

## Questions for any rock face 11: tectonic plates

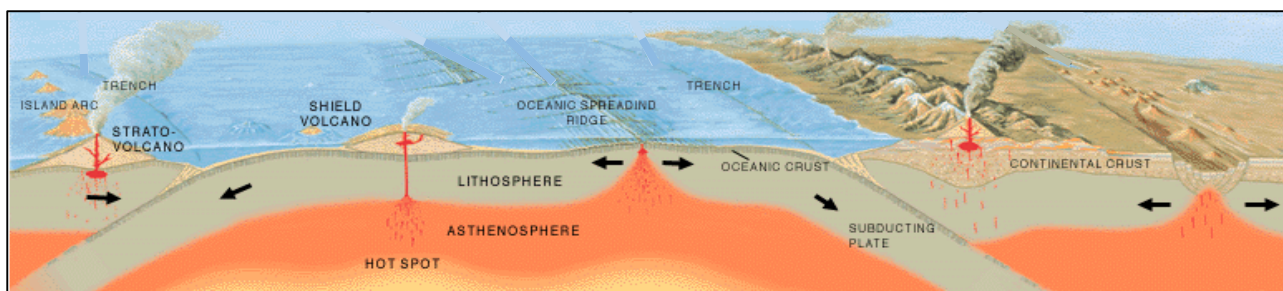
### What questions about relationships to tectonic plates might be asked at any rock exposure?

The ELI\* series of 'Questions for any rock face' helps teachers to plan investigative fieldwork at any rock exposure\*\*. In each case some possible questions are given, with some likely answers, to help you to decide whether the questions might work well at your site, or whether they would be asked better elsewhere. Answering the questions will provide basic understanding of the evidence preserved in rocks of the processes that formed them.

#### Tectonic plates

Much of the evidence from rock exposures can be linked to the previous plate latitudes and altitudes of the region, and the deformation associated with plate margins. Thus direct links can be made between the evidence and plate tectonic processes; these questions will help pupils to make these links at a rock exposure. They will need to know the altitude of the area to answer one of the questions.

Possible questions	Possible answers
Are there clues that suggest that this place had a different climate in the past?	<ul style="list-style-type: none"> <li>• Coral fossils – colonial corals are only found today in tropical and sub-tropical seas</li> <li>• Limestone – thick limestone deposits only form today in tropical and sub-tropical seas</li> <li>• Coal – thick organic deposits that form coal only accumulate today in equatorial conditions</li> <li>• Red sediments – these form today in tropical and subtropical conditions</li> <li>• Lowland glacial sediments have rarely been recorded below a latitude of 40°</li> </ul>
What might have caused the change in climate between then and now?	This place is on a moving plate that has been in different latitudes in the past
Are there clues that this place had a different altitude/ depth in the past?	<p>The land where this rock exposure is found currently has an altitude of X metres above sea level; the altitude when the rocks formed can be indicated by:</p> <ul style="list-style-type: none"> <li>• Limestones with or without corals form only in shallow seas</li> <li>• Fossil-rich sediments are likely to be shallow water or coastal sediments</li> <li>• Turbidity current deposits (turbidites) are only widespread as deeper water deposits</li> </ul>
What might have caused the change in altitude/ depth between then and now?	Most areas where deep or shallow sea sediments have been uplifted to form land, are associated with compressional plate margins
Are there clues showing that this place was near a plate margin in the past?	<ul style="list-style-type: none"> <li>• Evidence of a compressional plate margin, with mountain ranges and metamorphism and the plate being subducted into the mantle, producing magma which then rises, might include: folding, tilting, reverse faulting, regional metamorphic rocks, intrusive and extrusive igneous rocks</li> <li>• Any normal and tear faulting is difficult to tie in to a plate margin model – they are likely to be due to more local effects</li> </ul>
Are there clues which show whether or not this area is near a plate margin now?	<ul style="list-style-type: none"> <li>• If the area is near a compressional plate margin (convergent margin) now, there are likely to be: explosive volcanic eruptions and major earthquakes with associated tsunamis; there may also be volcanic island chains, an oceanic trench or mountain chains</li> <li>• If the area is near a divergent margin now, there are likely to be earthquakes and volcanic activity, which may or may not be explosive</li> <li>• If the area is not near a plate margin, absence of clues is evidence. If there are no nearby earthquakes, active volcanoes, mountain chains or other clues characteristic of a plate margin, it is because the area is not at a plate margin, but nearer the centre of a plate (although minor but usually non-damaging earthquakes do occur within all plates as they adjust to the forces at the margins of the plates)</li> </ul>



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\* ELI = Earthlearningidea

\*\* An exposure is where rocks can be seen at the Earth's surface, exposed by natural or artificial means; anywhere where a rock reaches the surface, even if it is covered by soil, etc. is an outcrop, so an exposure is also part of an outcrop.

## The back up

**Title:** Questions for any rock face 11: tectonic plates.

**Subtitle:** What questions about relationships to tectonic plates might be asked at any rock exposure?

**Topic:** Questions asking pupils to relate their observations from a rock exposure to the 'bigger picture' of plate tectonics.

**Age range of pupils:** 11-16 years

**Time needed to complete activity:** 10 minutes

**Pupil learning outcomes:** Pupils can:

- explain evidence for a difference in climate and altitude/depth between the environment in which the rocks were deposited and today;
- link these changes to plate movements;
- explain evidence for plate margin processes preserved in the rocks;
- describe any evidence or lack of evidence for there being a plate margin in the vicinity today.

### Context:

Many rock exposures contain evidence for the plate tectonic conditions under which they first formed.

Remember to carry out a risk assessment before taking anybody to any rock exposure.

### Following up the activity:

Continue with other 'Questions for any rock face' Earthlearningideas.

### Underlying principles:

- Sedimentary rocks can contain evidence for the latitude and altitude/depth at which they originally formed.
- Latitudes and altitudes different from today's can be explained by tectonic plate movement.
- Rocks can contain evidence for the plate margin conditions under which they were deformed or metamorphosed.
- Plate margins can be identified from similar evidence today.

### Thinking skill development:

Pupils have to understand the plate tectonic model in order to be able to bridge it to evidence preserved in rock exposures.

### Resource list:

- the resources needed for pupil fieldwork listed in the Earthlearningidea, '*Planning for fieldwork: preparing your pupils before setting out to "ask questions for any rock face"*'
- information on the altitude of the area

### Useful links:

Excellent animations of plate margin processes can be found at the Geological Society of London website at: <http://www.geolsoc.org.uk/Plate-Tectonics> whilst the '*Story of plate tectonics*' is told by the US Geological Survey at: <http://pubs.usgs.gov/gip/dynamic/dynamic.html>

**Source:** Devised by Chris King of the Earthlearningidea Team.

## The 'Questions for any rock face' series of Earthlearningideas and the sites where they may be applicable

'Questions for any rock face' Earthlearningidea	Site
Planning for fieldwork	Preparation in school beforehand
1: weathering	Any exposure (cliff, coastal exposure, quarry, cutting) or weathered constructions (wall, gravestone, monument)
2: erosion	Any exposure and many walls
3: soil	Some exposures have a useful soil profile at the top (but many do not)
4: rock group (igneous or sedimentary)	Any exposure of igneous or sedimentary rock or both; also applicable to sedimentary and igneous building stones, gravestones or monuments
5: sedimentary grains	Any exposure of sedimentary rock and also building stones, gravestones or monuments
6: fossils	Any exposure containing readily found and obvious fossils, including some building stones, gravestones or monuments
7: tilted or folded rocks	Any exposure of clearly tilted or folded rocks
8: faults	An exposure where rocks are clearly faulted, preferably where beds can be matched up on either side of the fault
9: metamorphism	An exposure where metamorphic features are clearly visible and preferably, where there is also evidence of the former rock type
10: sequencing	An exposure where a sequence of geological events can be relatively dated using 'Stratigraphic Principles'
11. tectonic plates	An exposure of sedimentary rocks containing evidence of deposition in different climates and altitude/depths from today, with further evidence of plate margin processes
12. quarry/ cutting potential	An exposure in any quarry or cutting
13: quarry economics	An abandoned (or working) quarry
14: recording	Any exposure

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