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The Silurian

The Magazine of the Mid Wales Geology Club

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The Magazine of the Mid Wales Geology Club
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Cover Photo: View from the top of Gouray Castle Jersey, looking west over the harbour. ©Chris Simpson

All photographs and other illustrations are by the author unless otherwise stated.

As always many thanks to those who have written a contribution for this edition, and also as always this is a plea for more articles for a future edition.

With the possibility of an end to the covid pandemic in the reasonably near future and the end of lockdowns now may be the time to get writing, before field trips and other activities take up all of your time again.

Michele Becker

Submissions

Please read this before sending in an article.

Please send articles for the magazine digitally as either plain text (.txt) or generic Word format (.doc), and keep formatting to a minimum. **Do not include photographs or illustrations in the document.** These should be sent as separate files saved as maximum quality JPEG files and sized to a **minimum size of 1200 pixels** on the long side. List captions for the photographs at the end of the text, or in a separate file.

'Members Photographs' and cover photos are also wanted. Cover photos need to be in 'portrait' format and a minimum of 3000X2000 pixels.

Coastal Landslips South of Aberystwyth

This article focuses on landslips at an easily accessible part of the Wales Coastal Path, and the underlying cause of this phenomenon.

The Location

The landslips are visible along a two mile stretch of the coast path south of Aberystwyth from Allt Wen to Morfa Bychan, (SN577796 to SN566778). The closest car parking is at the Tanybwlch car park, (SN579807).

Warning: the ascent up Allt Wen is steep, and is slippery in wet weather.

Fig. 1 *The view of Allt Wen from Tanybwlch beach. Much of the hillside is bare rock due to landslips of varying size and age. Near the top, there is a V-shaped indentation in the grass which is an old, vegetated landslip.*

Fig. 2 *Near the top of Allt Wen. The ridge along the right hand side of the picture is material which has slipped a short way down the slope leaving the bare rock along the left. It happened many years ago as it has stabilised and vegetated.*

Background Geology

The rocks forming this part of the coast are part of the *Aberystwyth Grits Formation* – alternating sandstones and mudstones from the Silurian period around 440 Ma.

The Landslips

Even from a distance, as you approach Allt Wen from the north, the irregular nature of the cliff face is apparent. Closer inspection reveals extensive landslips of varying scale. They also vary in age, with the older landslips now showing complete regrowth of the surface vegetation, while the younger ones still show extensive bare rock. At the bottom of the slope there are blocks of rock several metres across containing up to 20 strata. Down on the foreshore in places, you can see large pieces of flat rock which are clearly broken fragments of single intact rock strata that have fallen down the slope in a landslip, but were strong enough to retain their shape without being shattered into small pieces.

Fig. 3 *Fallen blocks of rock at shore level, haphazardly arranged with differing orientation. Each block consists of multiple strata.*

Fig. 4 *Individual slabs of fallen rock visible at low tide. Each piece is clearly identifiable as a large, flat piece of a single layer of the Aberystwyth Grits.*

Fig. 5 *The area at the top of the picture has slipped partially down the slope. The bare area at the bottom of the picture is where rock has previously slipped.*

Fig. 6 *Enlarged section of the slipped area at the top of* **Fig. 5** *with individual strata visible on the surface rotated from around 40° to near vertical.*

Fig. 7 *View looking South towards Morfa Bychan caravan park. There are three separate lines of exposed rock running down the slope: one at top left, a second above that crossing the whole picture and a third (difficult to see) in the distance beyond that. These rock exposures demonstrate the general trend of the rock strata – dipping at around 40° to the west.*

Fig. 8 *Enlarged section of the view in* **Fig. 7** *clearly demonstrating the general trend of the rock strata on this hillside.*

Figs. 9 (L) & 10 *The hillside from the shore. The downward slope of the rocks at about 40° is clear, as is the almost complete lack of vegetation cover. Near the top of* **Fig. 10** *the edges of individual strata are clearly seen.*

Fig. 11 *The rocks at the northern end of the North Beach at Aberystwyth at the base of Constitution Hill. The orientation is dipping to the east, away from the sea.*

Fig. 12 *Shows a localised area of rapid slumping erosion, the photo was taken from the small headland jutting out into the sea in* **Fig. 13**

Fig. 13 *View of the headland at the southern end of the area of rapid slumping erosion. It is clear that the triangular area of rock in the foreground is sloping to the west at about 45°. In contrast, the rocks of the headland slope at around 45° to the east, which is why they are resistant to erosion and project out into the sea.*

Why is this area subject to landslips?

The main reason is the orientation of the strata along this area of the coast.

When the rocks are dipping towards the sea, as they do south of Aberystwyth, any weakness in a particular rock stratum will result in the overlying rocks sliding down towards the sea. Rainwater on the top of the hill will percolate down through the rocks. If any layer is more permeable that the others, then water will preferentially track along that layer producing weakness and subsequent landslip. A superficial landslip can involve just one stratum; and small-scale slippage on bare areas merges into ordinary rock erosion as can be seen anywhere. Bigger landslips produce the large blocks as seen above.

What happens north of Aberystwyth?

The predominant orientation of the Aberystwyth Grits north of Aberystwyth is dipping towards the east – the opposite orientation of the rocks south of Aberystwyth – as seen in Constitution Hill (**Fig. 11)**. These rocks are therefore immune from the type of slumping seen south of Aberystwyth. There are, however, occasional small areas of the coast north of Aberystwyth where the rocks are dipping to the west, and these do show the same slumping as seen south of Aberystwyth, albeit on a smaller scale. **Figs. 12 & 13** are from the coast north of Clarach at grid reference SN585845.

Finally

If you time your descent of Allt Wen for late afternoon or early evening, you will be rewarded with splendid views of Aberystwyth and the Welsh coastline to the north. If you can also time your descent to coincide with low tide, you will have fantastic views of the Aberystwyth Grits beds exposed on the shoreline with their intricate patterns caused by compression and reorientation due to large-scale movements of the earth's crust in the 440 million years since they were first laid down.

Chris Simpson

Geodes

I have always been fascinated by the beauty of geodes, and by writing this article I have been prompted to learn much more about them. Geodes are highly complicated, so a comprehensive description of all the different types and how they form would take up a tremendous amount of space. Therefore this article is a basic description of the how and where geodes occur together with a few illustrations.

The first thing to do is to explain the definition of a geode.

There are three major types of inclusions in sedimentary, and volcanic rocks. Concretions, Nodules, and Geodes.

In sedimentary rocks, concretions **(Fig. 1)** are what their name suggests, that is smaller sedimentary particles are cemented together by a mineral, usually calcite.

Nodules **(Fig. 2)** are solid masses of material which have a contrasting composition to the surrounding rock, for instance, flint in chalk deposits, pyrite in coal deposits, or chert in limestone.

Geodes **(Fig. 3)** have an internal cavity which is occupied by mineral crystals. The wall, or shell of the geode is more durable than the surrounding rock, probably due to strengthening by the cementing properties of another mineral.

In many publications there is a blurring of lines when describing concretions and nodules, sometimes even describing a nodule as a type of concretion, but that is another story, so to continue on the subject of geodes.

Fig. 1

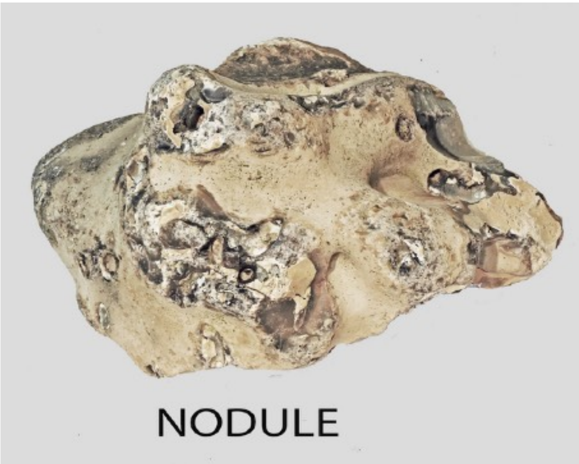


Fig. 2

Fig. 3

Most geodes have a silica or quartz content, for instance amethyst geodes are the most striking example. and can often be seen in retail shops advertised as Cathedral geodes. **(Fig. 4)** These are probably recovered from basaltic lava tubes and voids. By its very nature a lava flow has the ability to cool quite quickly entrapping pockets of gas, and leaving behind lava tubes. Over time the silica content of the lava migrates to the pockets and tubes depositing crystals on the walls, The specimen illustrated has been levelled at its base to give it stability when displayed.

One specimen, from my own collection (**Fig. 5)** poses the question, Is it a nodule or is it a geode? I think it is a geode, because it has a hollow interior. The walls are chalcedony, and the interior deposit is botryoidal chalcedony.

Fig. 6 is another geode from my collection. The walls of this geode are very thin, and almost non-existent in places. The crystals are the mineral celestine, old name celestite, which is a strontium sulphate. Among the worlds largest geodes is a celestine geode about 10 metres in diameter, located at Put-in-Bay, South Bass island, Lake Erie, Canada.

Geodes are not random occurrences, but mostly found in particular geochemical environments in sedimentary or volcanic stratified deposits. The most sought after geodes are found in volcanic

Fig. 4 Amethyst geode ©Rob Lavinsky iRocks.com /Wiki Commons

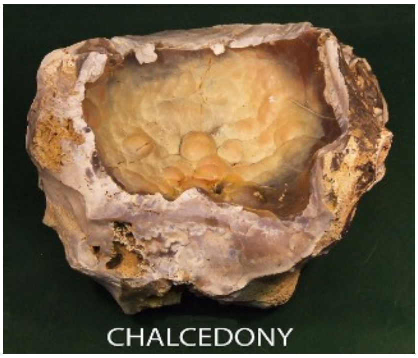


Fig. 5

Fig. 6

rocks, because volcanic lava flows provide an environment rich in dissolved gases and minerals, especially silica. Trapped gases in the rapidly cooling lava create cavities, and even larger cavities are left behind as lava tubes empty. Lava tubes can be very branch like in their formation, many meters long, and up to a meter in diameter. When the lava has cooled, groundwater, and hydrothermal activity, transport minerals into the cavities, where they are deposited, and form geodes. Lava tubes can provide very elongated geodes, and smaller truncated branches off the main lava tube can produce the most sought after “ Cathedral” geodes.

As an illustration of scale see **Fig. 7**, note the shadows of spectators standing around this collapsed lava tube in Iceland. I walked across a part of the roof that was concealed by ice and snow. The roof suddenly collapsed, and I started to disappear, before the quick thinking of one of our group saved me by grabbing my rucksack. I was pulled out, and saved from falling about ten feet onto the rocky floor below. There are no minerals lining this tube, because it was only formed a short time ago. As time passes minerals will probably be deposited.

There are locations around the world that are renowned for the abundance of geodes, and many of these locations are noted for the type of geode which are found there. So much so that nicknames are assigned to their peculiarities, and their location. Many localities have a different set of “ingredients” to other localities, so there is a wide variance in geode appearance.

The U.S.A. has some interesting geodes, for instance Dugway geodes. These were flushed from geode bearing rhyolite flows, by wave action on the shores of a lake which once covered most of western Utah. They eventually accumulated in lake sediments which are now known as the Dugway Geode Beds. The geodes are mostly filled with agates, quartz crystals, and chalcedony, but some Dugway geodes are renowned for trace amounts of uranium in their filling which causes them to fluoresce under U.V. light.

Another type of geode also comes from the U.S.A. They are found near the intersection of three states, Iowa, Missouri, and Illinois, in an area surrounding Keokuk, a community in Iowa **(Fig. 8)**. The Keokuk geodes are so plentiful that this is regarded as one of the best sites in the world. The geodes have weathered out of the limestones and dolomites of

Fig. 7

Fig. 8 *Keokuk geode ©Astynax/Wiki commons*

Missisipian (Early carboniferous) age. The geodes are mostly composed of quartz crystals inside a chalcedony shell, but there are a few have been found that contain other minerals, such as kaolinite, calcite, pyrite, sphalerite, aragonite, and a few others. The geodes are are so plentiful that a search on online retailers will come up with many adverts selling them by the dozen or more, to be broken open by the buyer.

Geodes are found in the U.K. but obviously not on the scale that they are found in the U.S.A. Kenfig sands, at Porthcawl, in south Wales is a possible hunting ground. Geodes found on the beach are thought to be washed in from offshore.

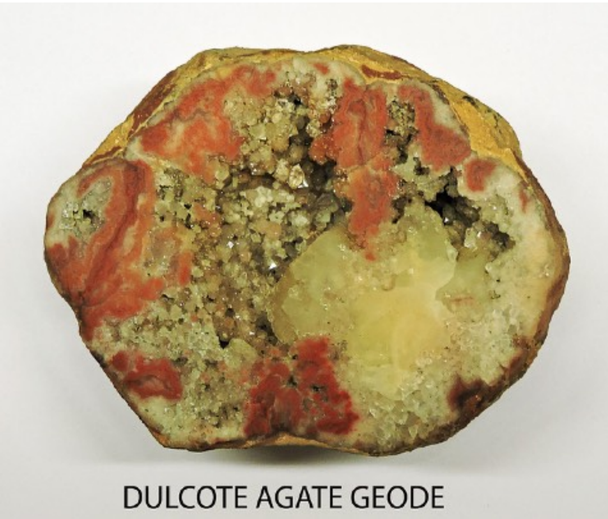


Fig. 9

The geode above in **Fig.9** is from Dulcote hill quarry in the Mendip hills. The geode is a mixture of agate and chalcedony with a large crystal of calcite taking up about one third of the interior space. The reddish colour is probably from trace amounts of iron.

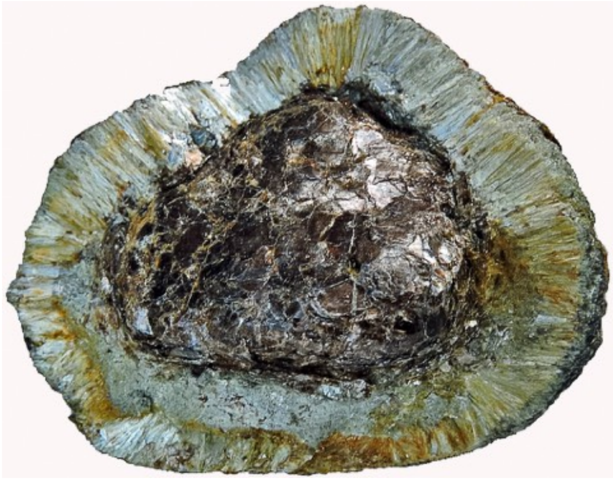


Fig. 10

The specimen in **Fig. 10** is an anomaly to me. Is it a concretion, a nodule, or a geode? Whichever description is attributed, it is a beautiful specimen. It is from Hefmanov in the Czech republic, and unsurprisingly it's nickname is a "Hefmanov ball". It is about 5 cm. across and has a centre of phlogopite mica surrounded by a fibrous aggregate of anthophylite.

Fig. 11 shows a geode that I discovered on a building site excavation when passing through Bridgenorth in Shropshire. The area is predominately sandstone, and this geode is calcitic, with a centre of dirty brown calcite crystals.

Fig. 11

In conclusion, geodes are so varied and so colourful, that it is hardly surprising that there are dedicated collectors of geodes. I have quite a number, and for me the most interesting part is to examine the pristine central crystals under the microscope.

Bill Bagley

Evolution of the Eye

Introduction

My interest in eyes was triggered during Lockdown as I read books I had on the shelf into which I had previously only dipped. Specifically, Darwin's Origin, Ed. 2 and Ed. 6 (usually regarded as the definitive one), as abridged, illustrated and with comments by Richard Leakey. Ed 2 is heavy going, but Ed 6 is a "good read" and the book Darwin would have produced had he written a popular science one now.

Why light, why sight?

Life may have originated some 3.7 billion years ago (Ba) and all life requires energy. We don't know what energy source first life used, but solar radiation became the prime energy source for simple cells, such as the ancestors of cyanobacteria. Long wavelength, heat and infra red photons are insufficiently energetic to do much chemistry, and UV, X ray and gamma radiation is very damaging, so visible light became the preferred energy source for cells because it does both chemistry and it penetrates water. Since then, photochemistry has been key to evolution and the eye reflects that.

Darwin devoted much of his chapter VI to a convincing counter to the well known Daley's "Blind Watchmaker" and the religious "Half an eye" arguments against evolution, by proposing that small incremental changes to a simple eye spot or photoreceptive cell took place, each step being of benefit to the organism concerned. Half an eye was indeed better than no eye! He postulated that two cells, photoreceptor and pigment got together and developed from a simple pigment spot through stages, each beneficial to the organism, to a functioning eye **(see Fig. 1)**.

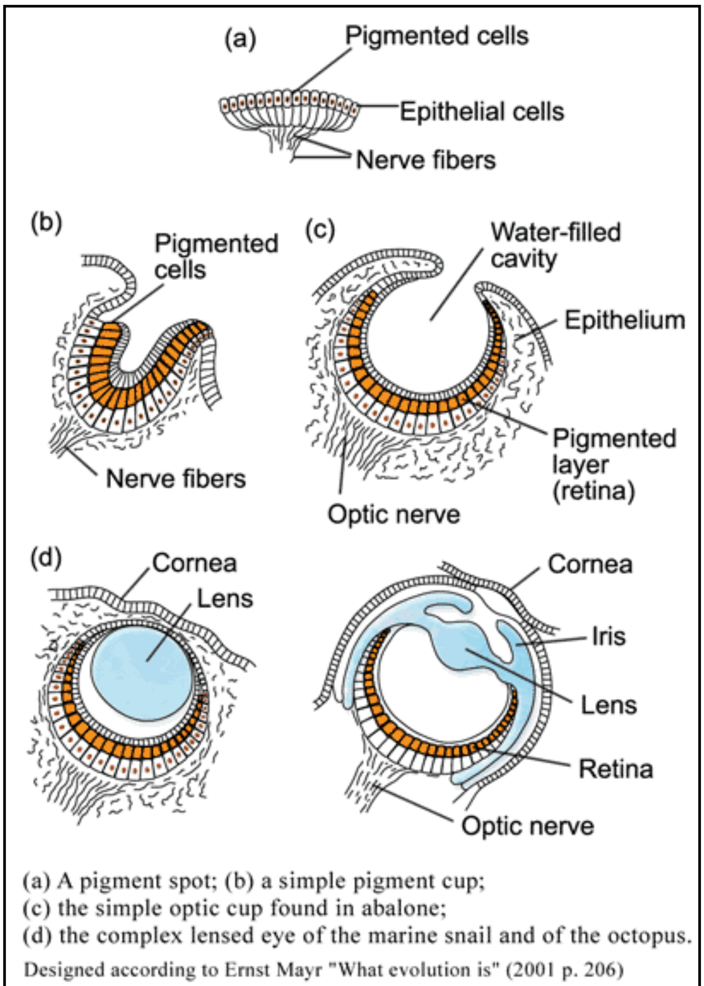


Fig. 1 *Stages in the evolution of the eye.*
Relicenced ex Wiki: CC Attribution - Share Alike 3.0.

Since Darwin, the evolution of eyes has been strongly debated and their development since the early Cambrian is now well established. Their early development in the Precambrian during which the "toolkit" of chemicals and genes came about, less so; although genomics is now steadily increasing our understanding.

The basics: how a photoreceptor cell works.

Each cell has a chromophore (retinal) which is sensitive to light, plus a transmembrane protein (opsin) coupled to it. Retinal is a simple derivative of vitamin A with some 20 carbon atoms and is used by all four types of human receptors. Cis-Retinal couples with and fits in its opsin. A light photon has enough energy to break a double bond in the middle of the molecule, allowing it to change to the trans form, altering its shape and breaking down the complex, thus bleaching it. This triggers cellular processes resulting in a signal telling the brain that the photon has struck.

The amino acid sequence of each of the four types of opsin (rods, S,M,L cones) is similar, but the differences account for their differences in absorption spectra, thus enabling colour vision. The retina also contains a complex array of interneurons, bipolar cells and ganglion cells, that together form a path from the receptor rods and cones to the brain. Other interneurons form synapses with the bipolar and ganglion cells and modify their activity. A good analogy is that of television, in which all pixels are not transmitted for each frame, but just those that are active, thus cutting the necessary bandwidth.

Ganglion cells are always active. Even in the dark they generate trains of action potentials and conduct them back to the brain along the optic nerve. Sight is based on modulation of these nerve impulses and vision is developed in the brain from the optical input, memory and computation.

Developing the "toolkit" in the Precambrian

Gehring and others at the University of Basel (1) have shown that the Pax gene family were in at an early stage as they are present in phyla from insects to mammals (Pax6 and six1 and six3 genes famously induce ectopic eyes and encode transcription factors). Many of the present variety of opsins were also around very early on. All this indicates a very early monophyletic origin of the chemical "toolkit"

Maybe the breakthrough was when retinal plus an opsin plus pax genes came together, perhaps with a cilium or flagellum to produce an organism with an eyespot and the ability to move towards or away from light.

Whatever the case, the Ediacaran was very relaxed, with floppy organisms lying about with no backbone. The shakeup came in the the Cambrian Explosion as predation arose with the resulting "arms race", where sight became key and the chemistry kit was available! At that time, the kit and necessary genes were both applied and the arms race took off during which diversification, both divergent and convergent took place and has been happening ever since.

Vision is more than recording photons

We are visual animals. The retina is closely connected to the brain and, in vertebrates, the two have evolved together with the retinal image as an input to vision. Vision is developed by the brain. However, eyes could well have evolved independently of brains, as many invertebrates with no brains have eyes, so eyes either evolved autonomously, or brains were lost as being of no benefit to the organism. The development of individual eyes in different species is an extraordinary illustration of how well evolution works to hone an organ to a degree of perfection. Its failing is that it is incapable of correcting basic design faults!

Early Eyes: Lampreys

Jawless lampreys eyes have been minutely studied by a team at the University of Lund.(1) Their ancestors existed in the L. Cambrian and separated from the main line of vertebrates some 500 Ma. Southern hemisphere lampreys have complex camera eyes and have 5 types of opsin genes, of which 3 are clearly

Fig. 2 *Sea Lamprey. ©E. Lee, USFWS Pivnio.*

orthologous with those of vertebrates. This suggests that the LCA (Last common ancestor) had complex colour vision **(Fig. 2)**. All lampreys studied had multifocal lenses indicating that well focussed colour images evolved very early, before 500Ma. This is quite extraordinary. Humans have found that, to achieve a clear colour image where red and blue light comes to the same focus with a telescope, an achromatic lens made from two different glasses is necessary. Some lampreys do it differently. Annular areas of the lens bring red and blue light to the same focus while necessarily, the red light traversing the "blue" annulus causes blur, and vice-versa. It is left to the brain to interpret the image by rejecting the out of focus blur. Interestingly this anticipates, by 500 Ma, our use of computers to extract information from non-focal images in microscopy!

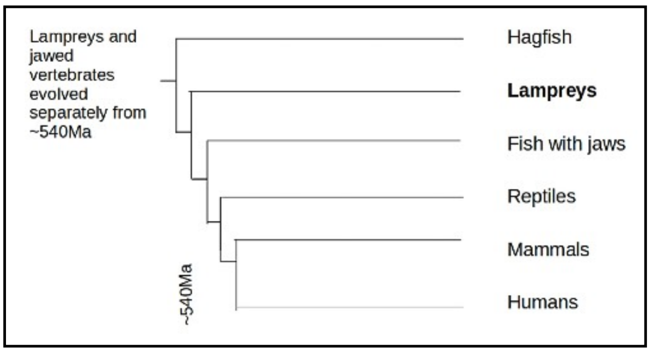


Fig. 3 *Lamprey, simplified phyogenetic tree.*

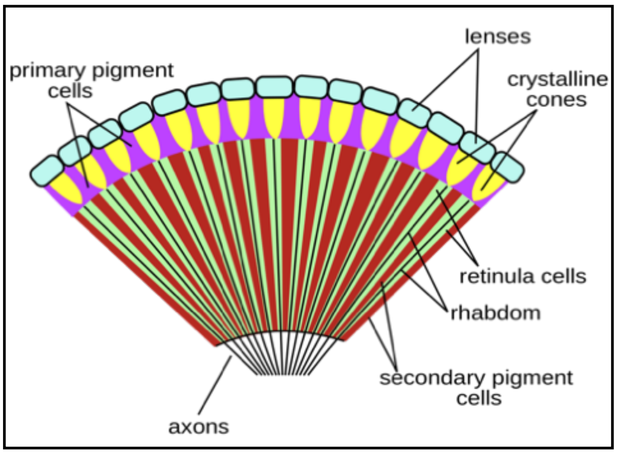


Fig. 4 *Anatomy of the compound eye of an insect.*
By Bugboy52.40 - Own work, CC BY-SA 3.0,[Wikipedia]

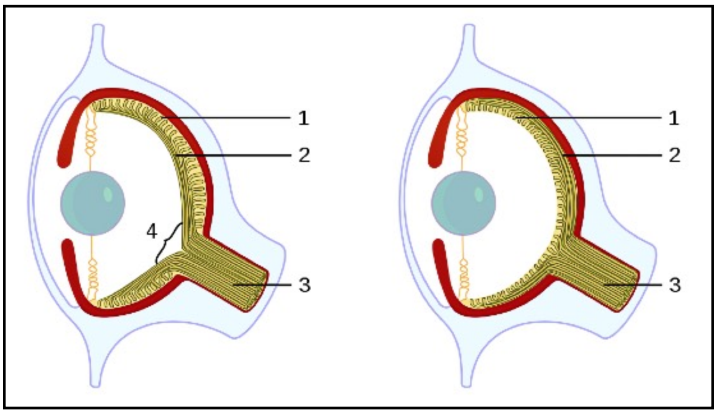


Fig. 7 *Camera eyes, Human eye (L) & Octopus eye (R).* ***1****. Retina.* ***2****. Nerve fibres.* ***3****. Optic nerve.* ***4****. Vertebrate blind spot.* *Wiki Caerbannog CC.*

Insect, or compound eyes:

Totally different, but using similar opsins and nerve cells is the compound eye **(Fig. 4)** which achieves a wide visual field by duplicating simple "ommatidia" some thousands of times. Each element sees a narrow cone, but is good at detecting movement by a flicker effect as neighbouring elements are triggered. That is good for detecting the descending newspaper! This is carried to an extreme in the Striped Horse Fly **(Fig. 5)** which achieves near 360 degree vision. Beautiful, but the females bite!

Fig. 5 *Female striped horse fly.*
©T. Shahan. CC by 2.0.

Fig. 6 *Trilobite* Erbenochile erbenii.
©Moussa Direct CC3.0.

Fossil evidence of eyes is sparse. Optical pigments can be preserved, but all structure is generally lost. The exception is that of some trilobites that evolved calcite lenses as the elements in their compound eyes. This fossil eye of Erbenochile erbenii **(Fig.6)** even has an eye shade showing it was diurnal!

Camera eyes

In mammalian eyes, the nerve fibres route before the retina, blocking some light and creating a blind spot where the fibres pass through the retina. In some cephalopod eyes, the nerve fibres route behind the retina, and do not block light or disrupt the retina **(Fig. 7)**.

These two eyes are very similar in design but contain the same parts in a different order, so could not have co-evolved. They are a good example of convergent evolution. They show one deficiency in evolutionary development as the "fault" in human eyes resulting in a blind spot could never be corrected by evolution. It requires a redesign!

Fig. 8 shows another cephalopod eye. This nautilus eye is a simpler version of the octopus, above. It uses a pinhole rather than a lens. The blurry image is no doubt adequate for maintaining its depth in the water and obtaining food, but a lens would provide for better focussing and protection.

Fig. 8 *Nautilus eye.*
©Hans Hillewaert CC 4.

Prey and predator. Cats and Sheep

Cats hunt in the dusk and have a reflective layer behind the retina which causes their famous bright reflecting image. It increases sensitivity by causing photons to pass twice through the retina but sacrifices acuity. They are short sighted and the slit narrows in daylight, increasing depth of field and perception. Small cats have multifocal lenses (annular areas of differing focal length) and slit

Fig. 9 *Cat's eye. Wiki Zakabog CC 3.0.*

pupils **(Fig. 9)** keep sharp focus at small aperture. The slit iris is comparable to a focal plane shutter on a SLR camera, as opposed to an iris shutter, providing a greater range of *'f'* numbers. Interestingly, large cats, like lions, have round pupils because, from a higher vantage point, the horizontal ground is foreshortened, thus not requiring such depth of field. This rule applies to dogs as well as cats, as the small European fox has vertical slit eyes, whereas his cousins, the wolf and our domestic dogs have round ones.

Fig.10 *Sheep's eye. Wiki Bullenwächterre CC 3.0*

In contrast, as prey rather than predator, sheep's eyes **(Fig. 10)** are on the sides of their heads and have horizontal slits increasing light from front and rear to pick up on preying wolves. Amazingly, they rotate through 90deg, so remain horizontal even in grazing position!

The most amazing eye!

Not only does the Mantis Shrimp (**Fig.11)** have three regions of ommatidia, giving it trinocular vision, but it has a large variety of opsins tailored for different parts of the spectrum. It can see from the deep infra red to the far ultra violet. It also detects polarisation, including circularly polarised light! It is said to have better quarter wave plates than manufactured ones. This enables it to increase the contrast between object and background.

Fig. 11 *Mantis Shrimp. ©A. Vasenin CC BY-SA 3.0.*

Evolution is versatile and parts of the brain in the visual cortex can be adapted for other purposes. For example barn owls **(Fig. 12)** can hunt effectively in complete darkness and strike their prey accurately, but not from hatching, they have to learn by using sight to train their ears and brain.

Fig. 12 *Barn owl. Wiki public domain CC.*

Conclusions

The evidence is that the photochemical toolkit developed early in the Precambrian, together with the associated genes, in readiness for the Cambrian Explosion, during which an arms race developed between predator and prey in which sight was key. At that point eyes diversified by both divergent and convergent evolution, resulting in the remarkably well adapted organs we see in different species today.

Perhaps Darwin's postulated 2 cells, photoreceptor and pigment accidentally came together with Pax genes in the Precambrian and that enabled eye types to evolve. The complete 'Meccano' kit plus instructions (genes) were then available for evolution to play with! It has been playing with different combinations ever since!

Tony Thorp

Member's Photo

Trimming roofing slates to shape, Langdale slate mine, Westmorland. Photograph taken by Percy Lund circa 1910. ©Clarence O. Becker Archive.

Geological Gems from Jersey

In 2019 I went on a guided geology trip to Jersey. This article is not in any way comprehensive or authoritative – it is just a collection of some of the most interesting features of the island geology – something to whet your appetite for going there yourself.

The government of Jersey, the largest island of the Channel Islands, has recognised the tourist potential of the island's geology, and has produced very useful guides which assume no previous knowledge of geology. They include detailed illustrated descriptions of the different rock types seen on the island, timelines for laying down the various formations, and articles on aspects of geology such as faults and dykes. See www.jerseygeologytrail.net for details.

If you want to go on a geology based holiday to Jersey, remember to consult the tide tables before you book. The tidal range is 11m, and the land area of the island at low tide is 30% greater than the land area at high tide due to the huge area of shallow rocks surrounding much of the island. Many interesting exposures can only be seen at low tide!

Jersey, like that of the other Channel Islands has geology similar to and linked with that of Normandy. A summary of the succession is given below.

Dykes and Sills

Fig.1 *A typical dyke cross-cutting pink granite.*

Figures 1. to **3.** were taken at Le Portelet Bay within the South-west granitic intrusion.

Fig. 2 *A dyke petering out.*

Jersey - Summary of geological succession.

900 – 700Mya	*Brioverian sediments laid down. These are mainly turbidites and make up the base of the island geology.*
700 - 500Mya	*The Cadomian Orogeny. Initially, the rocks were compressed from east to west, and later they were compressed from north to south.*
Circa 530Mya	*Brioverian volcanics. A variety of extrusive rocks including rhyolite and tuff.*
550 – 480Mya	*South-west Jersey granites intruded.*
465 – 426Mya	*North-west and South-east Jersey granites intruded.*
?	*Jersey dyke swarms. Clearly younger than the youngest granites, these dykes are numerous, but not much recent work has been done on dating. Some of the dykes are related to the Variscan Orogeny.*
?	*The Rozel Conglomerate. A large conglomerate deposit which occurred at some point between Cambrian and Ordovician.*
Eocene period	*Some limestone is present in the seas around the island; but none is found on Jersey itself.*
Quaternary	*Evidence of raised beaches from the last interglacial period, peat beds and dune sands.*

Fig. 3 *A sill at the base of a vertical cliff. The sill is 15 to 20cm thick.*

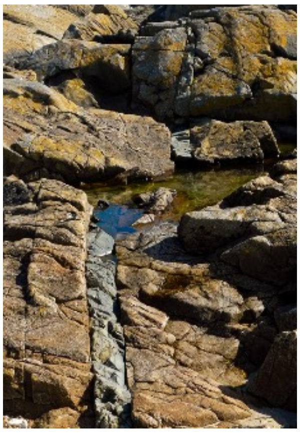


Fig. 4 *A dyke on the beach near the south-east tip of Jersey. There is a fault running from left to right near the centre of the picture producing about 50cm offset in the line of the dyke.*

The Rozel Conglomerate

Taking its name from Rozel Bay at the north-east corner of the island, this formation occupies several square kilometres.

Fig. 5 *The Rozel Conglomerate on the sea shore.*

Fig. 6 *An interesting "clast within a clast" piece of conglomerate.*

Granites

The aplites are generally red to brown and finely crystalline. They represent late stage, low temperature magma, intruded along fractures within granite and cooled quickly.

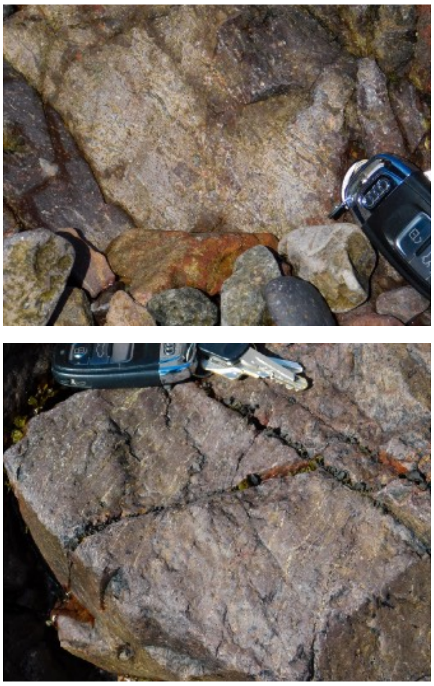
Fig. 7 *A coarse granite on the beach at St Helier.*

Fig. 8 *Pegmatites in South-western granite.*

Fig. 9 *Aplite veins in North-west Jersey granite.*

Extrusive volcanics

Fig. 10 *Spherulitic rhyolite pebbles on Rozel Beach.*



Figs 11 & 12 *Ignimbrites on the eastern side of Jersey.*

Rainy Day Activities (See Figs. 13 - 17)

There is an excellent museum in St Helier with a geology section. The Pallot Steam, Motor and General Museum is also well worth a visit.

There are several castles too, including Gouray Castle on the eastern side facing Normandy, and Elizabeth Castle off St Helier. The visit to Elizabeth Castle involves a short ride in an amphicar.

Chris Simpson

*A detailed description of Jersey geology can be found in the 2003 Geologists Association Guide, no 41: T**he Geology of Jersey Channel Islands**, by Clive Bishop, David Keen, Stan Salmon & John Renouf.*

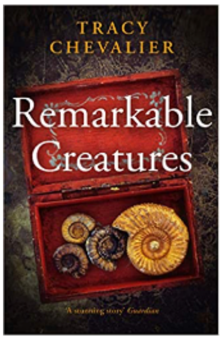
Fig. 13 *The Pallot Museum*

Fig. 14 *Gouray Castle.*

Fig.15 *Elizabeth Castle with St Helier Harbour in the foreground.*

Figs. 16 & 17 *The amphicar at sea and as it lands.*

Book Reviews



Remarkable Creatures.

Tracy Chavalier

The Borough Press 2014
Paperback £7.15

ISBN-13: 978-0007178384

A novel by Tracy Chevalier. It is fiction, but based on fact and is well researched. It is a "good read." It tells the story of Mary Anning and her family. She was an early geologist who was not recognised by the "establishment" and faced prejudice from them.

The family lived in poverty in Lyme Regis. Father was a carpenter and mother took in laundry, but collecting fossils was an interest as well as a source of income. The work could be dangerous as landslips were very common, but usually after such events many more fossils were to be found.

They found "crocs" their name for the ancient creatures. After her father's death, Mary did most of the fossil hunting; her brother was not that interested and trained to be an upholsterer (financed by money earned for an important find). The work was hard, often in bad weather and generally unpleasant conditions.

It also tells the story of Elizabeth Philpot, an amateur collector and a friend of Mary's. Her particular interest was fish fossils. She was a middle class spinster living with her sisters in Lyme Regis; in a gentile fashion on a low income in a relatively inexpensive town.

She played an important part in getting money for Mary from the collectors who wanted the specimens.

Many collectors just wanted the fossils for show and often claimed that they had found them. Elizabeth helped get the recognition for Mary.

Other "famous"geologists make appearances in the book eg William Buckland, Charles Lyell and Henry de la Beche.

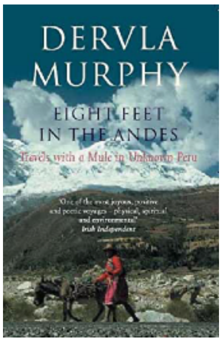
Mary's name was first mentioned in a scientific context in France in 1825 in a book by George Cuvier. She was first mentioned in Britain in 1829 in a paper by William Buckland. The Ichthyosaurs and Plesiosaurs she found are in the Natural History museum. She died in 1847 aged 47.

The book is about a dedicated, knowledgeable female geologist who did not, at the time, get the credit she deserved but whose contribution to the work of others was invaluable.

However, it is a work of fiction and does include some romantic elements.

Eleri Houghton

Reviews of 3 books on Andean travels



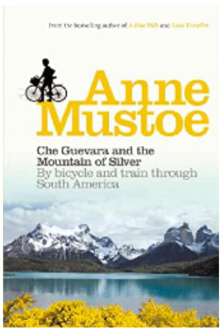
1. Eight feet in the Andes: Travels with a Mule in Unknown Peru

Dervla Murphy

Eland Publishing 2016

ISBN-13 : 978-0879512453

This is about a trip Murphy made in the early 1980 with her 9 year old daughter and a mule. They travelled the length of Peru from the Ecuadorian border to Cuzco. They are very intrepid and this is not a trip I can imagine ordinary mortals making! She talks about the landscape and how it has affected the lives of the ordinary local people. Although not about geology as such, it certainly features in the book. Mining areas are mentioned as are earthquakes and landslips.



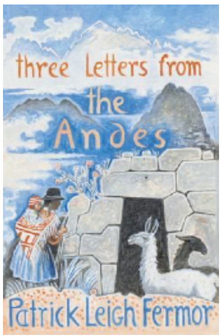
2. Che Guevara and the Mountain of Silver: by bicycle and train through South America

Anne Mustoe

Virgin Books 2007

ISBN-13 : 978-0753512746

I enjoyed this book, even though it does not really deliver what is says it on the cover! It is supposed to be South America by bicycle and train. Mustoe abandons the bike very early on - apparently it is too time consuming for the time available. Trains are used rarely, mainly because they do not leave on the "right day." Most of the trip is by bus. Although she is supposed to be following in the footsteps of Che Guevara and his motorcycle journey; this seems to be incidental and mentioned only occasionally. However, the parts on the silver mines - past and present are very good. She sees other kinds of mining, travels across the Atacama desert, sees the effects of earthquakes and visits Chilean lakes.



3. Three Letters from the Andes

Patrick Leigh Fermor

Pub. John Murray

ISBN-13 : 978-0879512453

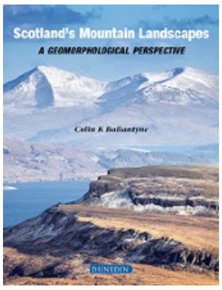
This third book is about a trip to the Andes in 1971 and involves some of the party climbing some high peaks, spending time at lake Titicaca and walking amongst some of the high pastures.

These are three very different books and see the same area from different perspectives. Dervla Murphy take the minimum of equipment with her, Anne Mustoe has a rucksack, suitcase on wheels and hand luggage, whilst Patrick Leigh Fermor and his party hire a lorry and helpers to move their stuff. Admittedly they do have climbing equipment - but even so! Dervla Murphy travelling later does have the advantage of high tech developments such as space blankets and specialised sleeping bags. Dervla Murphy and daughter sleep rough or in basic hotels or local homes. Patrick Leigh Fermor and co sleep in the best hotels (although this is relative) and when camping, have a tent each and a mess tent with servants to carry and do the work. Anne Mustoe stays in "decent" hotels.

They are all interested in the landscape, the people that live there, the culture and how it all interacts. Some are more interested than others in history, but all mention it.

Not specifically geology, but an interesting region.

Eleri Houghton



Scotland's Mountain Landscapes: A Geomorphological Perspective.

C.K. Ballantyne

Dunedin Academic Press Ltd 2019 174pp; hardback £28.00

ISBN 978-1-78046-079-6

'Nothing is static, nothing endures and nothing is eternal, even though within our brief individual lifetimes this may appear to be so.' This quotation from page 138 summarises the overall theme of constant change that Colin Ballantyne so eloquently achieves throughout this book. Having enthused about geomorphology with my students throughout a career of teaching geography I knew this was my kind of book and it did not disappoint!

This is much, much more than a book about Scotland's diverse mountains, it's staggering range of rock types of differing ages and the many processes operating here through deep time, many millions of years ago, through Ice Ages to today's weathering, erosion and deposition. The book as a whole tells a very coherent, detailed story of the development of the mountain landscapes we observe today and how these landscapes may look in the future. It's not a book of published scientific papers, equations and technical academic jargon, nor does the author shy away from all of those but hits the middle ground and it is immensely readable and wonderfully illustrated.

The author, Colin Ballantyne, Emeritus Professor of Physical Geography at the University of St Andrews, with 40 years of glacial, peri- and postglacial research experience working in a variety of global mountain environments has a wealth of ideas and material from which to draw for each chapter.

The introduction provides basic concepts and terminology for readers without prior knowledge, seating geology and geomorphology in time and space. The complex geological evolution of Scotland, no mean feat to comprehend, is systematically approached in Chapter 2 and usefully linked to five distinct, fault-bounded Scottish terranes and the text refers to individual sites within these. Chapter 3 considers the influence of differing rock types on relief but also highlights exceptions to the norm, for example, within the Hebridean terrane where Lewisian gneiss, Torridonian sandstone and Cambrian quartzite all underlie both mountains and low ground. The text is thought-provoking throughout; here, the reader is introduced to the idea that rock resistance to weathering and erosion is secondary to the combined role of landscape inheritance and patterns of Cenozoic tectonic activity, slope retreat and deep weathering.

There follow two chapters that consider how successive episodes of glaciation have modified Scotland's mountain landscapes into their present forms. Specific glaciological terms, processes and landforms are dealt with in an easy style, aided by well-chosen photos, maps and diagrams. Catastrophic slope failure, in addition to lesser processes, are introduced in a further chapter with a stunning photograph of Beinn Alligin viewed across Lake Torridon where a large landslide scar can clearly be seen. I was pleased to see a chapter considering wind as a geomorphological agent as these processes, as the author states, are often underestimated. The text highlights among others deflation surfaces on the northern plateaux of An Teallach in Wester Ross, wind stripes in the Cairngorms and windblown sand deposits at the summit of The Storr (719m) on the Trotternish peninsula on Skye. Anthropogenic influences are mentioned in places, especially our effect on the processes that are changing landforms at present.

I especially enjoyed reading the Key Sites chapter, sections of which could be followed as a kind of travelogue, that highlight specific areas to observe a range of processes and landforms, sometimes from roadside vantage points. There is a good 'further reading' section, specific to each chapter, but the author doesn't overload here. Rather, references are designed to provide readers with appropriate, comprehensible source material. There is an index to locations and an index of Scottish mountains and hills, as well as a comprehensive general index.

I found Colin Ballantyne's book to be very accessible and, although I read it cover to cover, it is also one to easily dip into. I recommend this book to anyone with an interest in mountains, from the walker and budding geologist through to those who study the mountains of Scotland.

Sue Hughes

From the Club Archive

Rock haul goes on show

On show at Newtown library are rock specimins collected by Mid Wales Geology Club, collected through various field trips. Taking a look in the display cabinet is branch librarian Jane Rimmer.

A cutting from the County Times, from around the year 2000.

ON THE ROCKS: Lembit Opik MP joined local schoolchildren on a visit to a geology and mining history exhibition at the Minerva Arts Centre, Llanidloes.
Around 200 primary school children are attending the exhibition, which is run by Mid Wales Geology Club, to see demonstrations of how volcanoes work, try their hand at panning for gold, investigate fossil casts and to take part in a variety of other activities.
Lembit visited the exhibition with children from St Mary's School, Newtown.
He said: "Mid Wales Geology Club is doing a marvellous job in attracting people, young and old, to the earth sciences.
"When presented properly science is amazing and this combination of an exhibition, hands-on schools activities, and evening talks for the public, shows what can be done with a little creativity and a lot of enthusiasm. I've just watched the kids enjoying science; they were inspired and so was I."
Pictured, from left, are Lembit Opik MP, Suzanna Wieczorek and Colin Humphrey of the Mid Wales Geology Club.
Picture: Phil Blagg (PB567D)

From the County Times 2007.