GRAVEYARD GEOLOGY

A Guide to Rocks in Graveyards and Cemeteries

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Introduction

Walk around graveyards and cemeteries (in this case, those of London and the southeast of England) and it becomes apparent that, prior to the latter part of the twentieth century, many memorials were made out of just a few different rock types. These were chosen for reasons of appearance, cost, workability and ease of transport to the cemetery, as well as for resistance to weathering and dependence on local regulations. In the last few decades, a range of different, interesting and beautiful stones have appeared, many brought in from abroad, enhancing the diversity of materials used. The intention of this guide is to help a non-specialist identify the main rock types, to recognize some of the varieties and to know where some of these might have come from. Graveyards are a wonderful resource for those with an interest in geology at any level, wildlife, plants, history or sculpture. We hope you gain as much pleasure as we have done.

First things first

A useful place to start is to be able to distinguish between igneous, sedimentary and metamorphic rocks.

Igneous rocks form from melted rock called magma. If this erupts at the surface, it is called lava. It cools and crystallizes quickly, so the grains are too small to see even with a hand lens (magnifying glass). If the lava erupt explosively to form a spray, the cooled fragments are known as volcanic ash. On the other hand, if the magma remains several kilometres beneath the Earth's surface as it cools, it crystallizes slowly and forms interlocking crystals which are big enough to see with the naked eye (Figs 1 and 2).

The images accompanying the following text are of slices of rock, 0.03mm thick, as viewed through a petrological microscope; this type of specialist microscope uses polarized light to view the thin section. When polarizers are used above and below the thin section, but with the permitted vibration directions at 90 °, many minerals will appear coloured, as in the examples below.

Figure 1 Sketch of granite to show interlocking crystals (courtesy Dr. Eric Robinson)

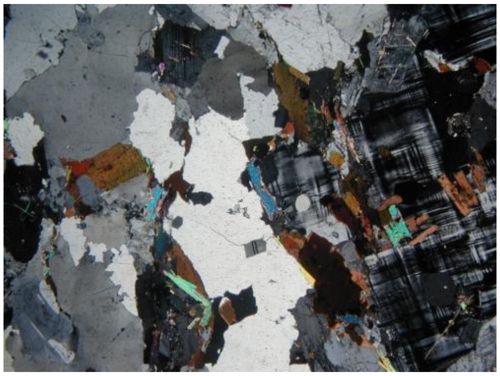


Figure 2 Thin section of a granite, between crossed polars (P5867, UCL Geology Collections)

Sedimentary rocks are often formed from the breakdown of existing rocks through the action of water, wind and ice. Small pieces of rock and mineral grains are transported in rivers or the sea, and are eventually deposited. They then compact and the grains become cemented together to form rocks such as sandstones. The sedimentary rock limestone, on the other hand, is formed from shelly matter in the sea, or by direct precipitation of calcite (calcium carbonate) crystals from seawater.

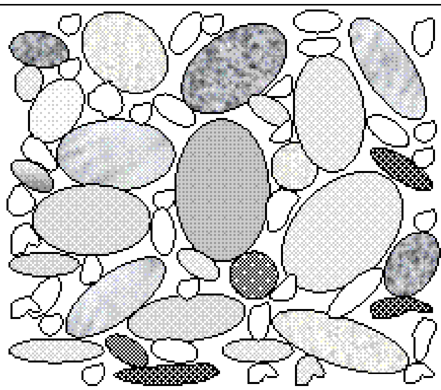


Figure 3 Sketch of grains in a sedimentary rock. Note the pore spaces between the grains.

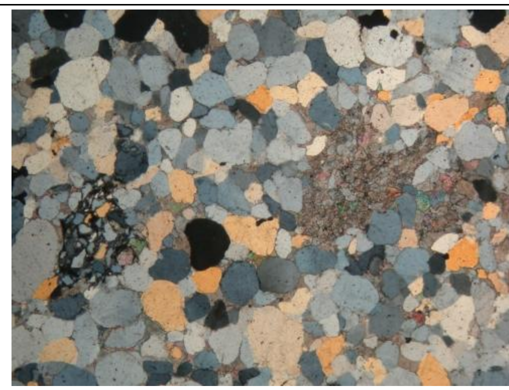


Figure 4 Thin section of a sandstone viewed between crossed polars (TS 33.4, UCL Geology collections)

Metamorphic rocks form when existing rocks – sedimentary, igneous or metamorphic - are buried within the Earth's crust. The ones we can see at the surface have generally been buried to depths of up to 10 kilometres. The temperature and pressure increase at depth causes the minerals which make up the rocks to recrystallize, and sometimes they react to form new, different minerals such as garnet. The shapes of the grains and the texture of the rock change. Marble is an example of a metamorphic rock formed from limestone. Schists and gneisses are strongly foliated or banded rocks which might form, from shales, for example, at around 600°C and 20 kilometres depth.

Figure 5 Thin section of a marble viewed between crossed polars. Note the equal sized, interlocking grains (P6149, UCL Geology Collections)

Figure 6 Thin section of a schist viewed in plane polarized light. Note the alignment of elongate grains (P6114, UCL Geology Collections)

__Geological Time__

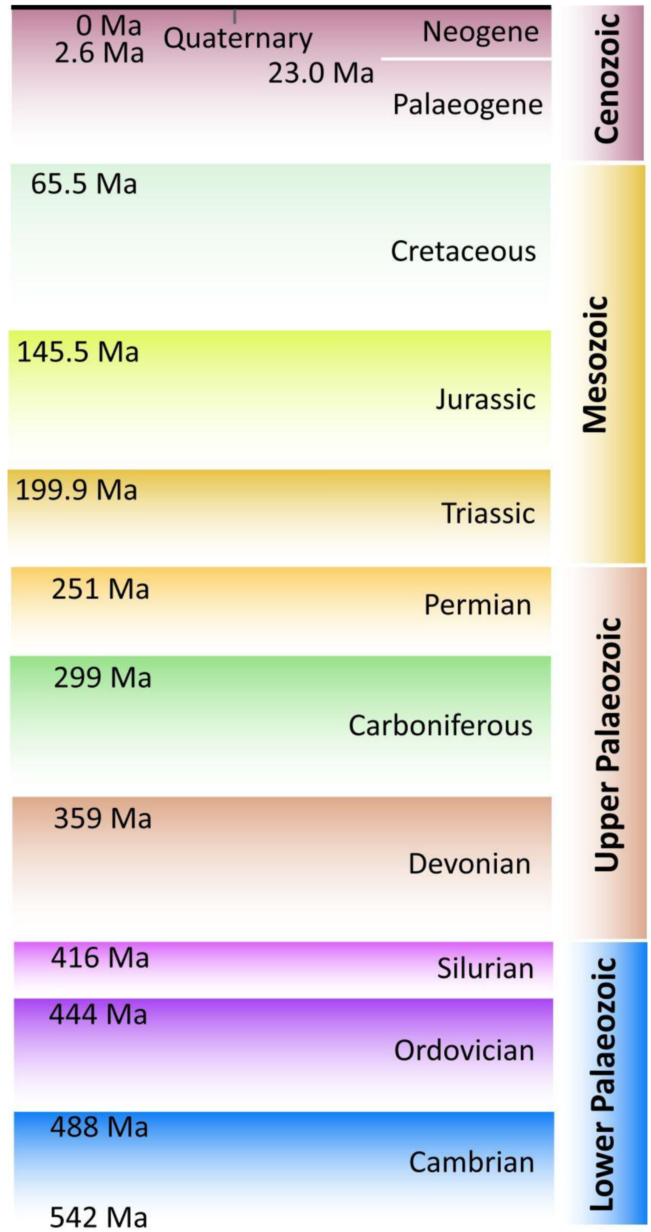


Table 1 Geological timescale

Within the text there is occasional reference to geological time periods. Table 1 gives the names and ages of the different time periods back to 542 million years ago, the start of the Cambrian period and the explosion of life. Prior to that, it is appropriate to simply refer to the Precambrian, which stretches back to the formation of the Earth at 4540 million years ago. For a geological map of Britain, see the relevant link from http://www.englishstone.org.uk/documents/dimension%20stone.html

GRANITE

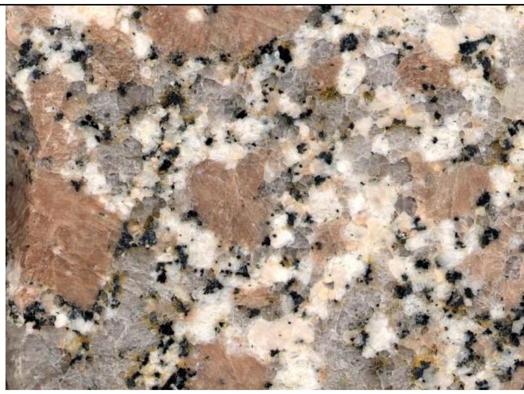


Figure 7 Pink granite, polished slab. The grey crystals are quartz, the white and grey are feldspars, and the black crystals are mica (UCL Geology Collections)

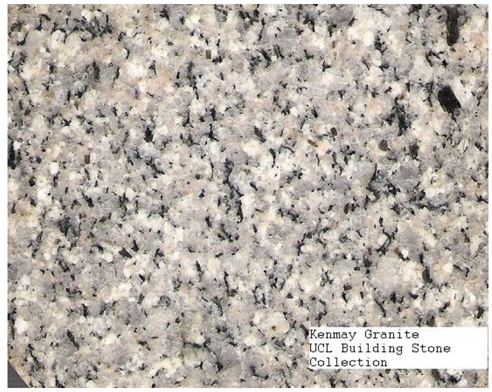


Figure 8 Grey Kenmay Granite from Peterhead, near Aberdeen. Note the black platy biotite micas (UCL Geology Collections)

Figure 9 Peterhead Granite memorial. The pink crystals are alkali feldspar (City of London Cemetery)

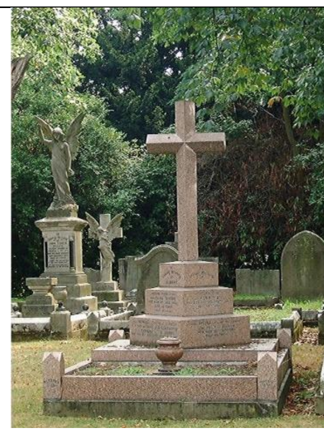


Figure 10 Peterhead Granite memorial (City of London Cemetery)

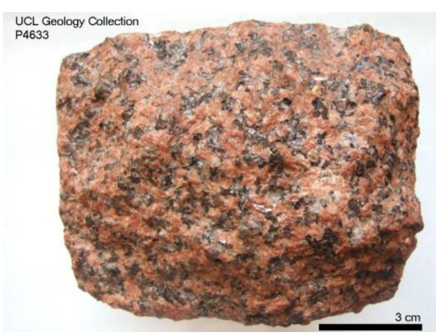


Figure 11 Granite with reddish feldspar crystals (P4633, UCL Geology Collections)

Figure 12 Granite with white feldspar phenocrysts. The rectangular feldspars show some alignment from lower right to top left. This granite was probably quarried in SW England. (City of London Cemetery)

Granite is a coarse-grained crystalline rock with a mottled appearance (Figs. 7-12). It is composed mainly of crystals of grey, glassy quartz, white, pink or red alkali feldspar and white plagioclase feldspar. Mica is also present, either black biotite mica, or silvery muscovite mica, both of which are platy. The micas shine as they catch the light. Feldspars sometimes occur as larger very well-shaped rectangular grains, known as phenocrysts. The colour of the feldspar is responsible for giving the overall colour to the rock.

Granite was often used for columns, chest memorials or more simple headstones, but was not intricately carved. It may be polished to a high shine, have an even, unpolished surface, or have a rough surface known as a rustic finish. A single monument may show more than one type of finish, and can either be granite all the way through, or have granite attached as a facing. A tough and durable stone, it is very resistant to weathering but sometimes shows some black coating of pollutants, or have lichen growing on it. A monument cut and carved a century ago will show little weathering, and carved lettering remains clear. In older monuments, the granite can be pitted where the micas have rotted away.

"Granite" is also widely used by stone masons for a variety of other rock types that take a polish. However, in the meaning of the rock as given above, granites form deep in the Earth at high temperatures and pressures, from molten rock known as magma. Magma can flow, and this accounts for the alignment of early-formed feldspar crystals sometimes seen in granites from the southwest of England. Magma cools slowly at depth to form large crystals; more rapid cooling results in smaller crystals. Sometimes other rock is caught up in the melt and can be seen as inclusions within the granite, known as xenoliths by geologists and as heathens by quarrymen.

Examples

Older granite memorials are likely to have come from a British quarry. Britain led the world in granite production during the 19th and early 20th centuries. Two centres were particularly important: Scotland and Southwestern England.

Scotland: Granites from the Aberdeen area are particularly well-known, where techniques for shaping and polishing the stone were renowned. The most famous is grey granite from the Rubislaw quarries which closed in 1971; Kemnay Granite (Fig. 8) is light grey, and contains muscovite and biotite micas; Peterhead granite (Devonian) from the Stirling Hill quarries contains reddish-brown feldspars (Figs. 9 and 10); look out for xenoliths in this particular granite.

SW England: Granites from Cornwall and Devon tend to be grey. They are commonly porphyritic (i.e. contain phenocrysts) and the phenocrysts are commonly aligned (Fig. 12). They are around 280 million years old (Late Carboniferous or Permian). Most quarries are now closed.

GABBRO and DOLERITE

Figure 13 Gabbro (UCL Geology Collections)

Figure 14 Gabbro, polished block. The feldspars are pale and rectangular (X892, UCL Geology Collections)

Figure 15 Dolerite (UCL Geology Collections)

Figure 16 Gabbro monument (City of London Cemetery)

Gabbro is a dark, even-grained igneous rock formed mainly of two minerals, black augite and white feldspar, although other minerals may be present (Figs 13 & 14). These two minerals can be distinguished where the grain-size is coarse, but finer-grained gabbros (also known as dolerites) can look dark and individual grains will be difficult to see (Fig. 15). The rough stone appears grey, but it becomes black when polished. Gabbro is sometimes known as “black granite”, but it is not a granite at all.

Gabbros take a good polish and can make imposing and distinctive monuments (Fig. 16). They are typically used for kerbed memorials and for headstones, which may be rectangular or carved, for example, into heart-shapes. Lettering is commonly carved into the stone and can be painted gold. Images may be etched into the gabbro and are sometimes painted.

The colour of gabbro makes it easy to recognize. Not generally used for older memorials, it has become more popular in the last 50 years, and particularly the last 20. Figs 12 – 14 show examples of popular gabbros, but it is difficult to identify the source of any particular gabbro without additional information.

In nature, gabbros can weather fairly easily when exposed to water, and it remains to be seen how resistant such tombstones will be when exposed to the elements for a hundred years or more.

Examples

Belfast Black (Fig. 17) is a fine-grained dolerite from Mpumalanga Province, South Africa. First exported to Europe in the early 1960s as Nero Assoluto (Price), it was the most commonly used gabbro until the 1990s. More recently, gabbros have been imported from India, China, Brazil and elsewhere. Black Galaxy (Fig. 18) is an unusual black gabbro containing bronze-coloured crystals of a mineral similar to augite, but aptly known as bronzite. It is quarried in Andhra Pradesh, India. A variety with very bright reflectors has been quarried since the 1980s and is known as Star Galaxy.

Figure 17 Belfast Black from South Africa

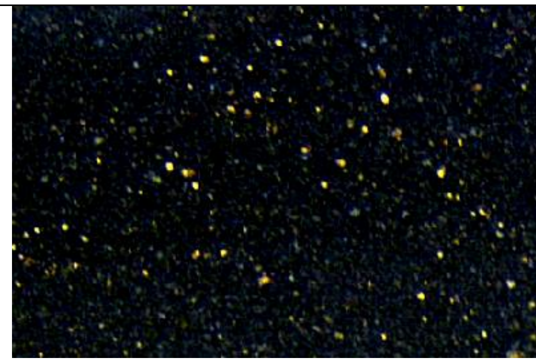


Figure 18 Gabbro Black Galaxy" (Taken by Halvard, from Norway; Wikimedia Commons)

Figure 19 Rustenburg, from South Africa. Also known as Nero Impala.

Rustenburg (Fig. 19) comes from the North West Province, South Africa, and is part of the Precambrian Bushveld Complex. It is still actively quarried, and also traded as Nero Impala (Price); Bon Accord is a coarser-grained gabbro but otherwise similar. It is 2 billion years old, and contains heavy metals such as chromium and platinum, which have been economically important.

LARVIKITE

Figure 20 Light coloured larvikite, commonly known as Blue Pearl (UCL Geology Collections)

Figure 21 Dark coloured larvikite, also known as Emerald Pearl. Polished slab. (UCL Geology Collections)

Figure 22 Larvikite (Highgate Cemetery)

Figure 23 Larvikite memorial (Highgate Cemetery)

Larvikite (Figs. 20 – 23) is a very distinctive coarse-grained igneous rock which occurs in a blue variety known in the trade as Blue Pearl, and a darker variety known as Emerald Pearl. It is a coarse-grained igneous rock, a type of so-called syenite which is intermediate between granite and gabbro in composition. It is easy to recognize because the main component present, the feldspar crystals, irridesce (shimmer in different blues, greens and yellows). The dark mineral is augite. Larvikite is familiar in buildings along an average high street, and it has been popular as a facing stone for pubs, earning it the nickname pubstone. It is also found along the coast in large blocks known as armour stone, used for coastal defence.

Larvikite is a relatively recent introduction as a memorial in England, being quarried on a large scale from the late nineteenth century. It is of Carboniferous age and comes from Larvik, which lies to the south of Oslo in Norway. It is not sufficiently old to know how it will weather.

LIMESTONE

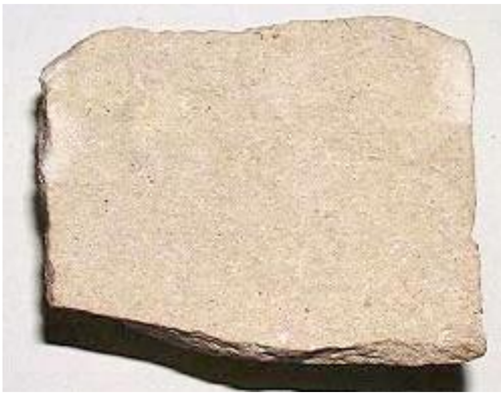


Figure 24 Oolitic limestone (UCL Geology Collections)

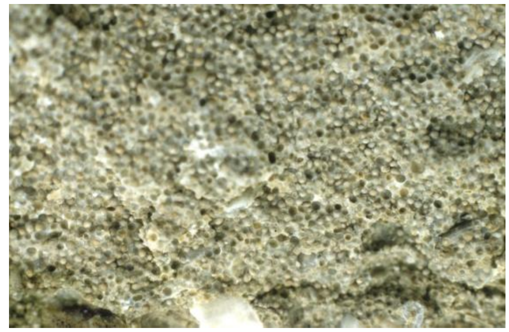


Figure 25 Oolitic limestone (http://www.jurassiccoast.com/images/zoom/weymouth-portland/ooliths.jpg)

Figure 26 Shelly limestone containing fossil crinoids (sea lilies). (City of London Cemetery)

Figure 27 Celtic cross of crinoidal limestone (City of London Cemetery)

Limestone (Figs 24-27) is largely made of the mineral calcite (calcium carbonate), with varying amounts of silicate minerals and impurities. In colour, limestones vary from white to dark grey, the purer ones being lighter coloured. Calcium carbonate may be precipitated directly from sea water, or go into the shells of marine creatures which eventually fall to the sea floor, where they ultimately compact to form limestone. An example of the former is the formation of roughly spherical grains the size of a pinhead known as ooliths or ooids, reminiscent in appearance to cod roe; such a limestone is described as being oolitic (Figs 24 & 25). The ooliths formed where small grains of shell or sand rolled around the sea floor in the current, and layer upon layer calcite formed onto these grains in concentric fashion. Calcite acts also as a matrix and holds the ooliths together. This process is going on today on the coastal margin of the Persian Gulf, and also on the Bahamas' Banks.

Limestones sometimes contain fossilised shells. The shells in the limestone of Figs 26 and 27 are the remains of crinoids, commonly known as sea lilies, which lived on the sea floor. They had bodies like cups, with arms that were waved about in the water to gather food towards the mouth, and beneath the cup was a flexible stem which was made of separate circular or pentagonal discs stacked up on each other – reminiscent of a packet of polos. When the animal died, these tended to break up somewhat, and small fragments of the stem, or single "ossicles" are abundant in the rather unusual crinoidal limestone shown above.

Limestones have been very popular as memorials and building stones in the south-east. Carboniferous Limestone from the Hopton Wood Quarries has been used to commemorate soldiers who fell in the First World War; those from the Second World War have also used limestone from quarries in Portland and Bath. (Lott http://www.englishstone.org.uk/documents/dimension%20stone.html)

Limestone weathers less well than granite but normally lasts better than sandstones. When weathered, limestone may be difficult to tell apart from weathered white marble. The presence of fossils or ooliths indicate a limestone.

Examples

Portland Stone

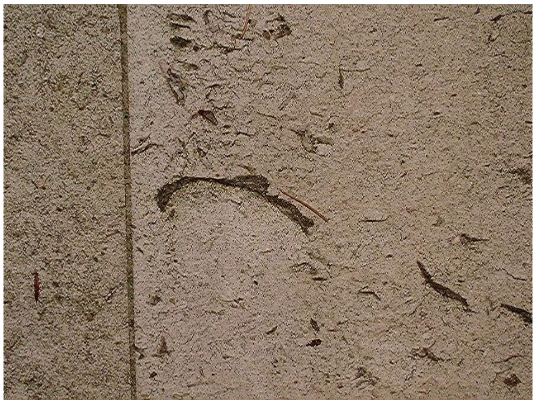


Figure 28 Close-up of fossil shell in Portland Stone memorial (City of London Cemetery)

Figure 29 Portland Stone in St Andrew's monument (City of London Cemetery)

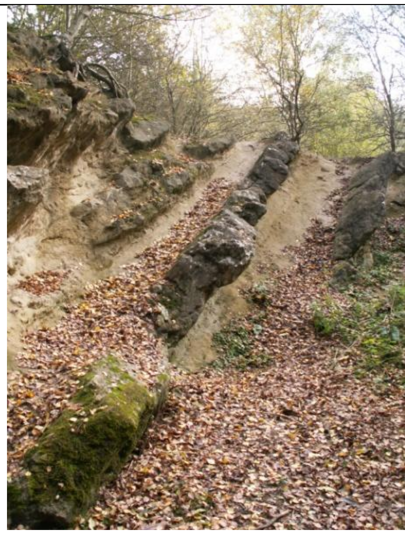
Portland Stone (Figs 28 & 29) formed around 140 million years ago, during the Jurassic period, when the south of England lay around 35° north of the Equator. This limestone is often oolitic, and contains fossils such as oysters, which show that it formed in a warm, shallow, sub-tropical sea.

Portland Stone is a freestone, which means that it can be worked with hand tools in any direction. The grains are well-cemented together, and it is fairly resistant to weathering, but can be readily smoothed down or carved by monumental masons. This feature, coupled with hardness, colour and durability, gives the limestone its quality as a building stone.

Freshly cut stone used for facing has a flat surface, and shells do not protrude. However, once acidic rain has got to work, the surface starts to weather back, the limestone dissolving at a faster rate than the shells. Rain-washed surfaces are kept white, but others became blackened from sooty residues, particularly so when exhaust from cars contained more particles, and in the days of coal fires. Close inspection can reveal a surface layer, not of limestone, but mineral matter produced by reaction between limestone and acidic rain. This tends to flake off, and leaves a roughened surface.

Portland Stone has been important since Roman times, as evidenced by its use for sarcophagi during that period. The oldest known building formed of the Portland Stone is Rufus Castle on the Isle of Portland in Dorset, which dates from around 1080. Other early buildings in London include the Palace of Westminster, built in 1347, and the first stone London Bridge. However, the person who was responsible for the many buildings in London constructed in Portland Stone after the Great Fire of 1666 was, of course, Sir Christopher Wren. Nearly a million cubic feet were required to build St Paul's Cathedral; the stone was quarried on Portland and then transported to London by barge from Portland to London via the Thames. Whether the islanders were happy with the amount of work brought to the island, or angry at the desecration that so much quarrying produced is debateable.

Kentish Rag

 **Figure 30 Kentish Ragstone (sandy limestone) at Dryhill, near Sevenoaks. The more weathered, orange layers between the stronger sandy limestone beds are much less well cemented sandstone, and have been given the name Hassock (Photo: Wendy Kirk)**	 **Figure 31 Kentish Rag in the walls of the old crematorium (City of London Cemetery)**

Kentish Rag is a rough sandy limestone from Kent (Fig 30). It is grayish in colour, and if you look very closely, you may be able to see very dark green or black grains. These are of the mineral glauconite, which forms only in the sea. Most of the grains, however, are of quartz, and these are held together with calcite cement. You may also be able to find evidence of fossils. It is Cretaceous in age, and formed around 115 million years ago in a warm shallow sea, of sediment brought down to the sea by rivers.

Kentish Rag is a difficult stone to work, but suitable for rough building (Fig. 31). It has been used for walls in London since Roman times, around 45 000 tons having been brought from Maidstone by ship along the Medway and Thames. Because it was relatively cheap, it was favoured by Victorian church architects; however, being unsuitable for carving, window surrounds would use a different stone, such as Bath Stone. It is worth looking at any graveyard buildings to see whether Kentish Rag has been used.

SANDSTONE

Figure 32 Sandstone showing roughly horizontal lines, which represent bedding.

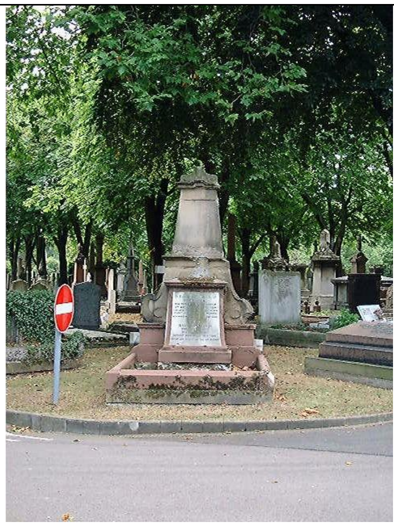


Figure 33 Memorial with red sandstone at the base, and buff coloured sandstone above. The white tablet is made of marble (City of London Cemetery)

Figure 34 Weathered sandstone; the flaking is particularly pronounced at ground level (City of London Cemetery)

Figure 35 Weathered sandstone memorial (City of London Cemetery)

Sandstone is a sedimentary rock made from grains of pre-existing rocks which have weathered away to sediment. These grains have been transported by wind or water, deposited in layers, or beds, and later compacted together to form a new rock (Fig. 32). In colour, they are often yellowish or buff, grey, brown, red or even greenish. They can show a great variety of grain shape, size and texture depending on what environment they were deposited in. The colour can change on wetting and weathering. Red sandstones are particularly striking, and tend to be associated with formation in desert environments. The red colour is caused by iron oxide coating the grains, when the rock was exposed to dissolved iron in sub-aerial (oxygen-rich) conditions (Figs. 32 & 33).

The grains mainly comprise the mineral quartz, and there may also be feldspar, other minerals, or small pieces of rock. Where the larger grains touch, there would originally have been spaces called pores, but these are infilled with much smaller grains to form a matrix, and/or with material precipitating out of solution to form a natural cement. The cement is usually silica, calcite or iron oxides. Any remaining pore spaces allow water to enter the rock, and the freezing and expansion as ice promotes weathering.

Sandstone is used for headstones, but may also form the base plinth for memorials made of a different rock type. Sandstone memorials generally do not last very well at all, particularly close to the ground where rain splash and capillary action cause water to attack the lower part first. Higher up, layers flake off, individual grains are loosened and fall away and there is often a black coating of pollutants. It is not unusual for the entire inscription to be lost, if not large chunks of the headstone (Figs 34 & 35).

Examples

Yorkstone

Figure 36 Newly laid Yorkstone flag, University College London

Figure 37 York stone flag, University College London

Yorkstone (Figs 36 & 37) s a buff, brownish or greyish sandstone which is commonly used for paving flagstones because it is well-bedded and so relatively easy to split into roughly parallel-sided slabs. It was the popular with the Victorians as it gave a tough, non-slippery surface, and may well be seen in the walkways of a churchyard. It is well bedded, and so splits readily into slabs. It often has a rather stripey appearance as it formed in an environment where the sediment was rippled, just as on a beach today, and so the surface may be slightly undulating. Yorkstone is a general trade term used to describe a type of sandstone formed over 300 million years ago during the late Carboniferous period. It is still quarried today in the North of England, but much of the market also makes use of reclaimed stone.

MARBLE

Figure 38 Marble, polished block (X897 UCL Geology Collections)

Figure 39 Pure marble (UCL Geology Collections)

Figure 40 Marble statue of an angel, surrounded by grey granite columns and with pink canopy and kerbed plinth (City of London Cemetery)

Figure 41 Weathered marble monument, showing discolouration, uneven surface and linear features. (City of London Cemetery)

Marble is a metamorphic rock, formed by the alteration of limestone under high temperature and at a range of pressures depending on how deep in the Earth it formed. Marbles formed from pure calcite limestones are white when pure (Figs. 38 &39), but become discoloured from algae, lichen or pollutants with age (Figs 40 & 41). Marbles have a sugary, or saccharoidal, texture, and it may be possible to stroke off a few grains when they are heavily weathered. Marbles, as limestones, effervesce when tested with dilute (~10%) hydrochloric acid. Impurities in the limestone lead to the formation of new minerals, giving the marble a variety of colours, but these are not normally used in a graveyard.

Stonemasons use the term marble in a wider sense to include any sedimentary limestone that takes a good polish.

Marbles are less resistant to weathering than granite, but are much easier to carve into ornate statuary. Over years, marble statues become dulled and blackened, especially where particles can settle. These can be cleaned and restored to their former glory.

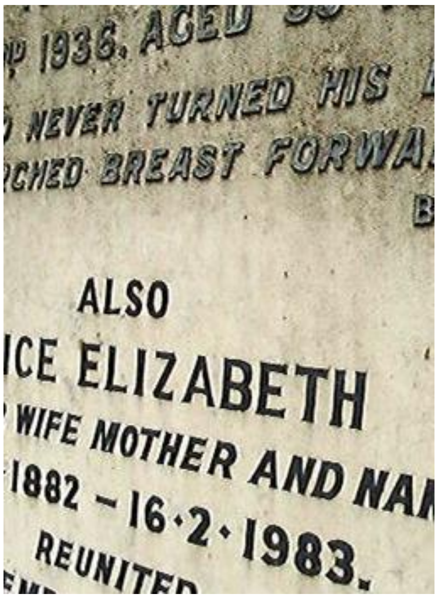


Fig 42 Lead lettering. The upper inscription is older, and therefore more raised, than the lower

Figure 43 Lead lettering. Marble rock has been dissolved from beneath the letter to expose the pegs

Inscriptions were often made using lead letters with pegs to hold them in place. When new, the letters would have been flush with the surface of the marble, but over many years, the marble would have dissolved in slightly acidic rainfall. An estimate of the average weathering rate can be determined knowing the date of the monument and the thickness of material removed. The letters eventually fall out altogether (Figs 42 & 43).

Marbles have rarely been worked in Britain, and the white marbles of the graveyard are likely to have been imported from abroad, especially from Italy.

Example

Carrera Marble

Figure 44 Monument in white "Sicilian" Marble, possibly from Carrera (City of London Cemetery)

A famous white marble comes from Carrara in the Italian Appenines where it has been quarried for two thousand years. It is probably the finest in the world for sculpture, and has been used by famous sculptors such as Donatello, Michelangelo and Canova for their masterpieces. Leonardo D Vinci made a marble-cutting machine for the quarry (http://earthobservatory.nasa.gov/IOTD/view.php?id=6936). London's Marble Arch, designed by John Nash in 1828, is built from Carrara Marble.

One type of marble from Carrara has been known as Sicilian marble in Britain (Fig. 44), but as Bianco Chiaro in Italy, and this was popular for monumental work (Pool, 1960).

SLATE

Figure 45 Stack of broken roofing slates, showing slatey cleavage

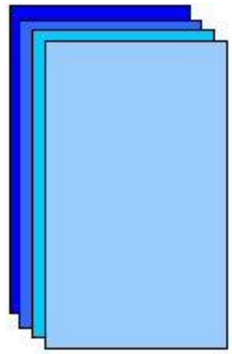


Figure 46 Diagram to show slatey cleavage surfaces. These are commonly vertical in headstones.

Figure 47 Slate memorial showing cleavage and original layering. (Highgate Cemetery)

Figure 48 Slate memorial (City of London Cemetery)

Slate is a fine-grained metamorphic rock, commonly grey, purplish, or greenish, which formed at high temperatures from fine-grained muddy sedimentary rocks, or occasionally volcanic ash. It splits readily into thin parallel slices, and is thus said to show slatey cleavage (Figs 45 & 46). The reason for this is the alignment of the platy minerals that form slate, too small to see with the naked eye or even a magnifying glass. Slate headstones tend to be set up with the cleavage vertical. Often, however, the cleavage itself is not visible, especially where the stone has been coated with a dark material. This helps stop water entering the rock along the cleavage. Another interesting but unusual feature which may be preserved is the original bedding, the layers in which the mud or ash was initially deposited (Fig 47).

Slate gravestones tend to be unembellished, being a rock that cannot be easily carved into intricate patterns. The inscriptions however are engraved and usually remain clear and fresh-looking; commonly the names are Welsh, which suggests that the slate has been sourced from quarries in Wales (Fig. 48).

The slate industry was once very important in Britain, dominating world production during the late nineteenth and early twentieth centuries. It is concentrated today in North Wales, the Lake District, Cornwall and Devon. Slate was commonly used as a roofing material on old houses because it splits so readily, and the quarries from North Wales were once widely used – in fact it has been quarried there for over 500 years. Nowadays, it is rare to see a new slate roof because alternative materials are cheaper.

Example

Lake District Slate, formed from volcanic ash

Figure 49 Volcanic ash showing fragments of different sizes. Probably from the Lake District

Figure 50 Memorial made from Lake District slate

Volcanic ash forms from lava which has been explosively erupted from a volcano, and falls through the air to settle in layers. Such rocks are called “pyroclastic”. Ash is composed of fine grains less than 2mm in diameter. When consolidated, cemented and formed into rock, it is called tuff. The rocks are made up of a mixture of different-sized rock fragments, crystals and glassy shards. Although they fall as a white or grey powder, as rock they are often coloured.

One particular rock that originated in this way comes from the Lake District (Fig. 49). Formerly known as Westmoreland Green or Lakeland Green slate, it formed around 450 million years ago (during the so-called Ordovician Period), but was deposited into water rather than on-land. This led to variations in grain-size in patches, and differently coloured layers in wavy patterns, which can indicate settling into channels or action by water currents. Such features are is particularly interesting to a geologist because it is sometimes possible to work out the original “way up”. Around 50 million years later, the tuff was altered by heat and pressure (metamorphosed) to slate, during a mountain-building episode known as the Caledonian Orogeny. Like all slates, it is characterized by roughly parallel surfaces in which the rock can be split relatively easily.

Lake District slate has been used in the Houses of Parliament, Scotland Yard, Westminster Abbey and the Ritz. Within the cemetery, there are rarely more than a few memorials made from Lake District Slate. It can be recognized from a distance by its greenish colour (Fig. 50), and on closer inspection by the lighter-coloured fragments it contains.

Honister is now the only working slate mine in England. It is owned by the Buttermere and Westmorland Green Slate Company Limited and slate has been worked there since the early 1700s. See:
http://www.honister-slate-mine.co.uk/honister_green_roofing_slate.asp
http://www.visitcumbria.com/kes/honslate.htm. http://www.visitcumbria.com/amb/hodgeclose.htm

GNEISS

Figure 51 Gneiss (P3286, UCL Geology Collections)

Figure 52 Gneiss (X903, UCL Geology Collections)

Gneiss is a coarse-grained metamorphic rock characterized by a banded texture (Figs. 51 & 52). The bands of light (white or pink) and dark minerals can vary in thickness from millimetres to a metre. This type of rock develops from a wide variety of igneous and sedimentary rocks which have been buried deep in the Earth's crust. This has led to the formation of new minerals and textures at high temperatures and pressures. In fact, the rock becomes able to fold over time, and produces interesting patterns. Some gneisses show large distinctive new minerals such as garnet, which is dark red and typically appears to have a rounded shape.

In Britain, large areas of gneisses formed in Scotland nearly 3000 million years ago; however these do not seem to have been used for memorials in Southeast England, unlike the granites from around Aberdeen. In recent times, however, a range of very attractive stones have been used, imported from around the world, and it is difficult to determine exactly where they have been quarried. These make very striking and beautiful monuments (see Figs 53-56).

Figure 53 Gneiss (City of London Cemetery)

Figure 54 Gneiss showing rounded crystals of reddish garnet (City of London Cemetery)

Figure 55 Gneiss with red garnets (City of London Cemetery)

Figure 56 Gneissic rock (originally an igneous rock?). Note the garnets, bluish quartz crystals, and the large feldspars, up to 10cm long. (City of London Cemetery)

References

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