

# Clophill Geotrail Educational Pack

Bedfordshire Geology Group

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## Introduction

There are several LGS (Local Geological Sites) across Bedfordshire. These are sites considered worthy of protection for their earth science or landscape importance. Some are chosen particularly due to their educational value.

Bedfordshire Geology Group produced this resource pack consisting of worksheets aimed at Key Stage 3 -4 science and geography studies to be used on a field excursion to the village of Clophill in Bedfordshire following the Clophill Geotrail.

The pack has been designed to aid the teaching of subjects which link to Bedfordshire's rocks and landscape. Supporting leaflets and information are available online at

[www.bedfordshiregeologygroup.org.uk](http://www.bedfordshiregeologygroup.org.uk)

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## Notes for teachers

This pack provides background information and supporting material for groups wishing to study Bedfordshire's rocks and landscapes.

The contents are outlined below along with suggested uses:

## Worksheets

### 1: Pooh Sticks - The Flit valley surface flow rate

To be completed by students.

**Notes:** The flow rate in a river, stream or pipe can be determined by multiplying water velocity by the cross-sectional area.

Measuring flow rate – one step further: Water at the surface travels faster than near the stream bottom due to resistance from gravel and stones, etc. We can correct for this by multiplying the flow rate on the surface by a correction factor, to get a better measure of the water flow. This number is 0.8 for rocky-bottom streams/streams or 0.9 for muddy-bottom streams/streams.

### 2: Fuller's Earth

To be completed by students.

Any fine-grained, naturally occurring earthy substance that has a substantial ability to adsorb impurities or colouring bodies from fats, grease, or oils. Its name originated with the textile industry, in which textile workers (or fullers) cleaned raw wool by kneading it in a mixture of water and fine earth that adsorbed oil, dirt, and other contaminants from the fibres.

### 3: Bricks and building stones

To be completed by students.

Building 1: 123 High St; fingerprints of the brick makers embedded into creamy white Gault clay bricks, the high chalk content in the Gault clay when fired keeps the bricks white.

Building 2: House and wall opposite 64 High St; the house is old but has a new build garden wall that uses old methods of building with glazed black bricks to form a pattern in the wall. This glazing method was very popular with Victorian house builders. It showed the wealth of the owner as these bricks were very expensive to produce. When new they were actually bright green but have weathered to black. The green glaze method and ingredients has been lost to time as no-one can determine how to produce the glaze today.

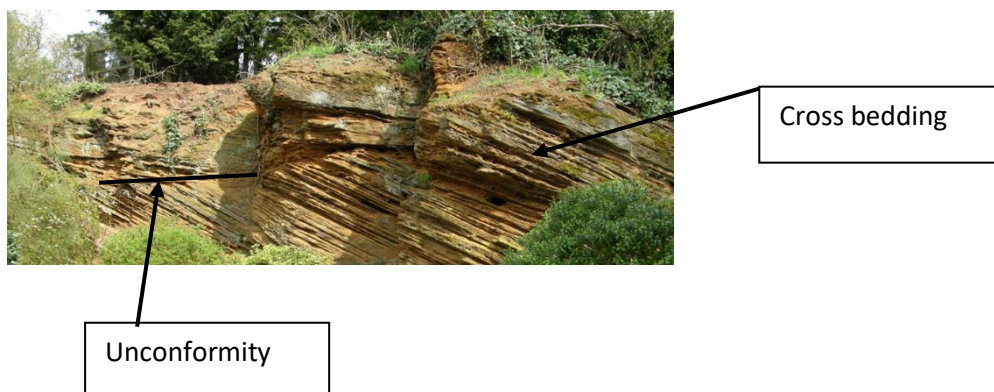
Building 3: Garden wall alongside building 2. These greensand sandstones have been eroded by pollution from road users. The grit that is laid down on the roads to de-ice gets splashed onto the rocks at this lower level and erodes the rocks.

Building 4: 19 High St; this building has the old glazed bricks which are not eroding as quickly as the unglazed red bricks. These red bricks are made from clay that has a lot of inclusions in and is probably brickearth clay quarried locally. Sometimes the brickearth was dug out of a local pit or even a back garden and fired in temporary kilns on your own land. The many inclusions mean that freeze-thaw weathering quickly erodes the bricks. You will notice most damage is at the base of the wall where the same erosional processes as in building 3 have occurred.

#### 4: The Flit Valley

The river Flit is a meandering river and it sits in an old valley.

#### 5: Geological outcrop features



## Sources of information

The Geological Society's Rock Cycle; an excellent source for prior reading  
<https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle.html>

River levels UK website: <https://riverlevels.uk/>

National river flow archive: <https://nrfa.ceh.ac.uk/>

## Introduction to the geology around Clophill

Clophill village sits in the valley of the River Flit, it is a mostly linear village following the valley floor. The river has cut down through the surrounding geology over millennia and created a wide flood plain with fertile soils. The church of Old St Mary's sits atop the Greensand Ridge, an outcrop of the Woburn Sands Formation, stretching 40 miles across Bedfordshire from Leighton Buzzard in the West to Gamlingay in Cambridgeshire in the East.

### The Woburn Sands

The Woburn Sands tell the story of a sudden rise in sea level 115 million years ago. England had been dry land for about 40 million years (from the end of the Jurassic period), and erosion by wind and water had worn away many layers of older rock. Then, sea-levels rose rapidly as the result of the most significant global warming the Earth has known. In Bedfordshire we see this event as the sudden influx of marine sands into a narrow seaway running right across the county, called the Bedfordshire Straits.

The Woburn Sands formation stretches right across southern England, showing on the surface as thin sinuous strips running from Norfolk, SW to the Isle of Wight, and again south and east of London. It changes its character and its local name across the country. In the Lower Cretaceous the sea washed these tiny grains of quartz sand south and west from Yorkshire to Bedfordshire and beyond.

### The Greensand Ridge

The Greensand Ridge formed during the elevation of The Alps in Europe. As the tectonic plates of Africa and Eurasia began to crash together, the Earth's crust lifted into a mountain range causing crumpling of the crust extending over vast continental areas. The Greensand Ridge is a remnant of those ripples.

Within the Woburn Sands are iron-rich layers that do not erode as quickly as the surrounding sands and the Greensand Ridge, which is capped with glacial till, allows it to stand proud in the landscape.

## Worksheet 1

### Pooh Sticks - The Flit valley surface flow rate

Complete the table below and take an average reading:

Pooh stick number	How many seconds does it take for the stick to travel under the bridge? (Flow)	Calculate the surface flow rate, or surface velocity, of the River Flit at this point in metres per second ( $\text{m s}^{-1}$ ).  ( $1 \text{ m} \div \text{Flow} = \text{flow rate}$ )
1		
2		
3		
4		
5		

### Complication

Now, an additional calculation is required to calculate the actual velocity of the water. This is because the water flows faster at the surface than it does at the bottom (where it flows over stones and rocks causing friction which slows it down). Unfortunately, for the River Flit we do not know this as it changes over time; however, you can research this as an additional exercise via the National River Flow Archive's website if you wish.

## Worksheet 2

### Fullers Earth

#### What is Fullers Earth?

Volcanic ash

Sand

Clay

#### How was volcanic ash deposited in Bedfordshire?

Decide for yourself which of the following two hypothesis you think is responsible for the Fullers Earth being deposited in Bedfordshire:

Hypothesis 1: Due to a volcanic eruption in Northern Germany and a subsequent pyroclastic flow.

Hypothesis 2: Deposits from the opening of the North Atlantic Ridge and the related volcanic activity.

Explain why you have chosen the hypothesis above....

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#### What is Fullers Earth used for?

Below is a list of some of the uses for Fullers Earth. Research other uses once you get back to school or home.

*Cat litter, toothpaste, fireworks*



## Worksheet 3

### Bricks and building stones

As you walk along the High Street in Clophill, you will notice lots of different building materials, but in particular the brick and stone houses.

Some of the houses are of special interest; try to spot the following houses and mark them off on the chart below, filling in the house number or name.

Descriptions of the feature are given to help you. Then, answer the questions related to these bricks and stones:

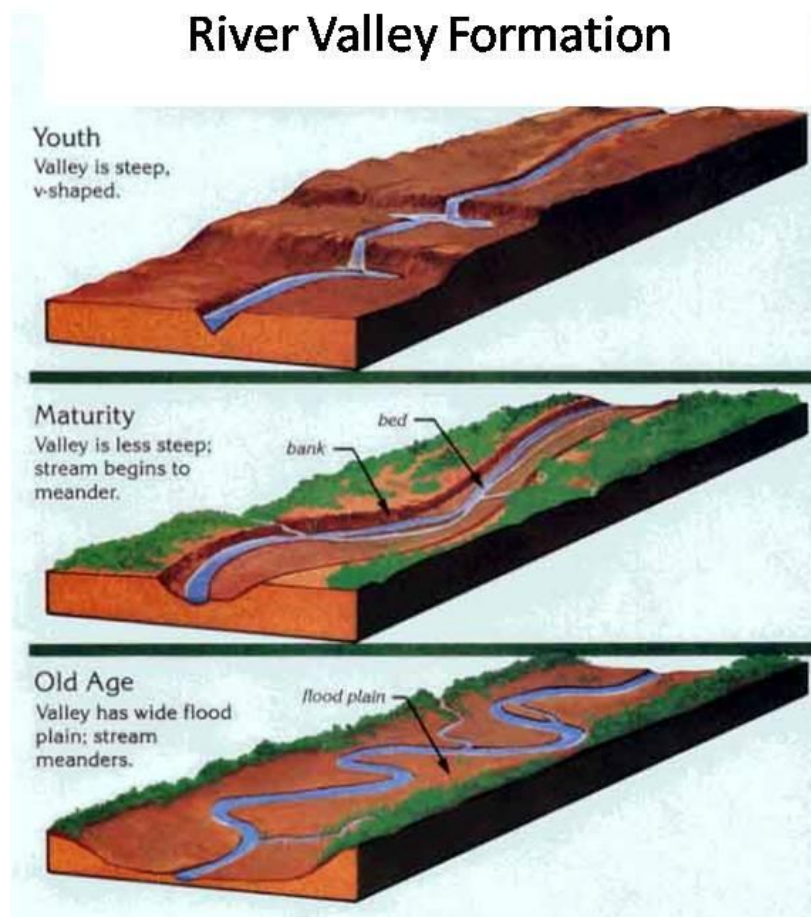
House number or name	Description of key feature	Question
	Brick building with fingerprints embedded in the bricks.	Why do you think these bricks are white and how did the fingerprints get there?
	Brick building with black shiny bricks in a pattern.	What process makes the bricks shiny?
	Stone building with heavily eroded front wall.	What natural modern process has affected these bricks?
	Brick building with heavily eroded bricks.	Why are some bricks more eroded than others?

## Worksheet 4

### The Flit Valley

From this vantage point along The Causeway, you can see the shape of the valley. The River Flit is a misfit stream, which means it is much smaller than the river that eroded the valley in which it sits today. During periods between the Ice Ages, the River Flit would have been a much larger braided system of streams eroding the landscape.

(Image courtesy of [www.geocaching.com](http://www.geocaching.com))



On the following blank page, can you draw the valley as you see it and compare it to one of images above.

Is the valley in its youth, or a mature or old valley? \_\_\_\_\_

**Blank page for valley drawing.**

## Worksheet 5

### Geological outcrop features.

At this exposure of the actual geological rocks that are beneath your feet, you can see two main geological features. These are listed below with a description; can you pick them out in the face before you? Indicate them on the photo below.



**Cross bedding:** In geology, layering within one or more beds in a series of rock strata that does not run parallel to the plane of stratification, or formation or deposition of layers.

**Unconformity:** An unconformity is a buried erosional or non-depositional surface separating two rock masses or strata of different ages, indicating that sediment deposition was not continuous.

