

What's beneath your feet?

All of the rock layers **around Oxford** were laid down as sediment by rivers, coastal lakes or the sea. This all happened millions of years ago during a period of complicated changes in sea level over (what is now) southern Britain. The accumulating sediment formed as :-

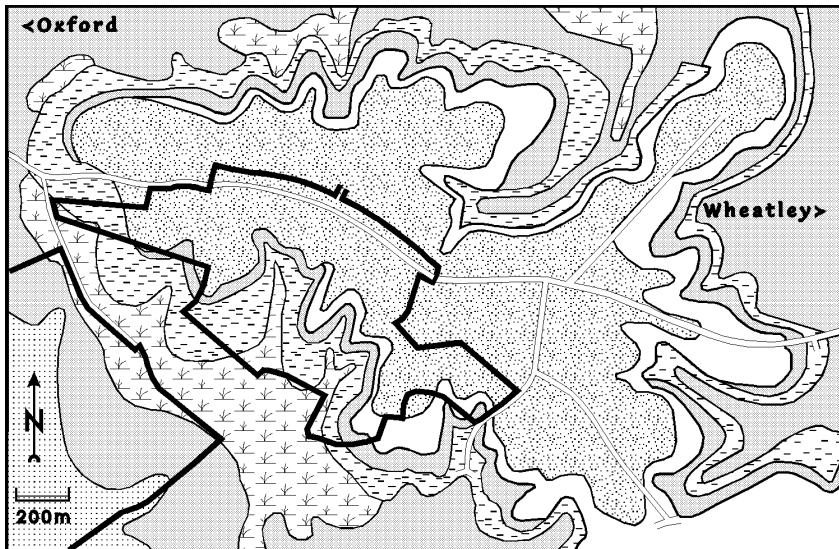
- clay in lakes and on the sea bed,
- limestone where there was a coral reef,
- sand at the shore-line,
- and gravel along the rivers.

Walking from Oxford City to Shotover, you pass over two different sands, two limestones and four different classifications of clay. This geological 'story' is worked out by geologists who can identify the fossilized plants and animals.

The main bulk of **Shotover Hill** is at the top of the Kimmeridge Formation, most of which is dense grey clay. However, layers of loose coastal Kimmeridge Sand were also formed at this time. The sea bed was being pushed up from below by older rocks, and the sea was becoming shallower. Then at the very end of the Jurassic period, coral

formed in warm and shallow coastal lagoons. This coral became the shell-encrusted Portland Limestone which lays on top of the Kimmeridge Clay. This was about 150 million years ago, and many millions of years before Shotover was formed into a hill by the glaciers.

Finally for this region, about **135 million years ago**, the first Cretaceous (or Wealden) deposits were laid down. The Whitchurch Sand Formation was formed by river sedimentation, as by now the underlying rocks were gradually pushing the Kimmeridge and Portland Formations out of the sea. Whitchurch Sands are a rich orange colour from the high iron content and will in time form the hard 'Ironsand' cap on Shotover. Classification of these rocks has been difficult because they were formed during the period of change, from the Jurassic to the Cretaceous. This has given rise to conflicts in taxonomy and the layers have been given various official and local names in the past. For example Whitchurch Sand was known locally as 'Shotover Ironsand' and classified with the Greensand at Tiddington.



THE KEY TO BOTH DIAGRAMS

	Whitchurch Sand
	Portland Limestone
	Kimmeridge Clay
	Kimmeridge Sand
	Glacial 'Head' Clay
	Amphthill Clay
	Boundary of Shotover County Park

It is only **'recently', in the last million years**, that Shotover was formed into a hill by ancient rivers and receding glaciers. As the glacial ice melted, a final layer of jumbled clay and eroded material was laid down on Shotover Hill. This 'Head' Clay now fills the valleys and covers the lower slopes of the hill.

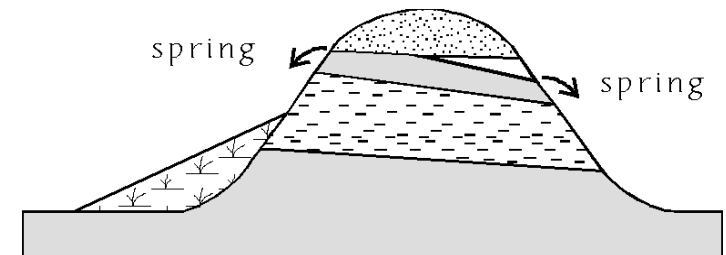
The cross-section diagram shows a simplified west-east section through Shotover Hill and gives some idea of the strata.

1 On the very top is the cap of **Whitchurch Sand**. The sandy soil is infertile and acidic, yet is important for sustaining the heathland that was once very extensive on the hill. This sandstone, and the thin layer of limestone, are porous but both sit on dense clay, and create a large store of water which flows out at springs around the hill.

In the 17th and 18th century, the valuable pigment Yellow Ochre was mined from the Whitchurch Sand. Thin layers of fine clay embedded in the iron-rich sand, and thousands of years of soil chemistry, produced a material that needed little processing before it could be used by artists. Wheatley windmill was modified to grind the ochre, in addition to milling bread flour.

Cross section of

Shotover Hill



2 The **Kimmeridge Clay** Formation which makes up most of the hill, contains a thick bed of sand, and gives rise to most of the sandy soils found on the sides of the hill. This sandy strata, which is most evident at the 'sand pit', is sandwiched within the clay and makes the Kimmeridge Formation appear as three layers.

The top layer of the sandwich is the thin seam of clay, quite high on the hill, that gives rise to the 'halo' of springs around the top of the hill. The strongest springs are near Wheatley, to the east, as the strata dip that way. Yet even the smallest springs flow all year round. (cont ...

(... Kimmeridge Clay Formation continued)

The purity of the spring water helps the diversity of flowers and mosses in the marshes.

The bottom layer of the sandwich is very deep (40-50 metres), and only appears at the surface in places where it is not covered by Head Clay (Brasenose Wood, Risinghurst and Shotover House). This clay once supported an important local brick industry, which has left us with the lakes near Risinghurst and two Kiln Lanes.

3 Towards the northern and eastern sides of the hill a thin layer of **Portland Limestone** outcrops between the top of the Kimmeridge Clay and the bottom of the Whitchurch Sand. This layer is obscured, or possibly absent, towards the west and does not outcrop on the Oxford side of the hill. However, as a 'rule of thumb' it is possible to say that the Portland Limestone occurs where the slopes are steepest on the side of the hill.

4 All that remains of the glacially deposited 'Head' Clay is where it has resisted erosion on the lower slopes and valley bottoms. Many of Shotover's flower meadows and acid marshes are formed on this semi-permeable clay.

The Giant's Marbles (Doggers)

The big round boulders in the 'Sand Pit' are called 'doggers', and there are many more scattered around the hill. There are folk tales of giants throwing these 'marbles' at each other, and are said to represent the fossilised tears of the Empress Matilda. In 1141, Matilda was fleeing from her enemies in London and wept copiously as Oxford (and safety) came into view from Shotover.

Actually, the doggers 'grew' in the Kimmeridge Sand over millions of years. Minerals in the ground water (calcium) stick to the boulders and cement the sand together like concrete. The doggers are exposed when the surrounding sand erodes away.

The multilayered geology of Shotover makes the hill what it is today: a fine mosaic of wildlife habitats. Sandy heath caps the hill, spring-fed marshes have developed on glacial clay in the valleys and there are remnants of ancient woodland on the surrounding heavier clays. The geology shapes the hill, dominates the distribution of vegetation and creates the beautiful diversity that is particularly important for wildlife.

For hundreds of years the main road to London went over Shotover as the sandy hill was always dry compared to bogs and marshes all around. The clay has been used for pottery and bricks since before roman times, and Shotover once provided artists with the highest quality Yellow Ochre in England.

Shotover Wildlife is a voluntary organisation founded to research and communicate the importance of Shotover Hill for wildlife

Chair: Ivan Wright
Tel: 01865 874423
enquiries@shotover-wildlife.org.uk
www.shotover-wildlife.org.uk

Related leaflet titles:

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Cover picture: Shotover *Pectinatites* from the Kimmeridge Clay
By Jacqueline Wright

Leaflet written by Ivan Wright
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GEOLOGY

on SHOTOVER



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