Will my gravestone last?: an investigative graveyard visit: teachers' notes

Level

This activity is most suitable for 11-14 year olds. It can, however, be adapted to work with any age range.

Topic

The main activity is an investigation into the weathering of different types of rock. The extension material is concerned more with identification of rock types. At a very simple level it can be about the weathering of rocks in general with time and location.

Description

The main part of the activity, which can be run as an open-ended pupil investigation, is a visit to a nearby churchyard or cemetery. This will usually contain a variety of rock types as headstones along with the dates at which they were first exposed to weathering. Students can work out how long the headstone has been in place from the date of death of the first occupant and visually estimate the amount of weathering. They can use a key and a set of photographs to help them identify the types of rock from which headstones are made and draw conclusions about the factors that affect the rate of weathering of different types of stone. With most groups it is wise to limit the number of different categories of rock types that they are going to record. For example, granite will cover many coarse-grained igneous rocks, without worrying about whether they are pink, grey or white.

Context

The activity is best undertaken after pupils have been introduced to the main groups of rocks (**igneous**, **sedimentary** and **metamorphic**) and have studied **weathering**. It could, however, be used as an introduction to weathering.

Teaching points

A preliminary visit to the site by the teacher is recommended in order to

- take photographs showing the different types of gravestones and the ways in which they have become weathered
- decide how many types of rocks to advise students to use
- prepare a sketch map of the site to be copied and issued to students

Pupils may be confused by the differences between **weathering** and **erosion**. Weathering is the breakdown of rock *in situ*, caused by atmospheric and biological agencies. Erosion is the removal of the rock debris by gravity or by moving agents such as water, ice or wind. Where rock material is removed in solution, *eg* limestone or marble, it is usually considered as an aspect of weathering.

Timing

One lesson is required for class preparation. About an hour should be allowed for the visit. One lesson is required for follow-up along with a homework.

Apparatus

During the visit, each group of students will need

- A hand lens.
- A copy of *Common rock types* or a set of *Building Stones Postcards*. These are available from ESTA Promotions, earthscience@macunlimited.net.
- A copy of the *Rock identification key*.
- A copy of the *Survey sheet*.
- A sketch map of the site prepared by the teacher on a preliminary visit.

During the visit, the teacher will need

- A magnetic compass to establish the orientation of the headstones.
- A tyre depth gauge.

During the preliminary lesson, the teacher will need

- Photographs taken on a preliminary visit to the site showing a selection of headstones, both weathered and unweathered, made from the types of stone commonly used locally.

Chemicals

During the visit, the teacher will need

- A few cubic centimetres of hydrochloric acid (0.5 mol dm^{-3}) (irritant) in a dropping bottle. Check that the lid will not come off during travel to and from the graveyard, and transport the dropping bottle in a plastic container with a screw top.

During the preliminary lesson, the teacher will need

- Samples of fresh ornamental stones, appropriate to the locality. These can often be obtained from a local monumental mason.

Safety notes

All schools and / or Local Education Authorities should have procedures and guidelines about out-of-school visits, covering such issues as parental permission, staff to student ratios *etc*. These should be rigidly adhered to. When asking for parental permission, also ask about any recent bereavements in the family that might cause difficulties for a pupil visiting a churchyard.

Pupils should be primed regarding appropriate behaviour in a place where grieving people may also be present.

Check for sensitivities among ethnic minority groupings. In practice, most faiths are amenable to such surveys, so long as graves are treated with respect and not walked over. Check first with the authorities responsible for the churchyard / cemetery that they are happy about the visit in general and about specific details (such as testing gravestones with acid). They will not usually worry about an occasional drop of acid being added on an obscure part of a gravestone - acid is often used to clean gravestones anyway.

Ensure that students wear suitable clothing on the day of the visit – both in terms of the weather and appropriateness in a cemetery.

A local monumental mason will usually provide much helpful information about the types of stone used locally for gravestones, as well as offcuts of the stones currently in use.

The activity

Preparation lesson in the laboratory or classroom

- Introduce the theme with samples of fresh ornamental stones, appropriate to your locality and remind pupils of the groupings into **sedimentary**, **igneous** and **metamorphic** rocks.
- Show pictures (*eg* photographs) or samples of fresh, unweathered gravestones and ask pupils to write down the rock type they would prefer for their gravestone (or that of a relative).
- Show photographs giving a general view of the graveyard and exhibit a map of it. Ask pupils to choose a site for their gravestone, *eg* in open ground, under trees, on a slope *etc*.
- Show photographs of weathered gravestones and revise the main processes of weathering which have affected them. These are:

  Physical processes – freeze / thaw; wetting / drying

  Chemical processes – oxidation ('rusting'); solution (*eg* of gypsum); carbonation-solution ('dissolving' of carbonates); hydrolysis (resulting in breakdown of silicates to clay minerals).

  Biological processes – tree-root growth; burrowing animals; acids produced by plants and soil.
- Ask pupils to write down their final choice for a stone type and location, now that they know more about the ways in which rocks react to weathering. They are allowed to change their minds! (Note. On a marble tomb, the lettering is usually cut into the stone; then sheet lead is hammered in and smoothed off flush with the stone surface. Over time, the marble reacts with acidic rain water and is removed in solution, leaving the lead letters standing out. This can be measured with a tyre depth gauge, and an estimate of the rate of weathering calculated.)
- Revise the acid test for carbonate – a small drop of dilute hydrochloric acid placed on the stone will fizz if the stone contains a carbonate (and is therefore likely to be limestone or marble).
- Working in small groups of about three, or alone, pupils then plan a visit to carry out an investigation in the graveyard, to find out which type of stone lasts the longest and where the best site for it would be.
- Encourage pupils to form hypotheses about what factors affect the rate of weathering which they can test on location (see *Survey sheet*). These may involve type of stone, orientation of the headstone, siting of the stone (under trees, for example), vegetation on or near the headstone, *etc*.
- Have some *Survey sheets* prepared on which pupils can record their data, to guide those who have difficulty preparing their own.

The visit

- Gather the group together inside the graveyard and check that the students can recognise the main rock types used for nearby graves.
- Allocate small groups to work as they have planned, probably advising them to survey as many graves as they can in the time available along a particular avenue of graves. Ensure that they record the date of death (the stone is usually set up a year or so after the death of the first named occupant). Give them the time and place for regrouping at the end.

- Tour the small groups, with colleagues doing likewise, checking on progress and discretely applying *one* drop of acid to the back of any grave which pupils think might be a limestone or marble.
- Allow time at the end to pull the visit together and to visit any particularly significant site with the class, *eg* the oldest tombs in the graveyard *etc*.
- Count heads and ensure that they all return safely to school.

Follow-up lesson

Allow groups time to follow up their results, share statistical information to compile more significant class data and to draw graphs. These might show the proportion of the total number of gravestones surveyed which are made of each major rock type. The types of stone may also be plotted against date, which may reflect the development of local transport, especially if the older part of the cemetery predates the coming of the railways.

Comment on students' hypotheses about weathering and whether or not they have proved them.

Extension work

- Students could be asked to draw up a simple guide to the graveyard, so that their parents could follow their route and understand what had been discovered.
- Students could use the key and / or a suitable set of labelled photographs to identify in more detail the various rock types found as headstones.
- Students could map the distribution of the main types of stone seen during their survey.

References

The following may be useful as background

P. Kennett, *The General Cemetery, Sharrow, Sheffield: a Geological Trail,* London: Earth Science Teachers' Association, 2nd edition, with colour plates, 2001.

P. Kennett *et al, The Building Stones of Sheffield: a Geological Walk in the City Centre,* Sheffield Building Stones Group, Sheffield, 2002.

There are many similar town trails, for other towns in the UK, available from Geo Supplies Ltd, 16 Station Road, Chapeltown, Sheffield, S35 2XE, Tel: 0114 2455746 or from local outlets, *eg* museums and visitor centres.