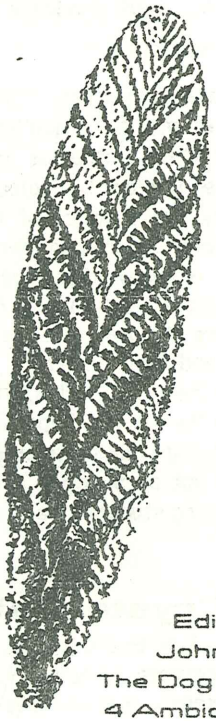
Newsletter of the
Leicester
Literary and Philosophical Society
Section C
Geology

Summer
1991

Charnia



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A New Venture

This first issue of the newsletter is unashamedly a selling tool. Over the past couple of years the committee has been wondering what it has been doing wrong - why the attendances at both lectures and field meetings have been in some cases minimal, and why, despite the general increase in interest in Earth Sciences in general and Geology in particular, this has been happening. Had the time come to shut up shop?

Some of us think not, and we are attempting to revitalise your society, which can lay claim to being one of the oldest geological societies in existence. This newsletter, incidentally, is planned for issue quarterly - if we get your support.

So now it is your chance to tell us, whether you are a regular attender at either lectures or field meetings or not what we are doing wrong and stop it, what we are doing right and how to capitalise on this aspect of the work. If you don't attend meetings we'd like to know why. So please complete the enclosed questionnaire and return it in the stamped addressed envelope provided.

The diary details eleven field trips and two residential weekends. There must be something here to suit you.

In this issue:

and introducing:

and

on the back page

Editorial

Newsletters, especially new newsletters, are sometimes waited for with bated breath by their intended recipients. However, this is an exception, as the majority of members in the society didn't know that there was one on the cards. A couple on months ago neither did the committee, old or new, or even the editor! It has been put together with the co-operation of various people who have presented articles for inclusion, and includes a questionnaire, the replies of which we need to test our own thoughts. However, this is adequately covered elsewhere in the Chairman's article. In fact, being unexpected, most of you won't know that its late!

Given good response it is intended that the newsletter be issued quarterly, and being a society of original thought and action, there will be Spring, Summer, Autumn and Winter issues, coming out in March, June, September and January respectively. So it could be said that this year's summer issue is actually a little early!

What is included in future newsletters is up to you. Certainly reports of field trips and lectures will feature, which means volunteers (in the Army sense) to write up some notes on these ventures and submit them for publication. The style of article is entirely your own, and the sole reward for your hard work is seeing it in print.

Rocks and Trips

"Them is the best geologists that 'as seen the most rocks" is a well known battle cry. Geological field trips are designed for the most part to look at rocks. Here I'm not speaking to the professionals or the converted, but the rank amateurs like myself who have an interest in geology, howsoever lowly, and looking at rocks is unarguably the best way of appreciating them - especially with a trip leader who knows the particular rocks under study. It is natural for the amateur to want to learn more about their particular interest, and this is some of what the field trip programme is all about. Other parts involve collecting from sites which can afford it, conservation and education - how many people teaching the National Curriculum Earth Science blocks are actually experiencd Earth Scientists? Field trips provide a very good background.

And here I must declare an interest. I joined the Lit and Phil after making enquiries on behalf of the society which I organise in the East Midlands, the Open University Geological Society. This society has a policy of field meetings only - we cover an area so diverse, from Towcester to Grimsby that evening lectures are not feasible, and so day field meets at weekends are the way that we can get together. Lit and Phil members are cordially invited onto the O.U.G.S. trips, where we form a contrast to the "native" trips which are quarry based by being walking trips over an area. Also we go out on Sundays, as the O.U. have a habit of filling students' Saturdays with Tutorials!

Crystal Balls

Not an affliction, but a look to the future. Not being blessed with accurate foresight I can only hope what will happen, that lectures fill up and field trips become more than a couple of people wandering round a quarry. Maybe Transactions can appear with greater regularity. Maybe publications on specific subjects can be made. Maybe we start sponsoring and tutoring our own evening classes. Maybe the amateurs in our midst will provide the professioals with a spur to use the resource - us - to do some work which they otherwise couldn't get done. After all, if no-one asks us amateurs, we don't know what work should be done. All I, as editor of this newsletter, can say at the moment is lets do something. If there are enough people doing, then some result must surely emerge, and that may well be tha salvation of Section C.

John Colby

Rejuvenation -

by Colin Green, Chairman

A period of uplift and rejuvenation is sweeping Section C of the Lit and Phil, and what better time of the year could I be writing this? Springtime is the appropriate season for this metamorphosis to take place.

Following a quiescent phase of declining membership and attendances at various venues I am hopeful of changes of tectonic proportions. If we get it right uplift will exceed erosion considerably throughout this orogeny. Without becoming too immersed in a complex discourse concerning the relativities of isostasy and eustasy - in other words, not trying to be too clever - I will describe the changes envisaged that will be of undoubted benefit to the Society.

Various committees over the past years have been concerned at the declining numbers of members at lectures and field outings, and have tried everything in their power to regenerate the enthusiasm of the membership. But, with little success. Why? despite the general increase in interest with earth sciences. Where is everyone? How long can we continue allowing speakers to travel great distances to lecture to a handful of members and there's even less turn out to the field meetings; is it time to call it a day? Depressing stuff are you saying, can I stand by and allow one of the oldest geological societies to go down the drain? Of course you can't. So why not help us (the committee) to resurrect the Lit. and Phil. Geological Society.

Like any new committee we have all sorts of wonderful ideas, but they will only work if the membership are behind us. One venture is a newsletter, articles, reviews, field meetings, swaps, items for sale (geological of course), so here again we need contributions from members. Would you like to see the society change its name? How do you see the Society - are we a learned society or do we wish to widen our horizons? So before we know which way to jump we need your opinion. How can you do that? Easy, just fill in the questionnaire provided with the newsletter and return it to John Martin at the museum. We've provided a return envelope, because we need this information from you the members. Its yours as much as my society which hangs in the balance, so come on, fill in the questionnaire and show your support.

....and now back to geological analogy. It was James Hutton who first described the cycle of events whereby birth of new material from pre-existing material within the Earth took place, only as long as there was a 'central fire'. As long as we can keep our central fire going we will doubtless survive another 156 years. I'm sure that the committee won't object to analogies like this! However, what we must not do is rely totally on the committee to do everything without any input from the general membership - all members have a contribution to make in the furtherance of this Society's adaptation and subsequent evolution.

Hutton wrote of Earth History that 'we find no vestige of a beginning - no prospect of an end'. Will the latter apply to Section C of the Lit. and Phil?

Beverly Halstead

We note with great sadness the untimely death of one of geology's most energetic and sometimes controversial figures. Dr Beverly Halstead was involved in a fatal accident near Bath on 30th April whilst travelling to Plymouth to arrange the August meeting of the British Association. He had been Reader in Geology and Zoology at the University of Reading since 1968, and was current President of the Geologists Association. He leaves a wife and son.

The Leicester Literary and Philosophical Society
Section C, Geology

A SHORT HISTORY

Leicester, 15th March 1835

" I have just taken it into my head what an excellent thing it would be to establish a Literary and Scientific Society . . . I intend sounding the people of both parties on the subject, but have not mentioned it yet. To be sure there does not seem much taste that way in the Town at present, but there is no way of knowing what latent talent might be called forth . . "

So wrote Mr Alfred Paget, a Leicester gentleman, to a friend. Paget knew Dr George Shaw, who had moved to Leicester from Manchester, where one of the very first Literary and Philosophical Societies had been started. The idea of a Literary and Philosophical (or Scientific) Societies was a middle class response to all the changes in English life - religious, political and artistic, but especially scientific - which were prompted by the industrial revolution; Mechanics' Institutes were the working man's equivalent. People felt a need to keep up with all the changes and developments by meeting and educating themselves or others. There were new ways of thinking about religion - the Quakers also started in Manchester, for example - and the "Great Debate" between Creationists and Evolutionists was in full swing. Geology was at the forefront of the New Science.

And so it was that the Leicester Lit and Phil was founded with, among its first Honorary Members, the pioneer geologists William Buckland and Adam Sedgwick. Sedgwick was invited to Leicester for a dinner in his honour; his visit in 1837 resulted in the first geological map of Charnwood Forest.

The Society flourished. Its founders were careful to "allay Party strife and bitterness" (the "two parties" referred to in Paget's letter were Whigs and Tories, of course) by "excluding theological and political questions", suggesting that the Leicester Society was not quite as radical as some others in the movement. However, lectures and debates were lively and well attended, often packed. The Sociey's museum grew, too, until by 1849 the original "cabinet" had become 10,000 objects housed, we believe, in the New Hall at the town end of Wellington Street. It was presented by the President of the Lit and Phil to the Town:

" To you, as chief magistrate of the Town . . I, as President of the Society and on their behalf, deliver to you the whole of the collection specified in this catalogue . . . to be held . . . in trust for the public, I hope for ever."

The collection was moved to the Proprietary School building on New Walk. Much of it, and the building, survive as the core of the Leicestershire Museums Service collection (now several million items!), and we still have the original catalogue. Because of the importance of geology in the Society many of the 1849 specimens were geological, and for the same reason, also in 1849, Sectional Committees of the Lit and Phil were set up, with the Geology Section as the flagship. The section and museum have been closely linked with the section metting, free, at New walk ever since. The Council Room where we meet is the Society's Council Room, portraits of all its presidents lining the long wall behind the shutters.

For many years the Society provided the Museum's honorary curators, one for each collection area (so one for geology, who was also the Chairman of the Section) to assist the one salaried curator. The Society also raised cash for the purchase of specimens including, in 1851, the big skeleton of the "Barrow Kipper" (the plesiosaur Rhomaleosaurus) and two ichthyosaur skeletons. Another indication of the popularity of the Geology Section in the early years is shown in the "geological picnic" to Bradgate Park in June 1861:

Leicester Chronicle, June 15th

" About 3 o'clock the party entered the Park, preceeded by the Volunteer Rifle Band . . . The party then proceeded to inspect the chapel. Next, lemonade, apple wine and sherry were freely distributed. The band struck up a lively air and a number of the company danced. Afterwards they made their way to the top of Old John, where . . . Mr Hollings delivered a lecture on the geology of Leicestershire. At the end of the lecture a rousing three cheers were given. "

Despite its auspicious beginnings and long history, the Section has had its ups and downs. Our falling attendances of the late 1980s are nothing to worrk about in comparison with 1881 - no geology collecting was done and it was reported that "sometimes the chairman alone attended meetings" (It has never been that bad, Trevor!). Nevertheless the geology section became section C in 1883, perhaps in simulation of Section C of the British Association for the Advancement of Science, and by 1899 much greater interest was being shown again. The improvement seems to have been connected with those "Victorian values" we heard about again in the 1980s and with an expansion of public education for both children and adults. There were geology evening classes, the Section's meetings were crowded, and all went well (except for the last few years of the Great War) for some 25 years.

But by 1938 Section meetings had ceased: again, the members had stopped coming. Why? And did the committee run a questionnaire then, too? Meeting were not to restart until 1949, when George Snowball (Keeper of Geology at the Museum) and former members reinstated field trips and evening lectures. In 1952 there were just 20 paid-up members, and (familiar story) a field trip to the Trias of Nottinghamshire had to be cancelled "because of insufficient support, due, no doubt to holidays".

The cycle has made one more revolution. The 1960s and 70s were good decades, with over 100 members and 40 or 50 at night meetings, again, it seems, at a time of expansion of school and adult education, evening classes and so on, but then the 1980s saw another decline in Section attendances. Was it television (it wasn't that in 1880)? The Weather? Or is the cycle caused by subtler, and much more interesting, political and social changes? If so, don't worry - Section C will be back, stronger than ever.

John Martin
Keeper of Earth Sciences, Leicestershire Museums, Arts and Records Service
May 1991

R.I.G.S.

At a lecture in March to the Society, John Martin and Roy Clements outlined the initial proposals for R.I.G.S. sites in Leicestershire. It may be that contributions in the form of labour in order to manage such sites becomes necessary. If you are willing to volunteer your services in the future please contact the Editor.

Events Diary

This diary combines the events from three societies, our own and the Stamford Geological Society which run common trips, the East Midlands Geological Society and the Open University Geological Society. All members are welcome on any trip, but it would be advisable to telephone the organiser first to check details.

Trips start promptly at the time mentioned, so please be there beforehand. Remember that it takes fifteen minutes at least to dress and boot up, have a cup of coffee and sign in.

Field events – Summer 1991

Saturday 1st June - All-day visit to the **Orton and Whittlesea Brick Pits, Peterborough**, the last two Oxford clay pits in the area still working. Home of pliosaurs, plesiosaurs, ammonites and mad geologists. Fossil collecting. This area is Alan's speciality, and source of many large fossil reptile finds.

Saturday 20th July - Dr Mike le Bas of Leicester University with a trip to **Judkins Quarry, Nuneaton**. This quarry exposes the junction of the Cambrian and Pre-cambrian, and displays what is thought to be the basal conglomerate of the Cambrian. Markfieldite intrusions in the volcaniclastics provide some of the boulders found in the conglomerate. There's also a good suite of minerals well exposed (at least they were on the last trip). Meet at quarry entrance, SP350926.

Saturday 10th August - All day at E.C.C. **Quarries at Little Paxton**, on the A1 south of Buckden in the Middle and Upper Jurassic, Callovian and Oxfordian stages.

All the above trips require hard hats and protective footwear. We have some hard hats you can borrow if you need so to do.
For further details of these field trips contact Alan Dawn on Stamford, (0780) 64714

Other Societies Trips

The **East Midlands Geological Society**
Sunday 9th June - Chrome Hill & The Roaches
Wednesday 19th June (Evening) Ashover Area
Contact Jack Fryer (0400) 81585

The Open University Geological Society, East Midlands Branch.

We ask for a contribution of 50p per member (full, associate or family) on each field trip to defray expenses, and £1.00 per non-member over 16. Persons under sixteen are deemed to be in the control of their parents. All attendees over sixteen must sign in so that they are covered by the Society's third party insurance. Unless otherwise stated, children and dogs welcome. Most trips require walking about five miles or so.

Sunday June 9th - **Manifold Valley - Led by Muriel Wright.** Meet at at the National Trust Car Park at Wettonmill Caves at SK095561 at 10.30am. That is in the Manifold Valley about two miles south of Ecton Copper Mine. The best way there is to turn right off the A523 Ashbourne/Leek road and fight your way through the country lanes. The area features some fine folding and other structural elements, and of course Thor's Cave, a spectacular feature, so bring the cameras. Bring packed lunch. Pubs are either scarce or packed.
Contact John Colby (0455) 290271

Friday - Sunday June 28-30th - Symposium 1991 - Durham. **From the Pennines to the North Sea Grabens - Economic Resources of the North East.** National Newsletter for details, cost £80.00 per person (Member). £85.00 (non member). The symposium consists of a series of lectures, semiars and field trips packed into a very busy but very enjoyable weekend. Staying in Grey College, University of Durham, with fine views of Durham City and the cathedral of Saint Chad dominating the hill. The cost covers everything from Friday night to Sunday afternoon.
Contact John Colby (0455) 290271

Sunday July 7th - Family Field Trip - **DIY Geology - Yes, there are some rocks in Northamptonshire** - The main site which will be visited is in the Irchester Country Park, which was created from the abandoned Ironstone Quarry known as the "Wembley Pit", where ore was worked until 1941. The last working face of the quarry is preserved, with exposures of the Northampton Sand Ironstone, the Lower Estuarine Series, the Upper Estuarine Series, and the Blisworth Limestone. After a picnic/pub lunch (we hope) there wil be an afternoon visit to the Canals Museum at Stoke Bruerne. Meet at 10.30am, at Irchester Country Park, SP912657, then at the museum SP745499. Museum admission charges £1.75 adult, £1.25 child, OAP, Student. £4.70 family.
Contact John Colby (0455) 290271

Sunday August 18th - **Conservation Day** Practical conservation in an area of Leicestershire which needs it, either a RIGS or an SSSI. Contact John Colby nearer the date for details.
Contact John Colby (0455) 290271

Sunday September 15th - **Cavedale, The Winnats, Dirtlow Rake.** Led by Brenda Humphreys and Muriel Wright. Visit a Limestone Gorge and Reef. Look at an old lead mine and a new opencast fluorspar and barytes working on the site of an old rake. Also some volcanics. Map O.S. Landranger 110. Meet at Castleton car park (SK149830) 10.30am, the earlier the better as it is popular with walkers and tourists.
Contact John Colby (0455) 290271

Sunday September 29th - **Open University Geology Course S236 Revision Day - Midlands and North.** We are looking for people with relevant skills to come and assist in the revision - cartographers, structural geologists, petrologists, sedimentologists, palaentologists and coffee makers. We're also on the look out for interesting samples. Cost £3.50 for participants including lunch. Leaders free.
Contact John Colby (0455) 290271

Sunday October 27th - **Post exam celebration - Ancaster (the Jurassic)** - Led by Jack Fryer. Details to be finalised.
Contact John Colby (0455) 290271

Tuesday November 12th - **Branch A.G.M. at the Octagon, Derby Road, Nottingham (Regional Office).** 7.30pm. After official business, cheese and wine and an audio-visual presentation on the years's activities. You may well be featured!
Contact John Colby (0455) 290271

Sunday November 24th. **Bradgate Park - National Field trip.** Visitors will be coming from all parts of the country, and the trip will be led by Dr. Richard Thorpe of the Open University. This will be an all-day trip, but break off when you like. Lunch can be booked.
Contact John Colby (0455) 290271

Friday - Sunday December 6th, 7th, 8th - **Snowflake 91** - Leader, John Downes, the Open University. Staying at Weston super Mare for Aust Cliff (Triassic/Jurassic, including the Rhaetic Bone Bed now under study from Mike Taylor and Arthur Cruikshank of Leicester Museum), Portishead (possibility of some man made erratics) and Kilkenny Bay (mesofolding of carboniferous and a Devonian-Permian unconformity, exhumed topography and wadis) and in the Mendips, Ebbor Gorge and Burrington Combe. This is a residential trip, staying in an hotel in Weston-super-Mare. Cost (from Friday night to Sunday including all meals and packed lunches, around £60.00 in stages in advance). £10.00 deposit required immediately to secure a place, as at the time of writing with seven months to go the trip is almost half full.
Contact Sandy Colby (0455) 290271

The O.U.G.S. welcomes people onto its field trips. Hard hats are sometimes necessary, but we have a supply, boots and warm clothing always, and packed lunch unless you're on a severe diet.

Gumdrop

Gumdrop is a vintage car which has adventures. Gumdrop is the creation of one Val Biro (surely a pen name) and has come into our household for the amusement of our five year old son (but on his insistance he's nearly six!). "Gumdrop and the Dinosaur" is the book's title, and involves a visit to a museum, a Triceratops skeleton, called Topsy in the Cretaceous, a duet of flower picking, singing Sauropods (Brachiosaurus and Brontosaurus), a time travelling computer, a Mesozoic dinosaur race and the extinction of Tyrannosaurus Rex! This is an example of dinosaur verse:

Gentle vegetarians are we,
Brontosaur, Brachiosaur and D.
We are most immensely tall,
The most gigantic pair of all
The dinosaurs. As for the third
He's just called D. (for Diplodocus)
He's longer than the lot of us.
Just the same we're harmless bods
And people call us Sauropods.

Amazingly they speak English! Its a far cry from the K-T boundary! This all happens when the dog accidentally sits on the commputer keyboard, and when they all return after a similar event the museum's Triceratops skeleton has muddy feet and a smile on its face . . . so if you visit Leicester Museum and find large muddy foot-prints turning right just inside the entrance . . . .

Lecture Programme

These are the proposed dates for the Lit & Phil Winter lecture meetings for 1991-92.

Wednesdays except where mentioned.
October 9th and 23rd, November 6th and 20th, December 4th and 18th, January 15th and 29th, February 12th and 26th, March 11th and 25th. The Parent Body Joint Lecture is on Monday March 2nd.

Mac Whitaker

Dr. John H. McD. Whitaker reaches a dual anniversary this year. It was his 70th birthday on Friday 17th May and the fortieth anniversary of the founding of the Geology Department at Leicester University this year. Celebrations held at the University mark these occasions. To make the third element of the celebrations the new extensions to the geology department are also being officially opened at this time.

Dr. Whitaker was responsible for the founding the Department, and in the time since has seen it grow beyond all expectations under himself and the late Professor P. Sylvester-Bradley to one of the most successful in the country, surpassing those of Sheffield, Nottingham and Hull which have now closed down. Latterly he was Editor in chief of Geology Today until his retirement from that post last year.

His speciality is the Silurian, and was responsible for the recognition in the rocks of the Silurian of Wales of fossil submarine canyons. He is still active in the field, and is off to "tie up some loose ends in the Welsh borders". However, reports have it that some of the exposures he examined are now so grown over that they can't be seen.

We wish him many happy returns.

Information supplied by Dr Trevor Ford.

Geology

A Science with an accuracy of a couple of million years or so.

Lava

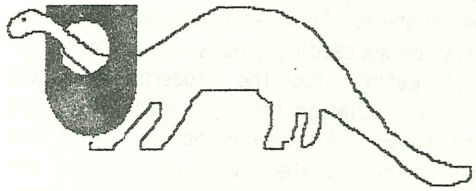
Froff wot you shaves wiv

All contributions for Charnia will be gratefully received

Sea Dragons

The 1991 Day School
by Sandy Colby

The day started auspiciously - the room was crowded. The speakers, Dr Michael Taylor (Leicester Museum) and Dr Arthur Cruikshank (Leicester Museum and the Open University), chaired and introduced by John Martin (Keeper of Earth Sciences at Leicester Museum), started off by giving their own interpretation of the events of Great Sea Dragons which could not have been publicised by Vaughan College - Sun, Sea, Sex and Saurians. They also advertised it as a Leicester Museum - Open University co-production.



(Logo cribbed from the Taylor Cruikshank conspiracy)

The Fossil Record

Starting off by looking at fossils and their collectors, from Mary Anning of Lyme Regis through to Alan Dawn's finds at Peterborough and Dave Martill's Ravenscar Crocodile, it was shown how the fossil evidence was collected and analysed. Collectors at this time were locals, mainly, working on the seashore and in quarries, with collectors being those with the money, well off people with leisure time to spare. Museums acted as "fossil libraries" and many regional centres grew up. Bristol Museum was one of those, but unfortunately suffered total destruction during the war, and most collections suffered war damage, when much irreplaceable material was lost. Other collections suffered attrition through neglect and want of curation. Technological changes in extractive industry technique, from main manual labour to mechanised excavation have also contributed to fossils being destroyed either partially or completely.

During this period the Darwinian concepts of evolution were being actively debated and various theories were proposed to deal with these supposed anomalies in the "natural order of things". The Creationist/Evolutionist arguments were in full swing, and religious literalism was also an inhibiting influence. (See also John Martin's article on the History of the Lit & Phil in this issue.)

Sea and Lifestyle

Sea Dragons are classified loosley as ichthiosaurs, plesiosaurs and pliosaurs, mosasaurs and marine crocodiles. Ichthiosaurs occurred from the late Triassic to the late Cretaceous, pliosaurs and plesiosaurs from the late Traissic to the Cretaceous, crocodiles from the Jurassic to early Cretaceous, and mosasaurs from the early to late Cretaceous (mosasaurs are related to lizards, but totally aquatic). There are modern physiological, but unrelated, equivalents of the sea dragons, the seals, sea lions and whales. There are other specialised adaptations - the kimodo dragon has no webbed feet and is at home on dry land but is a strong swimmer, the polar bear's soles of feet have hairs for gripping ice but the body is not adapted for an aquatic lifestyle, the Galapagos marine iguana - land animal which has adopted a semi-aquatic lifestyle, and the flightless awk, which has webbed feet but little else to show that it is aquatic. All these latter are known from live studies - it is only from the skeletons of the sea dragons that we can assess their lifestyle. All these adaptive examples show how difficult it is to piece together from fossil evidence a picture which can be called truly accurate.

Messy Eaters

One of the problems of feeding in water is that both predator and prey float - first you have to catch your ammonite, then you have to get hold of the juicy bits and separate them

from the rest of the animal, then swallow the results. Various methods of feeding were used, dynamic loading where the mass of either predator or prey was used to tear bits off the prey and then swallow them in the same way as the crocodile. Twisting or shaking motions could be used for the above, or ratchet feeding, where back curving teeth would rend bits from the prey. Further adaptations for tooth shape were for piercing, crushing or cutting, and the tooth shape determined the type of prey - piercing teeth were for soft bodied prey, crushing for hard bodied, and cutting teeth for prey with skeletons. Straining teeth for small prey were also present in some species, and these are analgous to filter feeding whales.

The shape of the head and jaw determined the type of prey. The variations in crocodile snout correlates with size and hardness of prey, from broad and muscular for catchiing and holding, to the modern gavial equivalent, a fish eating narrow snouted croc, were reflected in other types of sea dragon. Plesiosaurs were analagous to crocodiles and Ichthiosaurs had long snouts with snapping jaws to catch prey with some sort of precision.

x, y, z and t.

Three dimensional motion in a semi-resistive medium poses its own problems. First there is the necessity of providing propulsion, and second to provide as little resistance to motion as possible. Streamlining minimises drag due to turbulent eddies. Dolphins, tuna fish and submarines all have efficient streamlining. Propulsion and directional intent can be provided in a number of ways. A submarine used a propeller, a rotary device, and hydrofoils to provide the necessary motion and lift. The completely rotary joint is unknown in nature, so something must move up and down or from side to side. In dolphins the tail moves up and down like ichthiosaurs, with the forefins affecting attitude and hence direction. Plesiosaurs had four water wings, "flying" through the water somewhat like a turtle, although true subaqueous flying is reserved for the awks and penguins.

In order to have a successful aquatic life, the buoyancy of the complete animal must have been close to that of water, a balance of body mass, body fat content, bone density and air. Some plesiosaurs had stomach stones for buoyancy balance.

Old Crocs

Crocodiles show the advantages of an amphibious lifestyle, using land or water as suits best the needs of the moment, and using shallow water without being stranded. The first crocodiles from the upper Triassic were built like greyhounds, about a metre long and fast runners. They were displaced into the water by succeeding groups, but were not all meat eating like the modern croc, and adaptive radiation produced marine and dry land types. All crocodiles are twist and gravity feeders, they twist bits of prey off and then lift their heads to let gravity bring the bit twisted off into the throat for ingestion, regarding almost anything that moves as potential prey. They can control their body temperature to a certain extent, by opening ther mouths and gasping - they have no skin pores so sweating is out of the question, and can use their teeth to dig out burrows in which they can survive in drought for two or three months.

Fossil Evidence

The vast majority of marine reptiles do not survive as fossils. They were either eaten or just fell to bits. Preservation of a complete skeleton is a rare event, and even rarer is the preservation of soft parts like fins. In order for there to be something like a complete animal preserved, the body needs to settle into the mud in the bed off the river, lake or sea and then become fairly rapidly covered in sediment so that scavengers do not have time to eat the flesh and so allow the bones to become disarticulated. If the flesh just rots rather than being scavenged then articulation is preserved.

In the Oxford Clay the body could have been in about 300m of water, so that it was undisturbed by normal wave action. At this depth there might be one storm in (on average) 1000 years where the wave base reaches this depth, but the chances are that when any remains are at that depth then the chance of disturbance before burial are low, so the chance of preservation are correspondingly greater. It is these complete skeletons which give the best evidence for the shape of the living animal.

Other fossil evidence includes coprolites, which give prey remains, and a number of small ichthiosaurs within the ribcage of a larger animal of the same species. These are the embryos, usually, although there is evidence that cannibalism did take place. However, complete small skeletons suggest that unless they were swallowed whole than the embryo argument should hold water. In any case they were born tail first, as dolphins and whales so that the first thing that junior did was to get to the surface to breathe.

Rise of the Plesiosaur

Sauropterygian reptiles evolved from terrestrial animals through a series of more and more "aquatic" animals which swam by rowing to the ultimate plesiosaurian body with hydrofoil limbs. They filled various niches with feeding habits from sieving to hunting the largest prey. For instance the nothosaur lived in a lagoonal environment catching small fish and had good land locomotion. It swam with a undulating motion much like crocodiles. The pistosaurus was more compact, with more paddle like limbs with extra joints. It moved them partly as paddles and had a flight-like motion. The plesiosaur adapted to a fully aquatic lifestyle with paddle like limbs and this also flew through the water.

Feeding also showed structural adaptations, with the normal food of plesiosaurs being crustaceans, fish, squid, cephalopods and reptiles. Elasmosaurs, 14m long with 72 neck vertebrae (pliosaurs had as few as 14) and had a very small head were surface feeders whereas cryptocleidus fed deeper in the water like modern whales.

Inferences and Nessie

Convergent evolution is displayed when animals originally different evolve similar solutions to the same problems. Dolphins and ichthiosaurs resemble each other, but are very different animals, one not having evolved from the other Crocodile snouts are one example from the narrow snouted fish eaters to the broad bone crunchers. The whale is more complex. Although adapted to live in the same environment, their differences from ichthiosaurs and sharks stem from their ancestry as small, squeaking nocturnal mammals.

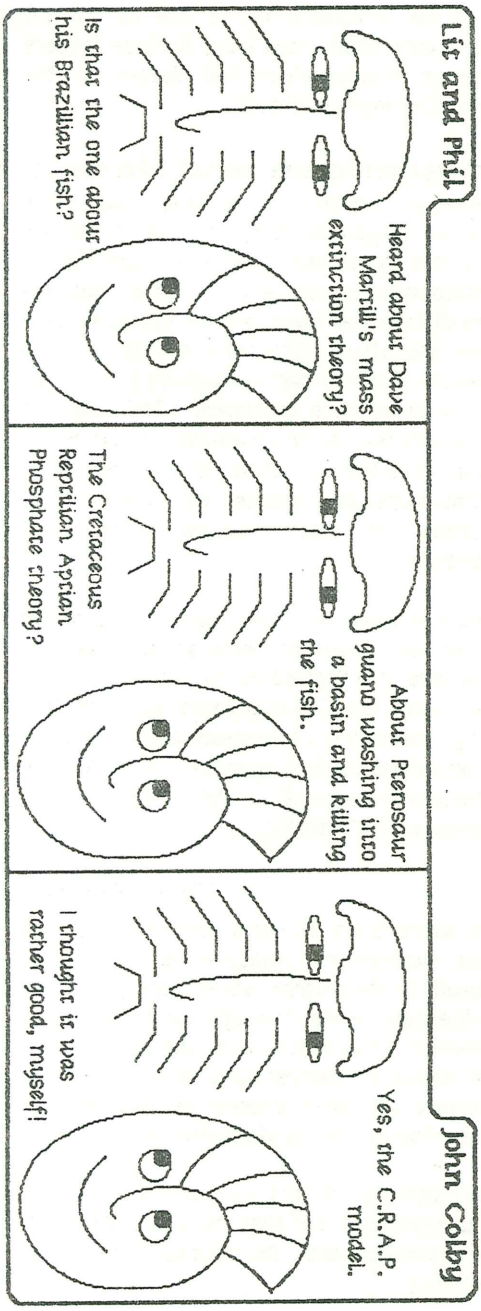
Nessie escapes not. The theory that he/she is a plesiosaur does not really stand up as Loch Ness was only formed in the last quarternary glaciation, some 10,000 years ago; the last thing resembling a plesiosaur became extinct at or before the K-T boundary. However, the large unknown animal in Loch Ness is a very good tourist attraction.

The End?

The whole story is quite complex, from the first collectors discovering something unusual to the modern researchers giving life to the bare bones, through Darwin's Natural Selection, the creationists, the religionists, the disputes, destructions and finally the immense upsurge of interest in the science of palæontology, both professional and amateur.

The conclusion of this summary is that there is no conclusion, but that the work, especially in Leicester and Peterborough Museums, continues.

Our thanks go to Michael Taylor, Arthur Cruikshank and John Martin for a thoroughly educating and entertaining day. A publication is promised by the leaders containing the proceedings.



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NEXT COPY DATE, AUGUST 20th 1991
