Farnham Geological Society

(A Local Group within the Geologists' Association)

Archive

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In August members of the Society had a very enjoyable week's Field Trip to **Shropshire** staying at **Preston Montford Field Centre** just west of Shrewsbury. We were lucky to have **David Cronshaw** as our leader; he had been with us at the Malham Field Trip last year. We hope to have a report in the next issue.
We are indebted to Cath Clemesha for a report on the Czech Republic, to David and Shirley Stephens for a tour of William Smith's stamping ground and to Cyril Dutton for a very interesting article on the Late Cretaceous Extinctions.

We greatly regret to announce the deaths of two former Members of the Society to whom we owe a great debt, **Ron Roberts** and **Marjorie Outlaw.**

John Williams has written the following obituary for Ron Roberts who died on 24th August aged 70 after a long period of illness.

Ron will be remembered by those of us who attended his evening classes at the Geological Museum where he was the Education Officer. He inspired us with his enthusiasm and love of geology and opened the earth for us. He always seemed to have the correct slide or rock sample to illustrate his point. He combined his love of geology with that of the Ancient World and his last talk to the FGS was on Egyptian and Classical building stones and methods. Over the years he has spoken to the Society and has also been Guest Speaker at our Annual Dinner.

Those who have joined him on field trips, either in this country or abroad, have had our eyes opened to practical geology. He will be particularly remembered for being able to fit in the maximum possible in one day. A climb to a viewpoint at the top of a distant hill, which could just be fitted in before nightfall at the end of an arduous day, was his specialty. An early long distance trip, remembered by the participants, was by overnight train to Edinburgh - a day in the field (city) - then return by the overnight train. (Note: non sleepers) Latterly it was by air and ferry to the Aegean for island hopping to view the contrast between the volcanic islands and the crystalline basement.

Nearer at home Ron led building stone walks around London and at one of our local meetings he arrived with freshly taken slides of the building stones of Farnham. On day trips he pioneered the idea of giving a running commentary on the geology as the coach passed by.

He will be a loss both to the FGS and the Natural History Museum Adult Education

Department and especially to field trip participants. We offer Nancy, his widow and their children Fiona and Ian, sympathy at their loss. A donation on behalf of the Society has been sent to the Macmillan Nurses Fund.

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Alan Darling has written this obituary for Marjorie Outlaw who died 7th August 1995.

Marjorie Outlaw will long be remembered by her many friends as one of the supporting pillars of the Farnham Geological Society. Due largely to her exertions, and those of her close colleague Diana Smith, the Society managed to survive, and in the later 1970s to flourish.

Marjorie was born and bred in Clapham, and became one of the star pupils of the Broomwood School for Girls, excelling in Latin and Geography. After leaving school Marjorie kept in touch with her former Latin teacher, with whom she corresponded in Latin prose and verse. Prevented by circumstance from entering a University, she joined the ATS at the outbreak of War and became involved in Radar technology when it was first applied to the control of AA Batteries. Nearly fifty years later she described her early fascination with the technique in vivid detail. The later stages of the War found her in Europe, and she rode on the gun turret of a tank during the triumphal entry of General de Gaulle into Paris.

After the War came marriage and teacher training and the up-bringing of children. Most of us at Farnham will first recall her when she taught Geography at Wispers School for girls at Haslemere. By the early 1970s she had decided that Geography could not be properly taught without an adequate knowledge of Geology, so she began to study Geology, initially via evening classes and later with the Open University and the GA. This ardent pursuit was integrated, very efficiently with her teaching duties, with her work as Secretary of the FGS, and with her household responsibilities. It led successfully to an Open University Degree.

Between 1978 and 1990 we participated with Marjorie in many field trips. One outstanding journey took us to Italy, Sicily and the Aeolian Islands to study volcanoes and to drink the wine. Many later expeditions were to wild and rugged landscapes, when the elation experienced by Marjorie when a stiff climb brought her to a magnificent viewpoint was evident to us all.

After her retirement Marjorie and Robin moved to Taunton where purely by chance Marjorie again made contact with her former Latin teacher who was still alive and well in Somerset. Marjorie kept in touch with her old friends and made many new ones in her changed habitat. Links were established with Bristol University and also with Exeter where she obtained a BA Degree. Another link was with the Devonshire Association which in the Spring of 1994 organised a very successful expedition to the granites and mining areas of the Czech Republic. This gave Marjorie and Robin a good opportunity to fraternise once more with old friends from Farnham. Marjorie then made an arduous geological trip to Norway followed by a gentler visit, with Robin, to New Zealand. This was followed by the onset of her fatal disease which Marjorie faced with characteristic fortitude.

Marjorie because of her dedication, industry and enthusiasm, epitomised all that is best in British amateur geology. It was a great privilege to have known her and our sympathy goes out to her husband Robin (John), her son and her daughter. A donation on behalf of the Society has been sent to the Exeter Kidney Development Fund.

TRIP TO THE CZECH REPUBLIC

12-21 MAY 1994

Six members of the **FGS** were pleased to join the **Devonshire Association** (Geological Section) trip to the Czech Republic, dates above.

The Object of the trip was to compare the geology of the area with that of Southwest England. Our leader from Devon was **Dr Richard Scrivener** of the British Geological Survey in Exeter and our Czech geologist guide was **Josef Tomas** plus local guides at various establishments we visited. Josef is an environmental geologist, a great extrovert with a booming voice, currently married for the fourth time. He was very concerned about the many environmental problems, most of which arose during what is euphemistically called the "Former Regime". He was always good humoured, even when our way to a former church which housed an exhibition of Bohemian garnets was barred by a dug up road, bulldozers and angry workmen. He allowed himself a terse comment that Katerina, the travel agent's courier had assured him she had checked access a few weeks previously. We had to retreat.

We stayed in five different places around the south-west to north-east of the country bordering Germany and Poland. I thought the hotels mostly good; only one did not have en-suite facilities; in two we had to share facilities between two rooms; the beds were very hard and the duvets dense and very hot. Food was tasty and very cheap. A decent evening meal with wine and coffee averaged under £4. The main meal for Czechs is at mid-day, so Josef arranged this each day. A typical meal would be meat, often pork, in a tasty gravy, sliced dumplings and sauerkraut. Desserts either tinned fruit and ice cream or apple strudel, copious amounts of Pilsner lager were offered, particularly at Plzen where we had lunch at the brewery restaurant. However one could have orange drinks.

Language was a problem unless Josef was there to help us. There are lots of accents over the letters which affect the pronunciation of that letter or the previous one. Few people spoke English except in Prague. German is their second language but a lot only spoke Czech. The menus were usually only in Czech although hotels sometimes had them in Czech, German and English. The waiters we encountered mostly spoke only Czech.

The **geology** is quite complicated so I am giving an over-all impression: of mineralisation round granite plutons (as in Dartmoor); metamorphic rocks of Hercynian age; garnets; Permian basalts (as in the Permian Exeter volcanic series); open cast brown coal mining (in a basin equivalent to the Bovey Tracy Basin); **Marianske Lazne** and **KarlovyVary** mineral water spas; **Jachymov** Spa with radioactive treatments; going down a garnet mine and visiting a garnet treatment works where the garnets are separated from placer deposits in which they occur and then sorted by hand for suitability for jewellery, the rest being ground up for abrasives.

From the environmental point of view we witnessed vast tracts of pine forests totally destroyed by acid rain caused by the burning of high-sulphur brown coal which in the past was the only source of power. The open cast brown coal mine itself was an eyesore and for miles around there is devastation. A great deal of work is going on re-seeding and tree planting after landscaping.

I picked up garnet amphibolite, fibrous aragonite, porcellanite, Karlsbad twinned feldspar, large augite crystals, agate amygdales in basalt, apatised peridotite with pyrope garnet and Permian basalt with various minerals in vesicles.

We visited three museums. On was at the garnet mine and specialised in garnetiferous rocks

and minerals from the area. The main one was the **National Museum** at the end of **Wenceslas Square** in **Prague** with it's internationally famous magnificent mineral collection.

The last one and one-half days were spent in Prague sightseeing. Some bought garnet jewellery or Bohemian Crystal. Others attended concerts at the International Music Festival. Most visited the National Museum. All of us met on the last evening in an exclusive little restaurant for a very enjoyable farewell meal.

If you would like to know more you can ask Mary or Alan Darling, Lyn or John Linse, Marybeth Hovenden, or me, Cath Clemesha.

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THE BIRTHPLACE OF ENGLISH GEOLOGY

A GEOLOGICAL EXCURSION SOUTH OF BATH

After the departure of the Farnham Geological Society from **Aust Cliff** on 30 April 1995, we stayed on a few more days in the area and continued our geological interests.

One day we followed much of the itinerary described by **R Bradshaw** in Chapter 13 of Geological Excursions in the Bristol District published by the University of Bath, to localities connected with **William Smith** "the father of English Geology".

We followed the route of the **Somerset Coal Canal** built between 1795 and 1805, near which we found a somewhat overgrown signpost in a hedge stating "William Smith lived here". Beyond was a 17th century house, formerly Rugbourne Manor near **Mearns**, where William Smith had lodged whilst carrying out this survey that he recognised the fundamental truths of stratigraphy from his observations of strata and fossils along the alignment and realised that as he went east the rocks became younger.

We walked round the site of the terminal canal basin at **Paulton** and found portions of Carboniferous fossil trees in the shales of the colliery tip nearby. Then we walked along the line of the canal at **Camerton** which ran alongside two coal-pits. We ate our lunch at the top of the New Pit tip after a stiff climb!

Later we walked alongside a chain of locks at **Combe Hay**, a loop of eight out of twenty-two locks which dropped the canal level by 40 metres. They were very derelict and overgrown but still recognisable. Elsewhere we found the remains of the aqueduct carried on three arches at **Midford** approached over private land after climbing a gate. Nearby a fossil *Trigonia* was found in a road cutting. At **Tucking Mill** we discovered a plaque to William Smith in front of a house where he had lived on several occasions. At **Dunkerton** we saw the Swan Inn, now a private house, where he had stayed whilst working in that area.

The last quarter of a mile of the Somerset Coal Canal has recently been restored, and is where it joins the **Kennet and Avon Canal** at **Dundas Aqueduct** over the **River Avon.** This was a very pleasant spot for an evening stroll before we partook of an evening meal at **The Hope** and **Anchor** in **Midford.**

David and Shirley Stephens

The Late Cretaceous Extinctions

Some Geological and Biological Views

A discussion by Cyril Dutton

***OUR IMAGINATIONS** have rightly been grabbed by the many Late Cretaceous extinctions. We are familiar with the popular concepts of the specialists: volcanism and extraterrestrial impacts. And there are also a number of other theories. But any theory must be acceptable in biological terms as well if it is to be viable.*

Dinosaurs could not adapt

It has been said that the dinosaurs were unable to adapt to a diet of angiosperms (flowering plants). This theory claims that the herbivores perished because of the decline of ferns and cycads. And with them their carnivorous predators. On the surface, that concept sounds possible.

But let us look at this more closely. This theory suggests that the herbivores were either poisoned by the angiosperms, or died of constipation on this new diet. The reason behind this is that angiosperms contain fewer oily substances than do most ferns.

So, let us recall when angiosperms first originated. They certainly did not originate in the Late Cretaceous. They originated much earlier in the Cretaceous, around about 120 Ma -- at least 50 Ma earlier than the extinctions! I am sure you see the difficulty with this theory.

If this theory is correct, the herbivorous dinosaurs should have become extinct long before the closing years of the Late Cretaceous! We know that *Triceratops* and many other herbivorous dinosaurs were numerous right up to the close of the Cretaceous!

In addition, this theory cannot account for the extinction of the marine reptiles at this time. These marine reptiles did not eat angiosperms! The marine reptiles ate fish and cephalopods.

To add another and final twist to the story, not all herbivorous reptiles became extinct. So, surely, the extinction of the dinosaurs cannot be traced to the rise of angiosperms.

And what about mammals?

Another suggestion is that mammals were the bottom line. The initial stages of their diversification, it is true, began in the Late Cretaceous. However, these mammals did not *suddenly* become more numerous nor did they become larger at the end of the Cretaceous. All the Cretaceous mammals were small creatures, none larger than cats. Nor is there any indication they were abundant.

It is known that all the abundant and large terrestrial Cretaceous animals were reptiles. In addition, there were many large and abundant lineages in the seas. Mammals and birds first appeared in the Triassic and Jurassic, respectively. And the reptiles were around since the Carboniferous. So they all had lived together for many millions of years without any major extinction taking place.

It is because the dinosaurs were dominant during the Cretaceous, their extinction has created so much attention. Some have suggested that the reptiles were stricken with various viruses. But it is unlikely that the effect would have been 100%. Nor would it have affected animals so diverse as sauropod dinosaurs and ichthyosaurs.

Reptile life-histories

A more convincing explanation of the extinctions came from a study of reptile life-histories. We know, of course, that some of the reptiles were large. Some exceptionally so. For example, we know a *Camarasaurus* was heavier than the weight of two present-day elephants. We are told that some could have weighed as much as 14 elephants.

African elephants can travel a good 15 km per day in search of food. And it takes about 17 years for them to reach sexual maturity. Moreover, they can live for about 60 years.

How does this compare with a very large sauropod? There are two possibilities: (a) Perhaps they grew extremely slowly and therefore had a very long life-span. Or (b) they could have roamed over a huge area searching for vast quantities of food.

The first option seems more likely. They do not seem to have been well adapted to become long-distance travellers. Nor did they seem able to eat vast quantities of food since the jaws of the *Camarasaurus* were comparatively weak.

So from a biological viewpoint we should go for the first option: that the large reptiles had long life-spans. This is born out by the knowledge that many present-day reptiles enjoy very long life-spans. Naturally, this means a slowness in reaching sexual maturity. The *Sphenodon* of today needs as much as 20 years to reach sexual maturity.

Considering these points, it would seem that sauropods and other dinosaurs could have been well-adapted to their stable environments during the Cretaceous. But any disruption to this stability would have severely affected their juveniles. Thus, the population would take a long time to recover from any losses due to the prolonged growth periods. And we have to remember that the juveniles were unaided by parental feeding before reaching sexual maturity.

During the entire Cretaceous, there would have been a maximum density of population that could have been supported by the plant cover. This would make the dinosaurs especially prone to extinction during any phase of environmental disruption.

Eggs and small mammals

There is yet another popular theory: It is suggested that many small mammals were omnivores, and so attacked the eggs of dinosaurs. But this theory makes no attempt to explain why the eggs of crocodiles and snakes were relatively immune from attack. Nor does the theory make any attempt to explain why this predation on eggs became effective only at the end of the Cretaceous. For millions of years there had been successful coexistence.

Other problems are about food, and parental care and attention. Unlike juvenile mammals and birds which are fed on the milk of their mothers, or on food brought to the nest, this personal care is absent in most reptiles. As a present-day guide, we note that crocodiles start

life eating insects and small crustaceans. The first change in their diet is to fish. Later there is another change to the adult fare of a mixture of mammals, birds, and other reptiles. So it would be reasonable to suppose that the breeding systems of the large Mesozoic reptiles were similar.

There had been a favourable stable environment during most of the Cretaceous which allowed juvenile dinosaurs to feed safely. And they were able to diversify to fill most niches. So it is reasonable for us to suppose that their breeding systems were unsuited to any major environmental disturbance. It would have affected the abundance and diversity of both prey animals and plants suitable for juveniles.

Causes of major disturbances

So what might have caused such a disruption? The specialists have proposed theories to account for this:

One specialist theory is that a supernova exploded just a few light years away from planet Earth. It is suggested that this may have released large quantities of high-energy radiation. And, of course, this would have had a serious effect on organisms which roamed our planet.

But there is no convincing known evidence to support this theory. And it does not even try to explain why birds and mammals escaped this deadly radiation. Surely birds and mammals, with their high metabolic and growth rates, would be highly vulnerable to any such radiation. Looking at the fossil record there is no evidence of any such disruption to these groups.

The element iridium is the basis of yet another theory. A high concentration of this element in the Cretaceous/Tertiary boundary layer has suggested an asteroid impact. It is figured that only an asteroid/Earth collision could produce such a highly disruptive effect.

It would throw up large clouds of dust which would remain in the atmosphere for about 5 years. Such a dust cloud would cut down the amount of sunlight reaching the Earth. In turn, this would drastically reduce the level of photosynthesis and so would seriously disrupt both marine and terrestrial food-chains.

How about impact sites?

Before we began to understand the mechanisms of plate tectonics, some suggested that the Icelandic and Deccan eruptions just had to be caused by asteroid impact.

Now we understand the plausible tectonic explanations of these events, we no longer believe in those theories. But what about the possibility of impacts at other less geologically-spectacular sites? A good place to look for such evidence would be to study a large area of ancient rock with little sedimentary cover. A good example would be the Canadian Shield.

In this large area are many impact sites. Their diameter and dates are well studied and recorded in the literature. Of the 19 sites recorded, only one is of a suitable diameter: the Sudbury structure. It is 100 km in diameter. But it is dated 1 700 Ma. Obviously, that is just a mere 1 635 Ma too long ago!

The only one that is nearest the right date is the Steen River crater (95 Ma), but that has a diameter of only 13·5 km. That is too small and rather too early for our purpose.

But more recently, two sites of a suitable size and age have been discovered. They are both in line with each other and relatively close enough together to have been part of a large group of impacts. They are dated close to the K/T boundary. This gives the impact theory valuable support.

But biologists consider the Late Cretaceous extinctions, which were selective and left some groups unscathed, were due to ***both gradual and catastrophic processes***. Can we identify these?

Conclusions

So what might be these gradual and catastrophic processes? The gradual geological and geographical evolution of our planet is related to plate tectonic processes. These gradual changes cause on-going changes in the climate. And the fact that sea-levels made a huge drop near the end of the Late Cretaceous confirms a plate tectonic cause. The lower sea-levels would have caused far-reaching changes to the climate.

My own view is that it has to be due to the closure of the Tethys Ocean. This was a huge ocean and its length of closure ran from its hinge near Spain right out to Burma! A distance of over 8 000 km.

In terms of mountain-building, we usually remember the dates of maximum uplift. And this certainly applies in the case of both the Alps and the Himalayas. Yet the earliest signs of recorded metamorphism in both areas span the Late Cretaceous and K/T boundary.

This indicates that the deep sediments in the trenches had begun to be metamorphosed -- the first phase of the slow mountain-building process. This would account for the lowering of sea-levels causing radical changes to the climate. Ultimately, many habitats and areas of rich food production would be eliminated.

In conclusion, we have identified the ***gradual*** processes required by the biologists.

In addition, the violent volcanism associated with the many and long subduction zones along the length of the Tethyan closure would have caused a gradual build-up of fine dust in the atmosphere. This accumulation would reduce photosynthesis and affect the food-chain. In terms of environment, it would have gradually caused it to become more unstable.

So far we have accounted for the gradual processes required by the biologists. But what about the needed catastrophic process?

To complete the equation, the ***catastrophic*** element could have been provided by a group of equatorial impacts mentioned above. These suddenly added a tremendous amount of extra atmospheric dust that would have lasted five years.

This shutting out of sunlight must have very seriously disrupted anything that might have been left of the stable environment which the dinosaurs had enjoyed for so long. The strain became unbearable. Their habitats lost; their food-chain broken. They were all run out of suitable food. Not only the juveniles, but the adults also perished!

Written March 1995 by Cyril Dutton 74 Netherby Park Weybridge Surrey KT13 0AQ

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