KENT GEOLOGISTS' GROUP

The Kent Group of the Geologists' Association

KGG

Founded 1990

NEWSLETTER

No.20 - December 2011

Website: www.kgg.org.uk

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THE KENT GEOLOGISTS' GROUP IS A LOCAL GROUP OF

THE GEOLOGISTS' ASSOCIATION

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As a local group we receive details of lectures and field trips organised by the GA and other Local Groups and Affiliated Societies. Copies of the GA Magazine and the Circular with these details are on display on the Secretary's Table at all Indoor Meetings.

MEMBERSHIP OF THE KENT GEOLOGISTS' GROUP

Membership is open to all who have an interest in geology, regardless of qualifications and experience. The annual subscription (which runs from January to December) is £7.00. The subscription for each Additional Member living at the same address is £2.00. There will be only one mailing to each address.

Membership application forms may be obtained from the General Secretary or downloaded from the Kent Geologists' Group website:- www.kgg.org.uk via the "How Do I Join" page.

Until the new treasurer is formally appointed at the AGM, completed forms should be sent to the General Secretary at the address shown on the application form.

Cover Picture: Field trip to Herne Bay, 25th June 2011. Members of the group searching for fossils and marine specimens on the foreshore. As always, Adrian is on hand to identify the finds.

Editorial

The year 2011 was not a particularly good year for the group. We faced some problems that required us to make some difficult decisions. The country is officially in a financial crisis. Bluntly this means that we are not creating sufficient material wealth to pay for the money we are printing. The message from government in these situations is always that we must 'tighten our belts'. This means that the cost of essentials such as accommodation, fuel and taxes is increasing leaving less of our income for leisure activities.

Such times are always bad for charities and interest groups who have to compete for a dwindling supply of funds. It means that, while costs around us are increasing, we have to provide better value for money than our competitors - or fail. It is a time when membership levels traditionally fall.

It was therefore bad news when, towards the end of 2010, Maidstone Museum informed us that they had to double the cost of accommodation from January 2011. We were faced with the alternatives of doubling our membership, doubling our subscriptions or finding alternative accommodation for our meetings. It was hardly any choice - the membership numbers of most interest groups are falling and increasing our subscriptions would only accelerate the loss for the KGG - we had to find alternative accommodation. It was a particularly sad time as we had been at the museum for more than ten years and many of the staff, who had become our friends and had served us well over the years, were losing their jobs. We thank them for their support and wish them well for the future.

Finding a new location for our meetings was not a simple matter. Our members come from as far afield as Ashford and Sheppey in the east and Richmond and Kingston in the west. A central location, such as Maidstone, with a good late night rail service within comfortable walking distance, was essential.

Fortunately we were able to book the large hall at the United Reformed Church in Week Street on a regular basis. We held our first meeting in the new venue on Tuesday 19th July. The church members are very friendly and have made us feel most welcome. We thank them for their hospitality.

The hall is ideal for our meetings and we have access to a separate kitchen; so please come along and join us at one of our meetings. We still meet at 7.00 pm on the third Tuesday of each month (except in December). If you would like to see the hall first, the ladies of the church hold a coffee morning on Mondays, Tuesdays and Wednesdays between 10am and noon when you can get a cup of tea or coffee and a biscuit as cheaply as anywhere in Maidstone!

I mentioned earlier the need to offer better value for money and I am happy to report that our indoor meetings secretary is still finding speakers to give us very interesting talks each month. Two of the talks feature in this newsletter. In July Dr Chris Woolston talked about the first nine billion years, the period between the creation of the universe and the appearance of our solar system and explained how the heavier elements, of which everything on our planet is made, were formed. It was quite a deviation from our normal type of talk but fascinating none the less. In November Tony Mitchell used samples of London Clay to illustrate how, by simple observation and intelligent deduction, we can learn much about conditions in the period when the clay was laid down and the creatures that lived at that time - a very interesting and educational talk.

Tony is a great, regular contributor to both the KGG and the Medway Fossil and Mineral Society of which he is Chairman. Earlier this year he had a holiday in Wiltshire and took the opportunity to explore the local geology. I am grateful to him for providing the text and pictures for the article on sarsen stones.

We are fortunate in recently having several new, young members join the KGG who have immediately taken an active part in group activities, We welcome them and, with their input, confidently look forward to a bright future for the group. It is perhaps unfair to single out one member but I would like to offer special thanks to new member Alex Bennett. He was not even a member when the last newsletter was produced but, on hearing that contributions were needed for this newsletter, offered the article on 'The Lake District', Thank you Alex.

Field trips were less successful. A full complement was planned but attendance was very low and some trips had to be cancelled because of lack of support. We need to know why this is so; if you think you know what we are doing wrong please tell any of the committee. I attended a trip to the Royal Botanic Gardens, Kew on Saturday 28th May to study conifers and a field trip to Herne Bay on Saturday 25th June to study the foreshore and the strata in the cliffs between Herne Bay and Reculver. Both were excellent trips, very informative and well attended. However many of those attending were colleagues of Adrian Rundle from the Natural History Museum. A report on the Herne Bay visit has been put on the KGG website for the benefit off those who were unable to attend. I believe many members missed a good day out.

In trying to offer better value for money to it's members and keep the subscription low, the KGG had to contend with increased costs for photocopying the newsletter and communicating with members. This raised two issues of which members need to be aware.

Firstly, the cost of photocopying and posting the newsletter has risen and could now account for more than fifty percent of our annual subscriptions. To tackle this problem we plan to put a downloadable, coloured, PDF version of future newsletters onto the KGG website in a password protected members page. This will avoid the cost of copying and posting for the sixty percent or so of members who have given us an email address. Several members, and all recipients of complimentary copies, such as the Geologists Association and the Natural History Museum, have already informed us that they would prefer to receive electronic copies; we thank them for helping us to provide value for money and to avoid increasing subscriptions.

Secondly, in October, we sent notification of the OUGS Winter Weekend near Ashford on 18th - 20th November to all members for whom we had an email address. The mail server was unable to deliver eleven messages as the intended recipient had changed his/her email address but had not notified us of the change. Internet Service Providers daily offer special deals (e.g. low rates and free for the first three months). Changing your email address can gain you worthwhile savings, but it can also make it difficult for others to contact you! We maintain a database of the name, address, telephone number, email address and GA membership for all members. To comply with the Data Protection Act this information is used only for KGG purposes, is available to only a few of the committee members and is not passed to anyone outside of the group. The GA membership information is a necessary condition for us to be covered by the GA's insurance as a local group. The other information allows us to contact you when necessary. If you have any reason to believe that we may not be aware of recent changes to your data please contact the Secretary.

Puzzle Corner - Only Connect,The Wall

Stephen Taylor

In geology, as in all sciences, extending our knowledge depends on recognising the connections or links between pieces of information. This month's puzzle is a chance for you to exercise that skill.

There is a popular television programme called 'Only Connect'. One of the puzzles in the programme is 'The Wall'. Players are given sixteen named tiles arranged in a four by four array. The aim of the game is to re-arrange the tiles so that they form four rows in each of which the four tiles have something in common. One then has to determine what is the connection that links the four tiles in each row.

Some tiles may have features that could place them in more than one combination of four tiles, but only one combination will enable you to finish the complete wall of four rows each of four tiles. If you have a computer you can play the game on-line; you then have the advantage that the computer tells you as soon as each row is correct - you don't have to get them all correct before you see that the complete wall is correct - but then you have a time limit of 150 seconds in which the wall has to be completed!

As a little light entertainment you might like to re-arrange the following 'geological tiles' into four rows. You will know that you have the correct answer if you finish with four rows in each of which there is a clearly identifiable connection between the four tiles.

ART	**BARRINGER**	**BEAGLE**	**BREEDING**
COPERNICUS	**EXPRESSION**	**GARDEN**	**LION**
MOLE	**MUSIC**	**OASIS**	**PIGEON**
SABRETOOTH	**VALHALLA**	**WOLF**	**WORMS**

If you enjoyed completing this wall, or found the wall a little too difficult there are two more walls on page 30, one has a loose local connection, the other is a general wall. Enjoy the challenge!

Sarsen Stones

Tony Mitchell

For once our main holiday was not abroad, but we did go to a strange part of England. Wiltshire is a land of ley lines, dowsing, white horses, crop circles and megalithic monuments, and it is the latter that I found particularly intriguing, particularly the stone used in the majority of early bronze-age constructions.

We were based near Devizes, with a white horse cut into the chalk hillside a few miles away and the Wansdyke, tumuli and barrows on the skyline. Just over the chalk downs was Avebury with its stone circle, and the West Kennet Long Barrow, also made of stone. Silbury Hill, composed entirely of earth and chalk, is between them. Our main aim was to walk part of the Greater Ridgeway, a long-distance path made by linking Hunstanton, via the Pedder's Way, the Icknield Way, the Ridgeway and the Wessex Ridgeway to Lyme Regis. The path goes through Avebury so we set aside a day to explore the antiquities.

Figure 1. Avebury Ring

Figure 2. West Kennet Barrow and Silbury Hill

The village is built partly inside an enormous ring composed of a ditch and bank with sarsen stones stood on edge inside the bank. We joined a free tour and discovered that Mr Keiller, of marmalade fame, did the original, scientific, excavations and is responsible for re-erecting many of the fallen stones and placing concrete markers where stones are missing. My first question to our guide was, 'How could you lose stones that size?' The answer was that a company was set up to mine them as building material. Fortunately for us it went bust when it was discovered that sarsen was not waterproof and houses built with it suffered badly from the damp.

A question neither the guide nor Google could answer is why the stones were put up inside the ring where they are invisible from outside. Actually there are three stone rings, two smaller ones inside the main one and, outside the main ring, two avenues of stones, one of which has only two stones left. A group of three stones "one is missing but can be found by dowsing" set in a 'C' shape several yards apart were supposed to act as a sound reflector "for priests".

Now for the geology. Sarsen is a silcrete, a fine sandstone cemented by silica. It is found above the chalk over Salisbury Plane and also in Kent, so must be post Late Cretaceous. Unfortunately no fossils have been found in it so it is just recorded as Tertiary. Our guide suggested that small holes in the surface and grooves on one side could be roots and branches and that it was the decay of this vegetation that catalysed the deposition of silica. I was less convinced by the examples of roots that we were shown.

Figure 3. A broken sarsen stone

However, during our walks on the downs we came across scattered sarsens a few of which were quite recently broken and showed very convincing roots. This indicated to me that the sand was exposed to the air for long enough for vegetation to grow on it; this would also explain the absence of fossils. The recent break and lack of counterpart also suggests that the rest of the stone had been removed. Certainly I would have expected a sheet of forest, some "branch" grooves are several inches in diameter, to have covered the whole area so sarsens should also cover the whole area, which they did not.

Figure 4. Sarsen with root holes

On Fyfield Down and near the village of Lockeridge there are hundreds of sarsens covering the ground. Well, not actually covering, they are spread out several feet or yards apart, and in a single layer. Also every one I saw had thick edges, seldom less than eighteen inches and often three feet or more. No sign of lenses of sarsen. Even stranger was the fact that they were almost exclusively in the bottom of the valley and there were no small pieces. Where the valley floor levelled out the stones were orientated with the downhill edge raised, in exactly the same orientation as the blockhouses on Warden Beach. My explanation is that solifluction and soil creep has slowly moved the blocks downhill and man has removed the smaller pieces for building and road stone. Agriculture is not easy with these stones about so they have been taken away or, in some cases buried below plough depth.

Finally I found a couple of sarsens of a lighter colour than normal with included flints, though nothing like pudding stone. The odd thing was that the flints were all rotten and one had shattered while in the sand and before silification, and the shards retained close by. I have since discussed these shattered flints with a sarsen expert. His opinion was that these lighter coloured sarsen formed close to the surface, indicated by the tree roots, and the flints were later fractured during an ice-age.

Figure 5. Descending Sarsen Stones

Figure 6. Shattered flint in sarsen

Figure 7. Sarsen Valley

Putting Things Into Perspective

Planet Earth is 4,550 million years old. If we rescale this time period to 24 hours and start the clock running at midnight we make the following discoveries:-

- Cambrian period started at 2 hours, 47 minutes and 44 seconds before midnight. It lasted for about 22 minutes and 9 seconds. There was a lot of earth time before our knowledge starts!
- The Cretaceous period, when the chalk was deposited, started at 43 minutes, 2.5 seconds before midnight and lasted about 22 minutes and 47 seconds!
- Trilobites appeared in the early Cambrian and lasted to the end of the Permian period. They were therefore around for about 1 hour 35 minutes - a very creditable performance!
- Placental mammals diverged from the other mammals at about 50 minutes to midnight.
- *Homo sapiens* did not appear until 3.7 seconds to midnight. You could say we were almost late for the ball!

What Constitutes Geology?

Recent events in the KGG calendar have included a field trip to the Royal Botanic Gardens at Kew, the addition of seed identification to the activities table, a predominance of microfossil slide displays at most indoor meetings and talks on fruits, building stones and 'The first nine billion years' that explained latest thinking on the creation of the universe and the formation of earth as a planet orbiting the sun, our star.

One or two members have asked 'is this geology?' and 'are these appropriate subjects for the Kent Geologists' Group to be addressing?'

These are good questions and deserve a considered answer. I shall do my best to provide one.

Geology comes from the ancient Greek and means 'study of the earth'. That alone would seem to imply an enormous scope for study. If one were to add to geology, biology, which also comes from ancient Greek and means 'study of life', it would be difficult to imagine anything that was excluded from these combined subjects. But these two subjects have much in common and overlap enormously, so that it is sometimes difficult to see where one ends and the other begins - so should we try to define a fixed boundary? The choice of names for these two subjects was no accident; the early pioneers were learned people with enquiring minds who wanted to know about all around them. They particularly did not want to exclude anything that was relevant to their studies. There is an old country saying that 'When a ferret chases a rabbit it goes wherever the rabbit goes!' In other words if you wish to know, you must follow wherever the lead takes you. But perhaps that does not help much to answer the question of the title.

The earth consists of rocks, rocks are minerals, and minerals are chemical compounds that are combinations of chemical elements which in turn consist of atoms and sub-atomic particles. We quickly move from geology to chemistry and particle physics. Where should we stop and what should be excluded?

Many rocks contain fossils, the long dead remains of once living things. To study fossils fully requires comparison with similar plants or animals that live today, but that leads us into botany and zoology. Again, where should we stop and what should be excluded? I imagine there would be uproar if one were to suggest that fossils were not relevant to geology!

One possible solution may be to 'ring-fence' our interest; that is, to define its boundary. Everything outside the boundary could then be excluded as 'of no interest'.

Even if we could define such a boundary for the KGG's view of geology, it would not be a completely satisfactory solution as I shall explain with a simple example.

A television set is a system with a clearly defined boundary, namely the physical case that contains it. It is possible to build it, test it and even repair it without knowing anything other than its component parts and the electronic functions they perform. In that state it is described as a 'closed' system. A closed system only serves a useful function when it reacts with its environment. The environment of the television set is those things outside its defined boundary, namely the video transmission and electrical power inputs and the picture and sound outputs to the viewer. Without knowledge of what crosses the boundary, our ring-fenced television set it is of no interest to anyone other than an electronics engineer. Even things that can be identified by a boundary and explained quite simply plumb hidden depths when studied in detail, making them seem very complicated to people who do not have the deeper knowledge. This makes those people feel cut off unless the complicated subject can be simplified to their level of understanding. I can illustrate this by another simple example.

In concept a steam locomotive is very simple. Fuel, usually coal, is burned in a fire box to produce heat. The resulting heat converts water stored in a boiler to steam. The steam is passed to a cylinder in which a moving piston connects via connecting rods to the wheels which rotate to cause the locomotive to move. What could be simpler?

With this description you may think that you understand a steam locomotive but, in reality, such limited knowledge is of little use. In-depth knowledge in a number of areas is necessary to produce an efficient working locomotive as the following simple questions show.

- What coal has the highest calorific value to avoid the locomotive carrying excess weight?
- What is the best design of firebox to convert coal into heat efficiently?

- What is the most efficient arrangement of tubes in the boiler to convert the heat into steam instead of wasting it all up the funnel?
- What thickness of boiler plate is necessary to withstand the high pressure of steam in the boiler?
- Should the boiler be welded or riveted?
- How does one top up the water level in a boiler when it is operating at about 200 psi?
- What is the most efficient combination of cylinders one, two or three?
- How does one calculate the stresses in the moving connecting rods to ensure they will not break under the loads imposed by the pistons when driving the wheels under the worst load conditions?

The list of 'need-to-know' questions is endless!

Experts in each of the relevant fields, working closely together as a team, will provide the answers to all of these questions for a particular design requirement but may otherwise not have much in common! In summary, applying a boundary to a subject may work but only if the subject matter itself is sufficiently limited to be understood by all members. As an extreme example, one could set up a group to study the gold currency of Charles 1. If an item was not gold and not legal currency issued by the government of King Charles 1 it would be excluded. I suspect that the membership of such a group would be low and the members would have little to discuss. The more normal condition is people with widely differing but related interests, working together and sharing their knowledge.

In contrast to the simple examples given above, geology is an all-embracing subject, covering many disciplines of which lithology, microbiology, mineralogy, palaeontology, petrology, plate tectonics, sedimentology, stratigraphy, and volcanicity are but a few. Experts in one of these fields may not have much in common with experts in another so which of these subjects should the KGG embrace and to what level of detail? A glance at the technical articles in the GA Proceedings should be enough to convince most people that many of the articles are beyond the interest of members who are amateur geologists with only a slight knowledge of geology; but that should not stop them wanting to learn! There is also a practical consideration; even if we could agree upon suitable subjects, who can be found to write an article or give a talk to the group? The number of volunteers is very small and many regular speakers now expect to be paid for their efforts.

May I suggest that it is really you the members who have the answer to the question 'What Constitutes Geology?'. The KGG, through its committee, attempts to satisfy the interests of its members. But the committee members have their own interests and limitations. So, if you are not happy with what is offered, tell the committee what interests you and what subjects you would like to have as articles or talks. If possible, try to identify an expert who would be willing to give us a talk or write an article, then pass the information to our Indoor Meetings Secretary. I can assure you that she works hard to arrange talks for our entertainment and will welcome your input. If you cannot make a direct contribution then read the newsletter, come along to our meetings, listen to the talks, join in discussions and field trips, but above all ask questions - there is usually someone who will know, or can track down, the answer. You may also learn something new and find an interest you did not know you had.

KGG Activities Tables

The KGG activities table was the brainchild of Adrian Rundle, our chairman, who provides all of the material for the various activities at his own expense. The activities are taken to all of the Kempton Park Rock Gem 'n' Bead shows where they are a great attraction for both young and old. Adrian is also regularly asked to take the activity to other events; the GA 'Festival of Geology', the 'GeoFest' held by the National Museum of Wales in Cardiff and the OUGS 'Winter Weekend' at Ashford are but a few examples. We don't charge for taking part in the activities as we want to encourage any young people who show an interest in things geological. There is a donations box for those who want to make a donation. An indication of the success of the activity is that, each year, it raises approximately the same income for the group as members' subscriptions. Adrian is always adding new activities to keep interest high. This year he has added three more activities, two on 'Fruits and Seeds' and one on 'Crystal Structure' as an aid to mineral identification. The new data sheets are shown on the next six pages. The activities would not have been possible without the help of members over the years. Dennis Fullwood and Angela Nazzanni must be mentioned and thanked for their regular current support; but more help is always welcome. If you are interested, please contact Adrian.

Adrian Rundle

KENT GEOLOGISTS' GROUP

SEED AND FRUIT IDENTIFICATION

INTRODUCTION TO SET 3

It is not generally appreciated that most flowering plants can be identified using only their seeds and fruits. This has proved very useful for palaeobotanists who are able to work out past floras and, following on from this, past climates. It is only the hard layers that usually preserve well as fossils. This can be the whole fruit, part of a fruit or just the seed. This activity is designed to give some insight and practice on how this is done using a mixture of ten plant species of the Family Apiaceae (carrot family) which can be identified using the drawings given overleaf. The drawings show the features of each species but are not drawn to scale.

What is a fruit? Flowers typically consist of four rings of structures. On the outside are the sepals which are thin and leaf-like and are usually green. Inside this are the petals which are also thin and leaf-like but are often brightly coloured. The next ring consists of the narrow thread-like stamens producing the pollen which is usually transferred to other flowers to fertilize (pollinate) the ovules. The innermost part of a flower is the ovary (or ovaries) containing the ovules which are destined to become seeds when fertilized. The ovary can be looked upon as a container protecting the enclosed ovules and with a receptive area (stigma) at one end to capture pollen grains. A fruit is the fertilized and fully developed ovary containing the seed or seeds. Examples of obvious fruits are tomatoes, plums and oranges.

The Family Apiaceae is characterised by having mericarps as their fruits. A mericarp is derived from a multi-seeded ovary which splits into one-seeded units with a leathery or papery wall when ripe. In Apiaceae there are two mericarps per fruit and they are particularly useful for identifying species. A simplified key to the mericarps of the species used here is given below.

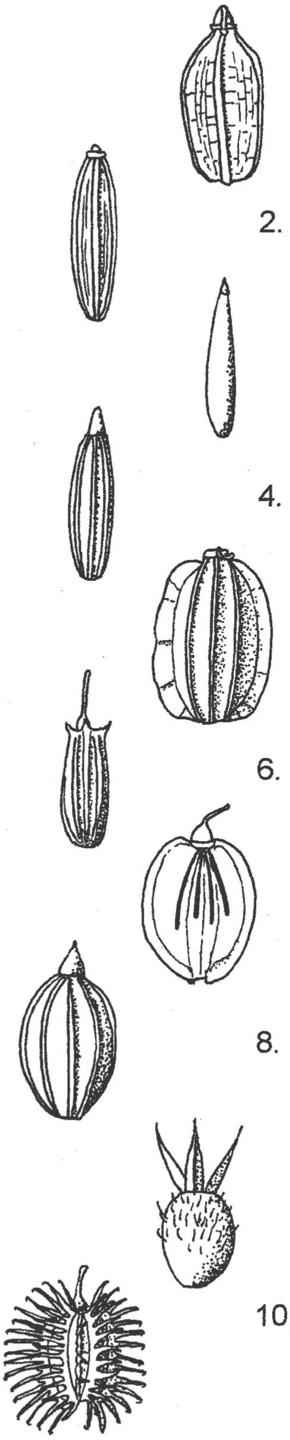
1.	Mericarps narrow and elongate	2
1.	Mericarps more rounded in outer view	5
2.	Outer surface smooth and shiny	COW PARSLEY
2.	Outer surface ridged	3
3.	Ridges not very clear; 3 thorns and long projection at one end	HEMLOCK WATER-DROPWORT
3.	Ridges distinct	4
4.	1 or 2 ridges on outer surface excluding edges	CARAWAY
4.	More than 2 ridges on outer surface excluding edges	FENNEL
5.	Outer surface of mericarp spiny	6
5.	Outer surface of mericarp not spiny	7
6.	With four ridges bearing many long hooked spines	WILD CARROT
6.	Surface irregularly spiny; with 2 or 3 large tapering bracts at apex	SEA HOLLY
7.	Mericarp thick, black and with 3 wavy ridges	ALEXANDERS
7.	Mericarp not thick or black	8
8.	Mericarp not compressed and lacking thin winged edge	ROCK SAMPHIRE
8.	Mericarp compressed with thin wings at edge	9
9.	Wing broad; with 4 dark oil canals radiating from one end	HOGWEED
9.	Wing narrow; with no radiating oil canals	GARDEN ANGELICA

Adrian Rundle (October, 2011)

SEED AND FRUIT IDENTIFICATION CHART

(SET 3 - APIACEAE)

Outer views of mericarps



1. ALEXANDERS *Smyrnium olusatrum*
2. CARAWAY *Carum carvi*
3. COW PARSLEY *Anthriscus sylvestris*
4. FENNEL *Foeniculum vulgare*
5. GARDEN ANGELICA *Angelica archangelica*
6. HEMLOCK WATER-DROPWORT *Oenanthe crocata*
7. HOGWEED *Heracleum sphondylium*
8. ROCK SAMPHIRE *Crithmum maritimum*
9. SEA HOLLY *Eryngium maritimum*
10. WILD CARROT *Daucus carota*

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SEED AND FRUIT IDENTIFICATION

INTRODUCTION TO SET 4

Did you know that most flowering plants can be identified using only their seeds and fruits? Palaeobotanists who study fossilised plants can use a seed or fruit to work out the kind of plant that was fossilized. Usually only the hard bits of a plant preserve well as fossils and leaves and flowers are less likely to survive. Most seeds and hard-shelled fruits (such as nuts) preserve well. This sorting activity gives a little practice identifying plants from their fruits and seeds.

Scientists look carefully at the structure of fruits and seeds to see how they are formed and what they look like. Flowers usually contain sepals, petals, stamens and a central ovary which contains ovules which later become seeds if they are fertilized by pollen. A fruit is the fertilized and fully developed ovary containing the seed or seeds. Examples of obvious fruits are tomatoes, plums and oranges.

A seed is the fully developed ovule from the ovary of a flower. They are often quite hard and durable. There are two examples here, White Pea and Pumpkin.

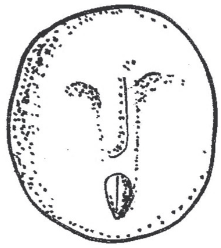
An achene is a type of fruit where the ovary of the flower develops into a leathery or papery container surounding a single seed which is not fused to the ovary wall. Sunflower is the example here. The seed inside a Sunflower achene can be separated easily from the ovary wall and is then called a kernel. It is edible and is eaten as a snack or used in cooking.

A caryopsis is a type of fruit only found in the grass family (Poaceae). It is distinguished by having the outer layer of the seed (called the testa) fused to the ovary wall when fully developed. There are two examples here, Wheat and Maize.

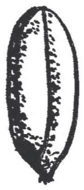
Bridget Steenkamp and Adrian Rundle
(October, 2011)

SEED AND FRUIT IDENTIFICATION CHART

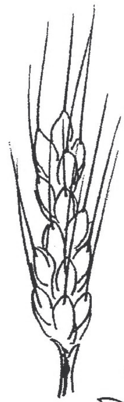
(SET 4 - LARGE SPECIMENS)

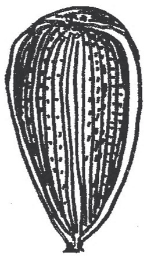


1. Family FABACEAE
WHITE PEA (*Lathyrus sativus*) - seed

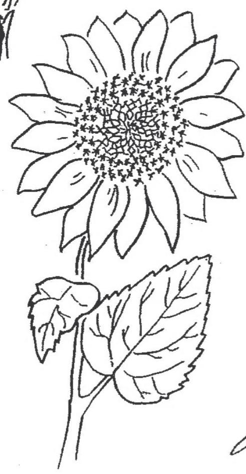


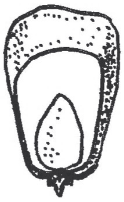
2. Family POACEAE
WHEAT (*Triticum aestivum*) - caryopsis



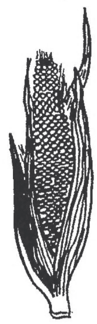


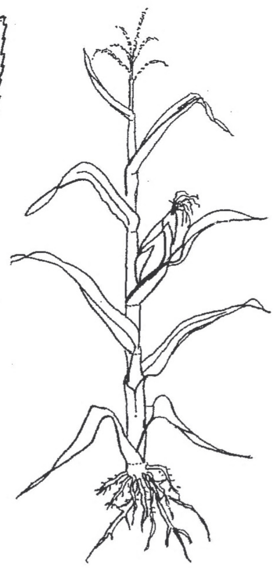
3. Family ASTERACEAE
SUNFLOWER (*Helianthus annuus*) - achene

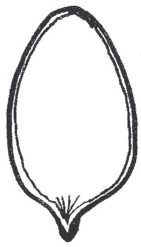




4. Family POACEAE
MAIZE (*Zea mays*) - caryopsis







5. Family CUCURBITACEAE
PUMPKIN (*Cucurbita pepo*) - seed

Bridget Steenkamp

KENT GEOLOGISTS' GROUP

KENT GEOLOGISTS' GROUP

INTRODUCTION TO MINERAL CRYSTALS

What is a mineral? A mineral is a naturally occurring chemical element or chemical compound. Examples of elements that occur naturally are Native Copper (Cu), sulphur (S), gold (Au) and carbon (Diamond, C). Chemical compounds can roughly be divided into two groups, those that have a fixed chemical composition and those that have a variable chemical composition. Examples of the first group include:

Sulphides - Iron Pyrites (FeS_2) and Galena (PbS),
Oxides - Quartz (SiO_2), Hematite (Fe_2O_3) and Pyrolusite (MnO_2),
Carbonates - Calcite ($CaCO_3$) and Magnesite ($MgCO_3$),
Sulphates - Gypsum ($CaSO_4.\ 2H_2O$) and Barite ($BaSO_4$),
Chlorides - Halite or Rock Salt (NaCl).

Minerals in the second group have a variable composition within tight limits. These include most silicate minerals where different metal ions can be interchangeable. Examples include:

Plagioclase Feldspar [nNa($AlSi_3O_8$) + nCa($Al_2Si_2O_8$)] where both components vary in a continuous series of compositions.
Garnets [$Fe_3Al_2(SiO_4)_3$] where iron (Fe) can be replaced by magnesium (Mg) or manganese (Mn).

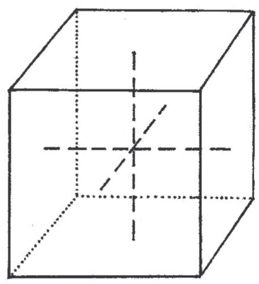
Most minerals can have a characteristic crystal form.

What is a crystal? A crystal is where a substance has a definite shape bounded by regular flat sides (faces). Crystals have a range of symmetries and forms depending on the internal arrangement of the atoms or molecules. This regularity can be compared to a box full of tennis balls after it has been shaken a bit. The balls arrange themselves in flat layers using the space in the most economical way. Different atoms and molecules arrange themselves in their own particular ways giving rise to various crystal types. These have been classified into six crystal systems based on the relative length and attitude of axes of symmetry. A cube, for instance, can be looked upon as having three axes of the same length at right angles (90°) to one another. Simplified diagrams of the six crystal systems are given overleaf.

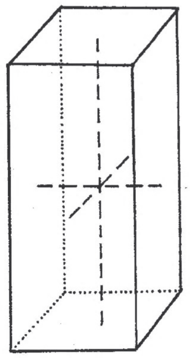
Features other than crystal form can be used towards identifying a mineral. Such things as hardness, density, cleavage, streak, composition, optical properties, lustre and colour are used in combination. Colour can be the least reliable of these because many minerals can have a range of colours due to impurities within the crystal. The more features used when studying a mineral the more reliable the identification. Scientists now use much more sophisticated methods, such as X-ray crystallography and electron microscope chemical analysis.

Adrian Rundle (October, 2011)

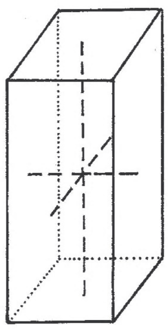
CRYSTAL SYSTEMS



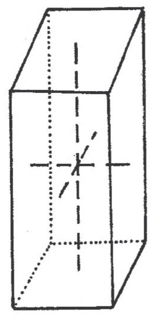
CUBIC
With 3 equal crystallographic axes
at right angles to each other
Examples: Pyrite and Halite.



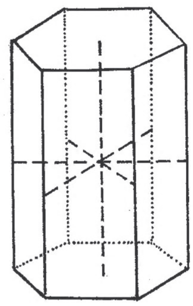
TETRAGONAL
With 3 crystallographic axes at right
angles, one being longer than the other 2
Examples: Cassiterite and Zircon.



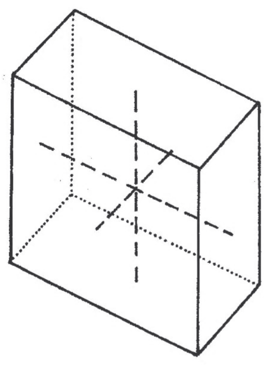
ORTHORHOMBIC
With 3 unequal crystallographic axes
at right angles to each other
Examples: Marcasite and Barite.



MONOCLINIC
With 3 unequal crystallographic axes,
2 at right angles and 1 oblique
Examples: Gypsum and Orthoclase Feldspar.



HEXAGONAL (including **TRIGONAL**)
With 3 equal crystallographic axes at 120º to
to each other and 1 at right angles to these.
Examples: Quartz and Calcite.



TRICLINIC
With 3 unequal crystallographic axes none
of which are at right angles to one another.
Examples: Albite and Kyanite.

AR

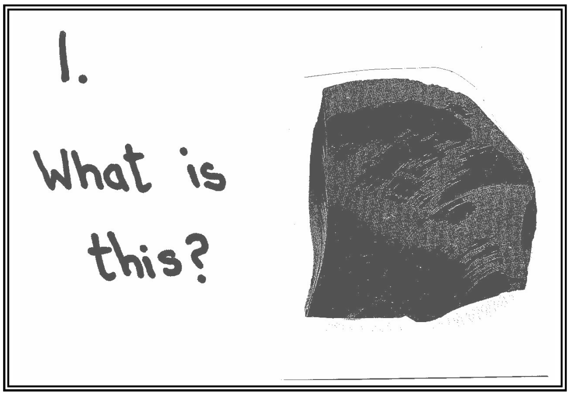
The Christmas Quiz - December 2011

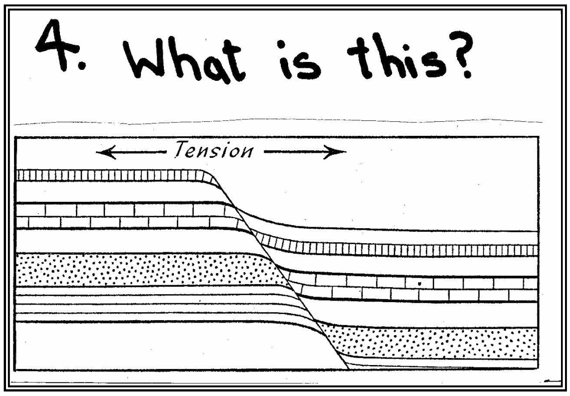
Adrian Rundle

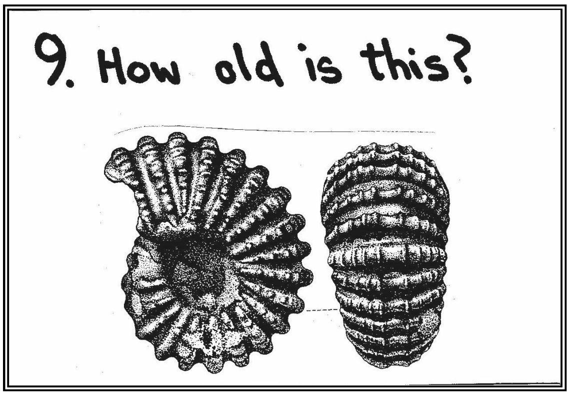
Members were divided into teams of two and had to first find twenty question cards disposed around the meeting room, then answer the question posed on each card. The questions are listed below, the picture cards are reproduced as pictures at the end of the list. There was one point for each question but extra points were awarded for additional relevant information. Good luck:-

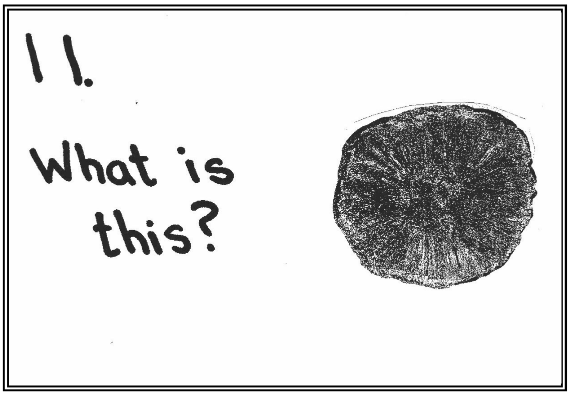
1. See picture card No.1 below.
2. What is the name of the sea channel separating the Isle of Sheppey from the mainland?
3. What is a "Osses 'ed'"?
4. See picture card No.4 below.
5. What is a coprolite?
6. What is an otolith?
7. What shape are the crystal faces on a dodecahedron?
8. What is Wren's Nest famous for?
9. See picture card No.9 below.
10. What is the chemical formula for Calcite?
11. See picture card No.11 below.
12. How many crystal faces are there on a dodecahedron?
13. See picture card No.13 below.
14. Where is the Corbula Bed in Kent?
15. See picture card No.15 below.
16. See picture card No.16 below.
17. Where is Copt Point?
18. How many squares on the Cyprus sand slide (Miscellaneous) have specimens that are unlikely to be preserved fossil? Square numbers please!
19. What mineral are the large crystals (phenocrysts) in Shap Granite?
20. See picture card No.20 below.

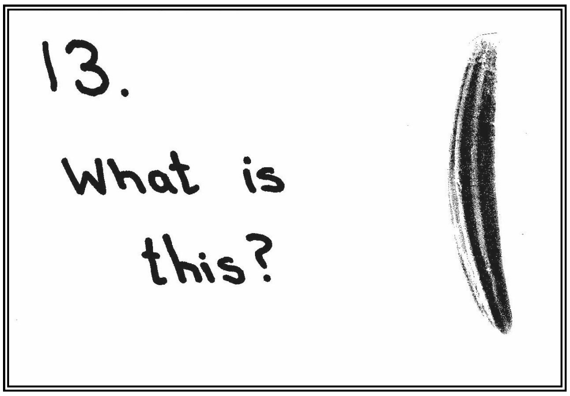
Where a question asks for 'age' the geological period is sufficient to gain the point. The approximate time in years (mya) may win an additional point.

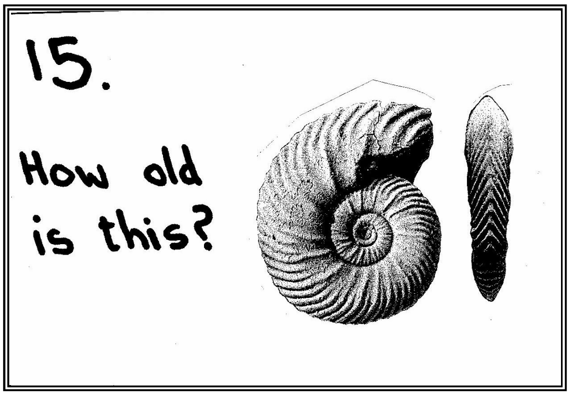


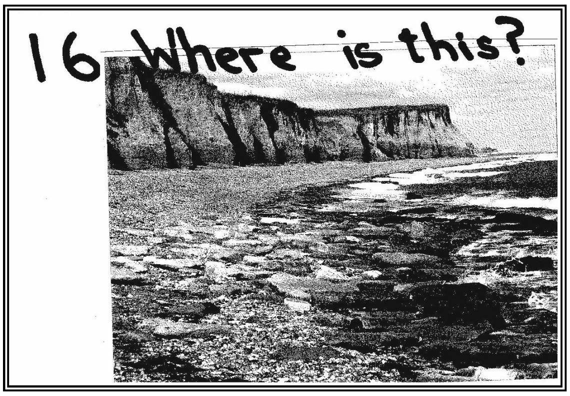


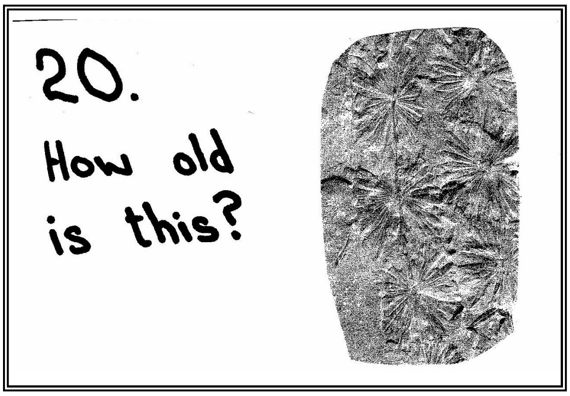












Test yourself to see how much you know, You may then calculate your score from the answers sheet on page 28 - Good luck.

Did You Know That…

Did you know that minerals and rocks are both naturally occurring chemicals. They differ primarily in form and composition. Minerals are mostly crystalline in form and of fixed chemical formula. In contrast, rocks are usually mixtures of chemicals, of variable form and commonly consist of solid solutions in which the chemical formula can vary continuously between two or three fixed end members. With experience, a hand-held mineral specimen can often be identified by a number of simple tests.

Crystal habit, not to be confused with crystal system, can be acicular, bladed, botryoidal, fibrous or massive. *Cleavage* planes relate to internal crystal structure and are a clue to the crystal system. *Fracture* is of slight diagnostic value and may be conchoidal (shell-like as in quartz) or hackly. Hardness varies from 1 (talc), through 3 (calcite) and 7 (quartz) to 10 (diamond- hardest). One can buy hardness test kits. *Specific Gravity* is the density relative to water (SG = 1) and is measured in gm/cc. *Colour* is the least valuable diagnostic as minerals are frequently coloured by impurities. *Streak* is the colour of the crushed powder and is measured using a streak plate or unglazed porcelain. Finally, *Lustre* is the surface appearance and may be described as vitreous, metallic, resinous, pearly or silky.

Once measured, these mineral properties can be checked against characteristics listed in any good mineral guide.

As a geological group our field trips and talks at indoor meetings necessarily address geology subjects. However our Chairman and Indoor Meetings Secretary occasionally organise events that, though related to geology, may be only slightly so. This adds variety and introduces us to a wider field of interests while retaining a geological connection. Two such talks given recently were 'The Building Stones of London' in 2010 and 'Some Ups and Downs of Sea-level' in July 2011 by Dr Brian Marker. In May 2011, we had our greatest deviation yet; Dr Chris Woolston gave us a talk on 'The First Nine Billion Years' that introduced us to a whole new world – literally!

For many centuries man has wondered about the earth - how and when was it created? The quest for an answer to this question goes back 350 years but it is only in the last 100 years that we have reached an answer that can be supported by experimental evidence.

In 1654 James Ussher, Church of Ireland Archbishop of Armagh and Primate of All Ireland, calculated that the earth had been created on 23rd October 4004 BC. Though occasionally ridiculed by some people today it was a considerable feat of scholarship at the time when many famous men, including Isaac Newton, were attempting to determine our origin and the date of creation. Ussher was a very learned man who reached his conclusion by studying numerous ancient documents written in Greek and Hebrew to produce a time line from related events.

It was nearly a hundred years before Ussher's date was seriously questioned and a more accurate estimate for the age of the earth was sought. Appropriately, it was geologists who led the way, pointing out that the rocks they studied could not have been deposited in such a short time scale. James Hunter (1727–1797) was considered to be 'The Father of Modern Geology'. Early in the eighteenth century, after studying the rocks in his native Scotland, he concluded that they had been deposited at the bottom of the sea and had subsequently been uplifted and exposed on dry land. Moreover, he advocated a revolutionary concept that was to form the basis for future developments in geology, namely 'uniformitarianism', the concept that rocks were deposited over very long periods of time by very slow processes that are still occurring today. For Hutton the quest for understanding was more important than fame and he published little of his findings. It was a fellow Scot who rectified the deficiency.

Sir Charles Lyell (1797–1875) was a wealthy land owner and lawyer but, at the age of twenty three, he abandoned law in favour geology, later becoming secretary of the Geological Society and Professor of Geology at Kings College, London. Today he is remembered as the principal geologist of his day and as the author of 'Principles of Geology'. Published between 1830 and 1833, this book popularised the principles of 'uniformitarianism' first proposed by Hutton. Lyell is remembered for his work on stratigraphy and the principle of 'superposition'. As sedimentary rocks are deposited over a period of time the lower rocks must be older than the rocks above provided that the rocks have not been over-turned by subsequent earth movements. Lyell and fellow geologists Murchison, Sedgwick and Lapworth were able to relate widely separated deposits by means of fossils that occurred only in limited beds. By this means they could place widely separated rock formations in chronological order but were unable to give absolute dates to the deposits.

Like the early geologists, Charles Darwin (1803-1882) also found it impossible to accept the estimate of the age of the earth calculated by Archbishop Ussher. His theory of evolution required a much longer time for changes to occur. Deducing that sedimentary rocks were deposited on the sea bed from the erosion of earlier rocks, and estimating erosion to occur at a rate of one inch per century, he calculated the earth's age as 300 million years.

William Thomson, Lord Kelvin, (1824-1907) assumed that the earth started as a molten globe that cooled to its present temperature by radiating heat into space, a concept first proposed by the ancient Greeks. He estimated the age of the earth to be between 20 million and 400 million years. Unknown to him his estimate was extremely low because he had been unable to allow for the heating affect of nuclear energy from radioactivity, a phenomenon that had not then been discovered.

It was now time for other physicists to take up the challenge using the results of new discoveries.

In 1896 Henri Becquerel, while investigating the phenomenon of fluorescence in minerals, discovered radioactivity. He believed the radiation to be similar to x-rays discovered by Roentgen only a year earlier

In 1897, while experimenting with a Crooke's tube, J. J. Thomson (1856-1940) discovered the first sub-atomic particle, the electron, and was awarded the 1906 Nobel Prize for Physics for the discovery.

In 1903 English Radiochemist Frederick Soddy (1877-1956), by an ingenious experiment, showed that radium generates helium as a product of radioactive decay. Helium was previously an unknown element on earth, having been discovered in the solar spectrum by Bunsen and Kirchoff as we shall explain later. The element was named helium after 'helios' the ancient Greek for sun.

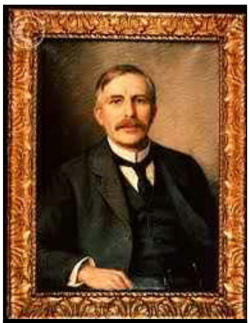


Figure 1. Ernest Rutherford

Ernest Rutherford (1871-1937) - see Figure 1 left, noticed that rocks containing uranium also contained helium and lead. Working with Soddy he produced the first radioactive decay chain, a fourteen stage process by which uranium decays to lead, generating helium in the process. Rutherford realised that he had discovered an atomic clock. By measuring the quantities of uranium, helium and lead in a rock specimen he calculated its age to be 500 million years. However, he also realised that helium, a gas, could escape from a porous rock; the age estimate was therefore likely to be low rather than high.

Soddy meanwhile had discovered isotopes. These are variants of an element that have the same atomic number, i.e. number of electrons and protons and so chemical properties, but different atomic mass, i.e. number of protons plus neutrons. Soddy identified three isotopes of uranium and four isotopes of lead and was awarded the Nobel Prize for Chemistry in 1921 for his discoveries.

Rutherford was quick to realise that two uranium isotopes ^{238}U and ^{235}U, having significantly different 'half lives', or rates of radioactive decay. and resulting in two different decay chains, gave him two different atomic clocks thus giving him the possibility of obtaining a much more accurate estimate of a rock's age. His revised estimate of the age of the earth using this method was 3400 million years and was the first age of the earth derived using radio isotopes.

Modern dating techniques have an added advantage of much improved instrumentation and the ability to measure the relative proportions of lead isotopes ^{206}Pb, ^{207}Pb and ^{208}Pb. It is the lead method that was used to give us the latest estimated age of the earth, namely 4.550+/-0.070 billion years.

If an internet search is made for the age of the universe one will learn that it was created 13.72+/- 0.11 billion years ago. Thus one concludes that the universe was 9.17 billion years old before our solar system was created.

This raises two important questions:-

- "How do we know this?" and
- "What happened in the intervening 9 billion years before our solar system was formed?"

These were the questions that Dr Chris Woolston addressed in his talk.

It was a series of amazing discoveries by some of the greatest scientists to have lived that gave us the answers. Curiously, with an estimated one hundred billions stars in our galaxy 'The Milky Way', and two hundred billion galaxies in the known universe, it is the sub-atomic, magical, fairy world of particle physics that has given us the final clues to the answers. But, to pick up the threads of this story we must first go back three hundred and fifty years.

Figure 2. Isaac Newton

In October 1661 plague hit Cambridge University and forced Isaac Newton (1642 – 1727) to retreat to his family home at Woolsthorpe in Lincolnshire. There he conducted his famous experiment with light that led to his paper on optics. When Newton directed a ray of sunlight obliquely onto a triangular prism in a darkened room he observed that the white light was deflected and split into a fan of colours ranging from red to blue/violet. Scientifically, this phenomenon is called 'a spectrum' - see Figure 3, and it provides the colours that we see in a rainbow. Newton placed a second, inverted prism in the path of the spectrum and the colours were converted back to a beam of white light. When Newton screened all but one colour and passed that through a prism no further change occurred. He concluded that white light was composed of the seven colours that we traditionally associate with a rainbow. We now know however that the spectrum is continuous, each colour blending seamlessly into the next. In Newton's time there were different opinions about the nature of light; some thought that it consisted of a stream of particles, others

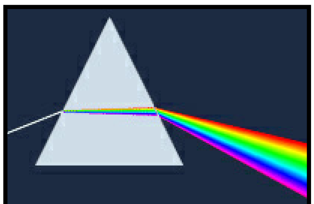


Figure 3. Spectrum

that it was a wave motion. Throughout his life, Newton was convinced that light was a stream of particles.

Christiaan Huygens (1629–1695) was a Dutch mathematician who explained the rings of Saturn, discovered its moon, Titan, and invented the pendulum clock. However, he is best remembered today for the Huygens-Fresnel theory, which states that light is a wave motion travelling at the speed of light in an unknown medium that came to be known as 'the ether'. From wave theory Huygens was able to show that the deflection of a light path through a prism was related to the frequency of oscillation of the wave or its inverse, wave length. Thus a colour in Newton's spectrum could be related to the wave's frequency of oscillation and therefore its energy.

At the start of the nineteenth century Joseph Fraunhofer (1787–1826), a German optician and lens maker, made a study of the solar spectrum and observed that the spectrum was punctuated by a series of black lines - see figure 4 right. He eventually recorded 570 lines that he mapped as a function of frequency. These are known today as 'Fraunhofer lines' in his honour. With the benefit of improved technology and more accurate instrumentation we have now recorded several thousand lines, many outside the limits of the visible spectrum.

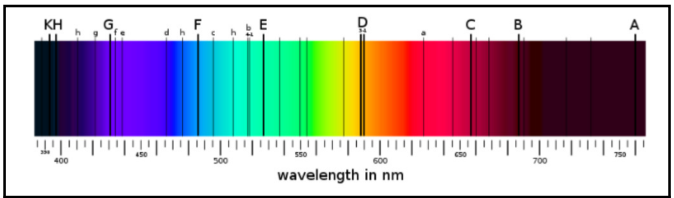


Figure 4. Solar spectrum showing Fraunhofer lines

Robert Bunsen (1811-1899) was a German chemist and geologist. He invented the Bunsen burner found in virtually every science laboratory and discovered the elements caesium and rubidium. However, it is his work on spectroscopy that is most relevant to our story. He observed that elements, when heated, emitted a range of colours that appear as intensified 'emission lines' in the solar spectrum and that these lines corresponded with the black 'absorption lines' mapped by Fraunhofer. In fact a cold gas between the observer and the light source absorbs energy at certain frequencies, a function of the element, to produce the black lines.

We now had the elements of the science of spectroscopy, a tool that would enable us to gather light from a distant source and analyse its spectrum to identify chemical elements. As we have described above, Bunsen and Kirchoff would use this technique to discover a new element in the sun that was then unknown on earth. They called it helium from the ancient Greek 'helios' meaning sun.

Modern spectroscopy is a powerful tool that has enabled us to learn virtually everything that we know about stars and galaxies millions of light years away.

The next scientist to make a contribution to our story was the Austrian physicist Christian Doppler (1803-1853).

If a source emitting radiation waves approaches an observer each successive wave peak is transmitted nearer to the observer who therefore receives peaks closer together, that is, the frequency appears higher than the actual frequency of the source. Conversely, as the source moves away from the observer the frequency appears to be lower. The change in frequency as the source passes the observer increases with the speed of the source. One can experience this effect as a vehicle with a siren passes. The siren's note drops in tone as the vehicle passes. This is known as the 'Doppler Effect' after Doppler who first presented his analysis of the relationship between the radiation frequency and the velocity of the source in 1842.

Credit for the next step in our quest to determine the origin of the universe undoubtedly belongs to American astronomer, Edwin Hubble (1899-1953). In 1924 Hubble was the first astronomer to discover galaxies beyond our own galaxy, the Milky Way. Moreover, he discovered that the galaxies numbered millions or even billions and were more or less evenly distributed throughout the visible sky. The distances from the earth to stars can be calculated by a process called parallax in which a viewed object appears to move relative to its background as the observer changes his position. For maximum accuracy the observer has to choose as large a baseline as possible. In astronomy, this is achieved by making observations at positions diametrically opposite in the earth's orbit round the sun giving a baseline of approximately 300 million kilometres.


Figure 5. Edwin Hubble

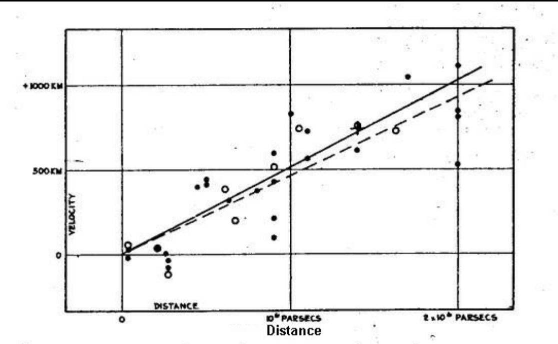


Figure 6. Hubble's Expanding Universe

It was while measuring distances to various celestial bodies that Hubble made the second discovery for which he is now famous. Spectroscopic measurements showed that the Fraunhofer lines in the spectra of all objects observed exhibited a shift towards the red end of the visible spectrum, a feature now known simply as 'red shift', indicating that all of the stars were moving away from the earth. Plotting receding velocity against distance for as many objects as possible resulted in a straight line - see Figure 6 left. The further an object was from the earth, the greater was its velocity away from the earth. This proved that the universe was expanding. Armed with this information and projecting the movement backwards, Hubble predicted that the universe originated as a point source in which all of the matter in the universe was compressed into a microscopic volume of unbelievable density and high temperature about 14 billion years ago.

This divided astronomers into two opposing camps, those who supported Hubble's theory and those who supported a 'steady-state' theory, namely that the universe was never created and will never end – it simply 'is'. One of the major proponents of the 'steady-state' theory was English astronomer Sir Fred Hoyle (1915-2001). In 1950, Hoyle derisively called Hubble's theory a 'Big Bang' in an attempt to discredit it. Until evidence was found to support one theory or the other they would remain just theories and the arguments would rage on; but the name 'Big Bang' has stuck to this day.

In 1948, theoretical physicist George Gamow (1904-1968) predicted that, if Hoyle's theory was correct, the creation would have been accompanied by high levels of radiation and that, even after cooling for billions of years, low levels of cosmic background radiation would still be detectable. As the universe expanded it cooled. The radiation, initially gamma radiation, would decrease in frequency over time but, even today, should be detectable as background radiation in the microwave frequencies. In 1964, three astrophysicists at Princeton University, Dicke, Peebles and Wilkinson, tried to set up some equipment that would enable them to search for the cosmic background radiation.

At the same time two astronomers Arno Penzias and Robert Wilson were calibrating a horn antenna for radio telescope work. They measured a level of interference in their equipment that they could not eliminate and found that it was the same value regardless of the direction they pointed their antenna. Quite by accident they had discovered the cosmic background radiation that Gamov had predicted if the universe had originated in a big bang and for which the astrophysicists at Princeton were planning to search. Moreover, the measured radiation level was very close to that predicted theoretically by Gamow. Ironically, in 1978, Penzias and Wilson were awarded the Nobel Prize for Physics for their discovery; Gamow received nothing.

But what were the conditions immediately after the big bang and could the predictions be supported by experimental evidence?

Early in the twentieth century physicists had confirmed that matter consisted of elements, that the smallest amount of an element that behaved as an element was an atom, and that atoms consisted of negatively charged electrons, at different energy levels, surrounding a nucleus comprised of positively charged protons and neutrons having no charge. They had made these discoveries by bombarding matter with high energy particles and observing the products of the collisions. Due to limitations in the energy of early particle accelerators it was originally thought that these were the 'elementary' particles of which all matter was made.

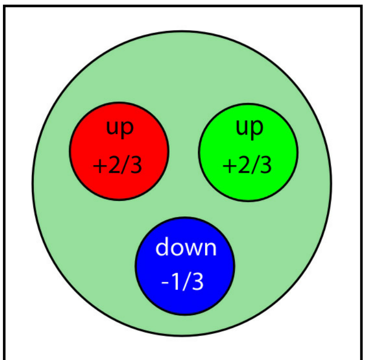


Figure 7 Proton with quarks

Since the 1930s particle physicists had been making significant progress in defining the nature of matter and it was this work that would provide the required experimental evidence for the plausibility of the big bang theory.

By 1970, physicists had defined a 'Standard Model of Particle Physics' that listed the matter particles (fermions) and force particles (bosons) that are the fundamental building blocks of all matter. The particles were both predicted by theory and substantiated by experiment in particle accelerators. The electron remains an elementary particle but the proton and neutron have now been superseded by new elementary particles quarks and neutrinos. Figure 7, right, shows that a proton consists of two 'up' quarks of charge + 2/3 and one ‘down’ quark of charge -1/3 giving a nett charge of +1. A neutron comprises two ‘down’ quarks and one ‘up’ quark giving it a nett charge of zero. Quarks have another property that physicists call colour; they are said to be red, green or blue. These are not the visual colours that we all recognise, merely names given to a particular property of the quark. The principle that ‘unlike items attract and like items repel’ still applies and causes quarks to form stable groups of three

We now know that electrons and protons are stable but that neutrons can only exist long-term if linked with protons in an atom. A neutron in isolation has a half life of ten minutes causing it to decay into a proton, an electron and an anti neutrino as one of the ‘down’ quarks changes into an ‘up’ quark, an electron and an anti-neutrino. It is this property that is the cause of beta particle emission during the decay of radioactive elements.

Readers will be familiar with the fact that as the air in a bicycle pump is compressed it gets hot. Similarly, when the universe was first formed it was unbelievably compressed and hot. If the temperature of a solid is raised sufficiently it changes to a liquid and then a gas. At higher temperatures still, electrons become so mobile that atoms break down, electrons separate from the nucleus and the gas ionises. Eventually, even protons and neutrons will have so much energy that they will separate into their component quarks. This was the state of the universe shortly after creation, with quarks and electrons moving around and colliding like a swarm of angry bees!

After the ‘big bang’ expansion of the universe caused its temperature to decrease. As the universe cooled, quarks grouped into threes to form protons and neutrons; protons and electrons combined to form hydrogen atoms; protons and neutrons combined with electrons to form helium. A few protons and neutrons managed to group to form other light elements such as lithium. Eventually, the universe cooled to a temperature where no further generation of elements was possible and that is the way that things have remained ever since.

From theoretical models, particle physicists were able to calculate the proportions of these light elements as hydrogen 75%, helium 25% with very small amounts of other light elements. Recent analysis of inter-stellar matter has confirmed these proportions giving further support to the theory.

So where did all of the other elements essential to our life such as carbon, oxygen nitrogen etc. come from? The answer is ‘ from the stars’.

Over millions of years the hydrogen and helium accumulated under the force of gravity to form dust clouds, then stars, then galaxies. Stars shine because the mass of accumulated material bearing down on the star’s centre, due to gravity, raises the temperature to millions of degrees Kelvin creating the conditions under which elementary particles can combine to form atoms, releasing vast amounts of energy in the process. Initially the products will be hydrogen and helium as in the origin of the universe and in our sun. As a star gathers more material its mass increases creating the conditions under which heavier elements can form. The larger a star gets, the heavier are the elements that can be created. Eventually a star grows so large that it collapses under it own gravitational force and explodes, spreading material into space. Such stars are called super novae. Eventually, some of the debris from long dead super novae coagulated to form our solar system.

So every living organism and rock on the earth was formed from debris from long dead stars. One could therefore say that we are all aliens from outer space!

Some milestones from this momentous journey are given below (the times are ‘from the big bang’):-

- Nothing can be known about what happened up to 5.4×10^{-43} seconds after the big bang (that is the Planck quantum unit of time, the smallest unit of time that can exist.) It is equal to one divided by (1 followed by 43 zeros)! The temperature was a staggering 10^{32} degrees Kelvin (that’s 1 followed by 32 zeros).
- At 10^{-33} seconds the temperature was about 10^{28} Kelvin. Theoretical physicists estimate that the universe experienced a rapid expansion known as inflation.
- At about a billionth of a second the temperature had fallen to 10^{12} degrees Kelvin (a million million degrees!): Quarks started to bind together in threes to form free protons and neutrons.
- After 10 seconds: The temperature had fallen to a billion degrees Kelvin. At this temperature, protons and neutrons can bind together to form the nuclei of the lightest elements, hydrogen, deuterium, helium and lithium. Observing very small particles requires very high frequencies and

vast amounts of power. That is why the latest particle accelerator sizes are measured in kilometres and their cost in billions of dollars. Due to the limitations of present test facilities, this period after the big bang is the earliest time that the theoretical predictions can be verified by experiment.

- After 370,000 years, the temperature had fallen to 3000 degrees Kelvin: At this lowered temperature, the reduced mobility of the electrons allows them to combine with free ions to form atoms of the lighter elements, hydrogen and helium, releasing excess energy as radiation, as predicted by Gamow, and the universe became transparent. The remnant of this radiation is detectable today as Cosmic Background Radiation. The COBE (COsmic Background Explorer) satellite is now providing valuable information to verify the theoretical predictions.
- After 100 million years the temperature of the universe had fallen to 30 degrees Kelvin*:* As a result of variation in the density of matter that can be seen today in the most distant galaxies, matter started to coagulate to form the first stars which then grouped to form the first galaxies.
- After 9 billion years the temperature of the universe had fallen to 6 degrees Kelvin: Our sun, a second generation star, started to form and gather up debris thrown into space by exploding super novae.

All of this knowledge, theories supported by experiment, has been gathered in just one hundred years. So are we now close to knowing everything about our planet and the universe of which it is a part? The answer is an emphatic no!

We can only support theory with experimental evidence back to about 10 seconds after the big bang. This is because we have not yet been able to generate enough energy to separate quarks to measure their individual characteristics. There are also other particles that we have not yet been able to isolate for investigation. While we can predict how sub-atomic particles behave under certain conditions we have no idea why they behave as they do.

We don’t know where the massive injection of energy at the big bang came from. We don’t know what if anything lies outside our universe. There are even theories that our universe is only one of many. Latest cosmological observations confirm that only five percent of matter in the universe is made of the matter we know. Ninety five percent is made up of a combination of ‘dark matter’ and ‘dark energy’. We don’t know what these are; we can only measure the gravitational effect they have on the stars and galaxies in our observable universe.

There is plenty to keep the very best brains of our planet going for the foreseeable future – but at least we now know where our planet came from, how and when! The rest of our story is pure terrestrial geology.

One of the fascinations of geology is that geologists, by studying rocks, and the fossils contained in them, have been able to tell the story of the last billion years of the earth’s history. But the rocks lie beneath our feet, are tangible and can be examined. Moreover, their story covers only the final 7.3% of the history of the universe.

We live on a planet that orbits a small star that is only one of billions of stars in our galaxy, the milky way. Our galaxy is one of billions of galaxies in the observable universe. That scientists have been able to explain the evolution of that universe over 13.7 billion years from just a few seconds after its creation, and support the explanation with experimental evidence, must surely be one of the greatest achievements of mankind.

References

1. Chown, Marcus: *The Magic Furnace*. Vintage Books, London, 2000.
2. Coles, Peter: *Cosmology*, *A very Short Introduction.* Oxford University Press, 2001.
3. Close. Frank: *Particle Physics, A very Short Introduction.* Oxford University Press, 2004.
4. Magill, Joseph and Galy, Jean: *Radioactivity, Radionuclides, Radiation*. Springer Verlag, 2005.
5. J. P. McEvoy: *A Brief History of the Universe*. Constable & Robinson Ltd, 2010.

Recreating An Ancient Environment - The Eocene of Sheppey

Tony Mitchell

Between the 18th and 20th of November this year, the Open University Geological Society (OUGS) held a Winter Weekend at Hothfield near Ashford. One of the speakers was Open University graduate, and KGG member, Tony Mitchell. His subject was 'Recreating an ancient environment - the Eocene of Sheppey'. KGG members were treated to a dry run of this interesting and educational talk at their indoor meeting on 15th November.

Figure 1 The London Clay at Sheppey

Let us start by looking at some fossils that you may recognise.

In the late eighteenth/early nineteenth century most people had never seen anything like these. The first, in figure 2 was thought to be a petrified, coiled snake - and I suppose that that was not unreasonable. The second, figure 3, was thought to be a fairy bun - that's less plausible! The problem was that these things were rare and so not easily explained by the observer's experience.

Figure 2 Coiled snake?

Figure 3 Fairy bun?

The man who applied scientific logic to the subject and so stopped this speculation was James Hutton, often called 'The Father of Geology' (see Figure 4).

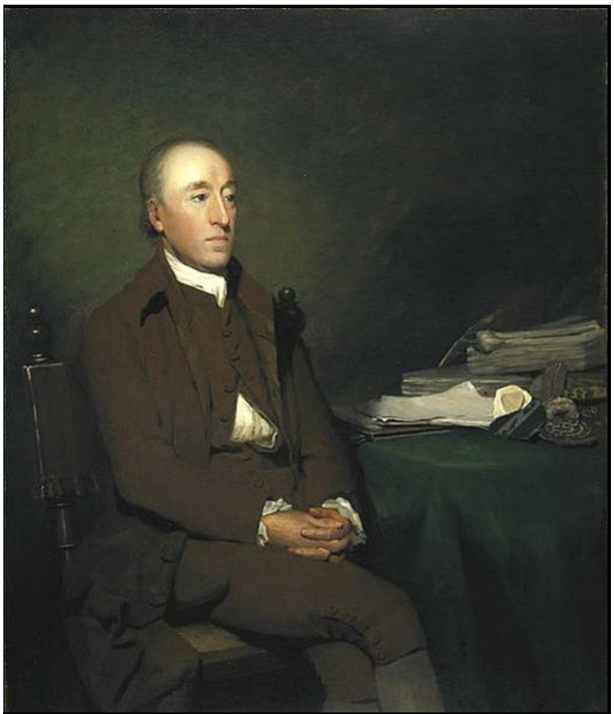


Figure 4 James Hutton (1726 - 1797)

He proposed a theory of 'Uniformitarianism' explaining that the rocks we observe were laid down millions of years ago by very slow processes that are still taking place today. In other words, 'The present is the clue to the past' - study the present and you will understand the past.

Often, when told about geology and the distant past, we ask 'How do they know that?'

The answer is that specialists have applied sound scientific principles. These require making detailed observations, pulling together pieces of information that might to the uninitiated seem to be unrelated, making deductions and formulating a hypothesis. It is then necessary to devise tests calculated to prove or disprove the ideas in order to develop the hypothesis into an accepted theory.

Tony has spent years collecting fossils from the London Clay at Sheppey and is one of the four authors of the excellent book 'London Clay Fossils of Kent and Essex'.

What could be more natural therefore than for him to choose the deposits at Sheppey as a way of illustrating these principles?

Tony kindly made his presentation material available for this newsletter article but his talk lasted about an hour and included over seventy illustrations. It is only possible to give an overview of the points that Tony made but we hope that it is sufficient to illustrate his message.

Figure 5 Warden Point

Samples of London Clay were passed around the audience who were asked to describe what they saw. Was the material coarse grained or fine? What was its colour? Was it deposited under water or on land? What could be deduced from what we saw?

The general concensus was that it was greenish-grey in colour, was very fine grained almost like dried mud, must therefore have been carried a long way before being deposited, probably in deep water. Why? Because it requires more energy to move a heavy object than a light one. In flowing water boulders move hardly at all, but very fine material is held in suspension and is carried the greatest distance. Streams and rivers flow into lakes and seas. The finer the deposit, the deeper is the water where it is deposited.

Examination of the exposures at Warden Point on the isle of Sheppey shows that the fine deposit changes gradually to more sandy grains higher up the face. This suggests that the water depth must have reduced over time because the higher deposits must be younger than the lower deposits. There are also signs that creatures had lived in the clay as the following pictures show. But was the clay deposited in a fresh water lake or a marine environment?

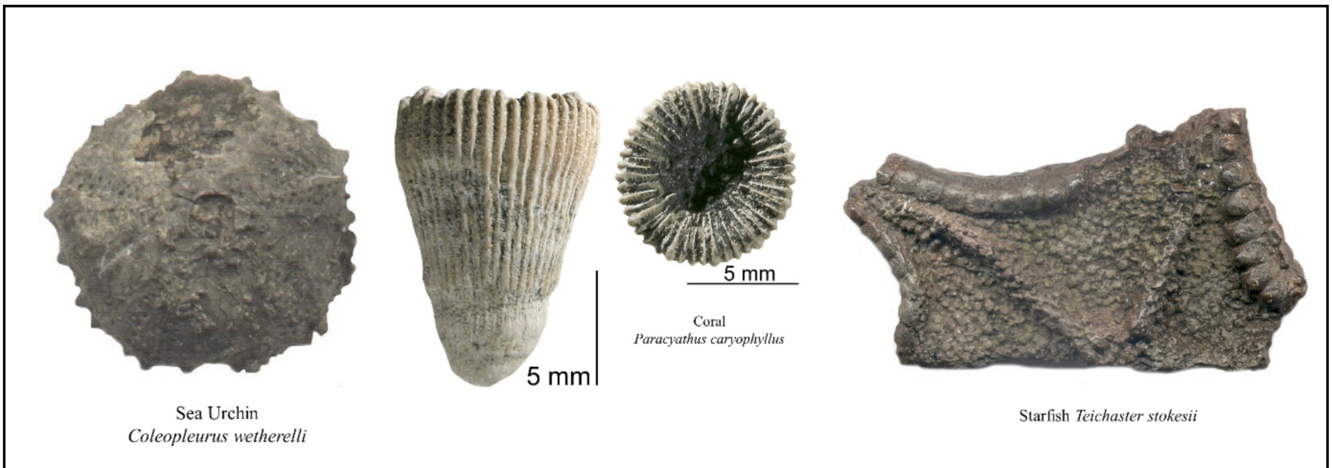
Figure 6 Close up view of Sheppey Clay

The first clue is the greenish colour of the clay. Examination under a microscope shows that the green colouration is caused by the presence of glauconite, which is a basic potassium, magnesium iron silicate. Glauconite is a phyllosilicate formed by the action of sea water on biotite mica, feldspar or pyroxene. It forms in shallow seas around continental margins and is a common constituent of all 'greensands'. The Sheppey clay was thus deposited in a marine environment.

Chemically, Glauconite is $K(Mg, Fe^{2+}) Fe^{3+}[(OH)_2 | Si_4O_{10}]$ and it is the potassium in this formula that gives us our next vital clue. Potassium has a radioactive isotope K^{40} that decays by beta emission to argon, A^{40}, with a half life of 1.248 billion years. Argon is an inert gas. It does not act chemically and the only free argon is in the atmosphere. When a mineral is formed it is therefore argon-free. When radio-active potassium decays to argon in a mineral the argon product of decay is trapped. By measuring the relative percentages of potassium-40 and argon-40 in a mineral it is possible to calculate the number of years since the mineral was formed. Analysis shows that the deposits at Sheppey were laid down over a period of three million years about fifty million years ago, placing the Sheppey deposits in the Ypresian stage of the Lower Eocene.

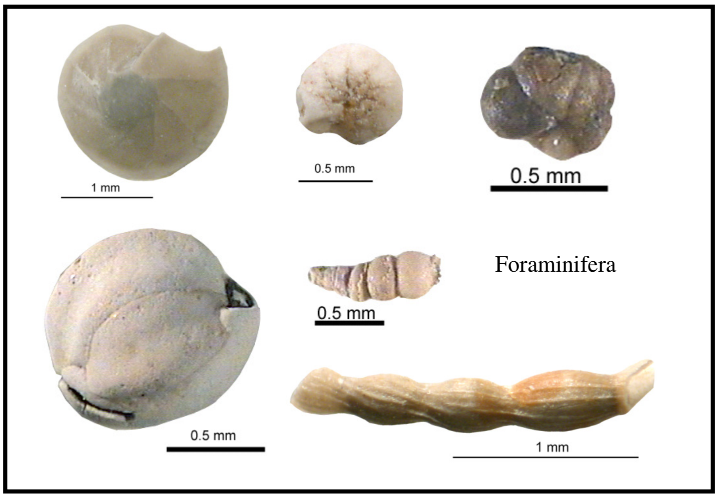
So far so good! But as Tony eloquently put it 'Two swallows do not a summer make'. Now if we could add a cuckoo and a swarm of bees we could be sure that summer had arrived!'.

Shown below is a sample of fossils collected at Sheppey:-

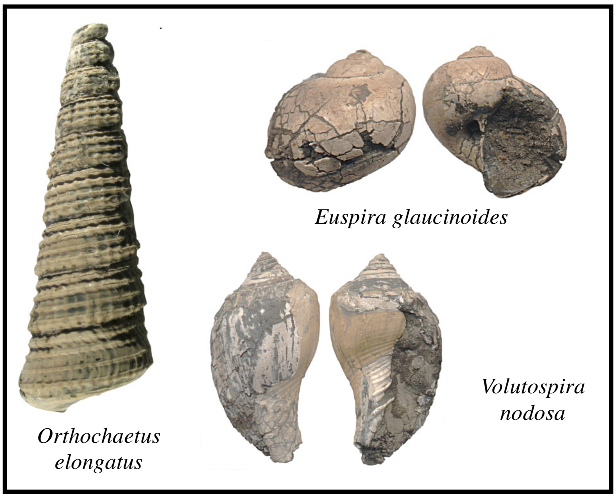


The sea Urchin *Coleopleurus wetherelli,* the coral *Paracythus caryophyl[us,* and the starfish *Teichast-er stokesii* have all been found at Sheppey.

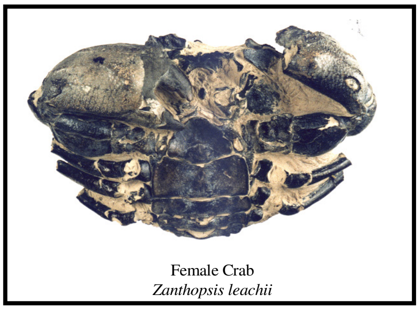
So have foraminifera,

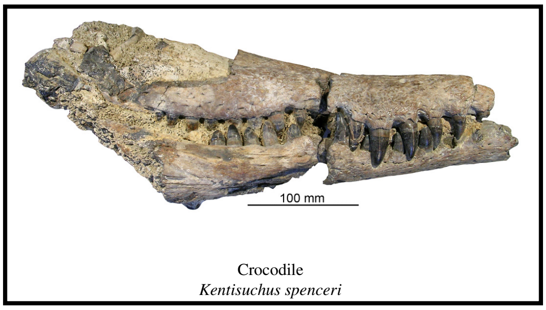


Foraminifera

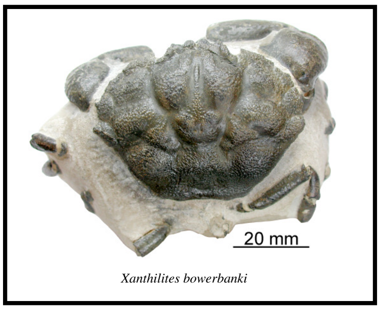

Orthochaetus elongatus
Euspira glaucinoides
Volutospira nodosa

crabs and crocodiles,


Female Crab
Zanthopsis leachii



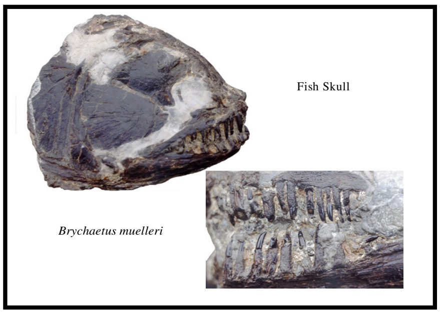
Crocodile
Kentisuchus spenceri

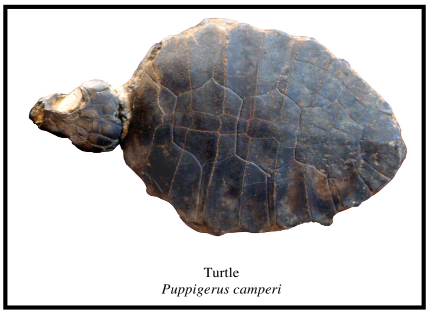


Xanthilites bowerbanki

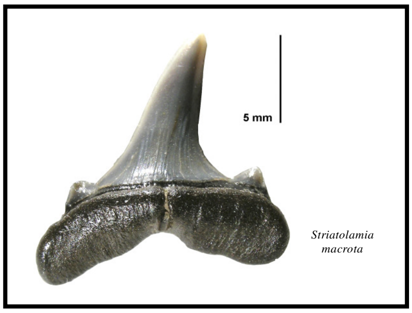
fish, and turtles,


Fish *Eocoelopoma curvatum*

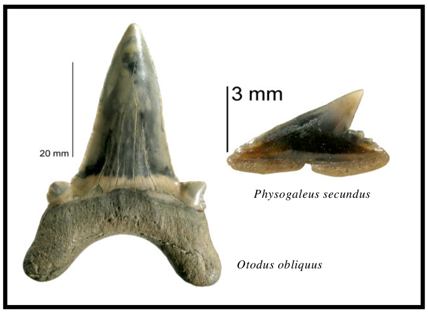

Fish Skull
Brychaetus muelleri


Turtle
Puppigerus camperi

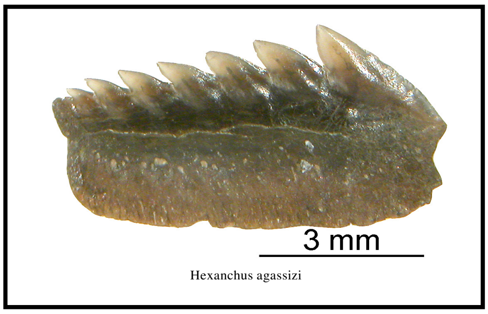
and sharks



Striatolamia macrota



Physogaleus secundus
Otodus obliquus

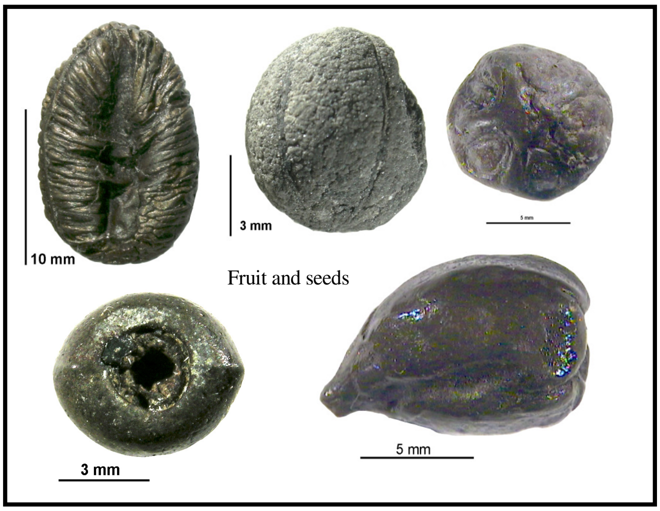


Hexanchus agassizi

The fossil record clearly shows that fauna in our marine environment was abundant, with the full food chain being represented from microfossils up to large predators. But, though fish and sharks abound in the seas around our present shores, what are turtles and crocodiles doing in a fossil record of Sheppey? Surely these are creatures that live in tropical or sub-tropical seas.

We have a well oxygenated marine environment with extensive bottom fauna and many predators. What are they eating - presumably each other! So why are there so many fossils?

Most fish fossils exist only as heads. This suggests that the more fleshy part of the fish was eaten. It is also possible that when the fish died it sank head first into the bottom sediment. The fact that on some fossil fish heads half of the skull is missing also suggests that putrefaction affected the buried side and exposed side differently. This would support the argument that the creatures were feeding on each other, but why then are there so many fossils? The answer lies in other fossil finds in which unrelated bones have been found cemented together in a ‘death assemblage. Modern remains of the stomach content of dead predators shows similar assemblages implying that many of the fossilised creatures were predated before being fossilised. But still further fossil types have been found at Sheppey as the pictures below show.

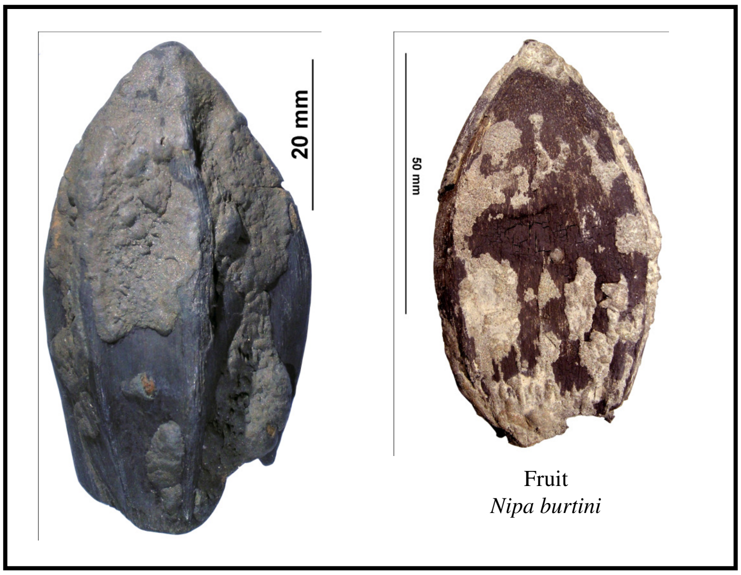


Why are fossil seeds and wood found with fossils of fauna that lived and died in a deep subtropical sea several miles from a coastline - trees don’t grow deep under water!

We were looking for a cuckoo and a swarm of bees to confirm that summer has arrived and a waxwing has suddenly arrived to spoil the show! What does this mean, is all of our reasoning incorrect?

Fortunately, an observation made by H. N. Moseley in his account of the *Challenger* Expedition of 1872-1876 makes all clear:-

> “On February 22nd, at noon, the ship was about 70 miles north-east of Point D'Urville, New Guinea, where the great Ambernoh River, the largest river in New Guinea, runs into the sea. This river probably rises in the Charles Louis Mountains, on the opposite side of New Guinea, which reach up to the great altitude of 16,700 feet. So large is this river that even at this great distance from its mouth, we found the sea blocked with the drift-wood brought down by it.”
>
> “The majority of the pieces were of small wood, branches, and small stems.”
>
> “Various fruits of trees and other fragments were abundant, usually floating, confined in the midst of the small aggregations into which the floating timber was almost everywhere gathered.”
>
> “But besides these fruits of littoral plants, there were seeds of 40 or 50 species of more inland plants.”
>
> “Very small seeds were as abundant as large ones, the surface scum being full of them, so that they could be scooped up in quantities with a fine net.”
>
> “I observed an entire absence of leaves, excepting those of the Palm, on the midribs of which some of the pinnae were still present. The leaves evidently drop first to the bottom, whilst vegetable drift is floating from a shore. Thus, as the debris sinks in the sea-water a deposit abounding in leaves, but with few fruits and little or no wood, will be formed near shore, whilst the wood and fruits will sink to the bottom farther off land.”



Fruit
Nipa burtini

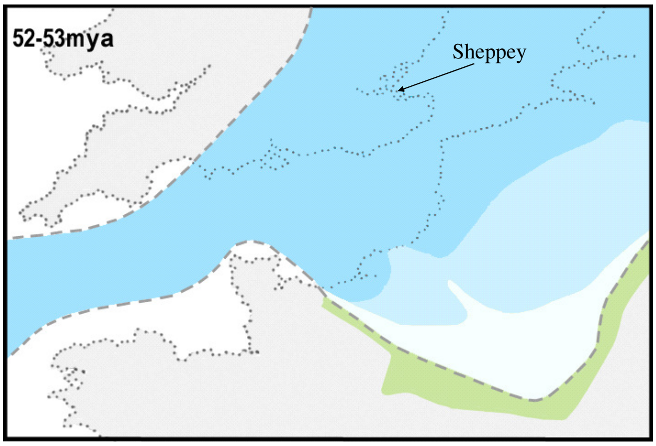
Modern
Nipa
fruits

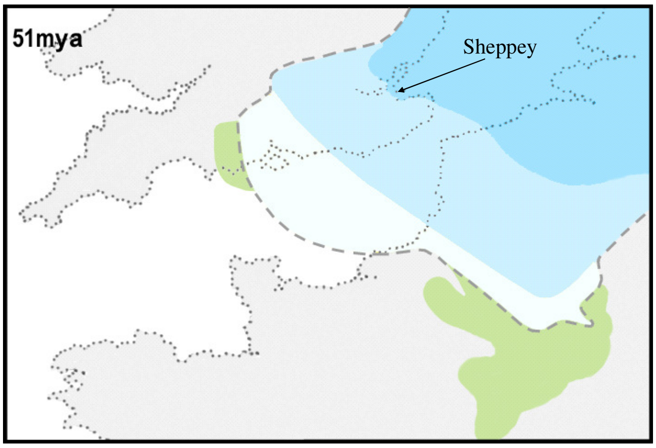
Another interesting find from Sheppey is shown above, it is a fruit of *Nipa burtini*. Comparing this fossil fruit with those of a modern *Nipa* fruit in the adjacent picture shows how little this plant has changed over 50 million years.

The modern *Nypa fruticans*, the Nipa Palm, is a native of the Indian and Pacific oceans. It grows in soft mud or slow flowing rivers with its trunk totally underground. Only the leaves grow above the water level. The palm grows to about nine metres and its flowers produce a woody nut cluster up to 25cms across - see the picture, right. Common in Indonesia, the Phillipines, Sri Lanka and Vietnam it is also known as the Mangrove Palm. Today, it is a monotype species.

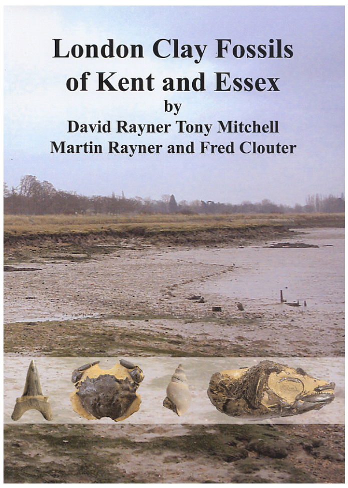
Finding fossilised fruit of the related *Nipa burtini* at Sheppey confirms the early conclusion that fifty million years ago Sheppey was tropical or sub-tropical.

The following sketches by David Rayner show how the sea around Sheppey gradually receded around fifty million years ago, reducing the depth of the water and so coarsening the sediments deposited.





In this article we have tried to show briefly how studying the nature of a sedimentary deposit, the fossils found in it and how those fossils relate to fauna and flora that exist today, can tell us much about conditions when the sediments were deposited several millions of years ago.



If you would like to learn more about the London Clay and the fossils found in it, not only at Sheppey but also across the Thames Estuary in Essex, then you may wish to buy the book "London Clay Fossils of Kent and Essex" by David Rayner, Tony Mitchell, Martin Rayner and Fred Clouter. (see the illustration of the book cover, right).

For cost and availability contact Tony Mitchell using details on the front page of this newsletter, quoting KGG newsletter, December 2011.

The Christmas Quiz - Answers

Adrian's answers to the quiz and the points he awarded for complete answers are given below. Points awarded to incomplete answers were determined by Adrian.

1. Obsidian (volcanic glass) – 1 point
2. The Swale – 1 point
3. The internal mould of a double-valved bivalve (Myophorella incurva) from the Upper Portland Stone Roach Bed – 3 points
4. A normal fault – 1 point
5. A vertebrate dropping – 1 point
6. The ear stone of a bony fish – 1 point
7. Pentagonal – 1 point
8. Early Silurian Wenlock Limestone exposure/ the trilobite *Calemene blumenbachi*, the Dudley Locust – 2 points
9. Early Cretaceous (Lower Greensand) [Ammonite – *Douvilleiceras mammilatum*] – 1 point
10. $CaCO_3$ – 1 point
11. A broken pyrite nodule from the Chalk (FeS_2) – 1 point
12. Twelve – 1 point
13. Hypocotyl or root of germinated seed of fossil Mangrove [*Ceriops cantiensis* from the London Clay] – 3 points
14. Bishopstone Glen, near Herne Bay – 2 points
15. Late Jurassic (Upper Oxford Clay) [Ammonite – *Quenstedtoceras lamberti*] – 1 point
16. Between Herne Bay and Reculver – 1 point
17. East Wear Bay, Folkestone – 1 point
18. Four [squares 2,13,14 and 18] – 4 points
19. Orthoclase Feldspar – 1 point
20. Late Carboniferous (coal measures) [Horsetail – *Annularia stellare*] – 1 point

Maximum Points = 29

The prize winners, with their scores, were:-

First Prize: Ann Barrett and Anne Padfield - 22 points

Second Prize: Bill Marshall and Tony Mitchell - 21 points

Third Prize: Richard Davis and Alan Kelford - 15 points

Indoor Meetings Programme, 2012

Ann Barrett

Please bring any interesting material to Indoor Meetings. It does not have to be related to the subject matter of the day's talk. It could include recent finds, specimens for identification and books, maps, photographs, etc. of general interest.

Details of forthcoming field trips will also be announced at Indoor Meetings.

Tea and coffee is available at 20p cup. Non members are always welcomed but are asked to donate £1 to the Group's expenses, unless joining on the night. For any queries concerning this programme, or to suggest speakers or subjects for talks, please contact:-

Indoor Programme Secretary: Ms. Ann Barrett.

Tel. 01233 623126, e-mail annbarrettgeo@gmail.com

17th January 2012	**George Gilbert-Smith**. Eclipses
21st February 2012	**Dr John Horder** Polymorphism in minerals
20th March 2012	**Annual General Meeting:** **Bob Higgins.** Display and talk on fossils and dinosaurs on stamps
17th April 2012	**Dr Geoff Turner.** Egyptian geology and the pharoahs
15th May 2012	**Dr Alan Heyes.** Topley and the geology of the Weald.
19th June 2012	**Dr Brian Marker.** When brachiopods thrived - some thoughts about the Middle Jurassic
17th July 2012	**Dr Anne Padfield** Geological maps.
21st August 2012	**Speaker to be confirmed**
18th September 2012	**Nick Baker.** Captain Scott, Glossopteris, and the Beacon Sandstone
16th October 2012	**Dr Chris Woolston.** What is this thing called Quantum Theory?
20th November 2012	**Dr. Angela Self.** Reconstructing Holocene climates.
18th December 2012	**Christmas Evening [3rd Tuesday]** Please bring labelled fossils, minerals and rocks for sale for the benefit of the Group and any other specimens found during the year for display. Members may also care to bring in refreshments.

The Lake District

Alex Bennett

The Lake District is the second largest National Park in the British Isles. It is in Cumbria, and was established as a National Park in 1951. The Lake District contains the highest mountain in England, Scafell Pike, which is 978 metres high and has a prominence of 912 metres.

The oldest rocks in the Lake District are the slates of the Skiddaw Group in the north of the National Park, which are about 500 million years old. To the south of the Skiddaw Group is the Borrowdale Volcanic Group (BVG), which includes lava and pyroclastic rock. Even further south is the Windermere Group which consists of sandstone, siltstone and slate. The BVG is very resistant to weathering and erosion, and so currently forms the highest mountains of the Lake District. The Windermere Group is less resistant to weathering and erosion and so forms a range of foothills from Kendal to the Duddon estuary.

Over 700 million years ago (MYA), active subduction occurred on the Amazonian edge of Gondwana. This created volcanic island arcs, which ultimately formed the mountainous microcontinent of Avalonia. In the early Cambrian period, Avalonia rifted away from Gondwana, opening up the Rheic Ocean and pushing the Iapetus Ocean towards Laurentia.

500 MYA in the early Ordovician period, black mud accumulated at the bottom of a relatively deep sea bed. This formed the rocks of the Skiddaw Group.

450 MYA in the late Ordovician period, the Iapetus Ocean subducted beneath Laurentia and formed intensely powerful volcanoes. The resulting lava formed the igneous rocks of the BVG. 420 MYA, the sandstones, slates and siltstones of the Windermere Group formed. 400 MYA, Avalonia collided with Laurentia and uplifted the rocks of the Skiddaw Group, the BVG and the Windermere Group into mountains as high as the Himalayas are today. This mountain building phase is known as the Caledonian orogeny. As a result of the Caledonian orogeny, many tuffs from the BVG were affected by regional metamorphism and formed the Westmorland green slates. The rocks were intruded by magma, which formed a large granite batholith beneath the BVG. This granite is exposed at Skiddaw, Carrock Fell, Ennerdale, Shap and Eskdale.

During the Devonian period, the high mountains were subjected to erosion and were reduced to low hills. 350 MYA, much of the area was submerged by a tropical sea. Broken calcareous shell fragments from dead marine animals accumulated at the bottom of the sea and later formed Carboniferous limestone. In the latter stage of the Carboniferous period this tropical sea became bogged with sand and mud and a swampy forest grew in its place. The fossilised remains of this forest formed coal. 280 MYA, the rocks of the Lake District were uplifted once again by the Hercynian (Variscan) orogeny. This formed the Cumbrian Mountains which still exist today.

During the Quaternary period, the Cumbrian Mountains have been subjected to glaciation, adding features to the mountains such as dales, cirques, arêtes and tarns.

Puzzle Corner - 2 (for instructions see Puzzle Corner on page 4)

Stephen Taylor

Here are two more walls for you to tackle; the first has a loose local association:

ARUNDEL	BAILEY	CATIGERN	COB
COURT	DALTON	EGLANTINE	FEATHERSTON-HAUGH
FIRE	FRANKLIN	GLORY	MESSER-SCHMITT
PLOVER	REEVE	TOWN	TREVITHICK

The second requires just general knowledge. Good luck!

AMAROID	BASIL	BILBO	CHARLOTTE
DAISY	EROS	HERMES	JAVELIN
MACE	MIMI	PIKE	ROCKET
SPONGE	STRAP	TIMER	TRIGGER

Saturday 10th - Sunday 11th March 2012.	**Group Stand at the Rock, Gem and Bead Show at Kempton Park Racecourse, Sunbury.** (map reference TQ 108702, OS Landranger Map 176). Microfossil and mineral slide-making and other activities. Help on stand always welcome. It is great fun and no prior knowledge is required. Setting up on Saturday at 9.00am, doors open at 10.00am. Please let Adrian know if you can help.
Sunday 18th March 2012.	**Joint Field Meeting to Sheppey Kent with the Medway Fossil and Mineral Society.** **Leader:** Tony Mitchell (telephone 01634 235507) The early Eocene London Clay of Sheppey is world famous for the diverse fauna and flora it yields. This is a chance to find a selection of the fossils and to learn something about the geological sequence exposed there. Full details will be available nearer the date.
Sunday 15th April 2012.	**Field Meeting to Smokejacks Brickworks, near Ockley, Surrey.** <u>This meeting is not suitable for juniors</u> Meet at 10.30 a.m. in the car park at Smokejacks Brickworks (Wienerberger Limited - Ewhurst Works). Smokejacks is just south of Walliswood (4 km southwest of Ockley), Surrey. O.S. map 187 - 1:50,000 series, grid reference TQ 116 372 Two further visits to Smokejacks in Surrey.are planned for 2012. This Weald Clay brickpit has yielded a number of important finds over the past three decades. The Early Cretaceous Weald Clay has yielded dinosaur remains, fish, plants and microfossils. Bring a hard hat and reflective jacket (<u>Compulsory</u>). It is also recommended that you bring eye protection, hammer chisel etc. and a packed lunch including sufficient drink. Please note that the pit is running on reduce capacity, so there have been no fresh scrapes since early 2008, hence no fresh exposures since that date. **Note:** Members wishing to attend must contact Peter Austen at least ten days before the visit date. All attendees must familiarise themselves with the Risk Assessment. If you have not seen a copy please contact Peter Austen:- Tel. 01323 899237 or E-mail: p.austen26@btinternet.com Copies will also be available on site. Further information about the brickpit and a downloadable, PDF version of the Risk Assessment, are available on the KGG website from the Fragments (News Items) page.
Saturday 21st April and Sunday 22nd April 2012	**KGG Workshops on a comparison of a microfossil sample and a Recent shell sand.** **Leader: Dr. Adrian Rundle** (telephone 0208 878 6645) There will be a short talk in the morning covering aspects of sample collection and processing as well as the use of looking at Recent sediment samples as a means of undersanding the remains found in fossil residues. There are many groups of organisms that are much larger than microfossil size but break up on death to small elements.

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There are also groups that are soft-bodied or very thin skinned and delicate that rarely get preserved as fossils. It is hoped that the workshop will give an insight into how to understand the contents of microfossil residues as well as their limitations. In the afternoon there will be a chance to study some literature, look at samples and make your own slides. As numbers have to be limited to 12 on each day further date(s) will be arranged if the workshops are over-subscribed.

Meet at 10.30 a.m. at the leader's house, 55 Dancer Road, Richmond, Surrey. TW9 4LB (map reference TQ 191759)

Equipment: If you have a suitable binocular microscope (about x20 to x40) please bring it along together with its light source. Salad and fruit salad provided, plenty of tea and coffee is available

Friday 4th - Sunday 6th May 2012

Lyme Regis Fossil Festival

The Group will have two tables at the 3-day event and six microscopes for microfossil, shell sand and mineral slide making as well as seed and fruit identification. This should be a very busy and interesting weekend with many other activities taking place. Any helpers would be much appreciated. Let Adrian know if you can help.

Saturday 9th - Sunday 10th June 2012.

Group Stand at the Rock, Gem and Bead Show at Kempton Park Racecourse, Sunbury

Details as for 10th/11th March.

Saturday 16th June 2012

Field Meeting to Newhaven, Sussex.

Leader: David Bone (telephone 01243 788474)

Meet at the end of the Newhaven Harbour Car Park (there is a charge for parking) at 12.00 noon. People travelling by train can be picked up at Newhaven Railway Station (details of train times closer to date of trip)

With low tide at about 4.30 p.m. we will start by climbing up to study the Tertiary sections (quite degraded) which sit on top of an eroded Chalk surface. The group will then walk along the cliff top to the outskirts of Peacehaven to return to beach level down concrete steps. Return will be along the beach back to Newhaven across very fossiliferous sections of Chalk. This should take about 4 hours overall (give or take) depending on weather.

Saturday 21st July- Tuesday 31st August 2012.

Proposed visit to the Slovak Republic by the KGG and Medway Fossil and Mineral Society to study minerals and fossils.

Following on the success of the visit to Slovakia last year, members asked that a future trip include both minerals and fossils.

The planned trip will be led, as before, by Professor Stanislav Jelen, a mineralogist with an international reputation. Professor Jelen has recruited the help of palaeontologist colleague Peter Ledvak to cover the fossil interest

Please Note: Because of the effort required to organise such a trip, It will only go ahead if sufficient members indicate early in the New Year their intention of joining the excursion.

Saturday 4th - Sunday 5th August 2012.

Group Stand at the Rock, Gem and Bead Show at Kempton Park Racecourse, Sunbury

Details as for 10th/11th March.

Sunday 9th September 2012.

Visit to Smokejacks Brickworks, near Ockley, Surrey.

Details as for visit of 15th April.

Saturday 27th - Sunday 28th October 2012.	**Group Stand at the Rock, Gem and Bead Show at Kempton Park Racecourse, Sunbury** Details as for 10th/11th March.
Saturday 3rd November 2012.	**Geologists' Association "Festival of Geology"** At University College London (UCL), Gower Street , London. Many local geological and lapidary organisations, affiliated to the Geologists' Association will be represented, and there will be demonstrations, walks and a lecture programme. (See the Rockwatch and GA websites for more details closer to the time of the event. The Group hopes to have numerous tables for its various activities in the Discovery Room. We are always kept very busy at these events so any help would be gratefully received. It should be fun.

Important Notice: Members wishing to join one of the events listed above must contact the leader well before the event so that the leader can plan for the numbers coming and, on the day, knows who to expect and who is missing.

Last Minute News

Shortly before issue of this newsletter we received an invitation from the Open University Geological Society (OUGS), South-East Branch, for KGG members to join the following society excursion:-

OUGS Geological and archaeological trip to the ancient land of Lycia on the Teke peninsular of Southern Turkey, April 21st to 28th 2012.

Leader: Professor Erkan Karaman of Akdeniz University, Antalya

The excursion will visit:-

- Phaselia, an ancient site
- Chimera, the fire mountain
- Kekova, a city sunk by two earthquakes
- The ancient city of Myra
- Xanthos
- Saklikent gorge

The cost, based on a party of 14 and two people sharing, will be about £420, to include bed and breakfast in hotel accommodation and some, but not all, meals. The price also includes airport transfers on arrival and departure, transport throughout the week and a compulsory guide.

Flights are not included but Easy Jet flies into the arrival/departure airport of antalya for around £200.

If you would like to take up this offer, or require more information, please contact Alison Ure, the event organiser on ougs.southeast@hotmail.co.uk

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