

## Opengeoscience 2: tilted and folded rocks

### Opening geological maps to the world

Open the British Geological Survey 'OpenGeoscience' website at <http://www.bgs.ac.uk/OpenGeoscience/>. In the section 'What is OpenGeoscience' click on 'Geology of Britain' to open the BGS 'Geology of Britain viewer'. You can use this to see how geological formations appear on maps and also how they affect the shape of the land – and apply this understanding anywhere in the world.

The viewer is part of the BGS's 'Opengeoscience' website showing geological maps down to 1:50,000 scale, of the whole of Britain. The BGS viewer uses different basemaps; by clicking 'Switch basemap' and 'Imagery' you can choose an aerial view for one end of the scale and a geological map at the other – with all gradations in between. So you can choose a geological feature on the map and then slide the slider, then click the location again to see how it affects the landscape.

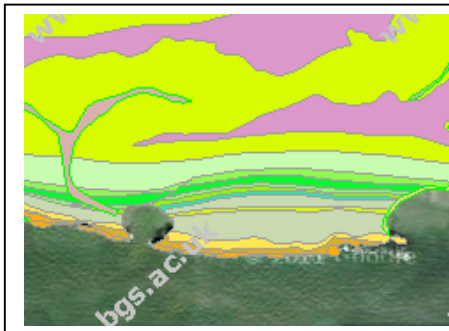
Follow the instructions to find the examples of bedding and folding below – and much more.

**Shallow-dipping sedimentary rocks** – type 'Wenlock Edge' (Shropshire, central England) into the viewer and 'travel' south west to see Silurian rocks like the Wenlock Limestone cropping out from north east to south west and dipping gently towards the south east (shown in turquoise). By using the transparency slider, you can see that the limestones in this sequence are more resistant to erosion than the shales, so that a series of cuestas (escarpments) has been formed, with the steeper wooded scarp slopes towards the north west and the shallower dip slopes towards the south east. A fault in the Wenlock Limestone has affected the geology and relief.



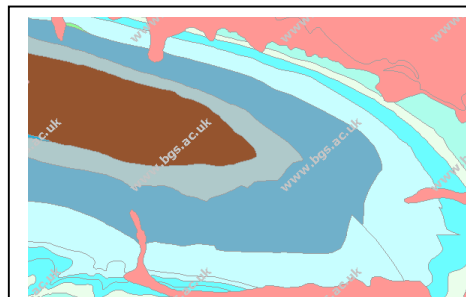
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**Vertical sedimentary rocks** – type 'Lulworth Camp' (Dorset, English south coast) into the viewer to see vertical east-west trending Jurassic and Cretaceous rocks, including the Chalk, which have been breached by the sea to form the nearly circular Lulworth Cove, whilst other headlands and bays occur further along the coast.



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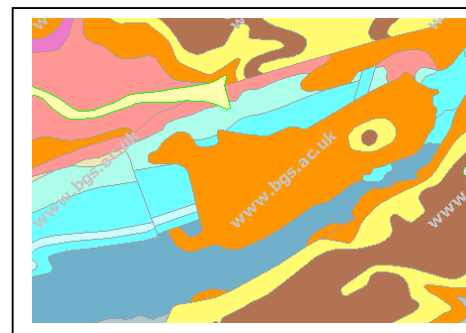
**Folded sedimentary rocks** – type 'Blagdon' (Somerset, south west England) into the viewer to see folded Devonian (brown) and Carboniferous rocks (blue tints). They are folded into an upfold or anticline with the oldest rocks in the centre. The crest of the fold is not horizontal but dips (slopes downwards) towards the east, which is why you can see the beds folding around the 'nose' of the fold. Later Triassic rocks (pink) were deposited on top of the folded and eroded Devonian/ Carboniferous rocks; the junction between the Triassic rocks and the older rocks below is an unconformity (see below).



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See how the Turquoise Limestone forms a series of small cuestas (escarpments) with steeper wooded scarp slopes facing south.

**Unconformity** - by typing 'Mells' (Somerset), see how the east-west formations of the Carboniferous 'Clifton Down' limestone (blue tints) are overlain by the much younger Jurassic 'Inferior Oolite' limestone (orange). Unconformities like this are visible on maps because the formation boundaries disappear beneath the unconformity, and faults do too – as seen at the top right of the main Jurassic outcrop. The transparency slider shows how the Jurassic rocks have been quarried away to expose the Carboniferous rocks beneath – which are now being quarried as well.



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### Try it out for yourself

Try identifying the following features:

- the boundary between the turquoise and pink rocks seen when you type 'Ingleton' (North Yorkshire) into the viewer;
- the topographic feature found WSW of 'Bratton' (Wiltshire) – if you zoom in you will see an extra feature of the steeply sloping part of the area;
- the coastal topography seen by typing 'Woolacombe' (Devon) into the box – and the geological reasons for this scenery.

## The back up

**Title:** Opegeoscience 2: tilted and folded rocks.

**Subtitle:** Opening geological maps to the world.

**Topic:** Using the 'Geology of Britain' web browser on the interactive British Geological Survey (BGS) 'Opegeoscience' website to explore how geological features appear on maps and how the formations are linked to relief features seen on the Google Earth™ viewer.

**Age range of pupils:** 14 – 19 years and adults

**Time needed to complete activity:** To view the examples shown takes about 15 minutes, but it is easy to get 'hooked' and spend a long time looking for other geological features and landforms.

**Pupil learning outcomes:** Pupils can:

- access geological and landform information from the BGS 'Opegeoscience' website;
- use examples from the web browser to show how different types of geological formations appear on geological maps;
- show how landforms are related to the geological formations beneath them.

### Context:

The examples used in the activity above only show the geological map, since we have received kind permission from the BGS to show the geological maps in our Earthlearningidea work; gaining copyright permission to show the aerial imagery as well proved too complex.

### Try it out for yourself

- The feature seen near 'Ingleton' is the unconformity between the underlying steeply dipping Ordovician rocks (pink) and the overlying Carboniferous Limestone (turquoise).
- The Cretaceous Chalk Escarpment is seen near 'Bratton' with its steep scarp slope towards the north and west and the dip slope towards the south east. The 'extra feature' is the Westbury White Horse, cut into the chalk in ancient times. To the south west of the horse can be seen the White Horse Quarry, providing chalk for the Westbury Cement Works.



The Westbury White Horse, cut in the chalk of the steep escarpment.

Image by Chris Downer - licensed for reuse under the Creative Commons Attribution-ShareAlike 2.0 license.

- The geology of the Woolacombe Bay area is of steeply dipping Devonian rocks – the tougher slates form the headlands whilst the bay has been eroded into the weaker sandstones by the sea.

### Following up the activity:

If you have a Smartphone in the UK, you can download a free application (App) from the BGS website at: <http://www.bgs.ac.uk/igeology/>. This will show you the geological map of the areas where you are, anywhere in the country (with mobile phone reception), like the viewer used above – and also gives the name and rock type of each formation.

### Underlying principles:

- Geological maps are 'bird's eye views' of the geology seen at the Earth's surface.
- Satellite images provide 'bird's eye views' of the Earth's surface.
- When these are combined, they show how the geology directly affects the landscape.

### Thinking skill development:

Even when both the geological map and the aerial image can be seen together, it takes an effort of construction to see how one affects the other, including elements of 3D thinking.

### Resource list:

- a computer with internet access

### Useful links:

<http://www.bgs.ac.uk/igeology/> - noted above.

**Source:** Written by members of the Earthlearningidea Team

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