

## Unit 13 Limestone landscapes of England

### About the unit

This unit develops pupils' knowledge and understanding of the patterns and processes associated with massive limestone landscapes (rather than softer limestones such as oolitic limestone and chalk). Pupils are involved in two problem-solving activities: one that asks them to consider the impact of quarrying on the local community; the other to consider sustainable development as the way forward.

This unit focuses on specific landforms above and below ground in the Yorkshire Dales National Park, although other areas could be substituted.

Throughout the unit pupils are encouraged to work collaboratively, to discuss issues and solve problems. There are also numerous opportunities for pupils to develop literacy skills.

This unit is expected to take 8–11 hours.

### Key aspects

#### Geographical enquiry and skills

Pupils will:

- ask geographical questions
- suggest investigation sequences
- collect/record/present evidence
- analyse evidence and draw conclusions
- appreciate values and attitudes
- communicate appropriately
- use extended geographical vocabulary
- use atlases/globes/maps
- use secondary evidence
- draw maps, plans and graphs

#### Knowledge and understanding of places

Pupils will:

- locate places and environments
- describe scale contexts
- describe and explain physical features

#### Knowledge and understanding of patterns and processes

Explored through:

- geomorphological processes

#### Knowledge and understanding of environmental change and sustainable development

Pupils will study:

- environmental change and management
- sustainable development

### Expectations

#### At the end of this unit

**most pupils will:** know about the different types of limestone landscapes and where they are to be found in England; describe and begin to explain how physical processes interact to form massive limestone landscapes and a selected limestone landform (above/below ground) and their formation; recognise how conflicting demands on an environment may arise because of the need for an important industrial resource; appreciate that different values and attitudes result in different approaches for managing such an environment sustainably, and that these may have different effects on the environment and people living there; begin to suggest relevant geographical questions and a sequence of investigation into limestone landforms and related issues; select and use appropriate skills and sources of evidence; suggest plausible conclusions and present their findings both graphically and in writing

**some pupils will not have made so much progress and will:** know about some of the different types of limestone landscapes and where they are to be found in England; recognise and describe how physical processes create a selected limestone feature (above/below ground); begin to understand ways in which a human activity/process like quarrying causes changes to a limestone environment, how it can affect the lives and activities of people living there, and the different views people hold about it; recognise how people try to manage such an environment sustainably; suggest suitable geographical questions and sequences of investigation; use a range of skills and sources of evidence and communicate their findings using appropriate vocabulary

**some pupils will have progressed further and will:** distinguish between the different types of limestone landscapes, where they are to be found in England and why they are there; describe and explain the physical processes which create massive limestone landscapes and selected limestone landforms (above/below ground); understand that many factors, including people's values and attitudes, influence decisions about extraction of a valuable industrial resource in such an area and how people who live there may be affected; appreciate the need for considerations of sustainable development in the planning and management of similar environments in the future; suggest relevant geographical questions and sequences for investigation into landform formation and environmental issues; select and use effectively a range of skills and sources of evidence; begin to evaluate critically sources of evidence, present well-argued reports and begin to reach substantiated conclusions

### Prior learning

It is helpful if pupils have:

- used thematic maps in an atlas
- sent and received e-mail messages
- used OS maps at 1:10,000 scale
- surfed the internet

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## Language for learning

Through the activities in this unit pupils will be able to understand, use and spell correctly:

- words relating to rock formation, *eg sedimentary, limestone, Karst, clints, grikes, stalagmites, stalactites, pervious, permeable/impermeable, chemical weathering, swallow holes, joints, bedding planes, caves, caverns, calcium carbonate*
- other separate vocabulary:
  - evaporate, minerals, crystallise, waterfall, moor, springs

Speaking and listening – through the activities pupils could:

- discuss and respond to initial ideas and information, carry out tasks and refine ideas

Reading – through the activities pupils could:

- undertake independent research using knowledge of how texts, databases, etc, are organised and of appropriate reading strategies

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## Resources

Resources include:

- useful websites, *eg*
  - [www.holdenhurst.co.uk/mothershipton/index.htm](http://www.holdenhurst.co.uk/mothershipton/index.htm) (information about Mother Shipton's Cave and the Petrifying Well)
  - [www.education.leeds.ac.uk/~edu/technology/yorkshire/a9.htm](http://www.education.leeds.ac.uk/~edu/technology/yorkshire/a9.htm) (information about Gaping Gill)
  - [www.yorkshirenet.co.uk/ydales/index.html](http://www.yorkshirenet.co.uk/ydales/index.html) (information about the Yorkshire Dales)
- OS maps of this area at a variety of scales
- atlases
- supporting video programmes:
  - *Geographical eye over Europe, series 3: Yorkshire – Limestone Landscapes* (Channel 4 Education)
  - *Geography in animation* series (BBC), programme 9 on ground water hydrology, *The secret of Mother Shipton's Well*, provides additional case study material, including limestone features formation, Gaping Gill and the Petrifying Well, as do the teacher's notes that accompany this series. The teacher's notes also contain a 1:10,000 OS map extract of the Gaping Gill area

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## Future learning

These studies may lead on to studies of other areas of massive limestone, within or outside England. Equally, another type of limestone, *eg chalk*, could be explored and pupils' understanding deepened by comparing and contrasting the features. Considering people's interaction with the environment lays the foundation for more detailed work on sustainable development and the complex issues of how to balance the need for a resource with conservation for the future – see unit 14, 'Can the earth cope?', unit 19 'Tourism – good or bad?' and unit 23, 'Local action, global effects'.

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## Links


The activities in this unit link with:

- other geography units – unit 14 'Can the earth cope?', unit 19 'Tourism – good or bad?', unit 23 'Local action, global effects'
- mathematics – interpreting maps and scales
- ICT – using a presentation package, using internet search engines
- key skills – problem solving, working with others
- science – work on rock cycles, geological changes, chemical changes
- English – creative writing

### What do I already know about the relief of England?

- to use an extended vocabulary
- to use atlas maps to describe physical features
- Using an atlas, ask pupils to consider a relief map of England. Divide them into pairs and give them a series of true/false statements (between 10–15), *eg There is no land above 300 metres, All low-lying land, below 50 metres, is in the east*. Ask pupils to note true statements and correct false statements. Ask pupils, either in pairs or individually, to write a summary paragraph to describe the relief of England at a national scale. A glossary of key vocabulary may be helpful to support weaker pupils, who may also benefit from more structured guidance to write the paragraph, *eg using the cards as prompts*.
- classify information correctly based on map evidence
- describe the general relief pattern of England

### Where are some of the areas of higher land?

- to use atlas maps to obtain information and locate environments
  - Ask pupils, working in pairs, to find the areas of higher ground in the north, south-west and south-east of England and locate and name these on an outline map which already has them outlined. Ask them to add a suitable key to distinguish height range.
  - Provide pupils with a simple geology map of England and, using the key, draw out the link between relative height and geology in the various parts of England. A brief explanation of geological time will help pupils to group rocks into older/younger. Then, by moving to rock types, help pupils to identify the rocks which stand out as the higher ground. Eventually narrow this down to types of limestone (massive and softer) and, if possible, show examples and test reaction with acid. Finally focus on the higher areas of massive limestone.
  - use atlas maps to name and locate relief features correctly
  - The teacher may wish to consider carefully the pairings for this activity to facilitate some peer tutoring.
  - Key skills: links with problem solving, where a problem is posed and there are options for a solution, of which a suggested activity is one, and which involves pupils in confirming their understanding of the problem, identifying ways to solve it, planning and implementing the option, and reviewing how to improve their approach.
  - Science: links with materials and their properties – rock formations
-  **Safety** – use of acid and other issues: consult with the science department

**Learning objectives**

Pupils should learn:

**Possible teaching activities****Learning outcomes**

Pupils:

**Points to note****What is special about areas of massive limestone?**

- to identify the processes responsible for the development of a particular landscape
- how one type of landform is formed
- Use a brainstorming activity to find out what pupils know about massive limestone.
- Using resources, *eg videos, photographs, text*, discuss with pupils key limestone features and how they are formed. Include features found above and below ground. Then ask pupils to work in groups of three or four to select one landform feature and to list its characteristics on cards, which they present to the rest of the class. Give pupils the choice of medium of presentation, *eg video, presentation software, poster, overhead transparency (OHT)*. The presentations need to be shared with the whole class, either orally or by display. Alternatively, pupils can extract the information from texts, following guidelines they are given.
- describe the characteristics of a selected feature in a presentation and explain how it was formed
- ICT: this activity provides pupils with the opportunity to use a package for mixed-media presentations.
- Language for learning: this activity provides pupils with the opportunity to discuss and respond to initial ideas and information, carry out the task and then review and refine ideas.
- Key skills: links with working with others, where pupils work on a one-to-one or group basis and plan with others what needs to be done, confirm their understanding of the objectives, their responsibilities and working arrangements, carry out tasks and review progress.

**What features are typical of areas of massive limestone?**

- to select and use appropriate graphical techniques to present evidence
- to identify the processes responsible for the development of selected limestone features
- Give pupils a series of factcards about massive limestone, and ask them to produce a factual poster about this rock type. Pupils must choose five cards from those offered. They have 10 minutes to choose the information and prepare a poster. After eight minutes, give pupils two more factcards; they have to decide which, if either, of the new cards to select and which to reject. Factcards may include the following information, *eg 'carboniferous limestone is made up largely of calcium carbonate', 'chemical weathering is especially effective on limestone', 'the calcium carbonate is slowly being dissolved', 'a limestone pavement of clints and grikes is a surface feature of limestone areas', 'carboniferous limestone is pervious, allowing water to pass through its joints rather than the rock itself'*. It may be helpful to explain to pupils the difference between porous, pervious and permeable and for this to be noted, *eg in glossaries*. The posters may be used to form a classroom wall display.
- describe and explain the main characteristics of massive limestone
- Language for learning: this activity provides pupils with an opportunity to learn about word derivation.
- Science: links with work in science on pollution and chemical weathering.

**Learning objectives**

Pupils should learn:

**Possible teaching activities****Learning outcomes**

Pupils:

**Points to note****What is distinctive about the Yorkshire Dales?**

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| <ul style="list-style-type: none"> <li>• to follow the geographical route of enquiry</li> <li>• how to distinguish between national and regional scales and how a region may be identified</li> <li>• how to locate other regions with similar features, using an atlas</li> <li>• how to compare the geographical contexts of two regions</li> </ul> | <ul style="list-style-type: none"> <li>• Ask pupils to consider what makes a distinctive massive limestone area or region. Discuss with them how a region may be defined. Ask pupils to carry out an investigation of surface limestone features. Ask them to imagine that they have received an e-mail request from some pupils in the Karst area of Croatia, which is also an area of limestone scenery. Pupils use their atlas to locate it. The teacher in Croatia has asked them to find out about another region in Europe with similar features. Can the pupils in this class help? Ask them to work in groups of three or four to find information from a variety of sources, including video, print, the internet and CD-ROM. The choice of medium of presentation may be left up to the pupils. Encourage them to make their own judgements as they work.</li> </ul> |
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| <ul style="list-style-type: none"> <li>• examine a variety of sources to gather information for a particular purpose</li> <li>• research and select information independently of the teacher</li> <li>• describe and explain selected physical features of one region of England to exemplify landforms typical of massive limestone</li> <li>• accurately describe the national and international contexts of regions studied</li> </ul> | <ul style="list-style-type: none"> <li>• In this worked example the Yorkshire Dales have been chosen. Any limestone region would be appropriate, depending on the resources available to the teacher. Resources for the Yorkshire Dales are provided in the Resources section.</li> <li>• ICT: this activity provides pupils with an opportunity to use the internet to access resources.</li> <li>• Language for learning: the activity provides the opportunity for pupils to undertake independent research using knowledge of how texts, databases, etc, are organised and of appropriate reading techniques. Pupils may need reminding of efficient approaches for selecting and recording what they find.</li> </ul> |
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**What can an area of carboniferous limestone look like underground?**

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| <ul style="list-style-type: none"> <li>• to use OS maps at a range of scales</li> <li>• to select and use appropriate graphical techniques to present evidence on maps and diagrams</li> <li>• to identify the processes responsible for the development of underground limestone features</li> </ul> | <ul style="list-style-type: none"> <li>• Give pupils an OS map (preferably 1:10,000) of an area within the Yorkshire Dales, <i>eg the Ingleborough area, around Gaping Gill</i>. Ask pupils to produce a sketch map to show where Fell Beck disappears underground and where it reappears as Clapham Beck, and to illustrate in a separate annotated diagram what happens to it. (At Gaping Gill, Fell Beck drops 100 metres from the moor, forming England's largest cavern, and the fall of the Beck into the swallow hole is the highest unbroken waterfall in England.) Ask pupils to annotate the diagram with the names of features, <i>eg caves, caverns, joints</i>, and labels explaining the processes. Encourage them to refer back to their earlier investigation of limestone features to ensure accuracy. Some pupils may benefit from the support of a factsheet outlining features and processes, to use as stickers to add to their own sketches.</li> </ul> |
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| <ul style="list-style-type: none"> <li>• interpret an OS map of a massive limestone area</li> <li>• use geographical skills and techniques to present the information</li> <li>• use correctly specialist vocabulary</li> <li>• describe and explain the processes responsible for the formation of a specific massive limestone feature</li> </ul> | <ul style="list-style-type: none"> <li>• The most appropriate map scale is 1:10,000, although other scales may be used. This scale encourages pupils to be detailed in their analysis and to think about a small area for local study.</li> <li>• Key skills: links with problem solving where a problem is posed and pupils are given options for a solution. This could involve pupils confirming their understanding of the problem, identifying, planning and implementing solutions.</li> <li>• Mathematics: interpret maps and scales.</li> </ul> |
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**Learning objectives**

Pupils should learn:

**Possible teaching activities****Learning outcomes**

Pupils:

**Points to note****How is the landscape being changed?**

- to appreciate how people's values and attitudes affect environmental issues
- to communicate in ways appropriate to task and audience
- to consider how conflicting demands on an environment arise and may lead to change
- to explore the idea of sustainable development and its implications
- Ask pupils to undertake a local case study, *eg the Petrifying Well by the River Nidd, near Knaresborough, in Yorkshire*. (For centuries, this well gave rise to great superstition. Leaves, birds and small animals which fell into it were coated with a hard layer of rock, spreading rumours of witchcraft. In fact, the water springs from an underground lake. Its high mineral content means that everything porous left long enough in the water is turned to stone.) Ask pupils to solve the mystery *How can a teddy bear left by this river turn into stone?* Ask them to offer an explanation to the owner of the teddy bear. Suggest they do this by examining either video or website evidence or to go to any other source they might think helpful.
- Follow this with a more substantial investigation into the sorts of conflicts of land use that occur in some areas of natural beauty. An appropriate conflict to study may be the value of limestone as an industrial resource and the impact of quarrying on a community, through a real (*eg limestone quarry near Hope in the Castleton Valley in Derbyshire*) or fictional case study. Divide the class into two groups, one which supports quarrying and one which wants to preserve the landscape for today's and future generations. Ask each group to present its views in the form of a debate, during which pupils make their own notes. Ask pupils to write up a report including both viewpoints. Ask pupils to make and justify a decision on whether the quarry should go ahead or not. There is opportunity here to explore the concept of sustainable development as a possible way forward.
- apply problem-solving strategies to solve a given problem
- follow the investigative sequence to plan, follow and report on a specific issue
- describe and explain how people's different values and attitudes about development may affect an environment which contains an industrial resource
- Language for learning: this activity provides pupils with the opportunity to learn about word derivation.
- Language for learning: this activity provides opportunity for pupils to discuss in groups and respond to initial ideas and information, carry out tasks and refine ideas.
- Key skills: links with problem solving, where pupils confirm their understanding of the problem, identify ways of solving it, plan and implement the option, and formulate a review for improving their approach.
- Citizenship: this activity provides pupils with the opportunity to justify orally and in writing a personal opinion about such issues, problems or events.

**What do I like/dislike about massive limestone scenery?**

- to express substantiated views about geographical features
- to use geographical vocabulary correctly
- As an alternative to the last suggested activity, ask pupils to produce a 'shape poem' about limestone, using the shape of a limestone feature, *eg a stalagmite, stalactite or cavern*, as an outline. The writing could be a descriptive piece of prose or a poem, with pupils using some geographical vocabulary to say what they like and/or dislike about that particular feature or limestone features in general.
- produce a shape poem which describes their feelings about the landscape
- English: this activity provides pupils with an opportunity to write creatively.