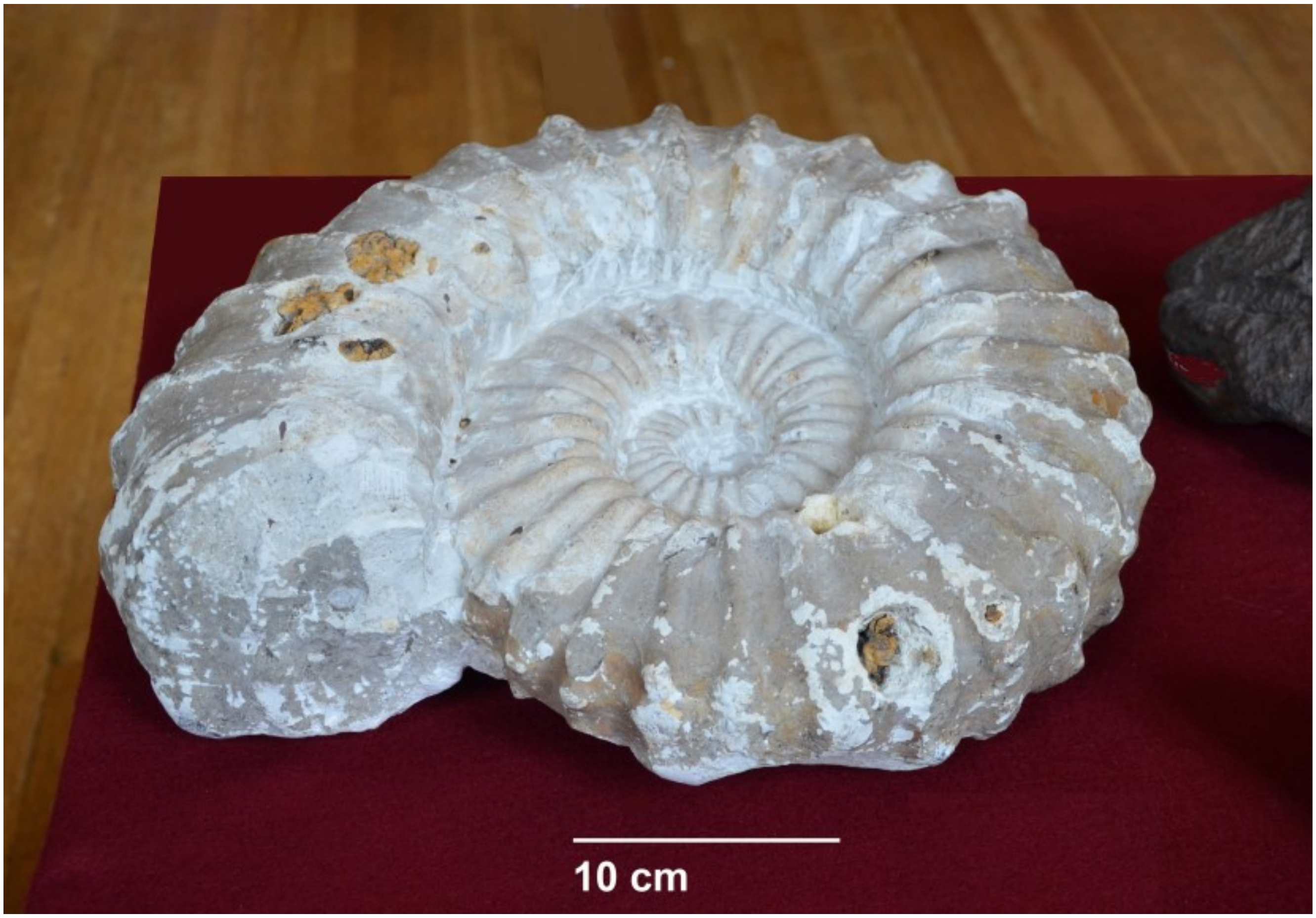
Occasional Erratics



Newsletter of the

MEDWAY FOSSIL AND MINERAL SOCIETY

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No. 11 Dec. 2018

I am obliged to add the following, to all those members of the Medway Fossil and Mineral Society, who receive this communication by direct email or by post, under the provision of the General Data Protection Regulation (2018)

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The editor of this edition of the MFMS Newsletter was Nick Baker

Cover picture

Ammonite in Rochester Guildhall Museum. Possibly a species of Acanthoceras, from the Chalk in the Medway Valley.

Index to editions 04-10 (index of no. 01 to 03 in earlier editions)

Contents of this edition No.11

Editor's notes.

Welcome to edition No. 11 of *Occasional Erratics*. The nearest I have to *Nick's Geological Journal*. I thank Gary for his contribution of a not (yet) very well known geological national park in Peru. Then comes the research in the sponge collection supplied by Steve Marshall. And then a report on a TV series, presented by Dr. Alice Roberts (some time ago now), in which I am not always in agreement with her. I am in her conclusion of the story and in the route of the journey, but not in some of the detail. Then a report on the Autumn program. And that brings me to the following news—I have no Spring program as yet. **We will begin our Spring program on January 16th 2019 with a welcome-back meeting and then have a planning meeting on January 23rd. This meeting may include details of future field trips, as well as the evening program**.

Now I want to consider a question. It comes in the circumstance of attracting new and (by definition) younger membership. What was it that triggered your interest in geology? Can you remember that far? Today we value the hands-on aspects of fossil or rock-n-gem shows. There is also the vast aspect of the Internet, but there can be a problem in the amount and speed of availability of information, which can overwhelm the investigator. For me, in 1960, it was the very slow access of information that spurred me on and the format was almost entirely the printed page. No click of a key to the next answer but rather saving up for the next book listed in the bibliography of the item I already had – and it often meant just four books a year – or the occasional map. I gained knowledge of geological maps before I had even one GA guide! The (then) Geological Museum sold 1" maps at very low cost compared with today and so, I was left to my own devices at the geological rock face (or, at least, strike and dip)!

The first book I obtained was ***The Observers Book of British Geology***. Yes, it was British geology back then! But the book was left unread for a year, and then a strange series of events added a sort of 'alchemical' aspect. A bonfire, casting a piece of granite into the fire, weeks later wondering what the strange black rock was in the ashes. The book is consulted before the rock is broken to reveal granite – but, too late, the bug had bitten.

The Observers Book of (British) Geology is a chatty little book, covering the basics of the science – sedimentary rocks, minerals, main groups of fossils, geological periods, and igneous and metamorphic rocks. The Permian age became a problem. *The Children's Encyclopaedia* discussed geological periods – The World in the Carboniferous, The World in the Triassic. And now the Observers Book listed a band of rocks assigned to something called the Permian, in between, but with little further information. Another enigma was the described fossil content, especially of a rock formation nearer to home – e.g. "The Chalk fossils include sea-urchins, sponges and shell-fish, fish, birds of a primitive type and the remains of evergreen trees". Now, this is the Observers Book of *British* Geology, but as far as I am aware, the birds were in the Niobrara Chalk of *Kansas*. And those evergreen trees? In 47 years I have never found another reference to evergreen trees found in the Chalk (I stand to be corrected). The only association I can think of is the Junipers growing on it. But, substitute Chalk for Cretaceous, and thereby include the Wealden, and we are in with more than a chance!

By the end of the 19th Century Darwin's theories had hit relatively difficult times - and that was the problem – time, there didn't seem to be enough. Objectors immediately saw holes in what had been a revolutionary theory. Darwin was ahead of his time and what would be supporting science had not caught up. To cite one objector – Lord Kelvin, the Earth had still too hot an interior for it to be of sufficient age to allow for the processes Darwin envisaged - knowledge of isotopic furnaces was still in the future - and Kelvin put the age of the Earth at no more than 40 million years. Darwin had called for much larger amounts of time for his gradualistic evolution to take place. Another problem was the infant stage of sedimentology, which, at first sight, seemed to match Kelvin's estimates.

These problems were carried over into the first decades of the 20th Century and can be illustrated by some books written in the period. ***The World in the Past,*** by B Webster-Smith, was first published in 1926. Admittedly, he has gone a way forward from Lord Kelvin, in that he places the base of the Cambrian at about 150 year BP. this being still based on sedimentary estimates.

Of the 'Permian question' the presence of boulder beds he ascribes to ice action, rather than desert storms, and so, even in Britain, the Permian comes over as a cold interlude between the moist heat of the coal forests and the dry heat of the Trias, this cold aspect being supported by, already well-documented, evidence from the Southern Hemisphere, suggesting a wide-spread global cooling.

In the years immediately after the Second World War, the spread of geological information seems to have had a renaissance in the form of books and museum exhibitions – I have already cited a basic introduction of this time. At, what was then called, the British Museum (Natural history), Gallery V had a series of exhibits (in the form of wall panels) illustrating the succession of life through geological time. The accompanying booklet, first published in 1948, was thus entitled – ***The Succession of Life through Geological Time***. Again, it is not an item of specialist literature, but as an overview of the subject at the time, I don't think it can be bettered – save on one glaring aspect. The matter of plate tectonics has (as stated in the introduction) been discarded when producing geographical maps of each period (which renders them of little value). Advances in the knowledge of radio-activity had helped to produce a time scale nearer to one we would recognise, rather than the sedimentary estimates of Webster-Smith two or three decades earlier. But, like the timescale, continental drift seems to have been left in the background until the supporting science had caught up in the last decades of the twentieth century. And, what of the Permian? Yes, the problem was solved. The (then estimated - 1959) 20 million year period (45 million by 1967) was one of hot deserts and declining coal forests, at least in the Northern Hemisphere. Webster-Smith's coldness was present, but as a vast ice-age, far longer than that of the Pleistocene, in the Southern continent of Gondwanaland.

Another aspect of that same renaissance was a book series called the New Naturalist, and in 1960 Prof. H. H. Swinnerton took on the subject of palaeontology, under the title of ***Fossils.*** It is a study through geological time of fossils and the background, character and methods of the geologists who studied them. So, as well as a study of trilobites, ammonites, brachiopods, corals, echinoids etc, we are also introduced to Murchison, Buckland, Sedgwick, Lapworth, Miller, Anning, Lamplugh, Spath, Rowe, - to name a few.

Hugh Miller published his work under the title of The Old Red Sandstone. A copy of this found its way to the little town of Thurso on the north shore of Caithness, into the library of the local baker, Robert Dick, a born naturalist, who knew Caithness as he did the palm of his hand. The writer, Samuel Smiles published a biography of Dick, entitled ***Robert Dick: Baker of Thurso, - Geologist and Botanist***. To him it seemed nothing to walk 20 to 30 miles to see a rare flower blooming afresh in its secret haunts. After reading Miller's 'Old Red Sandstone' he turned his attention to hunting for fossil fish. Rising early each morning he made and baked his batch of bread for the day. Then, leaving the bread to be sold, he set out on his fossil fishing foray. With unexampled energy and endurance he walked sometimes fifty miles in the day to distant exposures and returned heavily laden in time for some sleep and another early baking before repeating the programme the next day.

Robert Dick is a classic example of the old style field naturalist – a species in danger of becoming extinct, even in its 21st Century variety, but we must not forget that the geologist (primarily as palaeontologist) is also a variety of that species. The difference with people such as Dick is that their canvas was spread across several sciences, something that is becoming increasingly difficult. The question arises as to whether the digital age cuts us off from Nature. Also, there is the effect of increased urbanisation of the population, and as far as the Internet goes, there is the question of the easy availability of knowledge. Robert Dick had no such means of finding out and it may be that the best ways of nurturing a new supply of naturalists must best include the old hands-on experience. Then, perhaps some unknown quality may be transferred which other methods of enquiry do not always supply.

References

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Oakley, K. P. & Muir-Wood, H.M., 1948. ***The Succession of Life through Geological Time***. British Museum (Natural History).
Smiles, S., 1878. ***Robert Dick: Baker of Thurso, Geologist and Botanist***. John Murray.
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Webster-Smith, B., 1926. ***The World in the Past***. Frederick Warne

Paracas National Park, Peru.

When we went on our cruise to the South Pacific in early 2018 we joined the ship at Lima in Peru. The ship's first port of call before heading out into the vast Pacific Ocean was at Paracas. The port at this place (there are no buildings to call it a town) was constructed in order to load cargo ships with minerals mined in the vicinity. The area is very barren, indeed it is effectively a desert which stretches all down the coast for a thousand miles merging into the Atacama Desert of Chile.

The Paracas National Park.

Where the desert meets the sea.

The desert stops at the sea which is very cold as it is fed by the Humboldt current direct from the Antarctic. This is very rich in plankton and results in the waters being full of fish. This in turn provides food for marine mammals, primarily Sea-Lions, and many sea birds. Due to this abundant marine ecosystem the area has been designated a National Park.

However the marine life is not the only reason, the desert contains abundant fossils. A very good visitor centre has been built with information on the geology and ecology of the area. Obviously of particular interest to me were the fossil displays which primarily consisted of various shells, but also shark teeth. These fossils are of Miocene age and include the classic giant Chacharodon which is found worldwide from rocks of this time.

Visitor Centre

Shark Teeth Fossils

Fossil Information Panel.

Fossil Gastropods.

After stopping for a time at the visitor centre we headed off for stops at various viewpoints in the park. At one of these stops, the guide said there were many fossils to be seen but he had never managed to collect any. I asked about collecting and was told that that would be fine. They seem to have different rules in Peruvian National parks!

There was a good information panel about the fossils, which were gastropods, and even without any equipment I managed to collect a few that were weathering out. I didn't find any sharks teeth but when we returned to the ship there was a small market and some of the stall holders were selling fossils. Now, many of these fossils came from Morocco, typical! but a few were definitely from Peru. I managed to purchase a small piece of a conglomerate that contained several shark teeth as well as fish scales and teeth.

Gary Woodall

Flints, Silica and Rotting Sponges

Nick Baker

Introduction

First of all, I need to acknowledge the generous collecting of fellow Society member, **Steve Marshall** (and dog). I don't recall how this exercise began. My colleague, Steve Marshall began to show me some very rounded flint nodules he was finding on the top of the downs at Cossington Fields, near Blue Bell Hill. We were of the idea that there might be a strong connection to fossil sponges. He began to supply me with more of them and I began to break them open. I was not sure what I hoped to find. In some cases he found some good examples of quartz crystals. I had mentioned the need to look out for any brown powder (flint mill), which would be a good source of sponge material, mostly spicules. This was, indeed, the case of many of the flints that I broke open. But at first I was looking at the internal surface of the hollow flints to see if there was any sign of sponge structure. In only a few cases was this apparent, but the abundance (in some cases) of sponge spicules was noted, especially in the light of the fact that I had not come across such microscopic items in the numerous chalk samples I have in my collection. Thus, the sponge connection was well apparent, although it was not so apparent in much of the available literature. References are made to sponge spicules being source of silica, although sponges are more correctly the organisms consolidating the material and not the true source, that being rivers feeding into the Chalk sea, and perhaps even volcanic dust falling into that sea. Thinking of the chemical properties of silica, it may be hard to think of it being (1) sufficiently soluble to be available for metabolic processes, and (2) in what way can organisms such as sponges utilise such a substance. These are the first two questions we must confront.

The formation of flint.

In the formation of flint, its apparent insolubility is overcome by the fact that its precursors are relatively soluble. These hydrated forms of silica (opals) comprise the early stages. The first stage is an amorphous opal, referred to as Opal-A. It's very first formation is a gelatinous nature. Around 125g of this can dissolve in a cubic metre of sea water, at normal pH. A change in pH and/or raised temperature can cause the formation of less hydrated opals, known as Cristobalite and Tridymite.

This Opal-CT is formed of microcrystals and around just 25g will dissolve in a cubic metre of sea water. This change to Opal-CT is speeded-up by the presence of a raised pH, where there is an abundance of calcareous material and thus take the process right to mature quartz

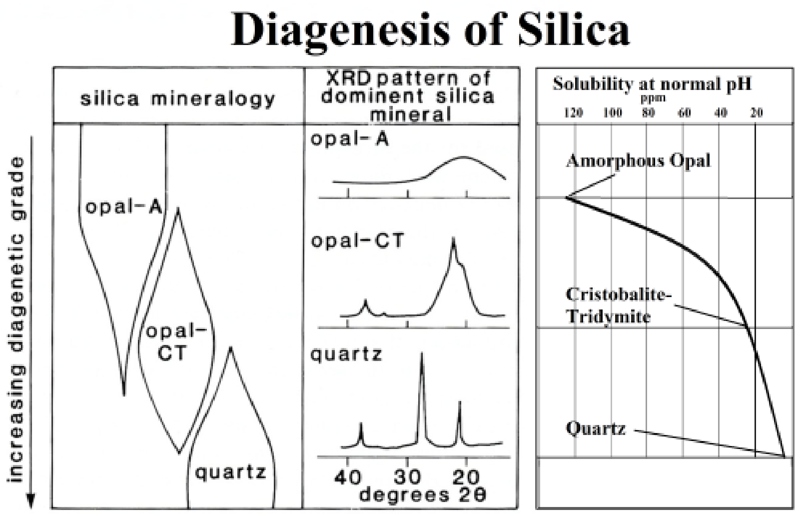
Where there is an abundance of clay material and aluminium or iron, the stage from Opal-CT to quartz can be halted altogether. This may explain the absence of flint in the Lower Chalk, although Opal-CT may be abundant at some levels, such as the Tenuis Limestone, or the *Pecten* Band at the junction of the *mantelli* and *rhotomagense* fossil zones. Such layers are often described as 'grit bands' or 'porcelaneous chalk'. It should be noted that the crystal size of Opal-CT may be as little as 5 microns diameter. So any field work would simply detect such material as a 'silica-rich clay'. But, in the higher chalk the absence of aluminium-rich or iron-rich clays, and a raised pH allows the formation of mature quartz, as flint or chert. As little as 5g of this material will dissolve in a cubic metre of sea water. Given that the sea water saturated with respect to mature quartz, one might expect the process to jump direct from Opal-A. However, the structure of quartz might require slow precipitation from less concentrated solutions. An absence of these circumstances would allow the Opal-CT stage to take place.

At source, the solution of quartz and the formation of Opal-A in rivers feeding the Chalk sea, would be aided by a high pH, while the presence of humic acids might lead to non-solution or early precipitation of quartz. A lack of humic acid would suggest a lack vegetation in the river drainage area. The idea of desert areas bordering the Chalk sea would thus favour early silica solution. The occurrence of cherts in the Carboniferous Limestone might indicate deserts bordering the sea, the seas (at that time) still occupying the northern edge of the southern sub-tropical high-pressure zones, in much the same way that Britain would have occupied the northern edge of the northern sub-tropical high-pressure zones in the late Cretaceous.

Sponges and silica metabolism.

Whatever the 'first cause', siliceous sponges would be a vehicle for concentrating silica from the water-column, to a higher degree than would otherwise be the case. The question remains, how do sponges metabolise such an unlikely material as silica?

Recent research has demonstrated the presence of two enzymes—silica polymerase and silica esterase—working in the metabolic pathway from the supply of silica in sea water to the building of sponge spicules (see Muller 2007).



Schematic changes in silica mineralogy with increasing diagenesis, and X-ray diffraction patterns for opal-A, opal-CT and quartz showing the increasing crystallinity.
After Pisciotto (1981). Tucker (1981).

Going back to the process of flint formation, it should be noted that each stage, from Opal-A to mature quartz tends to be destructive of previous structures. So, don't be surprised if there is no trace of the originating organism—and it may be that the organism was well-decayed before the process began. However, sponge spicules do seem to survive quite well, possibly because the material comprising the spicules had already reached the state of mature quartz.

Which brings me to mention the possible role of secondary deposition, mentioned by some authors such as Hancock (1975). The decaying organic material could act as a trigger for flint-genesis to begin. Just as phosphates can attract heavy elements such as thorium, uranium etc, so decaying carbon could be a focus for silica. A flint core alone might indicate a limited supply of silica, while a larger overgrowth of flint will have indicated less limitation. This silica-replacement may have little to do with the silica-metabolising process, since other organisms, such as echinoids are often replaced by silica, the silica replacement of decaying carbon material being indicated.

Nodular Flint structure.

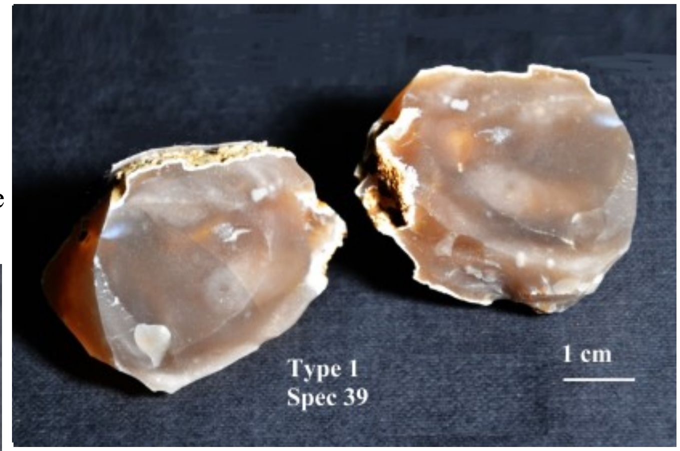
In most of the flints, the bulk of the flint is composed of an inner medulla, made up of amorphous quartz, often black to light grey in colour. This is surrounded by a skin or cortex of micro-quartz, often white in colour, but in some cases appearing to be absent. The centre of the medulla may have the appearance of a cavity filled with fine quarts, giving the impression of quartzite. In the specimens so far analysed this appears to be of a maze-like structure. In many cases of the nodular flints, there is a true cavity. The lining of which may show remains of flint structures, with the surface as mature chalcedonic quarts. Why the cavity? Why is this space not infilled? Obviously, the supply of silica has been cut off. It is in these cases that sponge spicules are most abundant. The history could be that at the death of the sponge, silica is attracted to the decay site, which is finally shut in due to the overgrowth of silica. Thus, the interior of the flint is shut off from a new supply of Opal-A. The water being super-saturated with respect to quartz, means that the last of the opal is deposited on the sides of the cavity as mature chalcedonic quartz. The interior stable solution remaining as approx 5 ppm of mature quartz. Subsequent to erosion, holes in the flint might allow the ingress of micro-fossils, including sponge spicules from neighbouring sponges, as well as chalk and clay.

Sometimes the cavity contains a so-called 'flint core', more or less rounded, but rarely completely so, except in the loose specimens found in the Chalk. They are almost always composed of micro-quartz with a maze-like structure. This appears to be all that remains of the original organism, and whether it is present or not would depend on the supply of silica. It is these that have often been mistaken for *Porosphaera*. However, *Porosphaera* is not a silica-metabolizing sponge, although it could be involved in the process described above. Also true *Porosphaera* demonstrate a detailed calcitic structure. At best the silica cores, in these cases, can be described as trace fossils. It may be that the flints that have a strong medulla structure lay exposed on the sea floor, allowing a continuous supply of opal, whereas the isolated cores were buried mainly due to bioturbation, with a limited supply of fresh opal. Those *Porosphaera* preserved in calcite may have been buried too deep for silica replacement to take place at all. Such specimens are common in the higher Chalk—Coniacian division and above.

The Research

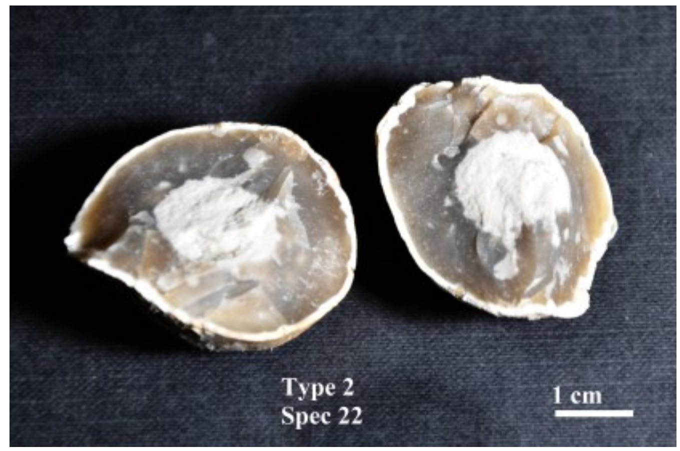
In the early stages, the breaking of the flints often resulted in the loss of internal loose material. This may have affected the first 10 or so specimens. Subsequently a method was devised where the whole of the flint and content was captured. At the time of writing c70 flints have been / or are in the process of being examined.

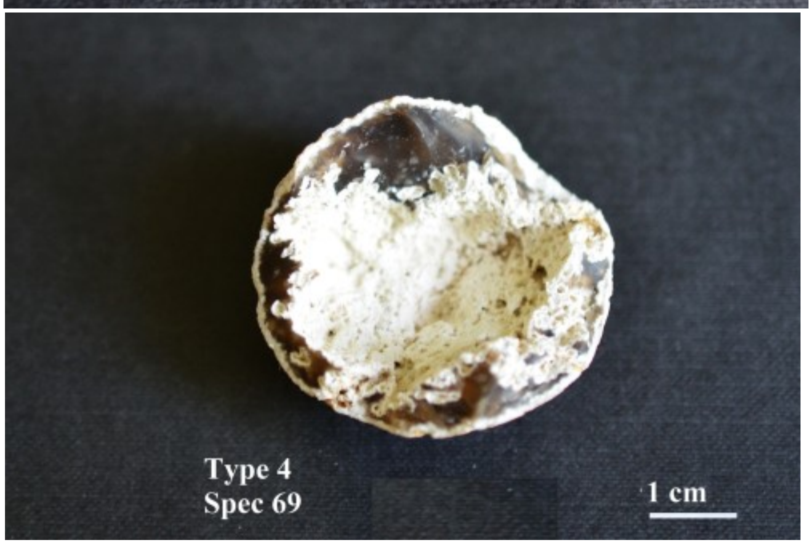
This area of search was new to me and it became apparent that the flints fell into a smaller number of distinct types. Most of the flint nodules fell in to the range of 3 to 8 cm in diameter. They ranged from almost complete spheres to 'irregular'. I have grouped them as follows.

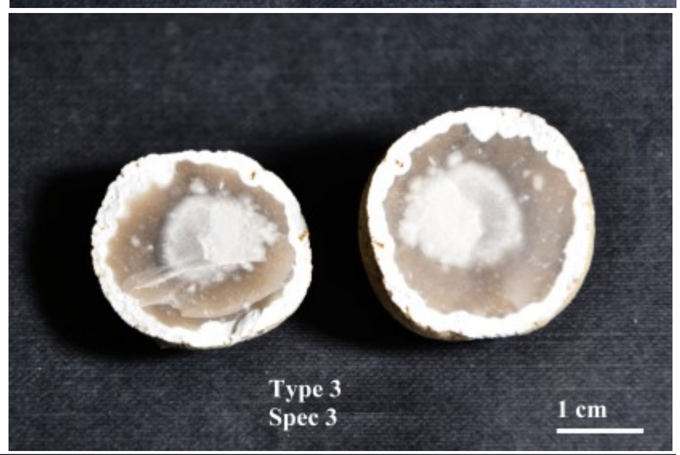


Type 1.
Solid, dark flints. Cortex, thin or absent.

Type 2.
Solid, dark flints. Lighter flint or fine maze-like quartz filling the cavity. Cortex variable in thickness





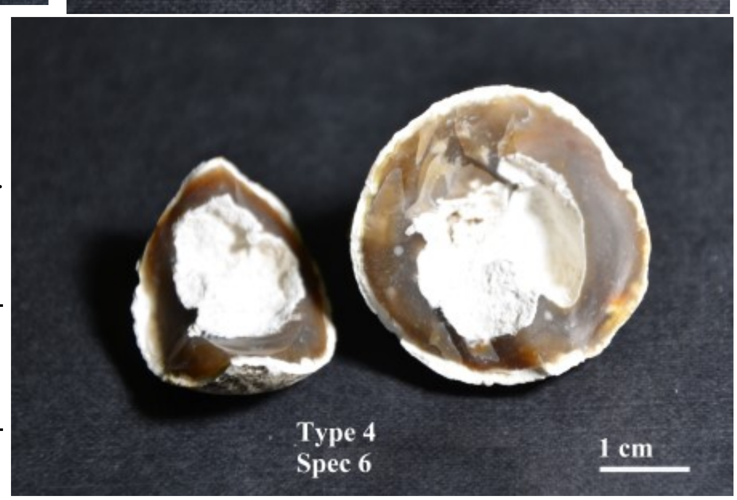


Type 3.
Solid, dark flints. Maze-like quartz core. Thick Cortex.

Type 4.
Dark medulla. Hollow centre lined with white micro-quartz. Mostly thick cortex

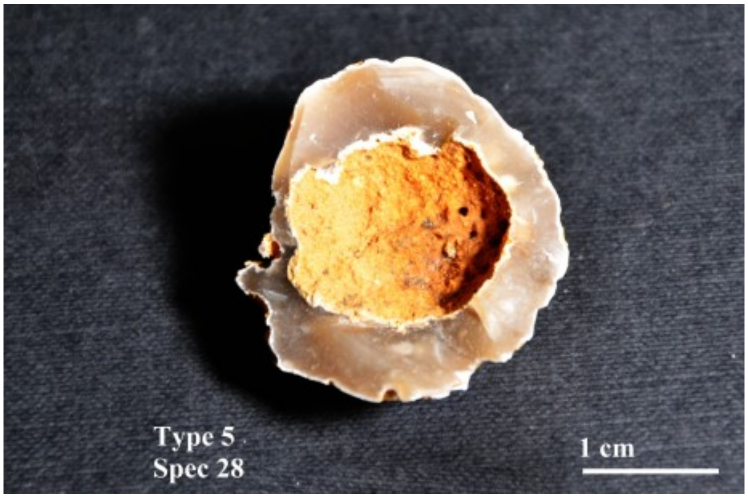
Type 5.
Dark medulla. Hollow centre lined with brown-stained micro-quartz. Mostly thick cortex

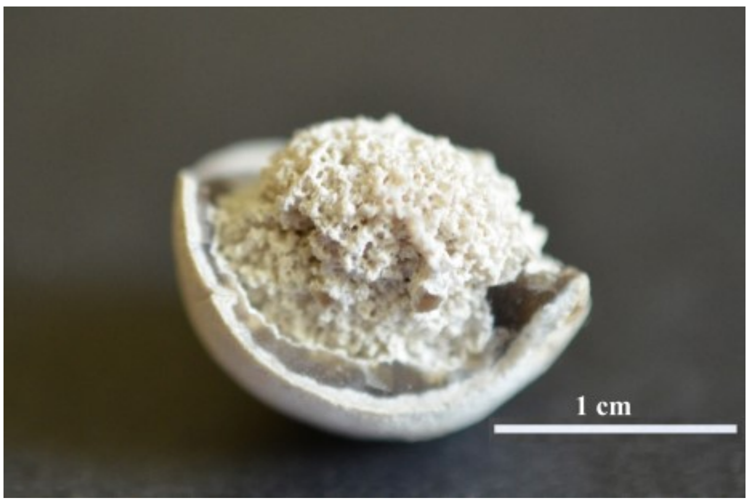
Type 6.
Thick dark medulla. Small nucleus filled with white micro-quartz. Mostly thick cortex



Type 7. Flints – nodular or tabular, large central void partially filled with white micro-quartz. (large silica core)

Type 8 Thin grey cortex surrounding silica core.





Type 9
Loose maze-like silica core – frequently mistaken for *Porosphaera*. (Trace fossil)

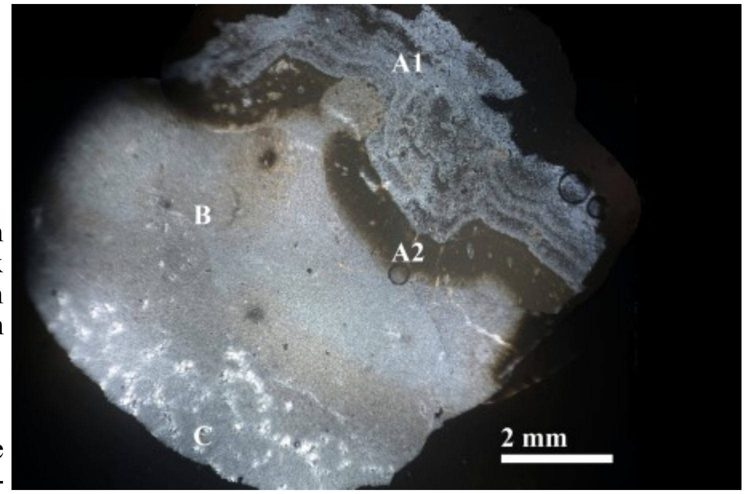
Type 10
Definite sponge contained in flint – detail still intact.

Silica Micrography

There are three basic types of silica involved in this research.

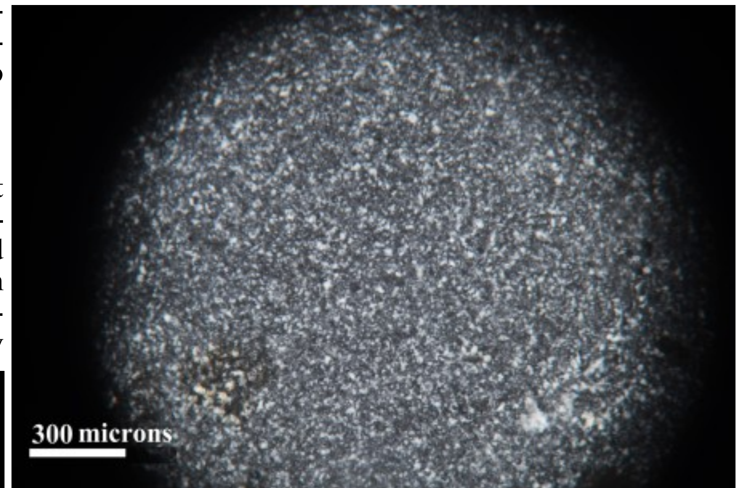
1. Medulla silica
2. Cavity silica
3. Cortex silica

First of all I have a micrograph (see right) showing a thin cross-section of a small flint. This is a small flint with a cortex (A1-2) almost as thick as the medulla (B) There was no open cavity. It was completely filled with maze-like material, often associated with flint cores or with the lining of the cavity (C).



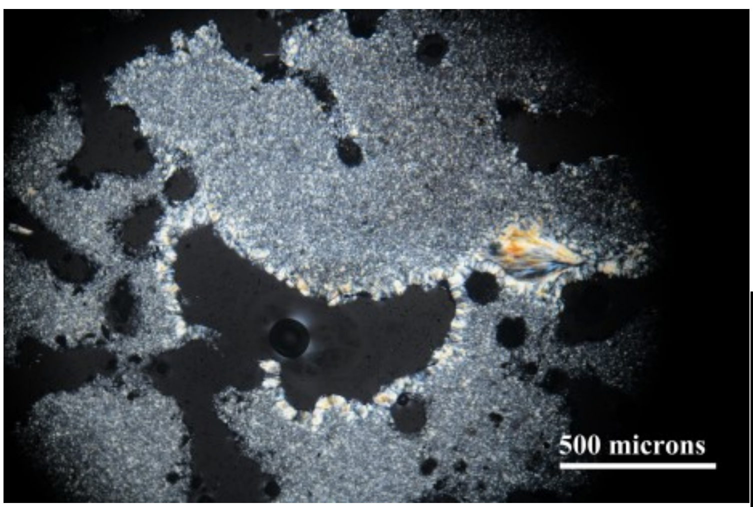
Medulla.

This is composed largely of crypto-crystalline quartz. The crystals may be as little as 10 microns across. (see right-below) Its formation appears to be 'post-mortem'. The carbonaceous products of decay appear to attract opal from sea-water. It should be noted that this process is not confined to sponges, echinoids being other candidates.

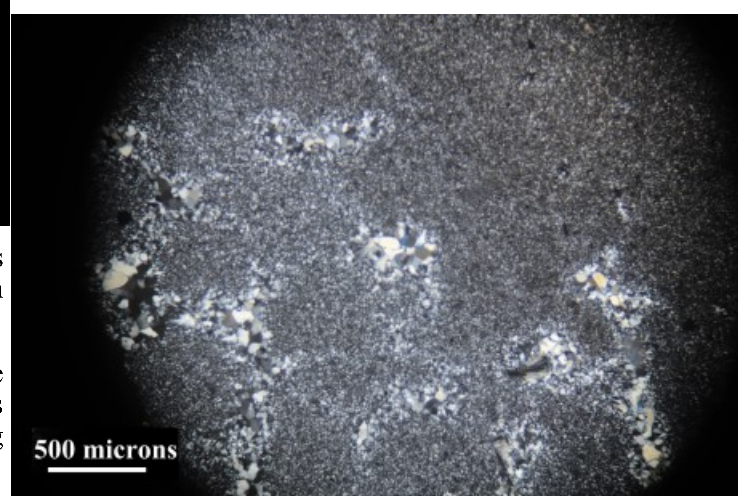


Cavity

This material differs from the medulla in one major respect. It is not uniformly compact. It seems to have a maze-like structure. Where the cavity is totally filled, the spaces are inifilled with mature chalcedonic quarts. There are two micrographs on this page to help with this illustration. The different morphology may be due to the amount of silica available in the cavity area. An over supply of silica will lead to the compacted maze. In the case of lack of supply, the remains of the sponge is corroded, perhaps leading to a transfer of silica from the depleting core to the lining of the cavity.



Above is an example of the uncompacted 'maze-quartz'. It is composed of micro-quartz, with spaces, sometimes lined with chalcedonic quartz, as in the illustration.

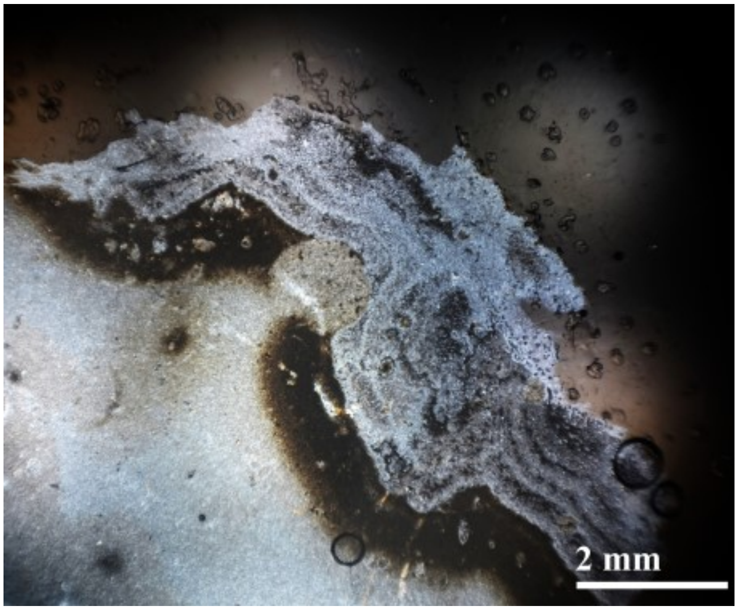


To the right is the compacted 'maze-quartz, the spaces are completely filled with chalcedonic quartz. Examples of this can be see in flints type 2 and 3—the cavity material having the appearance of quartzite.

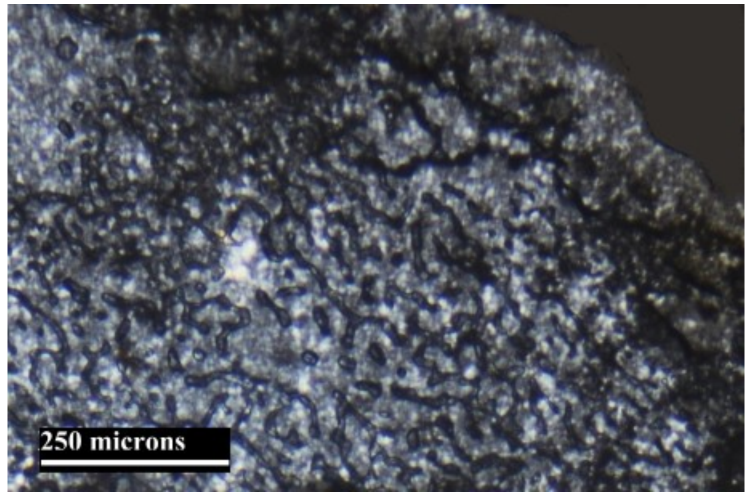
The Cortex

It seems highly likely that the cortex is a weathered portion of the medulla. In the micrograph on page 11, two divisions can be seen. A1 is micro-quartz with a slightly layered structure. The outer-most layers show very small inclusions in a chain-like formation. This may be a form of 'micro-honeycomb' weathering, later in-filled with fresh silica(?). Between these layers and the medulla is a highly compacted, semi-opaque layer. (A2) It appears to belong more to the medulla. But little detail can be seen with the magnification available.

Detail of cortex



Micro-honeycomb weathering of cortex ?



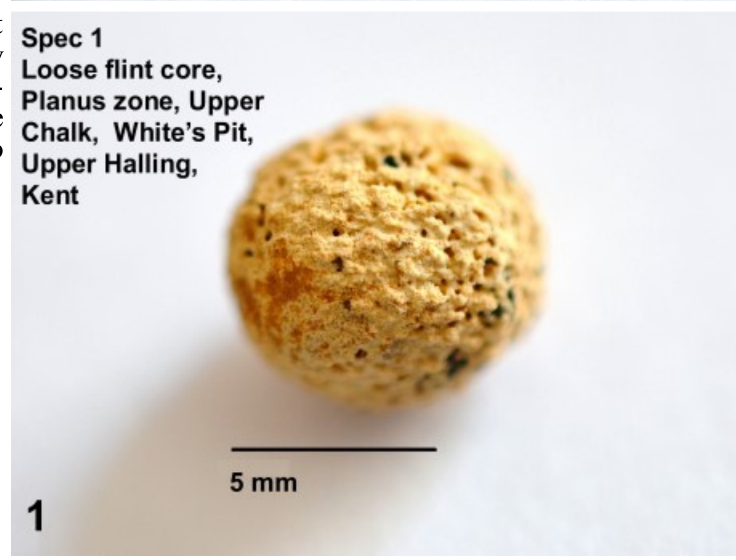
Loose micro material within the cavity

The flint nodules with the hollow centres often contained fine -grade material. In the case of the flints with the white quartz lining, the residue was often chalk. Examination of this often gave a Chalk-age micro-fauna, including foraminifera, especially of the Globigerinid group. The chalk could have penetrated to the cavity via holes in the flint. Often, in these cases, there were fewer spicules. In one specimen the residue was not chalk but fine-grade white silica, probably derived from the cavity lining. In the cases of the brown-stained silica lining, there was often a contaminant residue of clay or silt. These often contained a higher number of spicules. (**To the right—sponge spicules. Compartment size = 2x4 mm)**

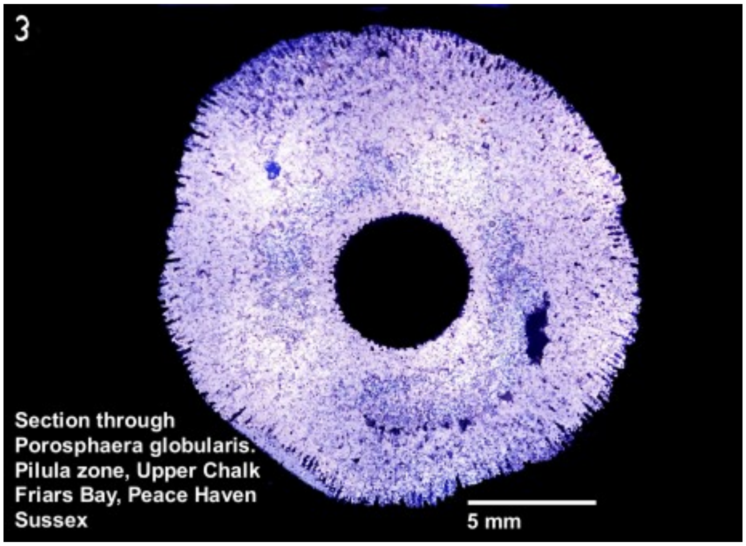
Comparison of flint cores with true *Porosphaera*

The flint core shown in Fig 1. is compared with a *Porosphaera* similar to that in Fig 2. at a micro level. The two specimens were ground down, using graded carborundum. The resulting flat surfaces were then mounted on to microslides with Loctite 358 UV resin, set with UV light. The remaining surfaces were then ground down to a thickness of 30 microns, the final thickness estimated using quartz birefringence.

There has been some argument over the nature of the flint cores. Given that *Porosphaera* were not silica-metabolising sponges it might be considered unlikely that the flint cores are the remains of *Porosphaera*. The one possibility lies in what I have said about the attraction of silica to decaying matter. Yes, in that sense, the flint cores *could* be the remains of *Porosphaera* where the specimen was exposed to the high-silica environment of the open sea-bed



Otherwise, burial due to bioturbation may be the reason for calcareous preservations (see fig 3). The material of the flint cores is the same as the maze-like quartz mentioned above. But silica diagenesis is often destructive of structure and without a definite trail it might be best not to give a genus or species name to such material..



In summary
On the death of the organism, silica is attracted to the site and the organism is surrounded by a layer of micro-quartz.. (**medulla**). What happens to the original organism depends on the supply of silica. A depletion can lead to the total destruction of the organism, the remnant silica being deposited on the inner wall of the nodule **cavity**. Alternatively a high supply of silica may mean that the cavity is completely filled. There may thus be a balance between a **remnant core** and the amount of silica deposited on the inner cavity wall. Finally, it is generally concluded that the **cortex** is a product of the weathering of the medulla.

Research is continuing, especially with regard to the chalk / clay contamination of some of the samples. Examination of this my give clues to the post-cretaceous history of the samples

These notes apply to **nodular flints** and should not be applied to **bedded flints,** which may have a different mode of origin, probably as autigentic sediments

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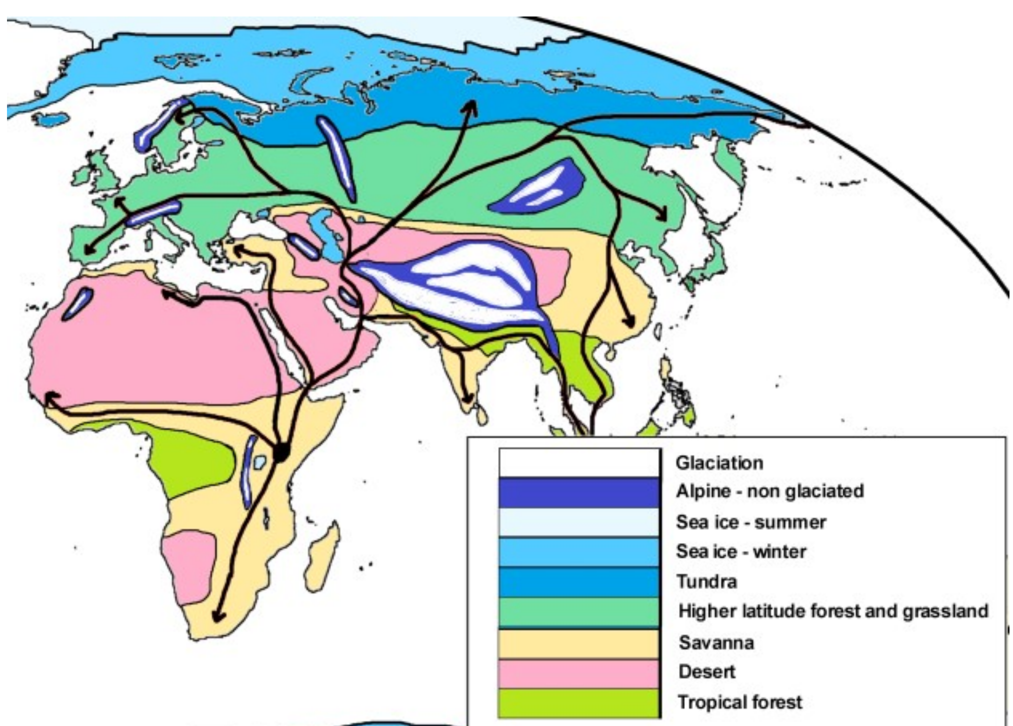
A long walk with Alice

Nick Baker

In this case I am referring to Dr Alice Roberts—she of *The Incredible Human Journey*. You may recall the five-part series, now some time back. You may have read the book. She begins by asking the question—"Why are we all so different, especially if we are descended from a few families emigrating from East Africa 70,000 years ago?". And so we begin in East Africa among the local Bushmen. We have to remember that *Homo erectus* had already spread far and wide. The move from the forest to grassland had already taken place perhaps as early as the beginning of the Pliocene. But we have to remember that changes in environment do not *directly* cause changes in a species. A mutation will occur, but environment will decide as to whether that mutation is favoured or not. In most cases the mutation is not favoured. We tend to say that a species has adapted, but the species had no say in the matter. *Homo sapiens* is the exception in that we can actively



Manipulate our environment. The new species will be adapted but rarely can we say that it is 'perfectly' adapted. Early *Homo sapiens* will have been adapted to the open grasslands but may well have had to live in forest environments from time to time.

It was the cooling down of the climate in the polar regions that caused the spread of the grasslands in the Tropics, and the story of the evolution of *Homo sapiens* is, at the beginning, a story of East Africa. To find out about that beginning Alice seeks out the hunter-gatherer culture that still exists, the African Bushmen. Alice finds out how well adapted they are to the heat, and a lot of their travelling involves running. But the assumption that all primitive *Homo sapiens* ran everywhere might be an assumption too far.

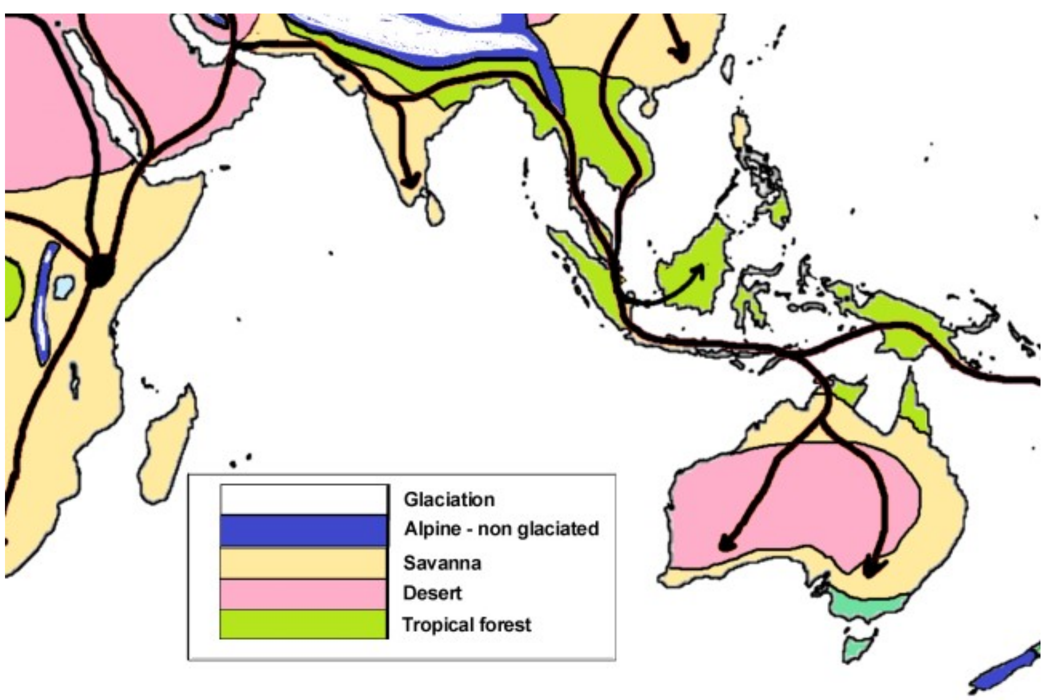
We do not know what caused the emigration. It may well have been a shortage of food, due to famine or just too many people. And so we leave Africa, and Part Two takes us towards **Asia.** The assumption is that crossings were made across the Red Sea and Iranian Gulf. For myself, I would have favoured the route with few obstacles, namely through Egypt to Palestine. Then there were several options. But for now, we are to take the Siberian Route and so we steer for the passes between the Elburz Mountains and the Hindu Kush. Then northeast to the land of the Reindeer People. Why would people travel from heat and then settle in cold? That is a question that is not fully answered, but food supplies would always by paramount. Aspects of appearance now come to the fore. Gone are the African features. Now flatter features and narrow eyes. An adaption to cold is decided. And that adaption is carried south to **China and Indonesia**. As with leaving Africa, a population is left behind, which is happy with the old life, and retains the original features. Some of those that left Africa will have followed the coastal route to India and will not have acquired the north Asian features.

But it is in China where the first challenge to the African origins appears. There is a widespread belief that the Chinese are descended form local *Homo erectus*. The puzzle is answered by DNA analysis. No, it was an African stock that came to China, via Siberia.

Our third journey takes us to **Europe.** We take the Urals as the eastern boundary. From the Middle East we travel northeast into Russia, northwest to Scandinavia, and west to France and Spain. A possible route from Africa to Southern Spain is not entertained. The problem of moving northward from Africa is a problem of melanin, Ultraviolet light and vitamin D. The emigrants from Africa would have had varying amounts of melanin in their skin. This meant differing absorption of ultraviolet light and production of vitamin D. In areas of lower sunlight, paler skin would be favoured by the new environment. But this is now one area where we can circumvent the problem by diet. *Homo sapiens* is no longer a slave to the environment.

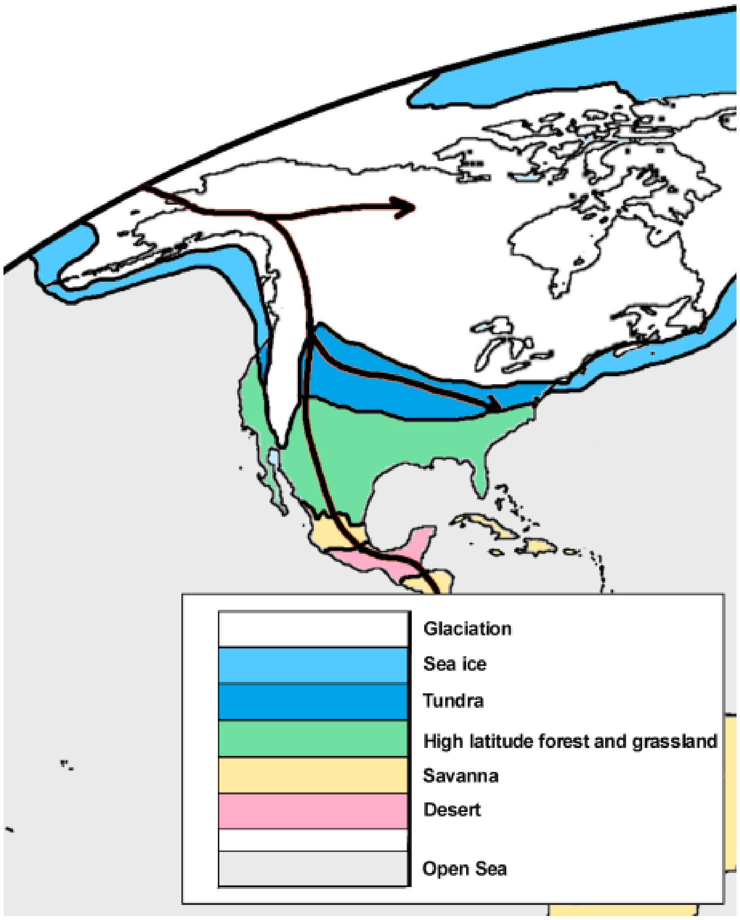
Alice goes on to discuss the **Neanderthals.** Why did they die our? Did they integrate with the 'modern *Homo sapiens*? She speculates on their unattractiveness and decides that it is unlikely that we would mate. She does not speculate on the possibility of rape ! None-the-less, she is adamant that there are no Neanderthal genetics in modern humans. But why did they die out? Studies of ancient art are considered and the apparent lack of examples from the Neanderthals. We are told that art gave us a superiority. I would have liked more discussion on the matter—perhaps there was a greater spread of ideas, but the art connection can be complex.

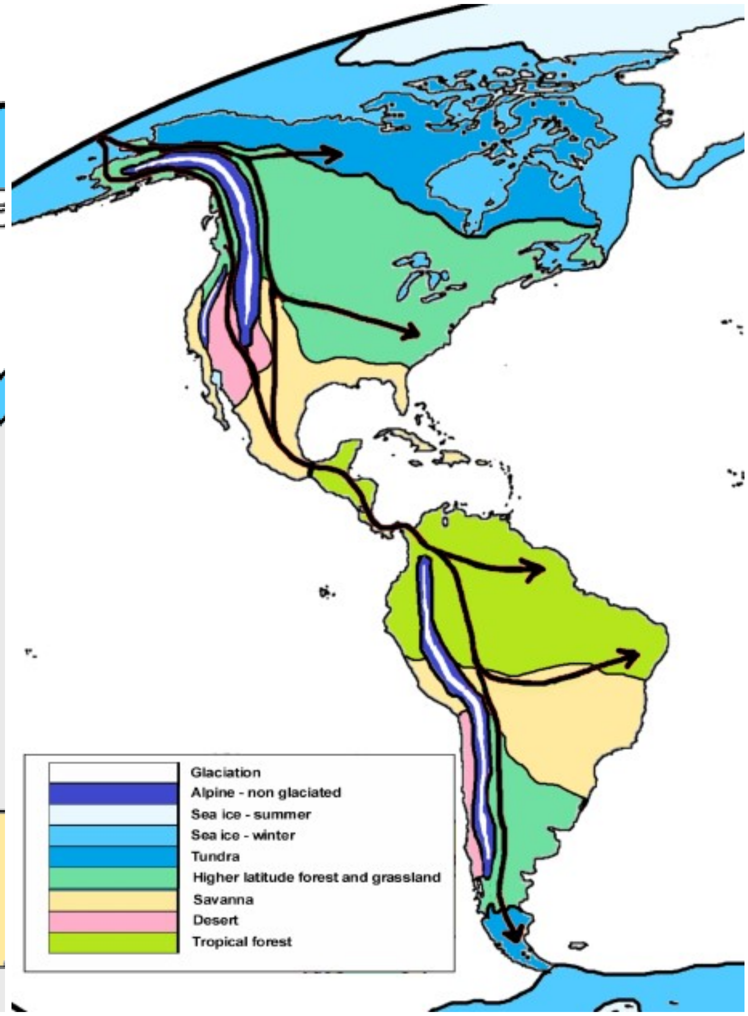
So, Journey Four takes us back southeast to **Australia,** the Mungo Wilderness, where Aborigine footprints are dated at 40,000 years. The first question is did the Native Australians evolve locally? The DNA evidence says otherwise. They seem to lack the Asian features. Assumptions are that they reached Australia via the southern route through India. They may have been the first of the migration and so retained something of their original features. But how did they cross large stretches of sea. Experiments were carried out successfully with large balsa wood rafts, but the Arafura Sea would have been a big challenge. But it is relatively shallow and Alice comes up with a solution. During glaciations the sea was up to 100 metres (?) lower. So the sea



journey would be shorter. But the amount of sea level fall of 100 metres does seem a little excessive.

And so our final journey takes us to the **Americas.** And we have to cross the Bering Strait from Siberia to Alaska. Ideas about the route are complex. I am presenting two maps. The one on the left shows North America during a glacial stage, while the map on the right shows the Americas during an inter-glacial. How the immigrants would have coped with the ice is complex. Food supplies could be a problem. An ice-bound landscape





would not support any game. Yet the Bering Straight seems to be the only possible route. It has long been thought that Native Americans originated from East Asia and that is still not in doubt but human skulls found at several sites in the two continents show a more complex series of invasions. For instance at Monte Verde, in Chile, s number of skulls show Australian or even African affinities, with none of the East Asian traits. Could, these have come by sea? The idea is roundly rejected—no!, these people came through South Asia, before the ‘Siberian’ evolution and then crossed the Strait into Alaska.

A glacial epoch would lower the sea level and the Strait may have been dry land. There are ideas that the ice may have retreated from the coast. Or that there was a clear road going southward through the ice-field. Such ideas are also mentioned in Native American folk law. And the Asian connection is compelling, and all the time the genetics takes us back to Africa. As Alice says right at the end, “We are all African under the skin”

Note. One might get the impression that we all knew where we were going. But we knew nothing of the world outside our particular settlement. It can’t possibly have been different to what we already knew, surely?. And when we crossed over the Red Sea, or The Gulf, or Sinai. Where next. Why go on? There were 70,000 years of arguments. But it would have been trial and error—and a battle between ‘lets stay here’ and ‘over the next hill or that bend in the river’. It may have been necessity or wanderlust. Leaving behind friends (or enemies) and never seeing them again. Creating a genetics of those who stay and those who emigrate. And generating a legend and folklore of the Traveller and finally a literature of the Journey and the Odyssey.

Autumn Roundup

September 19th

A welcome back and do it yourself evening (See photos). I think I brought in a collection of fossils—micro and miniature. Brian and Anne brought collections of minerals and metamorphic rocks. Tony demonstrated his rock splitter.



September 26th

D is for Dolerite, Dolomite, Diamond, *Dentalium, Discoidea*…..

October 3rd

A change in program. I gave my talk – *Captain Scott, Glossopteris and The Beacon Sandstone*. Brought along some memorabilia – *The Lost Photographs of Captain Scott. Birds of the Antarctic* by E. A Wilson. Also some fossils of *Glossopteris* from South Australia.

October 10th

Specimens from the USA.

October 17th

Another change of program. I brought along my collection of rock thin sections. I set up the microscope but found that the bulb giving transmitted light had expired. Tried all manner of plans to get around the problem but to no real success. Should have brought my video light.

October 24th

20 pictures on a stick. I was ill so you still didn't get to see the gannets !

October 31st

AGM. Our major change was to move to two types of membership. Senior (over 18) and Junior (accompanied under 18). We also had a bring and buy sale

November 7th

E is for *Echinocorys, Epiaster, Entolium*, Epidote

November 14th

Q and A. If the Yucatan impact wiped out the Dinosaurs, did it also do for Ammonites and Belemnites?

November 21st

Gary Woodall gave an interesting talk on Easter Island

November 28th

Alternative collections.—Pottery, coins. tokens, painted miniature models etc

December 5th

Anne to give talk on (the geology of) North Devon

December 12th

End-of-Term Party