

Unit 21 Virtual volcanoes and internet earthquakes

About the unit

In this unit pupils learn about the patterns and processes associated with tectonic activity. They are encouraged to use the internet to research the occurrence of tectonic events and the impact of these processes in countries at different states of economic development.

The unit offers a more analytical approach to the theme than is suggested in unit 2 'The restless earth' (carried out in year 7) and builds on unit 8H 'The rock cycle' in the science scheme of work. It is therefore more suitable for pupils in year 9.

This unit is expected to take 12–20 hours.

Key aspects

Geographical enquiry and skills

Pupils will:

- ask geographical questions
- suggest investigation sequences
- collect/record/present evidence
- analyse evidence and draw conclusions
- use extended geographical vocabulary
- use atlases/globes/maps
- use secondary evidence
- draw maps, plans and graphs
- communicate, including using ICT
- experience decision making

Knowledge and understanding of places

Pupils will:

- locate places and environments
- describe and explain physical/human features
- explore interdependence and global citizenship

Knowledge and understanding of patterns and processes

Explored through:

- tectonic process

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: describe and explain the distribution of the earth's earthquakes and volcanoes, the physical processes responsible for them and how people respond; recognise that these processes interact to produce the distinctive characteristics of 'active zones'; recognise how conflicting demands on such environments may arise and describe and compare different ways people try to prepare themselves for hazardous events and for managing such environments sustainably; suggest relevant geographical questions and appropriate sequences for investigation of tectonic activity; select and use effectively a range of skills and sources of evidence, especially ICT; present their findings in a coherent way and reach conclusions that are consistent with the evidence

some pupils will not have made so much progress and will: describe and begin to explain the distribution of the earth's earthquakes and volcanoes, the physical processes that cause them and how people respond; describe how these processes and people's responses can lead to similarities and differences in countries in different states of development and in the lives of people who live there; recognise how people try to manage such environments sustainably; begin to suggest relevant geographical questions to investigate tectonic activity; select and use appropriate skills and secondary sources of evidence, especially ICT; suggest plausible conclusions and present their findings both graphically and in writing

some pupils will have progressed further and will: describe and begin to explain interactions within and between the physical processes which cause earthquakes and volcanoes and how people respond to them; explain how these interactions create geographical patterns of tectonic activity and help change places and environments in 'active zones'; recognise that human actions may have unintended consequences, especially in less economically developed countries (LEDCs), and that appropriate planning is essential to save lives and manage such environments sustainably; identify geographical questions and establish their own effective sequence for investigation of tectonic activity; select and use accurately and effectively a wide range of skills and evaluate critically sources of evidence, especially ICT; present full and coherently argued summaries of their investigations and reach substantiated conclusions

Prior learning

It is helpful if pupils have:

- some knowledge and understanding of Mediterranean vegetation and climate
- previously carried out the components of geographical enquiry
- studied issues relating to countries at different states of economic development
- considered environmental issues and sustainable development
- carried out fieldwork activities
- some knowledge and understanding of changes in economic activity

Language for learning

Through the activities in this unit pupils understand, use and spell correctly words relating to:

- volcanoes and earthquakes, *eg vent, magma, ash, tremor, aftershock, epicentre, focus, pyroclastics, igneous, lava, active, dormant, extinct, natural hazard, seismic waves, seismograph, Richter scale, magnitude, tectonic plates, crust, mantle, core, friction, constructive, destructive, conservative, cause, effect*
- words associated with economic development, *eg more economically developed countries (MEDCs), LEDCs, sustainable development, social/physical/human cost, aid agency*
- the environment, *eg Mediterranean, climate, vegetation, physical*

Speaking and listening – through the activities pupils could:

- ask different sorts of questions to extend thinking and refine ideas

Reading – through the activities pupils could:

- appraise texts quickly and effectively for their usefulness
- identify what information is needed, then use different texts as sources

Writing – through the activities pupils could:

- structure paragraphs to develop points, by using evidence and additional facts

Resources

Resources include:

- earthquake maps and information, *eg about the San Andreas Fault at www.abag.ca.gov/bayarea/eqmaps*
- current satellite images, *eg images of Etna from www.ssec.wisc.edu/data/volcano/etna.gif*
- detailed reports and photos of a variety of recent earthquakes, *eg from www.ege.com/publications/disaster.html*
- useful websites, *eg*
 - <http://volcano.und.nodak.edu/>
 - www.volcano.si.edu/gvp/ (Global Volcanism program, Smithsonian Institute)
 - <http://vulcan.wr.usgs.gov/> (Cascades Observatory)
 - www.educeth.ethz.ch/stromboli/ (two virtual field visits and numerous volcanoes)
 - www.geo.arizona.edu/tools/seismo/ (pupils can make their own seismograph on this site)
 - www.fema.gov/mit/ (Federal Emergency Management Agency – site on mitigation)
 - www.city.kobe.jp/index-e.html (fixed-point observations of earthquake-damaged areas)
- supporting video programmes:
 - *Geographical eye over Asia, programme 5: Indonesia – Story of a volcano* (Channel 4 Education)
 - *Geographical eye – Disasters, programme 1: Earthquakes* (Channel 4 Education)
 - *Geographical eye special – Planet earth, programme 1: Tectonics* (Channel 4 Education)

Future learning

This unit provides a foundation for GCSE work concerned with knowledge and understanding of tectonic processes.

Links

The activities in this unit link with:

- other geography units – unit 2 ‘The restless earth’, unit 24 ‘Passport to the world’
- ICT – producing a web page using multimedia packages, using word-processing and desktop-publishing packages
- citizenship – global community
- science – work on the rock cycle

What is a real volcano like?

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| <ul style="list-style-type: none"> • to ask geographical questions and to suggest an appropriate sequence of investigation • to collect, record and present evidence • to select and use secondary sources of evidence, <i>eg photographs and ICT</i> • to make decisions about appropriate clothing/equipment for the visit • to identify the main geographical features of a real volcano and assess its potential dangers | <ul style="list-style-type: none"> • Explain to pupils that they are to carry out a 'virtual' field visit to Stromboli (locate on an atlas map) using an internet website at www.educeth.ethz.ch/stromboli/. The purpose of the 'visit' is to gather relevant information to produce an A4-size brochure of Stromboli's geographical features for tourists who visit the volcano, or a web page for the same purpose. Ask pupils to discuss in groups what sort of questions they will need to ask and find answers to, <i>eg details of altitude, relief, Mediterranean vegetation, hazards, eruption evidence, settlements and other human features</i>. Remind them that they should plan the contents of a visitor's rucksack for the time of year of the visit and to keep a note of potential dangers that tourists will need to be warned about. • During the visit, at each station, ask pupils to gather the relevant information (by copying/pasting into a word-processed document) and to draw annotated field sketches, <i>eg Station 5 – view across Sciara del Fuoco (standard route) and station 13 – on the Vancori (scenic route)</i>. Suggest that pupils download and save useful images, <i>eg maps and field-sketch photographs</i>. Remind them to sign the 'summit guest book' to receive an e-mail in return. • Discuss with pupils possible brochure layouts that they might consider and that they will need to include appropriate illustrations. Lower-attaining pupils are likely to need more structured guidance, <i>eg a brochure template, prompts for writing and map/sketch outlines</i>. Ask them also to evaluate rucksack contents, to identify good and poor choices and different choices for another time of year. | <ul style="list-style-type: none"> • illustrate and describe the geographical features of a real volcano • evaluate decisions about clothing and equipment • identify the volcano's potential danger spots | <ul style="list-style-type: none"> • Language for learning: this activity provides pupils with an opportunity to ask different sorts of questions to extend thinking and refine ideas. • ICT: pupils use ICT to find, select and evaluate information and to produce a brochure or web page. A number of software tools could be used to support the production of a brochure, including a word processor, desktop publishing or multimedia package. • The virtual field visit activities are most effective when carried out online, with enquiry questions and web links being provided in a word-processed file or on a page on the school's intranet/network. Alternatively, the resources can be printed off and copied by the teacher – this will have implications for listed learning objectives. |
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Are all volcanoes identical?

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| <ul style="list-style-type: none"> • to use secondary sources of evidence, including ICT • to identify characteristic features of volcanoes • to identify and compare distinctive features of different volcanic eruptions and their effects | <ul style="list-style-type: none"> • Ask pupils to consider this question and to find similarities and differences between volcanoes, using a range of appropriate textbook/reference books, and to identify the main features, using labelled cross-sections, <i>eg to show cone, crater, vent</i>. • Ask pupils to investigate a recent volcanic eruption, in groups, using a range of appropriate resources and to consider the nature of the eruption (explosive/gentle), and its products, <i>eg lava, ash, pyroclastics</i>. Ask them to distinguish also between local effects, <i>eg ash falls, lava flows</i>, and global effects, <i>eg climate</i>, and short- and longer-term effects. Help them to share and compare their findings, <i>eg in a table</i>. | <ul style="list-style-type: none"> • draw labelled diagrams to identify the characteristic features of volcanoes • compare the nature and effects of different volcanic eruptions | <ul style="list-style-type: none"> • Alert pupils that the use of a very recent report may be misleading, <i>eg casualty figures will probably be inaccurate in the early days following a volcanic eruption</i>. • Adjust number of websites to pupils' abilities. |
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Learning objectives

Pupils should learn:

Possible teaching activities**Learning outcomes**

Pupils:

Points to note**What is an earthquake? Are all earthquakes identical?**

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| <ul style="list-style-type: none"> • to use an extended geographical vocabulary • to use secondary sources of evidence, including ICT • to identify and compare the nature and effects of earthquakes | <ul style="list-style-type: none"> • As a stimulus show pupils a video snippet/pictures of earthquake devastation/eye-witness account/seismic trace, and discuss with them what the experience might feel like. Introduce appropriate terminology, eg <i>Richter scale</i>, <i>epicentre</i>, <i>focus</i>, <i>seismic wave</i>, <i>tremor</i>, <i>aftershocks</i>. • Ask pupils, in groups, to investigate the nature and effects of a recent earthquake, using a range of resources (newspaper articles/television reports/textbooks/the internet). Ensure there are examples from countries in different states of economic development. Useful websites include: Kobe at www.city.kobe.jp/index-e.html and San Francisco at http://quake.wr.usgs.gov/more/1906/got_seismogram.html and www.sfmuseum.org/quake/report.html. Ask pupils to write up their findings in the style of a newspaper report, emphasising the sequence of events, and the effects on buildings, infrastructure and people. • Rearrange pupils in groups to share their findings of the impacts of earthquakes in countries in different states of economic development, and to account for the differences. | <ul style="list-style-type: none"> • use extended vocabulary accurately • describe an actual earthquake • compare the nature and effects of earthquakes in countries at different states of economic development | <ul style="list-style-type: none"> • ICT: a word-processing or desktop-publishing package could be used to present the newspaper report. • Language for learning: this activity and other similar ones in the unit provide opportunity for pupils to identify what information is needed, then use different texts as sources. |
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Where do earthquakes and volcanoes occur?

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| <ul style="list-style-type: none"> • to use an atlas to plot locations on a world map using latitude and longitude • to describe geographical patterns | <ul style="list-style-type: none"> • Ask pupils to use internet research/textbooks to obtain locations of recent earthquakes and volcanic eruptions and to locate these on a world map using latitude and longitude positions. Ask them to describe the patterns they see and comment on the relationship between the two. • Useful websites are: www.gsrq.nmh.ac.uk/gsrq.html (recent earthquakes in the UK compared with world earthquakes) and www.geo.arizona.edu/tools/seismo (real seismic data). For other websites see 'Resources'. | <ul style="list-style-type: none"> • compile an accurate map of recent earthquakes and volcanic eruptions • describe and explain patterns related to tectonic activity | <ul style="list-style-type: none"> • Language for learning: this activity and other similar ones in the unit provide opportunities for pupils to appraise texts quickly and effectively for their usefulness. |
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What causes earthquakes and volcanoes?

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| <ul style="list-style-type: none"> • to make relationships between patterns on a global scale • to understand the causes of and processes involved in plate movements | <ul style="list-style-type: none"> • Provide pupils with a map of the world that shows plate margins and ask them to identify active and inactive zones. Emphasise that the activity is concentrated at plate margins. • Introduce pupils to the concept of plate tectonics and the 'nature' of plates, their movement and types of margins (constructive, destructive and conservative). • Help pupils to examine the causes of the earthquake and volcanic eruption case studies (above) in relation to plate tectonics, using simple cross-sections of the appropriate plate margins. | <ul style="list-style-type: none"> • illustrate, describe and explain the processes responsible for earthquakes and volcanic activity at plate margins | <ul style="list-style-type: none"> • Science: links with materials and their properties – rock formation. |
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Learning objectives

Pupils should learn:

Possible teaching activities**Learning outcomes**

Pupils:

Points to note**How do people live with earthquakes and volcanoes?**

- to use secondary sources of evidence
- to prepare a presentation using ICT to share with other pupils
- to analyse and evaluate evidence and draw and justify conclusions
- to explain how places are interdependent
- to consider human responses to hazards posed by tectonic activity
- to explore the idea of sustainable development in the contexts of volcanoes and their environmental management
- The activities listed below may be taken on by different groups of pupils and shared through presentations to the rest of the class.
- Help pupils to examine ways of reducing the hazard of earthquakes. Ask them to use textbooks/articles to study building techniques and measures aimed at reducing the likelihood of building collapse. Ask them to compare measures in countries at different states of economic development.
- Ask pupils to explore the role of aid agencies in emergency care following earthquake disasters – see unit 2 'The restless earth' for listed websites.
- Ask pupils to investigate some strategies aimed at reducing the effects of an eruption, *eg scientific monitoring* (see Stromboli website and other internet websites in 'Resources').
- How should Stromboli be managed in the future? Suggest that pupils consider prevailing physical, economic and social factors and the various groups of people who 'use' the volcano, *eg residents of Stromboli and Ginostra, scientists such as Dr Jurg Alaeen, tourists*; the sustainability of the natural environment and Stromboli's links with the rest of Italy, Europe and the world.
- Ask pupils to examine the advantages of volcanic activity, *eg geothermal power, fertile soils*. Ask them to find evidence of why people choose to live in active zone areas.
- Discuss with pupils how they might plan and organise a piece of extended writing entitled 'Living on the earth's plate margins'. Discuss with them what they should include, *eg What are plate margins? Where do they occur and why? Why do people choose to live there? How do they try to prepare themselves for such events? How successful are they?* Consider with pupils what maps and illustrations they would need to include. Suggest they might view the completed piece as an article for a glossy magazine, *eg National Geographic* or the type produced as 'in-flight' magazines on airlines. Weaker writers might be asked to select a series of pictures for which they write appropriate captions to cover the same questions, and organise these as a shared group display.
- describe and explain why people choose to live in 'active zone' areas
- describe various strategies for living in such areas and evaluate their success
- suggest ways in which volcanic environments may be managed sustainably
- plan and write a piece, *eg article*, incorporating structured text, maps, and instructions
- ICT: a range of tools can be used to support the development of the presentations. Pupils may use a desktop publishing package. Video cameras, audiotape, presentation packages or multimedia packages can be used to provide effective solutions.
- It is not envisaged that pupils will study both units on tectonic activity (unit 2 and unit 21).
- Citizenship: this activity provides pupils with an opportunity to reflect on the world as a global community and the political, economic, environmental and social implications of this.
- Language for learning: this provides pupils with an opportunity to structure paragraphs to develop points, by using evidence and additional facts.