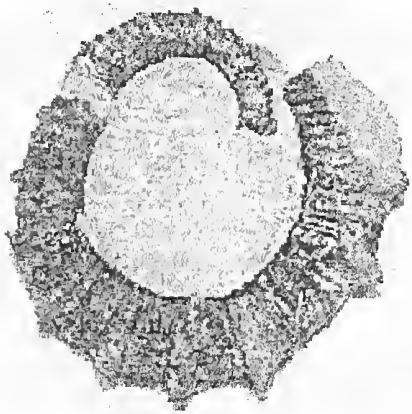
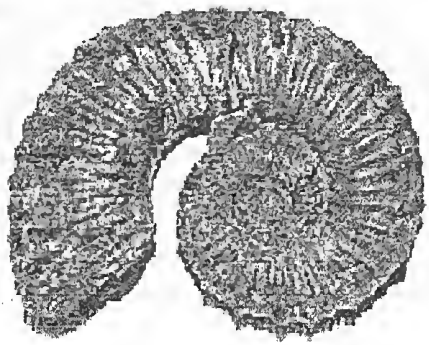
THE FOSSIL COLLECTOR

BULLETIN No. 60 MAY 2000



Australiceras serrata



Tropaeum sp.

Both specimens from the Walsh River area of far north central Queensland, see page 13 for more.

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THE FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA

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Taxonomie Diselaimer

This publieation is not deemed to be valid for taxonomie purposes [see artiele 8b in the *International Code of Zoological Nomenclature* 3rd edition 1985. Eds W. D. Ride et al].

CONTENTS

EDITORIAL NOTES

A big happy birthday to the Fossil Collectors' Association of Australasia. On Easter Sunday, twenty one years ago the FCAA formed, its primary role was to enable the circulation among members of a list of names, addresses, telephone numbers and particular interests of fellow collectors both in Australia and overseas. It was hoped that the offshoot of this would be that when members were travelling they might arrange visits with other members and exchange specimens and information. *The Fossil Collector* soon came into existence (or perhaps I should say evolved), with January 2001 being the 21st birthday for the bulletin. Frank Holmes has written a short history of the FCAA for this issue, so I will say no more at this stage and leave it to Frank, he has after all been the 'guiding light' of the FCAA.

Congratulations are also given to Evelyn and Selwyn Hewitt, from Maryborough, Queensland, on the celebration of their 50th wedding anniversary, this occurred on February 25. I personally find this an outstanding achievement given todays marriage failure rate, perhaps us younger types could take a lesson or two from the wiser generation in how to maintain a healthy marriage!! We will see Evelyn Hewitt's name mentioned again in this issue as Evelyn is a foundation member.

I am happy to say that my computer did survive the year 2000 roll over as well as the February 29 rollover, along with mostly everyone else, it would seem. I guess the question that has to be asked now is, was there any real major problem or was it just a few smart people who thought of a get rich quick scheme.

As this bulletin is late being issued (the editors fault entirely) it gives me the chance to mention a field trip I went on to the Rockhampton area of central eastern Queensland. We collected from the cave deposits in the limestones to the north of the city and also from a Devonian marine sequence in the same area, the success of this trip has been quite surprising. Although there are around ten new species of animal (probably Pleistocene) already found from the material we recovered, the most exciting for me was the Thylacine lower jaws and possible complete skull which was found on the last day of collecting (by an invertebrate palaeontologist). Cave deposits are an area which has received little attention in Queensland (other than Riversleigh of course) but I feel that this is about to change. Queensland now has a professional researcher who has taken a keen

interest in what these limestone areas of eastern Queensland have to offer in the way of vertebrate remains. There are quite extensive limestone areas right through Queensland and some of these have countless cave systems in them. Over the past five years, we (by we I mean the Queensland Museum) have visited only a handful of caves in just a couple of areas. Although I am more of an invertebrate type of amateur palaeontologist, it is really exciting to witness some of the new vertebrate finds which are coming from field trips I am lucky enough to attend.

I shouldn't fail to mention the invertebrate side of the field trip. In the limited time that was spent collecting from the Devonian rocks in which these caves are found, about five new species of gastropod were found plus one that has only been found in the northern hemisphere (I think I heard correctly here). It was left to a vertebrate palaeontologist on the trip to make the most exciting invertebrate find, that was of the most beautiful Devonian ammonite I have ever seen (okay, the only Devonian ammonite I have seen). Although only small, about 1.5 cms in diameter, it was just as perfect as the *Tropaeum* which is pictured on the front page of this issue.

Needless to say, with all that we collected in just nine days a return to this area is already in the pipeline. Though hopefully next time it will not rain the whole time we are there. As this new researcher is a friend, readers will see him pictured further on in this issue, I hope to be able to extract an article on the discoveries from this trip and other vertebrate topics for future issues of *The Fossil Collector*.

In late news, the discovery of a small dinosaur in North America has palaeontologists in somewhat of a spin. It would seem that this little dinosaur has been preserved well enough that an impression of its heart still remains and what has been found may force some kind of rethink on dinosaur physiology. I will endeavour to include something on this in the next issue

Readers will note that there is no major article in this issue. Now that Ralph Molnar has finished his series on fossil mammal teeth, we now have a large void at the spot which is reserved for major articles, that is page 5. I would like to put out the call, that if people wish to contribute material to *The Fossil Collector* now is the time to do it. Lets face it, I don't think readers want to see stories and photographs on my field trips, well, not all the time anyway.

The deadline for the next issue, Bulletin 61, will be July 31, 2000.

TWENTY FIRST ANNIVERSARY OF THE F. C. A. A.

Information compiled by Frank Holmes

As most of you know, the **Fossil Collectors' Association of Australasia** was formed on Easter Sunday 1979 by about 40 enthusiasts attending the Tununda Gemboree in South Australia's Barossa Valley. This resulted from a notice being placed in the March 1979 issue of *Australian Gems and Crafts Magazine* by members of a small group interested in palaeontology who had been meeting in the clubrooms of the Nunawading and District Lapidary Club, Melbourne, Victoria, during the late 1970s.

By July 1979, 55 individuals or families had joined the Association. Although the original aim was simply to circulate a list of members names, addresses and particular interests, by January 1980 the first issue of *The Fossil Collector* had been published.

Now, with this Bulletin (No. 60) we celebrate the 21st anniversary of the foundation of the Association and, in so doing, we again take this opportunity to acknowledge the continuous support of those who helped found the F.C.A.A. Although we can not be certain that all those mentioned below actually attended the foundation meeting, of the 55 entries in our first membership list (6th July 1979) the following still actively support the Association:

David ASLIN (Qld)
Ron and Mary CAVILL (Vic.)
Donald CLARK (S.A.)
Ada DONALDSON (Vic.)
Sheila DOYLE (N.S.W.)
Evelyn HEWITT (Qld)
Frank and Enid HOLMES (Vic.)
Gordon MARRIE (Qld)
Eric and Lilo NOWAK (N.S.W.)
Doris SIZELAND (Vic.)
Ian and Dianne SOBBE (Qld)
Merrilee WEBB (A.C.T.)
Chris YEE (Vic.)

Perhaps the most important reason for our success is the support we have received from numerous professional palaeontologists as well as dedicated subscribers who have over the years written major articles for *The Fossil Collector*. We are indeed indebted to these people and to all of you that have sent in items of news or offered advice on sources of information.

Authors and co-authors of articles written for The Fossil Collector

Neil Archbold, David Aslin, Robert Baird, John Barrie, Max Banks, Ken Bell, Tania Bennell, Lidsay Berry, Natalie Camillerie, David Cassel, Colin Chidley, Trevor Clifford, Alex Cook, Barry Cooper, Peter Corcoran, Tom Darragh, Steve Daymond, Steve Eckardt, John and June Fennell, Alan Goldstein, Lisa Gubby, Douglas Harbrow, Lindsay Hatcher, Edward Hennessey, Robert Hill, David Holloway, Frank Holmes, Philip Irwin, Peter Jell, Robert Jupp, Ann Kemp, George Kendrick, Michael Keats, Robert Knezour, Janise Krause, John Long, Steve McLoughlin, David Morley, Ralph Molnar, John Neil, Juliet O'Connor, John Pickett, Terry Poole,, Alex Ritchie, Alan Rix, Andrew Rozefelds, Alex Saar, Andrew Sandford, Noel Schleiger, Paul Seldon, Tim Spencer, Ian Sobbe, Paul Tierney, Anne-Marie Tosolini, Sue Turner, Anthony Vadala, Pat Vickers-Rich, Paul Willis, Marisa Worth, Chris AhYee.

Authors and co-authors of major articles reprinted, with permission, from other periodicals.

Michael Archer, Warren Allmon, Lynne Clos, Richard Dayvault, Peter Fenton, Kevin Lambkin, Jere Lipps, Mark Marshall, David Rudkin, Tom Rich, Graham Stevens, Larry Solomon, Jonathan Woolf.

Other information which may be of interest:-

Average number of pages per issue, 28 or 32 (31.2 o/a).
Shortest issue 20 pages (Bulletin No. 3, December 1980).
Longest issue 48 pages (Bulletin No. 22/23, September 1987).
Since inception the bulletins have been printed by either Ron Amess (former subscriber) or Peter Day (NDLC), assisted by Frank Holmes, at the clubrooms of the Nunawading and District Lapidary Club.
Average number of subscriptions per annum - 191 since reaching treble figures in 1982. Maximum - 233 reached in 1992/93.
Maximum initial circulation of a Bulletin - 265 (No. 39, January 1993).
Current number of subscribers - 180.
26 complementary and exchange copies are currently sent to Museums, Libraries and clubs etc.
A complete set of Bulletins is held by the National Library of Australia, Canberra, and Museum Victoria.

Although an amateur publication, *The Fossil Collector* is scanned for items of relevance for the *Zoological Record* (an annual bibliography of the world's zoological literature) published by BIOSIS, U.K.
Total cash receipts from formation of the Association to 2nd February 2000, $31,442.93; debits $29,057.18.

BOOKS AND BOOK REVIEWS

FOSSILS OF THE FLINDERS AND MOUNT LOFTY RANGES. by Neville S. Pledge, Curator of Fossils, South Australian Museum, Adelaide. Third Edition, published June 1999. 28 pages, 148mm X 210mm, fully illustrated with 55 colour photographs, 65 line drawings, map and time chart. Recommended retail price AU$13.95 plus $2.50 postage and handling within Australia. Payment by cheque or money order only made payable to the South Australian Museum.

Small but information packed, this book is a concise summary of the fossil animal and plants from 800 million years ago, almost until the present, found in the rocks of the most important Ranges in South Australia. The fossils give 'evidence of the history of the life during the most interesting and critical periods' of Earth history: the first appearance of animal fossils in the world famous Ediacaran Fauna, and then the explosion of diversity that occurred about 540 million years ago in the Cambrian Period.

Illustrated with excellent photographs and interpretive drawings, the text, and lists, of this third edition have been updated to give the latest information available on these South Australian fossils. An essential reference for professional, student and amateur palaeontologists and anyone interested in natural history.

Members interested in obtaining a copy should forward their order to:-

Jennifer Thurmer
Publications Manager
South Australian Museum
North Terrace, Adelaide SA 5000
Telephone: (08) 8207 7483
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From information supplied on flyer.

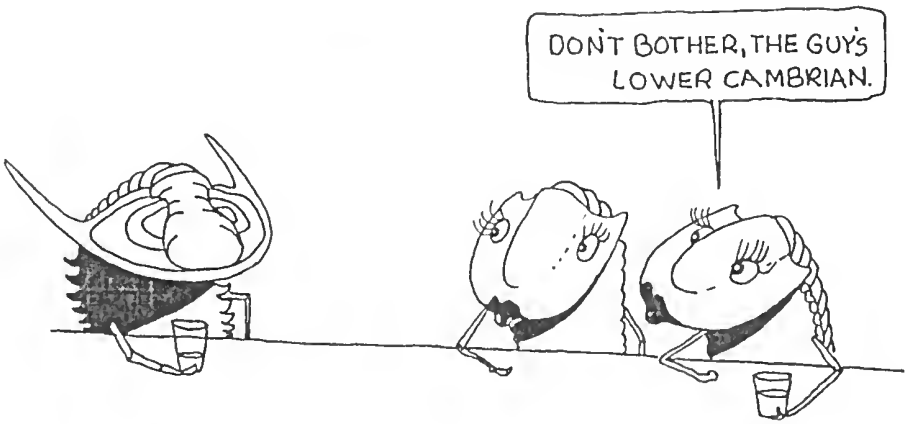
FIRST FAMILIES - A PRIMITIVE VIEW. by Larry Steinrock, James E. Conkin and Barbara Conkin. Hycliffe Publishing. P.O. Box 7434, Louisville, Kentucky 40207-0434. U. S. A. Price US$7.95 plus shipping.

I was a big fan of Gary Larson's *The Farside* cartoons, the way he poked fun at the sciences and the human spin on non-human subjects, was my type humor, alas, Gary retired from that career to head in another direction. Of course, as most *Farside* aficionados, he poked fun at the dinosaurs and their paleontologists - leaving the invertebrate fossils to fend for themselves.

This collection of cartoons assembled by Larry Steinrock, James E. Conkin an Barbara Conkin fills the void left by the retired Larson. Worms, starfish, crinoids, trilobites, clams, cephalopods - even sponges - find themselves being the objects of rather dry humor in an aquatic environment. I can imagine many of these being taped to the walls of biologist and paleontologist offices! Bryozoan and brachiopod lovers may be disappointed, but the other phyla are well represented.

Many of the cartoons can be used in an educational setting to promote the discussion of what we know about fossils, evolution, and life styles of the rich and boneless. The artwork is simple but accurate, the text is generally spartan - the humor is imaginative. What more could you want in this type of book?

Review by Alan Goldstein.



IS YOUR AMBER REAL

by Paul Tierney

Amber differs from most gem materials in that it is of vegetable origin, it is a fossil resin. Originally exuded from various species of trees (including conifers) at different times over the past 250 million years and often still containing insects and other creatures trapped within it. Several types of amber are recognised, though their properties are practically identical.

Baltic amber, or succinite, is commonly some shade of yellow, ranging from whitish to brownish-yellow; it may also be transparent, cloudy, or almost opaque due to the inclusion of myriads of small air bubbles. British ambers show similar variations to Baltic amber. Sicilian amber, simetite, and Romanian amber, rumanite, are seldom yellow and have shades of brown, reddish-brown, and even black being more common, Romanian amber is often extensively cracked. Burmese amber, burmite, is generally brown and contains many insects and sometime veins of calcite can be seen. Since World War II amber has been produced in considerable quantities from several localities in the Dominican Republic. Much of this amber is pale in colour but darker browns and reddish-browns also occur. Some Dominican ambers fluoresce bluish or bluish-green in daylight and all fluoresce strongly in these colours under ultra-violet radiation.

Slight differences in composition are known to exist between the above varieties of amber, all of which are essentially hydrocarbons. Succinite, as its name suggests, contains more succinic acid than the other ambers, giving rise to characteristic choking fumes when it is strongly heated. Gedanite is an amber like fossil resin which is found with succinite, it contains no succinic acid and is soft enough to be scratched with a fingernail.

The hardness of the main varieties of amber is from 2½ to 3 on Mohs' scale, Burmese amber being the hardest. The specific gravity (SG) ranges from 1.04 to 1.10, the presence of air bubbles in cloudy amber makes its SG slightly lower than that of clear specimens. Being amorphous, amber has only a single refractive index (RI), which averages 1.54. Amber softens at about 180°C, melts between 250°C and 300°C, and burns with a characteristic aromatic odour. One of the best known properties of amber is the ease with which it become electrified when briskly rubbed. In this respect several amber imitations behave in a similar

manner, so this eannot be regarded as a distinetive test, exeept in materials where no frictional eleetrieity is developed, this material is eertainly not amber.

First among the imitations of genuine block amber is **pressed amber**, or **ambroid** as it is often called. Since 1881 this material has been extensively made from fragments of Baltic amber which are too small to be used as individual pieces, these small pieces are softened by heating to between 200°C - 250°C and pressed through a fine steel sieve or mesh so that they become amalgamated into a single mass whieh has very mueh the same properties and appearance as block amber. The best method of detection is by examination under a lens or microscope, or simply with the naked eye. Pressed amber shows a flow structure, globules of clear amber among the cloudy mass following definite lines. There may also be elongation of included bubbles parallel to one direetion, whereas in untreated amber bubbles are usually spherical. It should be added that some reeent samples of pressed amber are virtually transparent, though with a treaely or oiled appearanee, this material had no bubbles, showed no sign of flow strueture and had a slightly lower density (1.06) when compared with true amber. The most striking feature of some modern pressed ambers is the brilliant ehalky blue fluoreseenee shown under long wave ultra violet light, under this illumination granular structures have also been noted.

The more reeent natural resin **copal** or **kauri gum**, which is extensively used in New Zealand, has very similar properties and appearanee to amber. It can however be easily distinguished by its readier fusibility when a hot needle is plaeed on some ineonspieuous part of the specimen (eomparison with amber will be neeessary to make this differenee notieable) and by its greater solubility in ether. When a spot of this liquid is placed on eopal resin (caution, ether is highly flammable - keep away from sources of ignition) it beeomes quite sticky, and a dull spot is left on the resin surfaee when the ether has evaporated; true amber and pressed amber are unaffeeted by this treatment. Copal resin ean nearly always be distinguished by its tendeney to 'eraze' at the surfaee, it is also mueh softer than amber. Included insects are not always a sign of true amber, they may be found trapped in eopal resin also, whilst insects embedded in plastics are usually far too perfect to be mistaken for the real thing. Insects embedded in plastics never show any sign of struggle, as they were dead before they were trapped.

Amber is effeetively and frequently imitated by various artificial resins whieh are grouped together under the inclusive term 'plastics'. The earliest of these, the

cellulose nitrate known as **celluloid**, is now less often used on account of its dangerous inflammability, though safety celluloid (cellulose acetate) bearing names such as **Cellon** does not suffer from this disability. The casein plastics **Galalith**, **Erinoid**, etc. are more suitable, and most used of all are the phenolformaldehyde condensation products **Bakelite** and **Catalin**. Some actual determinations on the SG and RI of imitation amber made from these plastics material are shown in the table below, the properties of amber and copal being included for comparison. Due to differences in the filling materials used to give body and colour to these plastics, there may be some variations in their SG and RI, but the figures given are typical.

Material	SG	RI	Under Knife
Amber	1.08	1.54	Splinters readily
Copal Resin	1.06	1.53	Splinters readily
Casein	1.33	1.54	Sectile, rather tough
Bakelite	1.28	1.64	Sectile, tough
Catalin	1.26	1.66	Sectile, tough
Cellon	1.26	1.48	Sectile
Celluloid	1.38	1.49	Readily sectile

It will be noted that the SG of all the plastic materials is considerably higher than that of amber, and this provides one of the most useful and reliable methods of distinction. It would, of course, be possible to dilute sufficiently one of the usual heavy liquids such as bromoform with toluene to make a solution of SG about 1.12, suitable for separating amber from these imitations, but this would be both wasteful and unnecessary, since a strong solution of common salt will answer the purpose equally well. Ten level teaspoonfuls of salt in an ordinary tumblerful of water (50 g salt in 250 ml of water) provides a liquid of the required SG, in this brine solution all specimens of amber, pressed amber and copal resin will float, while all the usual plastic imitations will sink.

Two plastics not mentioned above, since they have not yet been used to imitate amber, should be mentioned. One of these, **Perspex**, is a polymerized acrylic ester, and has an SG of 1.18 and RI of 1.50. The other, a polystyrene product called **Distrene**, has the very low SG of 1.05, though its RI is comparatively high, about 1.58. Distrene would, of course, float in the brine solution, but the fact that it peels under the knife, its much lower softening point (70-90°C), and its ready

solubility in benzene would enable it to be distinguished from amber if it should ever be used as an imitation.

Other test are available, but these involve marking the specimen to some extent, but with care such damage is almost impereeptible when carried out on an inconspicuous part of the specimen. One such test, already implied, is to determine the sectile qualities of the material by the carefully controlled application of a sharp blade. It will be found that amber, pressed amber and copal resin break away in chips or splinters under the blade, while plastic materials peel away in shavings, Bakelite is extremely tough and resistant to the blade, while celluloid and perspex yeild much more readily. Any peeling or chips removed can be further tested in the flame of a spirit lamp, placing the specimen on a knife blade or something similar. Amber, pressed amber and copal all burn with emission of aromatic fumes while plastic material melts. Fine chippings or peelings can also be heated in a small test tube. The various ambers, copal and plastic imitations all behave in characteristic way, and this can be observed by carefully heating in the tube. Amber and copal will melt and give off whitish fumes with an acrid smell, whereas the commonly used phenolformaldehyde plastics smell of phenol, celluloid is extremely inflammable while bakelite only chars under these conditions.

Glass imitations of amber are sometimes seen, and from a distance may look effective, but their coldness to the touch, hardness, and high SG compared with amber all serve to avoid any real confusion.

Caution. Readers should note that the use of a naked flame could be hazardous as the risk of fire does exist with some of the amber imitations, also, some of the odours given off when heated can be quite unpleasant. The easiest and recommended test to apply is the brine solution and then if there are still concerns try the sectile qualities. If the flame or heating tests are to be attempted, it is recommended that they be carried out in a well ventilated area and refrain from using large quantities of material as the larger the quantity the larger the possible problem.

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Grimaldi, D. A. 1996. *Amber: Window to the Past.* Harry .N. Abrams Publisher. ISBN 0810919664.

FIELD TRIP REPORTS

THE CRETACEOUS OF FAR NORTH CENTRAL QUEENSLAND

by Paul Tierney

Many people will have heard of that favourite collecting area in far north central Queensland called the Walsh River and in particular a spot on the Walsh called the Boomers. Each dry season this area suffers severe over collection at the hands of amateur collectors and professional dealers, who regrettably give the rest of us a bad name. Fortunately there are other localities, in the same area, which are largely unknown and thus uncollected and it is these areas which we were able to visit during August of 1999.

The Cretaceous rocks are Late Aptian in age and are part of the Doncaster Formation which is in turn part of the Carpentaria Basin. The Carpentaria Basin formed what was the ocean connection of the Cretaceous inland sea for most of its history, except during the Late Aptian at which time the inland sea was so extensive that mainland Australia was essentially five islands. Most of the fossils collected in the area are found in concretionary nodules that deposit in shales and sandstones of the Doncaster Fm. which form the banks and bottoms of many creeks and rivers, although some, like "Dave" the plesiosaur, are found in the shales and sandstones themselves. In areas of black soil plains, the nodules actually rise up through the soil to lay on the surface which makes collecting extremely easy.

Figure 1. Extent of the inland sea during the Barremian and early Aptian. From Cook & McKenzie, 1997.

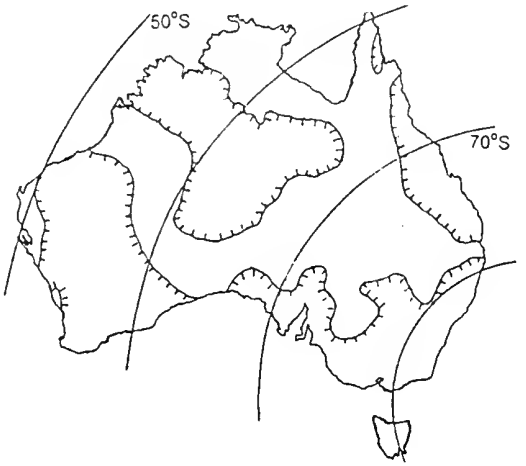

Figure 2. The inland sea during the late Aptian, a period when the inland sea was at its largest. From Cook & McKenzie, 1997.

Figure 3. Creek bank showing shales with concretionary nodules both in the bank and lying exposed on the creek bottom

Figure 4. Nodules lying exposed on the surface of a black soil plain, the Cretaceous sediments are between 30cm and 1m below the surface

The main fossils collected from the localities we visited were of course the ammonites *Tropaeum* and *Australiceras*, however it is possible to find other ammonite specimens of *Myloceras, Toxoceratoides, Saumartinoceras,* and *Aconeceras*. Some specimens of *Tropaeum* and *Australiceras* can be quite large (Fig. 5 & 8) and the detail preserved of most specimens is exquisite. Some nodules contain arthropods like crabs and prawns and very rarely a complete lobster will turn up. Many nodules also contain pelecypods, brachiopods and bivalves but the nodules that contain these never seem to split as well as those which contain the ammonites. It is the extremely rare nodule that contains vertebrate remains and it is a good idea not to split these (generally the bone will present itself on the surface of the nodule, thus giving away the nodules contents) but return them home to be mechanically prepared; this same treatment should also be considered for the nodules that contain arthropods. At some localities it is possible to find silicified wood specimens and wood that has suffered ship worm infestation (Fig. 6), they are not actually worms but bivalves which burrow into the wood.

Following are some selected pictures of the specimens we found while in the Walsh River area. Readers will notice that I have not mentioned any locality details other than a general area, it is not the policy of *The Fossil Collector* to give out locality information and in the case of this report it is not mine. It should also be mentioned that all the localities we visited are on private property and prior approval was gained.

Figure 5. The largest ammonite found was this 10kg *Tropaeum* sp. which is being held by its discoverer and the authors friend Scott Hocknull.

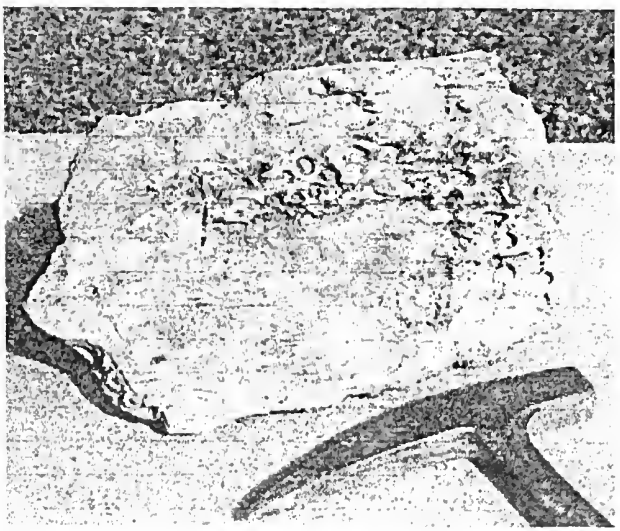

Figure 6. A specimen of wood with ship worm infestation. Some holes still contain the silicified remains of the bivalve that caused them.

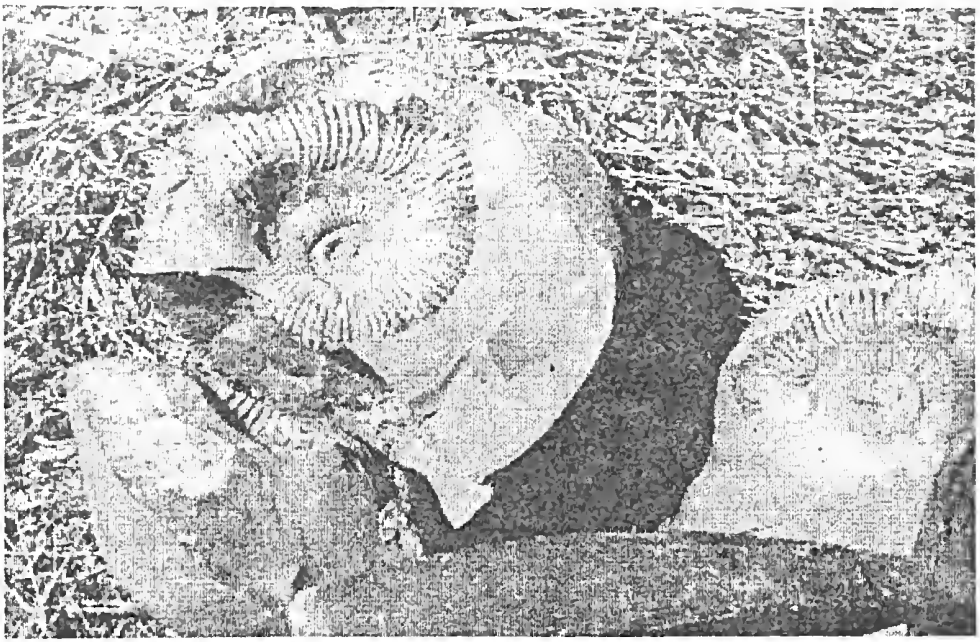

Figure 7. A small but attractive *Tropaeum* sp., this photograph was taken straight after the nodule was split, revealing its content.

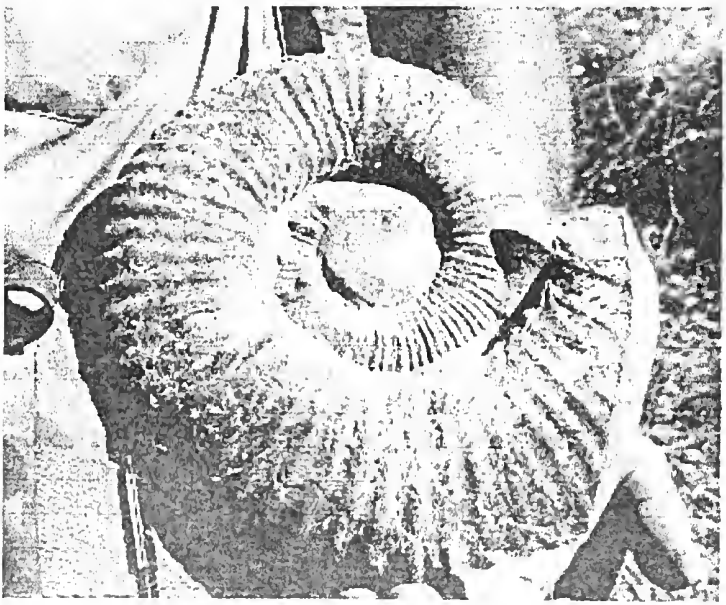

Figure 8. A large and attractive *Australiceras* sp. specimen. This was the largest *Australiceras* found and is being held by its discoverer Tom Bolam.

Figure 9. A *Tropaeum* sp. specimen as it was found on the black soil surface.

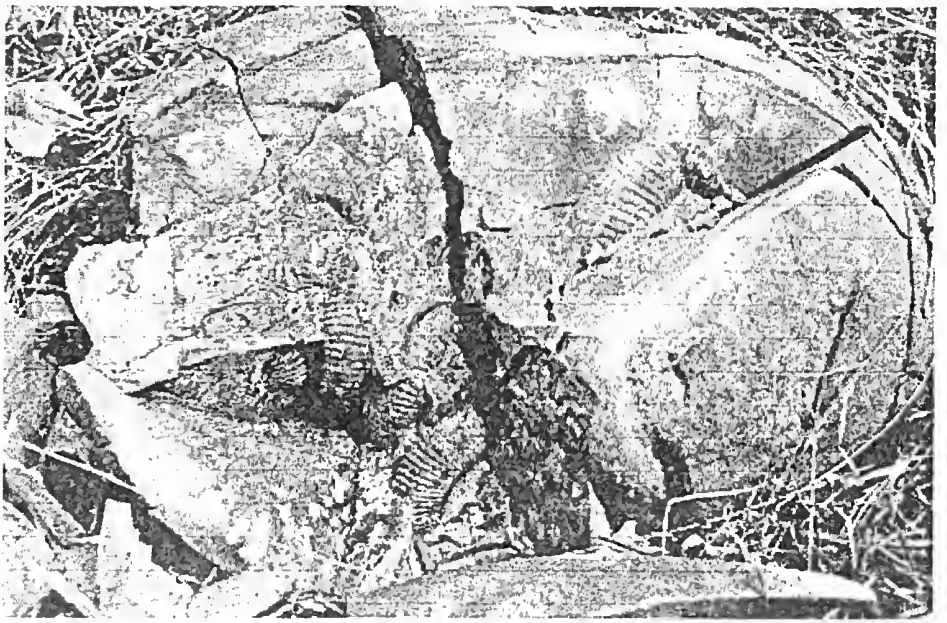

Figure 10. This 'mass mortality' nodule contained around 25 small ammonites.

Possibly the most interesting specimen found was that of the mass mortality nodule (Fig. 10). This nodule contained about 25 small ammonites which were all *Tropaeum* sp. ranging from between 2 and 7 ems in diameter, surprisingly there was no other genus of ammonite in the nodule

The Walsh River area is indeed a wonderful place to collect some beautiful Cretaceous fossil specimens and I am grateful to those people who made the trip a success and truly wonderful time. I am hopeful that the opportunity to revisit the Walsh River area will present itself again, as the chance to collect from the wonderful deposits is a special experience.

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IN THE NEWS

TAGGING FOSSILS TO FOIL THIEVES

Fossil theft is big business and its getting bigger, fuelled by the willingness of some collectors to spend millions snapping up rarities. Russia has suffered particularly badly, losing manuscripts, minerals, Egyptian artifacts and Stradivarius violins, some stolen to order. In 1997, a Chicago museum had to part with $8.4 million at Sotheby's to secure a *Tyrannosaurus rex*.

But apart from photographs and a tiny inked on serial number, there are precious few ways of distinguishing museum artifacts from those in legitimate private ownership. Now scientists at the Lawrence Livermore National Laboratory (LLNL) in California have come up with a way of "watermarking" fossils and other delicate valuables that can pinpoint ownership just as precisely as a DNA fingerprint can trap a criminal. The gamma watermark - a type of radioactive beacon - is almost impossible to forge and can only be read by those with specialised equipment.

Museums of art and natural history across America are expected to adopt the watermark although none, apart from the Denver Museum of Natural History,

wish to be identified. Few wish to advertise the little known fact that their valuable collections are being marked in a bid to stop the plundering.

The LLNL is one of several laboratories whose scientists solve problems for the government. In 1998 it was approached to come up with a way of marking government property, such as fossils, painting, meteorites and military items. "We were asked to develop a discreet, cheap way of tagging property that would provide legally sound proof of ownership," says Dr Lowell Wood, who led the watermark research. "We came up with the idea of using specially selected radioactivity, because it can't be readily detected, and it's microscopic."

The idea was to apply a tiny amount of radioactive isotope to a valuable artifact, its continuous emission of very low levels of radiation would be permanently active signature. Since the type of radiation chosen - gamma radiation - can penetrate material, the watermark could be buried up to a centimetre deep and its signal still be read. Only a millionth of a gram of material is needed for a watermark, about the size of a full stop.

Dr Wood and his team needed to select their radioactive substances carefully, there are roughly 90 unstable radioactive elements, however, many elements exist in several different versions, called isotopes. There are about 3,000 radioactive isotopes altogether and they all spontaneously decay over time, emitting radiation. In order for the watermark not to fade appreciably, the decay must happen over decades and centuries rather than minutes. Dr Wood adds: "We looked for isotopes that aren't found in nature, so the signal coming from the watermark could not be contaminated by something in the environment. This also means the substances would not be available to counterfeiters. However, we didn't want them to be so rare that we had to spend millions to chemically synthesise them."

The LLNL team selected a few dozen isotopes that were suitable but they are keeping the details secret, the only clue is that some are the products of high energy particle accelerators, all of which are under government control. Dr Wood says: "It would be almost impossible for counterfeiters to get around this one, because the ingredients of the watermark cannot be procured, they are not for sale and they can only be made in government laboratories."

The use of several isotopes in one watermark confers added bonuses, different permutations allow different watermarks, or radioactive barcodes, to be created.

Also, the watermark deeays in a very preeise way from the moment it is imprinted allowing scientists to determine the date it was inserted, even centuries after being created, this built-in clock gives an additional, valuable souree of identifieation. The radiation levels are perfeetly safe, the watermark emits about the same radiation as a banana, and about 0.01% the radiation given off by the human body.

A detector would have to be within a centimetre of the watermark to read it, these details, Dr Wood says, can be used to provide proof of ownership: "You have to know where to put the instrument and you have to know what it is going to say, this is good enough to stand up as evidence of ownership in a eourt of law."

For such an original idea, the method of application is surprisingly simple, rcsearehers have been using inkjet printers, filling eartridges with the isotopes and printing invisible barcodes on paper. The "ink" seeps into the material, so it cannot be scrubbed off, it eosts just under US$1 apiece for the watermark to be applied.

The interest from eurators and private collectors around the world, Dr Wood says, has been extraordinary: "This is just like DNA fingerprinting, you can never say a gamma watermark will always be unique, but it has the same one in a million or one in a billion quality that juries are willing to bet on."

Summary of story in *The Times (UK)*, November 24, 1999.

DINOSAURS OUT OF AFRICA

In the steady and unehanging crowd is *Jobaria tiguidensis* (Jobar is a mythical ereature among North Afriean nomads; *tiguidensis* refers to cliffs near the discovery site), a 20 ton (20.3 tonnes), 70 foot long (21.3 metres) cousin of *Apatosaurus* (a genus better known to many as *Brontosaurus*), *Diplodocus* and other sauropod dinosaurs.

What's most intriguing about *Jobaria* is not its features, but that it appeared to be living in the wrong era. The two specimens excavated (by a team led by Paul Sereno), one adult and one juvenile, date to about 135 million years ago, or after *Apatosaurus* and *Diplodocus*, which roamed North America, had already died out.

In appearanees, *Jobaria* is more primitive than its earlier North American eousins. Its neck is relatively short, with only 12 neck vertebra, versus 15 or more in more

evolved sauropods, and it has spoon shaped teeth, like the early sauropods, rather than the pencil shaped teeth of later versions. "It looks like it should come out of the Jurassic, but it is hanging out in the Cretaceous of Africa and doing quite well," Sereno says. Spoon shaped teeth may have been more suited to dining on conifers, while pencil shaped teeth are believed to be better fern munchers, possibly reflecting a shift in vegetation.

During *Jobaria's* time, the southern supercontinent of Gondwana was breaking up into Africa and South America, which may have provided *Jobaria* an isolated ecological niche, perhaps African forests were richer in conifers than those elsewhere. Or, "It could just be chance," Sereno says. "I don't know we have any reason to believe Africa was much different from any other place."

Sereno and his co-workers have dubbed their second African sauropod find *Nigersaurus taquetti*, a small 50 foot long (15.2 metres) sauropod that lived about 110 million years ago. It was a toothy dinosaur too, "There are 140 teeth exposed when it smiles," says Sereno. And stacked behind each pencil shaped tooth are up to seven replacements, ready to pop down when the tooth in front falls out. In all *Nigersaurus* had more than 600 teeth, giving the skull an angular shape, unlike other sauropods. "It's the most bizarre sauropod found in years," says Sereno.

Unlike the persisting shape of *Jobaria*, *Nigersaurus* evolved its unusual appearance relatively quickly, in a few million years. Ecological conditions probably are what causes some dinosaurs to transform radically in appearance in a short period of time, while other persist almost unchanged for millions of years.

Summary of story in *ABCNEWS.com*, November 11, 1999.

AUSTRALIAN FISH FOSSIL MAY BE DISTANT HUMAN RELATIVE

A 400 million year old fossil fish, recently discovered near the New South Wales town of Wee Jasper, may be one of the human race's earliest relatives, according to researchers at the Australian Museum. Museum research fellow Alex Ritchie said the fossil's braincase showed the fish had an eyestalk connecting its eye with its brain. It was the first fish of its type to be preserved well enough to show this, Ritchie said it was probably a primitive type of ray finned fish. Previously, it was thought only archaic armoured fish and some primitive sharks had eyestalks.

Ritchie said the fish could be part of the lineage that not only led to ray finned

fish, but also to land vertebrates and humans. "It's not only one of the oldest speeimens, but it's also the first speeimen that eould be affiliated with us as well," a spokeswomen from the museum said. Museum staff discovered the fossil fish about six months ago on the shore of a dam, the area is believed to have been the site of a reef 400 million years ago.

Summary of story from *Yahoo News Online*, January 17, 2000.

POSSIBLE BIGGEST DINOSAUR FOUND IN ARGENTINA

The bones of what may be the largest dinosaur yet diseovered were found by a villager in a vulture ridden series of eanyons in Argentina's southern Patagonia region.

The dinosaur is a herbivore that roamed the Earth about 105 million years ago with estimates on its length hovering between 157 feet (47.8 metres) and 167 feet (50.9 metres). "Two eervieal vertebrae 3.94 feet (1.2 metres) high were found, in addition to a femur 6.56 feet (2.0 metres) in height and some other indieative bones," paleontologist Carlos Munoz, direetor of the Florentina Ameghino Museum in southern Rio Negro said. The newly diseovered plant eater is thought to be 26 feet (7.9 metres) longer than the 100 ton (101.6 tonnes) *Argentinosaurus*, whieh was unearthed elose by and is the largest dinosaur of any type ever found.

The serubby, desolate region, called La Buitrera, has proved to be an extraordinary dinosaur graveyard. Argentine paleontologists have already uneovered the remains of what they think may be a meat eater larger than *Gigantosaurus*, the biggest earnivore on reeord.

A team of paleontologists is beavering away at the La Buitrera diseovery site with the aim of removing the eaehe of bones to the Florentina Ameghino Museum by the end of January. "We are going to be working until Jan. 31 and then we will take everything to the museum to remove the sediment, study it and later mount a presentation," said Munoz.

Summary of story from *Yahoo News Online*, January 20, 2000.

GIANT DINOSAUR EGGS FOUND

A team of South Korean palaeontologists say they have diseovered the world's largest fossilised dinosaur eggs. The 20 eggs, measuring 41 eentimters (16 ineh es) from tip to tip, were diseovered in a giant nest thought to be 100 million

years old. The nest, which measures 1.5 metres (4½ feet), could yield new information about how dinosaurs reproduced and the sort of parental care they gave their young.

Professor Kim Haang-Mook of Pusan University, who is taking part in the excavation, said he believed the eggs belonged to a plant eating dinosaur, he said the largest example is one centimetre longer than any previously found, the width is 12 centimetres (4.7 inches) across and the shell is 2 millimetres thick. "We are going to ask the government to designate this site as a national treasure and protect it," he added.

Summary of story from *BBC News Online*, January 22, 2000.

FOSSIL FAKE

The "missing link" dinosaur-bird featured by *National Geographic* magazine in November, 1999 is a fake. Archaeoraptor, the unofficial name of the fossil, is actually two animals pieced together either as an honest mistake by its discoverers in China or as a breathtaking forgery. The composite consists of a birdlike upper torso and the tail and feet of a small raptor, the magazine described it as a "true missing link in the complex chain that connects dinosaurs and birds.

The specimen, smuggled into the USA from China, was found at the 1999 Tucson Gem and Mineral Show by Stephen Czerkas, owner of the Dinosaur Museum in Monticello, Utah. He purchased it for US$80,000 and made a deal with *National Geographic* to study and publicize it and ultimately return it to China.

How *National Geographic* finds itself at the center of a scientific embarrassment is a tale as layered as the 120 million year old sediment from which the fossil was unearthed. "Assuming that all the evidence is in and it is a composite, not since I've been editor has anything happened like this," *National Geographic* editor Bill Allen said. "At any time prior to publication, if we had been informed of any problem at all, we would have yanked (the article)." The composite nature of the fossil was not detected by the magazine's team of scientists, and a scientific paper that was submitted to both *Science* and *Nature* was never published, as a result, *Geographic* was on its own with no independent review of the fossil.

Allen says he was notified on December 20 by a Chinese doctoral student and member of the *Geographic* team that the fossil was not authentic. The society

modified text on the public display to say questions had been raised about the fossil's origins.

But Storrs Olson, curator of birds at the Smithsonian Institution's Natural History Museum and an outspoken skeptic of the dinosaur-bird link, says he warned the magazine in November 1999, when the article was published, that there were serious problems with the fossil, he says he was ignored. "The problem is, at some point the fossil was known by *Geographic* to be a fake, and that information was not revealed," Olson says.

Summary of story from *USA Today*, January 25, 2000.

NEW SNAKE UNEARTHED

A new Australian species of prehistoric snake has been discovered and it could be a link between modern snakes and goannas, researchers say. *Wonambi barriei* was up to 3 metres long and lived up to 30 million years ago and the skull had both python and lizard like features. There is no record of it after 25 million years ago, at which time it either became extinct or evolved into another younger snake called *Wonambi naracoortensis.*

At 6 metres long, *W. naracoortensis* lived about one million years ago when other Australian animals were also huge, such as kangaroos, wombats, birds and diprotodontids.

Archaic snakes, called madtsoiids, died out about 50 million years ago - except in Australia where some, big and small, found a haven, but about 25-30 million years ago, more modern snakes arrived. Pythons ate the archaic snakes' big prey and Australia's infamous poisonous snakes ate small lizards, the extra competition could have wiped out Australia's giant snakes, says Dr John Scanlon, from the University of New South Wales, who studied the new find.

Certainly, by the time of the Pleistocene, one million years ago, there were only two species of ancient snake left and these both died out in the past 100,000 years along with all of Australia's giant marsupials and birds. Dr Scanlon suspects there are two reasons: "An ice age started about two million years ago and humans arrived up to 60,000 years ago, the ice age and human hunting and burning caused major environmental changes."

Summary of story in the *Herald Sun*, January 27, 2000.

LARGER THAN LIFE

Giant snakes, more than three metres long and up to 30 centimetres in diameter, roamed Australia less than 100,000 ago, and their anatomy casts new light on the evolution of their modern counterparts. A recent paper in *Nature* by John Scanlon, of the University of New South Wales, and Michael Lee, of the University of Queensland, describes their study of two species of fossil *Wonambi*, a giant snake which only became extinct during the Pleistocene era. The *Wonambi*, evidence of which has been found across the continent, may have still been living in Australia when the first humans arrived.

The most crucial finding of the researchers is that the *Wonambi* is not related to any species alive today, it is extremely primitive says Scanlon and Lee, similar to the snakes "which lived alongside the dinosaurs, over 70 million years ago". In the rest of the world such snakes disappeared a very long time ago, but somehow they survived in Australia.

The skull and teeth of the *Wonambi* link it to a group of extinct marine animals called mosasaurs. Lee and others published a paper last year showing that the mosasaur skull seems to be an intermediate stage between the inflexible structure of lizards and the flexible head and lower jaw of snakes, which allows them to engulf large prey.

One popular theory of the evolution of snakes is that they arose from lizards which lost their legs to become more efficient at burrowing into the ground. This would suggest that the ancestors of all modern snakes were small burrowing varieties of lizards. But Scanlon and Lee's study provides evidence that primitive snakes were either marine creatures or large form that did not burrow, their paper suggests snakes lost their legs and developed elongated bodies to facilitate swimming or moving through dense vegetation.

Summary of story in *New Scientist*, February 12, 2000.

LARGEST MEAT-EATING DINOSAUR DISCOVERED

Scientist have discovered the bones of what may be the largest meat-eating dinosaur ever to walk the Earth - a razor toothed beast more terrifying than *Tyrannosaurus rex*. A team of palaeontologists from Argentina, Canada and North America unearthed the fossils in the Patagonian desert, on the eastern slopes of the Argentinian Andes. There are at least six, and possibly as many as

ten, animals preserved at the site. The predators' graveyard ehallenges the theory that the biggest meat - eaters were always loners, it suggests that these animals lived in paeks, making them even more menaeing to their prey. "You always think of these things as being solitary, now we know they travelled in paeks," said Philip Currie, one of the team, at the Royal Tyrrell Museum in Alberta, Canada.

Dr Currie said the newly diseovered speeies lived about 100 million years ago and was heavier, with slightly shorter legs, than *T. rex*. The dinosaur also had a long, narrow skull and a jaw shaped like seissors, that suggests it eould have disseeted its prey with almost surgieal preeision, Dr Currie added.

Researehers estimate the meat - eating giant was 13.7 metres (45 feet) long, bigger than the reigning king of the earnivores, the 12.5 metre (41 feet) *Giganotosaurus* and *T. rex* whieh was 12.2 metres (40 feet). "I think it would look just as nasty, if not worse," Dr Currie said. "This guy has a long snout, long skull, ineredibly sharp teeth - I think it would have been terrifying."

"The bigness of it gets headlines but, scientifically, it's not that important. But the faet they travelled together, that's very interesting," said Jaek Horner, a palaeontologist from Montana State University.

Dr Currie believes the animal is related to *Giganotosaurus*, but is a new genus and speeies, making the two ereatures as elosely related as a dog and a fox. The new dinosaur is further removed from *T. rex*, at least as different as a dog is from a eat.

Thomas Holtz, a palaeontologist at the University of Maryland, said future researehers are not likely to come upon carnivorous dinosaurs mueh larger than Dr Currie's find. "I think we're getting elose to the size limit you eould be and still be an effeetive meat - eater," said Dr Holtz. "If you get too large, you won't be able to hunt down prey beeause you'll simply be too ponderous."

Extract of story in *BBC News Online*, March 13, 2000.

DISCOVERY CHALLENGES SNAKE ORIGINS

The view that snakes originally evolved from marine ereatures may have to be rethought, say seientists who have analysed a fossil snake with legs.The ereature was found in 95 million year old roeks near Jerusalem. The well preserved speeimen, ealled *Haasiophis terrasanctus*, is the seeond legged snake speeimen to

come from this particular site.

It was from studies of the first snake, called *Pachyrhachis problematicus*, that researchers first developed the idea that modern snakes might have descended from Cretaceous marine animals called mosasaurs. *Pachyrhachis* was viewed as an intermediate step, displaying features that lay somewhere in between those of mosasaurs and today's snakes. But the better detail in the new fossil challenges this theory, claim Dr Olivier Rieppel, of the Field Museum in Chicago, and Professor Eitan Tchernov, of the Hebrew University of Jerusalem.

The scientists looked closely at skull features, which are remarkably similar to boas and pythons. These modern snakes have a distinctively mobile skull structure that allows them to nearly unhinge their jaw in a formidable gape, the two fossil snakes look as though they had a similar ability. "We went back and looked very carefully at the skulls of *Pachyrhachis*, *Haasiophis* and animals like mosasaurs, looking at features like the brainease, dentition, and the joint in the middle of the lower jaw," says Dr Rieppel. "The better preservation of *Haasiophis* allowed us to use its anatomy as a guide, and gave us the background to see just how much these fossils looked like advanced snakes.

Both snakes appear to have unsnake like hind limbs which researchers speculate have evolved more than once during the snake's evolution. Scientists suggest that the snakes with advanced skull design regained hindlimbs that were lost by evolution.

"We know of at least 62 lizard and snake lineages that have undergone some degree of limb reduction," Dr Rieppel says. "Since the fossil record of snakes is very poor, we can't exclude the possibility that limbs in snakes were lost not just once in the beginning, but several times throughout their history." Dr Rieppel says that after studying the new fossils it is difficult to tell how the legs themselves might have been used, since they are too small in relation to the animal's whole body to have been of any use for movement.

The researchers conclude that *Haasiophis* and *Pachyrhachis* are not related to primitive mosasaurs. Dr Rieppel says he believes the ancestors of modern snakes were burrowing lizards that lived on land. However, he acknowledges that the West Bank fossils do not provide clear answers to the question.

Summary of story in *BBC News Online*, March 17, 2000.

PALAEO FUN

PALAEO QUIZ

What do you really know about Geology/Palaeontology? Test your general knowledge with the following questions on various subjects of the science and give yourself a score out of 20. Questions and answers kindly provided by Frank Holmes.

1 Point Questions:

1. What is a comatulid?

2. In what year was Charles Darwin's 'Origin of Species' first published?

3. The extinct Pleistocene animal *Phascolonus gigas* is closely related to what extant Australian marsupial?

4. The *Glossopteris* flora, common in New South Wales, flourished during which geological period?

5. Which of the following rock types is never fossiliferous? Chert, slate, conglomerate, granite, flint.

6. *Monostychia*, *Echinolampas*, and *Lovenia* are common genera of irregular echinoids found in the Australian Tertiary. Which is the odd one out?

2 Point Questions:

7. What animals are generally considered to be ideal zonal indices for late Cretaceous and Cainozoic marine rocks?

8. Which of the following Orders of marine animals does not belong with the others? Terebratulida, Spiriferida, Stromatoporida, Rhynchonellida.

3 Point Questions:

9. What fossils were historically referred to, among other names, as Rams' Horns, Snakestones, and Conger Eels?

10. What names are used to deserihe the three main transverse segments of a trilobite?

4 Point Question:

11. Name two localities where dinosaur footprints have been found in Australia?

Although the answers to the questions above are on the following pages, readers are encouraged to attempt the questions before looking at the answers. There will be another set of quiz questions in the next issue of *The Fossil Collector*, Bulletin 61.

PALAEO QUIZ ANSWERS

1 Point Questions:

1. A free swimming crinoid often referred to as a feather star. Segments of these creatures occur in the marine Tertiary deposits of southern Australia, particularly the Miocene.
2. 1859 (J. W. Murray, London).
3. The wombat- both belong to the family Vombatidae.
4. The Permian (approx. 290- 240 million years ago).
5. Granite, an igneous rock formed well below the Earth's surface. Note: the preservation of fossils in slate depends on the degree of metamorphism.
6. *Monosykchia*, a clypeasteroid, is known only from the fossil record of Australia (Late Eocene - Late Miocene). *Echinolampas*, a cassidulold, and *Lovenia*, a spatangoid, are cosmopolitan forms with extant species.

2 Point Questions:

7. Foraminifera, particularly the planktonic forms. They are small, usually abundant, widely distributed and often extremely diverse. Benthic forms tend to be more restrieted in distribution but can provide useful indicators for loeal correlation.

8. Stromatoporida, an extinet group of doubtful affinity (generally presumed to belong to the Phylum Porifera) that produee large coral-like ealeareous skeletons. The other three are Orders of the Phylum Braehiopoda

3 Point Questions:

9. Ammonites. The distinctive eoiling of the ammonite shell suggested to the Greeks a resemblance to the horns of the ram which was regarded as a saered symbol, partieularly assoeiated with the God *Jupiter Ammon*: specimens thus beeame widely known as *Cornu Ammonis* (horns of Ammon) and eventually in seientifie terms as ammonites. The other terms were commonly used in English folklore to describe ammonites from Whitby, Yorkshire, and Keynsham, Somerset (Snakestones) and by quarrymen of the Isle of Portland, Dorset (Conger Eels).

10. Cephalon (head), thorax (body), and pygidium (tail).

4 Point Question:

11. Dinosaur footprints are well known from Lark Quarry, near Winton, Queensland (early Late Cretaceous); and from beaeh exposures near Broome, Western Australia (Early Cretaceous). Other loealities from whieh dinosaur footprints have been reeorded inelude: Lion Headland, west of Cape Otway, Vietoria (Early Cretaeeous); Balgowan, Lanefield, and Westvale Collieries, Qld (Middle Jurassie); the Carnarvon Gorge and Mt Morgan, Qld (Early Jurassie); the Callide Basin, Qld (latest Triassie); and Rhondda Colliery and Goodna, Qld (Late Triassie). Triassic reptilian footprints from Berowra Creek, N.S.W. are probably not dinosaurian.

PALAEO QUIZ ANSWERS

WORD FIND

M	A	X	C	I	S	S	A	I	R	T
Y	E	V	G	R	Q	D	R	Y	T	S
O	A	S	B	T	D	L	E	O	Q	P
Y	H	N	O	R	I	A	N	K	E	A
Y	F	D	V	Z	N	T	B	R	F	K
D	G	H	K	G	O	Y	M	Z	A	X
I	O	F	R	F	S	I	F	A	Y	G
G	S	S	O	R	A	T	C	S	D	Y
E	J	H	N	N	U	G	T	O	J	R
O	P	Q	O	S	R	R	U	J	G	R
L	S	G	S	D	I	G	Y	K	R	A
O	O	C	A	D	Q	S	V	L	A	U
G	J	G	U	W	V	Q	E	T	P	Q
I	Y	R	R	T	U	R	C	S	T	K
C	A	C	U	X	R	B	H	A	O	R
A	T	U	S	E	G	B	I	H	L	A
L	I	M	E	S	T	O	N	E	I	L
V	V	D	H	P	D	O	O	Q	T	X
I	T	R	I	L	O	B	I	T	E	C
M	A	C	R	O	P	O	D	R	T	N

The words below can be found above, they can run vertically, horizontally, diagonally and reverse:-

Mesozoic, Dinosaur, Triassic, Lark Quarry, Era, Kronosaurus, Xystridura, Norian, MYO, Graptolite, Permian, Macropod, Trilobite, Echinoid, Limestone, Gogo, Geological.