

**© UKRIGS Education Project: Earth Science On-Site**

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**SITE:** BOULMER FORESHORE, NORTHUMBERLAND.

**AUDIENCE:** KEY STAGE 4 STUDIES.

**LINKS TO KEY STAGE 4 DOUBLE AWARD SCIENCE:**

**Investigative skills:**

- 2a) use scientific knowledge and understanding to turn ideas into a form that can be investigated and to plan an appropriate strategy;
- 2c) carry out preliminary work and make predictions, where appropriate;
- 2m) use observations, measurements or other data to draw conclusions;
- 2q) consider whether the evidence collected is sufficient to support any conclusions or interpretations made;
- 2s) suggest further investigations.

**Changing Materials:**

- 2r) how the sequence of, and evidence for, rock formation and deformation is obtained from the rock record.

This exercise introduces pupils to some aspects of Earth Science investigation in the field, including:

- plotting data,
- devising experiments using field data,
- making field observations,
- comparing observed features to an ideal model (of a fold),
- observing the partial nature of geological evidence and some of the reasons for it.

**AQA (GCSE Science A and B)****Biology 1b Evolution and Environment:****Using skills & understanding of how science works to:**

- interpret evidence relating to evolutionary theory.

**Substantive contexts:**

- fossils provide evidence of how much (or how little) different organisms have changed since life developed on Earth.

**Chemistry 1a Products from Rocks:****Substantive contexts:**

- Limestone, and the environmental, social and economic effects of exploration.
- Products made from Geological resources.

**Chemistry 1b Oils, Earth and Atmosphere:****Substantive contexts:**

- the Earth consists of a core, mantle and crust.
- The earth's crust and upper mantle (lithosphere) are cracked into tectonic plates caused by convection currents in the mantle to move at relative speed of a few centimetres per year.

**Physics 1a, 1b.****Substantive contexts:**

- Half lives of isotopes.

**Edexcel (GCSE Science)****B1a: Topic 1, Environment:**

- explain that fossils provide evidence for evolution.

**C1b Topic 7, There's One Earth.**

- discuss how the composition of the Earth's atmosphere and its temperature have varied over different timescales.

**OCR – GCSE (Gateway) Science)****B2: Understanding Our Environment**

- State that fossils can provide evidence for living organisms from a long time ago.
- Explain that animals and plants can change over long periods of time and that fossils provide evidence for this.
- Describe how the relative positions of fossils in rock layers can be used to show evolutionary changes during long periods of time.
- Describe how organisms may have become fossilised: (hard body parts buried and gradually replaced by minerals; casts / impressions; preservation in amber, peat, tar, ice).
- Explain that the fossil record is incomplete: some body parts are rarely fossilised; fossilisation is rare; many fossils have not yet been discovered.
- Explain that when environments change some animal and plant species survive or evolve, but many become extinct.

**C2: Rocks And Metals**

- construction materials, including those manufactured from rocks in the earth's crust.
- State that some rocks are used to construct buildings: granite, limestone, marble.
- describe that marble is much harder than limestone and that granite is harder than marble.
- Explain why granite, marble and limestone have different hardnesses.
- limestone is a sedimentary rock.
- marble is a metamorphic rock made by the action of high pressures and temperatures on limestone.
- granite is an igneous rock.
- State that limestone and marble are both forms of calcium carbonate.
- Environmental problems resulting from quarrying.

**C2: Rocks And Metals**

- State that the movement of tectonic plates results in volcanic activity and earthquakes.
- Describe the lithosphere as the (relatively) cold rigid outer part of the earth that includes the crust and outer part of the mantle.
- Explain that tectonic plates are found on top of the mantle because they are less dense.
- Describe the theory of plate tectonics.
- Describe how molten rock can find its way to the surface through weaknesses in the Earth's crust.
- Explain that magma from the mantle must have a density less than that of the crust in order to rise through it.
- State that igneous rock is made when molten rock cools down.
- Describe magma as molten rock beneath the surface of the earth, and lava as molten rock that erupts from a volcano.
- State that some of the rock on the Earth's surface has been formed by volcanic activity.
- Describe that some volcanoes give runny lava (iron-rich basalts) and some give thick lava and erupt violently (silica-rich rhyolites).
- Explain how the size of crystals in an igneous rock is related to the rate of cooling of molten rock.
- State that magma can have different compositions and that this affects the rock that forms and the type of eruption, limited to: basalt: runny and fairly "safe", and explosive silica rich rhyolite (producing pumice, and volcanic ash, and bombs, sometimes with graded bedding).

**OCR – GCSE (Gateway) Additional Science.****P4: Radiation For Life.**

- Recall that radioactivity can be used to date rocks.
- Explain how the radioactive dating of rocks depends on the calculation of the uranium / lead ratio.

**OCR – 21<sup>st</sup>. Century Science****P1 The Earth In The Universe:**

- Recall that rocks provide evidence for changes in the earth (erosion and sedimentation, fossils, folding, radioactive dating, craters).
- Understand that continents would be worn down to sea level if mountains were not being continuously formed.
- Understand that the rock processes seen today can account for past changes.
- Recall that earthquakes, volcanoes, and mountain building generally occur at the edges of tectonic plates.
- Understand how the movement of tectonic plates causes earthquakes, volcanoes, mountain building and contributes to the rock cycle.
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**B3 Life On Earth:**

- Understand that evidence for evolution is provided by fossils.

**P3 Radioactive Materials:**

- Understand the meaning of the term half life.

**OCR – 21<sup>st</sup>. Century Additional Science****C5: Chemicals Of The Natural Environment:**

- Recall that the Earth's lithosphere is made up of a mixture of minerals.
- Recall that silicon, oxygen, and aluminium are very abundant elements in the crust.
- Recall that much of the silicon and oxygen is present in the Earth's crust as the compound silicon dioxide.
- Recall the properties of silicon dioxide (e.g. hardness, melting point, conductivity and solubility in water).
- Explain the properties of silicon dioxide in terms of a giant structure of atoms held together by strong covalent bonding.
- Understand that silicon dioxide is found as quartz in granite and is the main constituent of sandstones.

**Welsh Board – GCSE Science.**

**B1: Topic 3, Evolution:**

- Examine evidence and interpret data about how organisms and species have changed over time. Suggest reasons why species may become extinct.

**C1 Topic 3, Using Chemical Reactions To Make New Materials.**

- Useful products from raw materials from the earth, sea and air.

**C1 Topic 6, Evolution And Maintenance Of The Atmosphere.**

- Be aware of the accepted explanations for the origin of the atmosphere and the changes that have occurred over geological time.
- Global warming.

**C1 Topic 8, Geological Processes.**

- (know that the slow movement of tectonic plates ) drives the rock cycle.

**WJEC – GCSE Chemistry (Separate Subject)**

**C3 Topic, Limestone.**

- Uses of limestone and the social, economic and environmental effects of limestone quarrying.