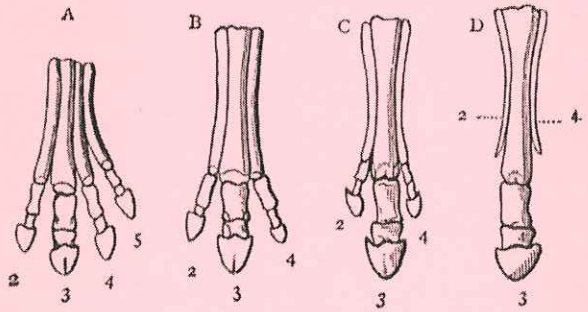
CHARNIA



LEICESTER LITERARY & PHILOSOPHICAL SOCIETY : THE NEWSLETTER OF SECTION C (GEOLOGY)

SUMMER 2002 EDITION

EDITORIAL

The scene portrayed in Brecht's play '***Galileo***' where the eponymous character is shown the instruments of his potential torture by the Pope's Inquisitors, has us believing that this persuaded Galileo to recant. Whether or not the detail in this scene of a play actually happened is open to conjecture. However, Galileo's words are recorded:

> "I Galileo Galilei, aged seventy years, kneeling before your most Eminent and most Reverend Lord Cardinal, Inquisitor General against heretical depravity, wrote and printed a book in which I adduced arguments in favour of the false opinion that the Sun is the centre of the world and immovable. For this cause I have been pronounced by the Holy Office to be vehemently suspected of heresy. Therefore, I abjure, curse and detest the aforesaid errors and heresies."

Recant what? Galileo had studied, researched and published his thoughts and findings on the Copernican System. In so doing, he had fallen foul of the Church and by decree of Pope Paul V was forbidden to have anything more to do with 'Copernicism'. Being what we now call a 'scientist', Galileo disobeyed the Decree and received the carpeting by Paul V's successor, Pope Urban VIII in 1633. Galileo was virtually banished to his villa near Florence for the rest of his days, where he remained under house arrest until his death in 1642. During this time the Church recognised Galileo as a heretic and did not allow his burial in hallowed ground on his demise. This must have hurt, since Urban VIII was a personal friend of Galileo's, being Maffeo Barberini in a former life. Still, Galileo was let off lightly, perhaps because of this friendship, when compared with the fate which befell Giordano Bruno (also a friend of Galileo) who was burnt at the stake. Bruno's crime? He had the temerity to voice the thought that it was likely that our world wasn't the only one in the Universe with life forms as worthy as ourselves.

Why do I mention the above schism in a newsletter concerned with Earth Science? Early in March this year Emmanuel College in Gateshead made headline news when the Head of Science promoted Christian fundamentalist and evangelical views on the subject of 'creation' over and above accepted scientific evidence on this subject. The ensuing row involved the Prime Minister, various MPs, academics, philosophers, Ofsted, the British Humanist Society, the National Secular Society and a host of other worthies defending either science or the absolute authority of doctrine and dogma. One leader of a teachers' union went as far as saying that teaching creationism would spawn bigotry and support for more faith schools. However, Mr. Nigel McQuoid, the Principal of Emmanuel, declined to comment! What was really worrying was that a registered Ofsted Inspector caught up in this brouhaha said. "The way science works is that you set up a hypothesis and test it and see if it is validated … There's absolutely no concrete evidence to prove evolution." I can only assume that this Ofsted Inspector, a Mr. Davidson, had spent most of his life in a deep coalmine - he certainly would not have been a welcome guest in my classroom or lab. However, he would be very welcome at any of our Section C meetings - indeed he and others of a like persuasion should be urged to attend!

Contemporary 'Scientific Method' evolved from methodologies first established by Francis Bacon and Immanuel Kant in the Seventeenth and Eighteenth Centuries. Later refinements came from Hume in the C.18th. and Huxley, Popper and Kuhn in the C.20th. Without enlarging this to the status of an essay on scientific method, all that needs to be stated is that we now have a system whereby observations are first of all described by hypothesis. The hypothesis is then used to make a prediction which is tested through experimentation. The results of these experiments, which must be repeatable and therefore consistent, are used to either confirm the original theory, or are modified until no discrepancies exist between theory and observation.

Since March, this evolution/creationism story has been running and running - especially in my local weekly, the 'Loughborough Echo'. Admittedly, editorial mischief-making has probably been at work, since we've had two months of the letters pages dominated by this theme. Scribblers have written all kinds of nonsense, from completely outdated and uninformed scriptural sources to (at best) only half-informed 'scientific' sources. Many writers have raised 'the survival of the fittest' as their fundamentalist argument for their concept of God-given human decency. These writers have completely missed the point that it is *reproductive* fitness which determines the biological success of an organism, whether it be a virus or a large mammal. Brute strength had nothing to do with Darwin's hypothesis. One writer even stated 'Evolutionists rarely live according to what they believe; most I have met are decent, kind people.' What can I say? Being educated and erudite people they could be nothing else! This, of course is why the Lit & Phil exists - to enlighten absolutely anyone by bringing together 'town and gown'.

It is early three hundred and seventy years since Galileo stood accused of heresy. Today, a new kind of the same persecution is taking place. An organisation calling itself 'Creation Research' is typical of the 'young Earth' creationist movement, which believes, among other things, that the Earth is only a few thousand years old. The Director of this organisation has stated that people have been "indoctrinated with evolutionary humanism, with ape-men,

and billions of years of change which denies creation, the Bible and Christ." It is refreshing to know that the Catholic and Anglican Churches accept evolution. Shortly after the Emmanuel College matter was reported, the Bishop of Oxford stated that 'young creationists' were bringing Christianity into disrepute.

Just to finish off this depressingly sad saga, here are a few of the letter-headings from my local paper: 'Evolution Theory Cannot Be Proved', 'Science Of Evolution Is Faith Based', 'Evolution Is A Fiction That Can Never Be Satisfactorily Proved', 'Lack Of Proof', 'Evolution Rubbish' and 'Why Darwin Regretted Expressing His Theory'. The best one so far has to be 'HOLES IN EVOLUTIONISTS' ARGUMENT - No proof that we come from chimpanzees'. Who could possibly disagree with that, eh?

Now then, just before I dash off to a Flat Earth Society meeting, see if you can guess who said this:

"New knowledge has lead to the recognition that the theory of evolution is more than a hypothesis. It is indeed remarkable that this theory has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge. The convergence, neither sought nor fabricated, are the results of work that was conducted independently, is in itself a significant argument in favour of this theory."

To lighten-up a little, I recommend the following two titles, which go a long way in pulling the rug from under anti-evolutionary thinking. One is 'The Seven Daughters of Eve' by Bryan Sykes, Professor of Human Genetics at Oxford (Bantam Press, ISBN 0-593-04757-5). This book reveals how human ancestry has been revealed through new biochemical techniques. One piece of evidence from this research proved Thor Heyerdahl's 'Kon-Tiki' hypothesis to be incorrect. A rather sad epitaph for a great explorer and archaeologist. Syke's book describes in a very readable way how the lab investigations are carried out and how the various techniques work - a lot of the early work was pioneered by Professor Sir Alec Jeffreys, working in the basement of the Adrian Building here at Leicester University, next door to where we have our Section C meetings. The second title is 'The Molecule Hunt' (Allan Lane/Penguin, ISBN 0-713-99423-1) by Martin Jones, a Cambridge man who began as an archaeologist and became a biochemist. This book is about the search for ancient DNA and other biomolecules. I recommend reading Sykes' book first, before settling down with 'The Molecule Hunt'. I think both titles will have an appeal to Section C members, if interest in our now regular Winter Season hominid talk is anything to go by. You will almost certainly be interested to know that next year's Saturday School will focus on Hominid evolution. Make sure that Saturday, March 1st., 2003 is booked for Vaughan College!

The above quote was made by Pope John Paul II, previously Karol Wojtyla.

GS

Insurance and the Section

Your Committee has reassessed our insurance cover for field work in the light of the need to renew our policy. The Section will only hold **Public Liability insurance cover** – in a nutshell this will protect us from claims from public bodies (like quarry owners, the National Trust, councils, etc) for damage caused by our members to their works, equipment or infrastructure. Whilst it would be very nice also to have third party accident cover for members, the cost of this is prohibitive. Thus, **we strongly recommend that all participants in Section events and field trips take out their own personal and third party accident cover**. All members and guests enter quarries and other dangerous areas **absolutely at their own risk**.

All participants in the Section's excursions and field visits **must strictly abide** by the following health and safety rules:

1. **Hard hats** and **high visibility vests** must be worn at all times in quarries and in the vicinity of other potentially dangerous places such as natural cliffs, roadside cuttings, etc.
2. **Stout footwear** and **warm/waterproof/protective clothing** must also be worn as appropriate. The latter should include **safety goggles, gloves**, etc., as necessary.
3. At all times **follow the instructions and advice of the leader**(s) or other **persons in authority** whilst on Section visits.
4. **Do not** climb on or work under unstable or steep rock faces.
5. **Do not** hammer unstable faces or cliffs, or undertake hammering in dangerous proximity to others, or from positions above others working below.
6. **Do not** enter areas of restricted or forbidden access within quarries, mines or other places the Section may visit.

7. **Unaccompanied minors** are not allowed on Section field visits; and in general, the Section can accept no responsibility for minors on its field excursions.

Before each field visit each participant will sign a form agreeing to abide by points 1-7 above, and absolving the Section and the leader(s) from any responsibility for personal injury incurred while taking part in that visit.

The "Section" referred to above is, of course, Section C (Geology) of the Leicester Literary and Philosophical Society.

We are having to take these steps to protect ourselves as far as it is possible from claims of negligence, as I am sure you will all understand.

Andrew Swift, Chairman, Section C

Programme of indoor meetings 2002/2003

All held at 7.30pm in Lecture Theatre 10 (LT10) in the Geology Department, Leicester University, except where stated

2002

Wednesday October 9th
Derek Pullan (Department of Physics & Astronomy, University of Leicester) - '*In-situ* analysis of the Martian surface with Beagle 2'

Wednesday October 23rd
Professor David Keen (Centre for Quaternary Science, School of Natural & Environmental Science, University of Coventry) - Title TBA. Theme: The Quaternary of the Midlands

Wednesday November 6th
Dr Bill Murphy (School of Earth Sciences, University of Leeds) - 'Earthquake-triggered landslides'

Wednesday November 20th
Speaker and title TBA

Wednesday December 4th
Professor Mike T. Lovell (Department of Geology, University of Leicester) - Title TBA

Wednesday December 18th
Christmas meeting, to be held at the **New Walk Museum**

2003

Wednesday January 15th
Dr Peter E. Long (ex-Department of Biology, University of Leicester) - 'When did the winkles come? Pre-Ice Age life in and around the southern North Sea'

Wednesday January 29th
Dr Rob A. Ixer (School of Earth Sciences, University of Birmingham) - 'Bronze Age mining under the (ore) microscope'

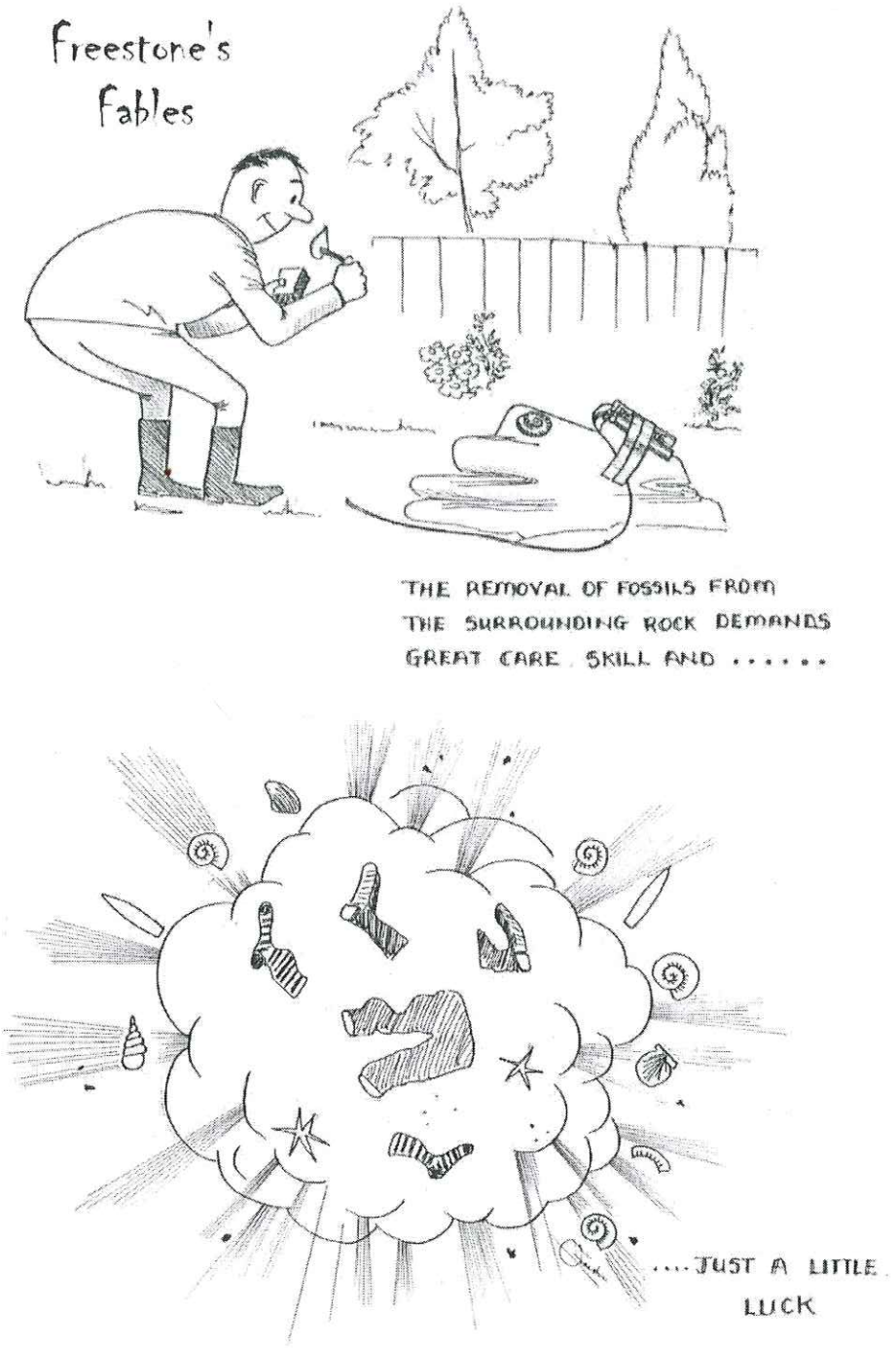
Wednesday February 12th
Members evening, to be held at the **New Walk Museum**

Wednesday February 26th
Dr Neville Hollingworth (NERC, Swindon) - 'Hunting mammoths in a Co-op creamery'

Saturday March 1st (whole day)
Saturday School, **Vaughan College**. 9.30 am - 5.00 pm. 'Climate and human evolution'. Seven leading experts in hominid studies including Professor Chris Stringer and Dr Rob Foley will talk on the role of climate in determining the success or failure of prehistoric human lineages.

Wednesday March 12th
Speaker and title TBA

Wednesday March 26th
AGM and Chairman's Address - Andrew Swift (Department of Geology, University of Leicester) - Title TBA



From the Archives

Our field meetings seem to be organised a little differently today! I cannot locate the map and sketch mentioned on the flier.

LEICESTER LITERARY & PHILOSOPHICAL SOCIETY.

Section "C" for Geology.

President—Dr. F. W. Rudler.
Hon. Secretary and Treasurer—E. Masters, B.Sc., Rock Mount, Hinckley Road.
Hon. Excursion Secretary—L. E. Lowe, The Museum.

Summer Session, 1910.

Fourth Excursion—Saturday, July 2nd,

ENDERBY AND NARBOROUGH.

Conductor Mr. W. KEAY, A.M. Inst. C.E.

PROGRAMME.

P.M.

2-0 Cycle or leave Leicester by brake from the "Globe" Hotel, Slater Street, or the "Hare and Pheasant," 85 High Street. Fare 4d.

2-45. Meet at Enderby Church.

3-0. Arrive at Enderby main quarry. Examine spheroidal and granular weathering of syenite. Junction of chalky boulder clay on west side with syenitic cliff. Relation of Charnwood area with Enderby. (See map.)

4-0. Arrive at Enderby old quarry, Coal-pit Lane. Interesting relations between Keuper marl and syenite and syenite and slate. (See sketch.) Characteristic horizontal surface of syenite.

4-30. Arrive at Brickyard, Forest Lane, Narborough. Glacial drift (reconstructed Keuper marl) with unusual quantity of erratics.

5-0. Arrive Narborough Inn. Tea 1/- per head.

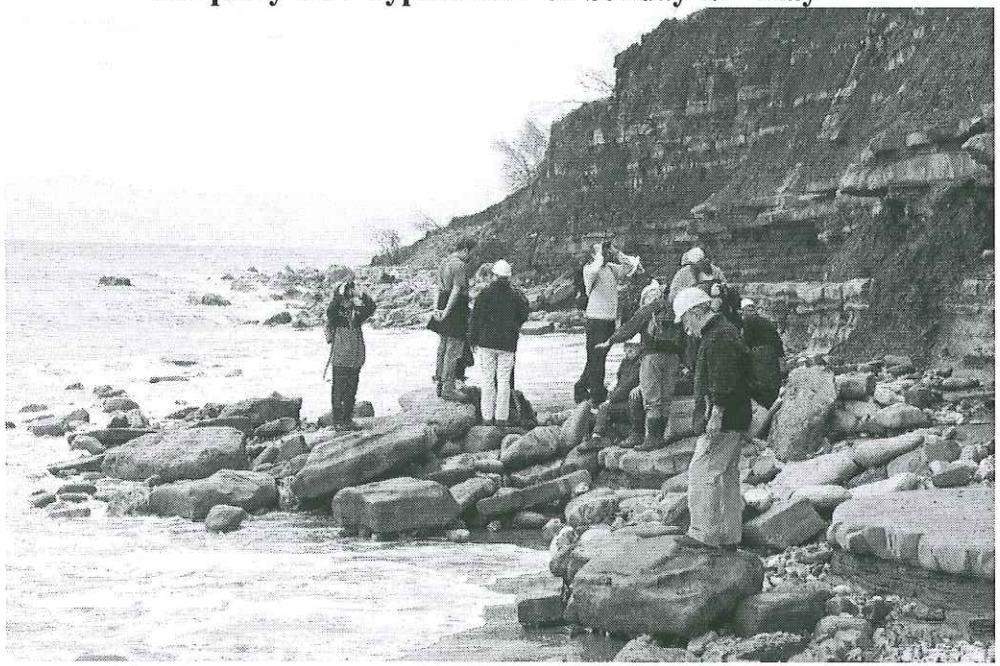
6-0. Arrive Red Hill quarry. Syenite and drift.
Return trains from Narborough, 5-55 p.m., 6-20 p.m. and 7-25 p.m.

Members are particularly requested to inform the Excursion Secretary of their intention to join this excursion, NOT LATER THAN WEDNESDAY, JUNE 29th, 1910.

Paul Monk

Weekend excursion to the Dorset Coast, May 17th-19th, 2002

The party near Eype Mouth on Sunday 19th May



Waiting for the tide to let us through, Chippel Bay, Lyme Regis

Two views of 'Dinosaur Island' (aka the Isle of Wight)

Near Hanover Point looking to the Chalk cliffs near Freshwater Bay

The crumbling cliffs near Blackgang Chine looking NW along the coast

PALAEOBARF

By David M. Martill

Not exactly the sort of title that you would expect in a respected scientific journal, with a history spanning more than 150 years. But barf, or vomit for those of you with less *street cred*, has been very much in the palaeontological news lately. Why? Well, because at a recent meeting of the Palaeontological Association held, somewhat surprisingly in Copenhagen, Professor Peter Doyle and his student Jason Wood of the University of Greenwich announced to the world that they had discovered an entire bed produced by vomiting ichthyosaurs. Well, they didn't actually say that, but that is how the media reported it. The idea was the novel explanation for an unusual accumulation of belemnites in a shell bed in the Peterborough Member of the Oxford Clay of Peterborough. So startling was this discovery that it was reported in the national press and no lesser a medium than BBC Radio 4.

The Oxford Clay, as most geologists are aware, is a highly fossiliferous unit of mudstones that, in the past, has been extremely important in the large-scale mass production of bricks. It forms an extensive, almost continuous low lying outcrop from Weymouth to Scarborough, though bricks are only manufactured at a few places, largely determined where the railway lines from London to the north of England cross the outcrop. The lower part of the formation is particularly famous for spectacular fossils of marine reptiles, rarer dinosaurs and fishes, including giants such as the more than twenty metre long ***Leedsichthys***. The formation also yields huge numbers of invertebrates, including ammonites preserved in white aragonite, often with mother-of-pearl iridescence, large belemnites belonging to the genus ***Cylindroteuthis***, of which more below, and a goodly number of bivalves, snails and shrimpy things.

A complex food web must have been present, and although it appears to have been dominated by top-level carnivores (there were at least five species of sympatric pliosaurs) there were presumably a good number of specialised feeding strategies. ***Leedsichthys*** for example, despite its massive size, lacked teeth in the jaws and is considered to have been a giant planktivore, at least as an adult, while the five metre long ichthyosaur ***Ophthalmosaurus*** is thought to have fed almost exclusively on cephalopods. And here is where we come to the vomit, or almost. Cephalopods were in super abundance in the Oxford Clay Sea. Any bedding plane in the basal monster- yielding beds of the Peterborough Member will yield up thousands of ammonites belonging to the genus ***Kosmoceras***. Some layers are plastered with them, and yet their delicate shells are in excellent condition suggesting little or no reworking to form the concentration. Belemnites too were abundant as were a number of squid-like cephalopods that lacked hard shells externally or internally.

Ophthalmosaurus, as a fairly large ichthyosaur with a presumed high energy budget… (its streamlined shape suggests fast swimming) must have needed a reasonable amount of food to sustain itself. There was no shortage of food; but of all the food on the table, what was its preference? The eyes of ***Ophthalmosaurus*** … the name means eyed reptile, are/were among the largest of any vertebrate animal (ever). Large eyes were either for acute vision for chasing fast prey or, for finding food in the dark. We can invoke both lines of thought for ***Ophthalmosaurus***. It lived in a sea where mud deposition was dominant and therefore at times the water would have been murky. Similarly, the TOC (total organic carbon) content of the basal Oxford Clay can reach more than 10%, which suggests that productivity in the water column was high. Again, this would lead to slightly murky water rather than crystal clear water. The Oxford Clay Sea was also quite deep. I say quite because it is difficult to put an absolute figure in the water depth. The bottom was stirred by the biggest tempests that came through every few thousand years, but it was not stirred by the normal monsoonal storms that the European archipelago would have witnessed at its position just north of the tropics. Thus a water depth in excess of 100 metres is envisaged, and at that depth there is very little light. Even less so if the water was murky with mud or plankton, or both.

Ophthalmosaurus was beautifully streamlined. It had a dolphin-shaped body, with a very elongate snout. The forelimbs formed part of the engine. A massively constructed shoulder girdle with large areas for muscle attachment suggest strong, sustained action of the fore flippers to propel the animal through the water. Similarly, a powerful forked tail, though here it is more like that of a tuna than a dolphin in that it was held vertically, could also have provided thrust. So, a twin-engined pursuit predatory life style is envisaged for ***Ophthalmosaurus***.

The diet of ichthyosaurs is well known in Lower Jurassic forms. Some specimens have been found with stomachs full of the hooklets from squids. These hooklets are highly resistant organic structures that the ichthyosaur was unable to digest. It is thought that they accumulated over time and may have been periodically ejected, though it has also been suggested that they may have accumulated very slowly over a long period and never ejected, rather, a

large accumulation may have been detrimental. Thus one argument would have that hookleted squid-like animals were the main diet, while the other would suggest that they were a rare, and rather dangerous food to eat.

In any case, there is good evidence that ichthyosaurs ate squids, and squids were abundant, fast moving prey. Belemnites on the other hand were not squids in the strict sense, but they did represent an important source of food. Did ichthyosaurs eat belemnites? Some would say yes. There are specimens of belemnites from the Posidonia Shale (Lower Jurassic, Germany) that reputedly have tentacles with hooklets preserved. However, very similar hooklets preserved in the Oxford Clay of Christian Malford, Wiltshire, do not have belemnite guards associated with them, and to the best of my knowledge, no belemnite guard in England has ever been found associated with hooklets. Thus, the presence of hooklets on the belemnite animal remains an unsolved problem. So, is there any direct evidence that ***Ophthalmosaurus*** ate belemnites? The answer must be 'no'. What about indirect evidence? This is dodgy, but there is circumstantial evidence. The jaws of ***Ophthalmosaurus*** are long and slender. Many specimens have been found to lack teeth, or have just a few small teeth deep in the tooth groove towards the anterior end. These teeth would have been ineffectual as they did not project beyond the groove. Thus, ***Ophthalmosaurus*** would have not been able to cope with strong, wriggling, slippery prey unless it killed it with one bite. But the jaws of ***Ophthalmosaurus*** did come together with a tight closure and this, with its powerful musculature would have meant instant death (by crushing) of anything that it did bite onto, provided it was soft. Squids certainly were soft, but belemnites were only soft at one end. Biting a belemnite may have proved painful if bitten at the rear where the guard was situated, but a well-directed bite in the middle would have cleanly severed the guard from the rest of the animal, especially if it was given a little shake. The guards of ***Cylindroteuthis*** commonly reach a length of more than 250 millimetres and the phragmacone can extend beyond that for another 100 millimetres. Thus, the entire animal may have had a length of around half of one metre, a considerable meal even without the guard portion.

Although it is possible to find belemenites in the Oxford Clay in which the phragmacone is intact, it is much more common to find isolated guards with only the portion of the phragmacone within the alveolus preserved. So where is the missing part of the phragmacone? This mystery is not a consequence of the fossilisation process. The phragmacone of the belemnite animal was composed of aragonite, which is very well preserved in the Oxford Clay. Equally, although the phragmacone is a delicate thin-shelled structure, so too are the lappets of male kosmoceratid ammonites, and these are commonly preserved in the shales. More likely the phragmacones were been bitten off, the belemnites were deguarded and the guard was discarded. And if this makes sense, the culprit could have been ***Ophthalmosaurus***. Why? Because ***Ophthalmosaurus*** had the wherewithal, and because scratch marks and grooves on the biting surface of the jaws of a well preserved specimen found in the Oxford Clay of Milton Keynes could have resulted from such bites. Not very good evidence I admit, but something was feeding on belemnites in the Oxford Clay Sea and ***Ophthalmosaurus*** is a prime candidate. Other marine reptiles, and indeed some of the larger and toothier fishes such as ***Hypsocormus*** and ***Osteorachis***, might also have feasted on them, but there is another line of argument to support ***Ophthalmosaurus*** as the main predator of belemnites.

The guard of belemnites is and was heavy. It is composed of solid calcite that grew by accretion and a cross-section shows regular, concentric growth lines that become more dense towards the periphery. It was not exposed in life and would have been covered by a part of the mantle. So why did belemnites have such a large and heavy guard? Buoyancy was regulated by the phragmacone, and so movement up and down in the water column was possible. One argument suggests that the guard acted as a counter weight that kept the animal horizontal. The phragmacone was situated toward the rear of the animal, so without a counter weight the belemnite animal would have hung tentacle (if it had tentacles) down. This is an attitude that may have worked, but if the belemnite animal was also a streamlined pursuit predator ... as many squid are, such an attitude would have been improbable. This is a simplistic argument, and for that reason alone has a lot going for it. But hang on. What happened when the belemnite animal had a stomach full of food? Did it sit at an angle in the water column, or was it able to move the guard to compensate for the offset in balance? Or, was the guard less to do with balancing the animal and more to do with ballast to keep it near the bottom?

Many aquatic vertebrates possess dense bone that provides them with neutral or negative buoyancy. Perhaps the most famous are the manatees and dugongs. These beautiful aquatic vegetarians graze on sea grasses, but being air breathers have to return to the surface periodically for a breath of fresh air. Thus, they have a lung full of air, which, with their fat reserves, makes them rather buoyant. To overcome this, some of their bones are very dense, a condition known as pachyostosis. This makes them negatively buoyant and allows them to feed on the bottom without having to exert too much energy to stay down there. Perhaps the guard of belemnites served a similar role. Rather

than being a counter weight, it may have functioned as ballast, or both. Thus belemnites may have been bottom dwellers rather than midwater swimmers. If so, then they lived in dark and dingy water. But this would not bother the ophthalmosaurs. With their big eyes they would have been well able to see the belemnite animals in their murky world. So, by a series of logical, but totally unsubstantiated steps it seems that ***Ophthalmosaurus*** was a deep diving ichthyosaur that habitually fed on belemnites that lived toward the bottom of the Oxford Clay Sea weighed down by their massive calcitic guards. The only truly supporting evidence for the deep life style comes from stable isotope studies of the belemnite guard which suggest that they inhabited cooler waters. Cooler waters might equate with bottom waters, provided that the Oxford Clay Sea was thermally stratified.

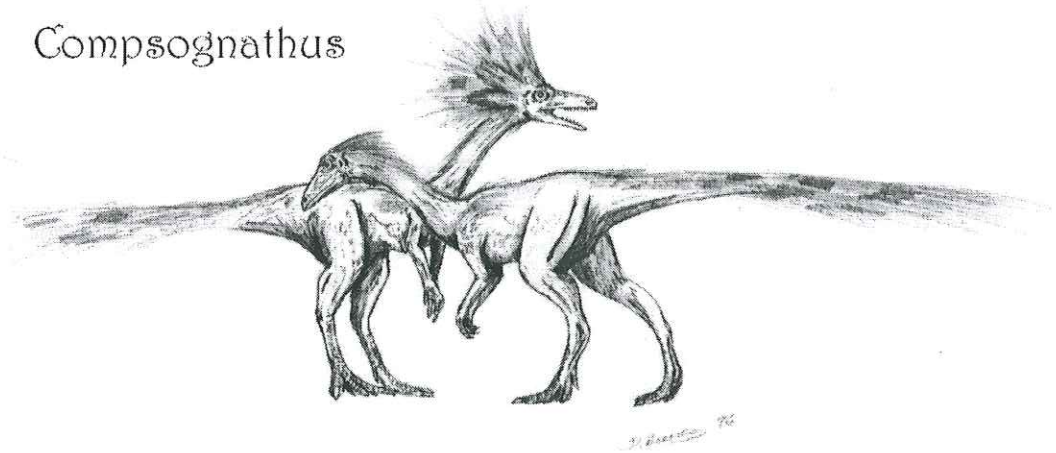
And now we get to the vomit, well almost. The alveolar border of the belemnite guard tapers to a thin edge which easily was broken when the ichthyosaurs, if it indeed it was they, bit off the guards. Broken alveolar margins are common for Oxford Clay belemnites. Usually the anterior part of any belemnite found in mudstone is crushed due to compaction, but this can be reconstructed from all the pieces, and re-assembly should prove the margin to be entire if the animal died a peaceful death and merely sank to the bottom. Such specimens occur, though they are rare, and they have their phragmacone preserved. But those that lack a phragmacone also have damaged alveolar margins, showing that the guard was brutally detached from the rest of the animal. This suggests that detached fragments from the guard may have been swallowed by the predator along with the meaty bits. These alveolar fragments would have been remarkably thin, and quite likely dissolved in the gut acids of the animal. But what if an ichthyosaur, or any other marine reptile or fish, were to swallow all of the guard? This would surely have caused painful indigestion. In the case of one hybodont shark from the Posidonia Shale of Holzmaden in Germany this is an understatement indeed, as the shark in question in fact swallowed many tens of belemnites, guard and all, and died as a consequence. The guards are clearly visible in its stomach. For any air breathing animals a surfeit of guards could pose severe problems for returning to the surface for a breath of fresh air. Could guards that were swallowed accidentally have been regurgitated? This is the conclusion reached by Peter Doyle and Jason Wood who, on discovering abundant belemnite guards in a shell bed in the Oxford Clay that have etched surfaces, surmised that they had been partly dissolved by gastric juices and then regurgitated as unwanted ballast. I like the idea and I like it a lot; for one reason alone. Many years ago I found part of the body of a marine crocodile in the Oxford Clay at Dogsthorpe near Peterborough. And in the region of the rib cage were numerous hooklets and a fragment of the alveolar region of a belemnite guard that had a characteristic etching. The crocodile was ***Metriorhynchus***, and perhaps it was this animal after all, and not ***Ophthalmosaurus*** that was adept at nibbling belemnites. Regardless, this was evidence, of a kind, that belemnite guards became etched if they entered the guts of marine reptiles. No surprise there! And of course, such remains, especially the larger chunks or entire guards, would be better regurgitated than allowed to pass pointy end first on a tortuous journey through a rather delicate intestine. But in Doyle's and Wood's shell bed most of the belemnite guards are etched. Could the bed be a regurgitate horizon? Probably not. The bed in question is so-called Bed 13. A very thin (say 20-30 mm) shell bed that weathers orange because of a high iron pyrite content. It is enriched in coprolites (= fossil poo), slightly etched otoliths (the ear stones of fishes) and highly weathered pieces of wood, broken bivalves and ammonites, and a surprisingly high number of microscopic sharks teeth and dermal denticles. No other shell bed in the Oxford Clay has these characteristics and so its genesis is clearly distinct. It lies at a zonal boundary, between the jason and coronatum ammonite zones and there is quite likely a considerable time interval at this level. One feature about the bed is the very poor preservation of ammonites and the presence of large fragments of the zonal ammonite ***Erymnoceras coronatum*** that are also heavily etched. There are also some bizarre, hatchet-shaped pieces of pyrite that, even in fresh examples of the bed, are weathered black, and rarely have an encrusting serpulid worm on their surface. For a long time the origin of these unusual pyrite pieces had people baffled. The best explanation that I can offer is that they are geopetal infills of large nautiloid phragmacone chambers. This idea would explain their slightly flattened face, their gently convex face and their taper from broad to narrow. Arguments against this explanation are the rarity of large nautiloids in the Oxford Clay. I have only ever found small specimens of around 100 millimetres diameter. But if this interpretation is correct, or nearly correct, then an explanation is required. For the pyrite 'hatchets' to be loosely distributed within the shell bed a nautiloid must have been broken up and the pyrite infills scattered.

Originally the nautiloid must have been buried in the zone of sulphate reduction; for that is where pyrite forms, and then been reworked (by a storm or benthic current). Such reworking would also rework every other fossil in the sedimentary pile and generate a shell bed. Depending on the conditions prevailing at the time, those reworked fossils could have been undergoing

dissolution due to low pH levels of the pore waters in the sediment. Such conditions are commonplace and are responsible for the removal of many shelly fossils. While it might not take long to dissolve a thin-shelled aragonitic bivalve or ammonite, a big robust calcitic bivalve would take a longer time…and it would be no surprise if this dissolution process was not interrupted from time to time by reworking. If the conditions that prevailed after reworking were less hostile (i.e. non-acidic) then the half-etched belemnites would be preserved. And this is my explanation for the abundance of etched belemenites in Bed 13 of the Peterborough Member of the Oxford Clay. Of course, there must be a few in there that were puked up by ichthyosaurs, but quite how you distinguish them from the majority is beyond me.

But by way of an epilogue, don't be too disappointed to learn that there is not a fossil barf horizon in the Oxford Clay, for Russian palaeontologists Fiodorov and Nessov have described regurgitates from velociraptorine dinosaurs in the Lower Creatceous of Russia. So fossil puke does exist after all, as does fossil poo in the form of coprolites. To the best of my knowledge, evidence for fossil wee has yet to be reported for certain. Should you know of an example of urates from the Urals, or pisolites of peculiar origin, then my slightly sordid mind would like to learn of them.

David M. Martill, School of Earth and Environmental Sciences, University of Portsmouth, Portsmouth, PO1 3QL.



Summer Programme 2002

Sunday June 23rd
Lower Jurassic of Blockley Quarry, near Moreton-in-Marsh
Leaders: Dr Mike Howe (BGS) and Pete Blake

Saturday July 13th
Chalk of South Ferriby Quarry, plus a tour of the cement works or another locality in North Lincolnshire.
Leader: Steve Thompson (Scunthorpe Museum)

Saturday August 3rd
Upper Triassic and Lower Jurassic of Long Itchington (Southam) Quarry, near Rugby
Leader: Andrew Swift (Geology Department, Leicester University)

Sunday in late August/mid September
Derbyshire. Details and leader to be announced

Saturday September 28th
Warwick Museum and local exposures, possibly Edge Hill quarries.
Host/Leader: Dr Jon Radley (Warwick Museum)

LEICESTER LIT & PHIL SOCIETY SECT C GEOLOGY

STATEMENT OF ACCOUNTS 27TH MARCH 2002

Receipts	2001-02	2000-01	Expenditure	2001-02	2000-01
Cash in hand . 4.87			Photocopies	31.15	1.20
B.S.Balance 645.58	650.45	510.30	Insurance	104.12	99.16
B.S. Interest	8.53	9.26	Stationery	3.35	4.42
Subscriptions	513.00	556.00	Postage	23.82	51.42
P'ment for Field Trip	40.00 ..	20.00	Repayment Field Trip	40.00	20.00
Sale of coffee	37.55	34.79	Speakers' expenses	326.07	246.10
Donation	70.00		W/e Leaders' expenses	100.00	
			Charnia & printing	194.46	57.60
			B.S. Balance 482.74		
			Cash in Hand 113.82	596.56	630.45
	1319.53	1130.35		1319.53	1130.35

M. Taylor
25. 3. 02

Leicester Literary and Philosophical Society

Geology Section (C)

Officers and Committee 2002/2003

Life President: Bob King,
The Oak,
Longdon.
TEWKESBURY.
Glos GL20 5SE

Life Vice-President: Trevor Ford OBE,
21 Elizabeth Drive,
Oadby.
LEICESTER LE2 4RD
0116 2715265

Chairman: Andrew Swift,
208 Milligan Road,
Aylestone.
LEICESTER LE2 8FD
0116 2523646 or 0116 2833127
e-mail: swifta51@hotmail.com

Vice-Chairman: Mark Evans,
Leicester Museum and Art Gallery,
New Walk,
LEICESTER LE1 6TD
0116 2473081
e-mail: evanm003@leicester.gov.uk

Secretary: Joanne E. Norris,
208 Milligan Road,
Aylestone.
LEICESTER LE2 8FD
0116 2833127 (after 6pm)
e-mail: norris_joanne@hotmail.com

Treasurer: Doug Lazenbury,
39 Station Road,
Countesthorpe.
LEICESTER LE8 5TA
0116 2776407

Field Secretary: Dennis Gamble,
43 Somerset Avenue,
LEICESTER LE4 0JY
0794 7725361

'Charnia' Editor: Graham Stocks,
63 Barrow Road,
QUORN.
Leics LE12 8DH
01509 415186
e-mail: graham.stocks@lineone.net

Publicity Officer: Vacant

Student representative: Ben D. Ennis,
34 Knighton Drive,
Stoneygate.
LEICESTER LE2 3HB
0870 0152594
e-mail: bde1@le.ac.uk

Committee: Mark Purnell,
Department of Geology,
University of Leicester,
University Road,
LEICESTER LE1 7RH
0116 2523645
e-mail: map2@le.ac.uk

Keith Smithson,
36 Coverside Road,
Great Glen.
LEICESTER LE8 9EA
0116 2592611
e-mail: keith@webleicester.co.uk

Andy Saunders,
Department of Geology,
University of Leicester,
University Road,
LEICESTER LE1 7RH
0116 2523923
e-mail: ads@le.ac.uk

Roy Clements,
Department of Geology,
University of Leicester,
University Road,
LEICESTER LE1 7RH
0116 2523800
e-mail: rgc@Leicester.ac.uk

Co-opted: Margaret East,
36 Brambling Way,
Oadby.
LEICESTER LE2 5PA
0116 2716252

Paul Monk,
2 Rennes Close,
ASHBY-DE-LA-ZOUCH.
Leics LE65 2YD
01530 411563
e-mail: paul.monk@virgin.net

Dennis McVey,
130 Carisbrooke Road,
Knighton.
LEICESTER LE2 3PE