a RIGS Group in almost every county, comprising volunteers (both amateur and professional) who have an enthusiasm for geology. They identify and monitor sites of geological importance, with the aim of conserving them and gaining recognition for them nationally.

In Surrey, the RIGS Group is very active and, in creating the Newlands Corner-Albury Trail, it hopes to impart to the public the exciting geological history of this area (a magnet for geologists for more than 100 years). The Group meets every two months or so, at Leatherhead.

If you want to know more about geology, or would like to help, here are some links:

RIGS

Surrey RIGS Group: Iain Fletcher, 020 8543 0179, or via the Surrey County Council Planning Department.

National RIGS website: www.ukrigs.org.uk

Geological societies

Farnham Geological Society: Ms Stephens, 01252 680215.

Guildford Gem, Mineral and Lapidary Club: Mr Thomas, 01483 488459.

Mole Valley Geological Society: Ms Bignold, 01372 272933 (www.dendron.net/mvgs)

National society: Geologists' Association, Burlington House, Piccadilly, London W1J 0BG (runs field trips, lectures and courses for amateur geologists and professionals).

Local Surrey museums with geological collections

Dorking and District Museum, The Old Foundry, 62a West Street, Dorking, Surrey RH4 1BS. Tel: 01306 743821. [Wed/Thurs 2.00-5.00pm, Sat 10.00am-5.00pm]

Guildford Museum, Castle Arch, Quarry Street, Guildford, Surrey, GU1 3SX. Tel: 01483 444751.

Haslemere Educational Museum, 78 High Street, Haslemere, Surrey, GU27 2LA. Tel: 01428 642112.