

ALBERTA PALAEOLOGICAL  
SOCIETY

# BULLETIN

**VOLUME 3, No. 4**

**DECEMBER 1988**

**ALBERTA PALAEOLOGICAL SOCIETY**

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	Programs & Education	Darren Tanke	823-6420

The Society was incorporated in 1986, a non-profit organization formed to:

- A. Promote the science of palaeontology through study and education.
- B. Make contributions to the science by:
  - 1) Discovery
  - 2) Collection
  - 3) Description, curation, and display
  - 4) Education of the general public
  - 5) Preserve material for study and the future
- C. Provide information and expertise to other collectors
- D. Work with professionals at museums and universities to add to the palaeontological collections of the Province (preserve Alberta's heritage).

**MEMBERSHIP:** Any person with a sincere interest in palaeontology is eligible to present their application for membership in the Society.

Single Membership	\$10.00 annually
Family or Institution	\$15.00 annually

OUR BULLETIN WILL BE PUBLISHED QUARTERLY: March 1, June 1, September 1, and December 1 annually

DEADLINE FOR SUBMITTING MATERIAL FOR PUBLICATION IS THE 15TH OF THE MONTH PRIOR TO PUBLICATION.

Mailing Address: Alberta Palaeontological Society  
P. O. Box 7371, Station E  
Calgary, Alberta, Canada  
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**PRESIDENT'S MESSAGE**

**WAYNE BRAUNBERGER**

In the March edition of the "Bulletin" I indicated that I would not stand for re-election, this will become a reality in January. Candidates have cane forward for the positions of President and Vice President, I look forward to becoming the Past President. It is my contention that in order to have a successful and vibrant Society, new members are always needed on the executive and board of directors. This brings in new ideas and new approaches to problems, which prevents stagnation and helps to keep the Society moving forward.

Over the last year we have been in a holding pattern. We must make some changes, particularly in the area of education. At the present time we only offer the three summer field trips, expansion in education is needed. Any ideas on this subject are welcome, in particular suggestions regarding some form of evening class. Also, we should look at some modification to the monthly meeting in order to increase the educational content.

Over the last three years much has been accomplished. We conceived and built the Society from scratch and have seen it grow and mature. This, I feel, is quite an accomplishment, considering the fact that none of us have had much experience in society inauguration. Those who have worked with me over the past three years are to be commended for their efforts. Not only have they worked hard for the Society but they have also worked well together. Hopefully, this will continue well into the future.

Three years is not a very long time. I have enjoyed my tenure as President and shall continue to work for the good of the Society. I wish my successor well and hope he enjoys himself as much as I did. I also thank you, the members, for the confidence placed in me.

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**ELECTIONS**

The annual election of the officers and directors of the Society will take place at the general meeting on January 20, 1989. Everyone is encouraged to participate.

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**MEMBERSHIP FEES**

Membership fees are now due! Please submit your payment as soon as possible.

Single	\$10
Family	\$15
Institution	\$15

To ensure that your name is included on the membership list, payment must be received by February 15, 1989.

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**SOCIETY OF VERTEBRATE PALAEOLOGY, MEETING AT DRUMHELLER, 1988**

**LES ADLER**

The Society of Vertebrate Palaeontology meets annually near fossil sites in U.S.A., Canada and Mexico. This year's meeting was held at the Tyrrell Museum of Palaeontology, October 13-15, with field trips before and after. Of the 450 participants, representing many countries, about 10 were members of the Alberta Palaeontological Society. Dr. Philip Currie chaired the host committee, comprised of the Tyrrell Museum staff. Phil also chaired the banquet. One of our Drumheller members, Bob Findlay, greatly assisted in the catering of the banquet.

Darren Tanke gave a paper on Pachyrhinosaurus at Pipestone Creek, Dr. Michael Wilson of Lethbridge gave a paper on a mid-Holocene fauna near Medicine Hat, Dr. Mark Wilson participated in papers on fossil fishes and Dr. Don Brinkman extended the paper on micro sites, previously presented at a meeting of the Alberta Palaeontological Society. Approximately 100 scientific papers were presented on fossil mammals, reptiles, amphibians, fishes, birds and fossil preparation. Posters, paintings and slides were shown. APS member Sue Marsland attended many sessions and went on field trips to mammal and dinosaur sites, whilst Les Adler visited mammal sites.

The banquet featured Dr. Fricke of Germany, who had arranged his own financing of a submersible, built to his own specifications for the purpose of filming and studying live coelacanths. He succeeded in locating these fish off the Comoro Islands in the Indian Ocean and showed us slides and his movie featuring live coelacanths, demonstrating how the fins operate. He intends to search for coelacanths in other waters, (à la Cousteau).

Outside the banquet hall there is a "Broncosaurus". This looks like the Triceratops at the Dinosaur Provincial Park Field Station, except that this one is trying to throw off his cowboy rider. Everyone had an interesting time.

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I received a letter from Anna Curtis of the Tyrrell Museum in which Anna informs me of a service being offered by the Resource Management Programme (of which Anna is the Head), whereby private collections could be photographed and documented for registration, at the convenience of the individual member.

The Resource Management Programme has acquired two assistants, Christine Scotland and Kevin Lyseng, who would be willing to supply the equipment and manpower, the member being responsible only for the purchase and development of the film. Should anyone require further information with regard to this service, please feel free to contact Anna, who will be happy to answer any questions.

Readers may recall that in an earlier "Bulletin" I mentioned having met with Anna, for the purpose of setting up a "Question and Answer" column. The idea behind this was, initially, to answer members' queries regarding Bill 11 and its implications, but could easily be expanded to include other topics relating to palaeontology I shall be in contact with Anna in the near future in order to finalize the details, hopefully this column will become a reality in time for the next "Bulletin".

Should you have any questions regarding collecting restrictions, identification, preparation, curation etc., please mail them to me at the Society address and I will forward them to Anna. Editor.

105 E. Victory,  
Temple, TX 76501  
U.S.A.

31 October, 1988

Alberta Palaeontological Society,  
P.O. Box 7371, Station E,  
Calgary, Alberta,  
T3C 3M2  
CANADA.

Dear Geoff,

Except for getting older, fatter (me, at least), and further behind, we are in good shape. All but the getting older part - these shows, set-up dinners, etc., are responsible for much of the above.

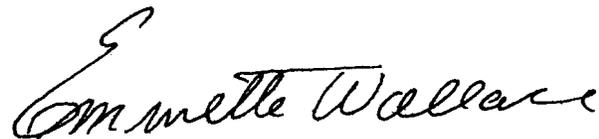
At FOSSILMANIA (the Austin & Dallas Paleo Clubs' all fossil show) the Friday night show was "Dinosaurs in 3-D". This is a 2 camera, 2 Projectory slide show done by Chuck Finsley, curator of the Dallas Museum of Natural History, done in conjunction with the Tyrrell Museum, the Smithsonian Museum and the American Museum of Natural History.

While it does not take the place of a visit to the dinosaur section of these museums, it does present a different viewpoint. This is at least partly due to the filming being done while the museums were not open to visitors and thus allowed greater freedom, especially as to placing the two cameras.

I wish you could all see it.

Next year, a preparator from Tyrrell is coming to Dallas to help the Dallas Museum people in work on a large fish (Xiphactinus) which was removed from the limestone bed of White Rock Creek in North Dallas on Friday, September 9, 1988.

Since this concerns both of "our" clubs we thought it might make an interesting article for the "Bulletin".

A handwritten signature in cursive script that reads "Emmette Wallace". The signature is written in dark ink and is positioned in the lower right quadrant of the page.

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Front Cover: This month's cover features another original from Jeff Doten. Jeff has a hectic academic schedule but has still found time to submit more of his "Bulletin" cover drawings.

FOSSILS MADE EASY .....(2)

LES ADLER

In a previous 'Bulletin' it was suggested that we examine some brachiopods from Canyon Creek, because specimens are common and easy to find. The easiest way to have fossils identified is to go to some experienced person and get the names, otherwise use a publication such as Bulletin 378, Geological Survey of Canada, available at \$12, and containing many photographs. This may not do the trick, so you may have to go to Special Paper No.2 of the Geological Association of Canada : "Mississippian Faunas of Western Canada", or "Index Fossils of North America".

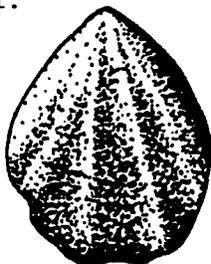
The more that you read, the more complicated each living thing turns out to be, so then you have to read books that have things simplified. Here are some simplified notes on brachiopods. A common name for brachiopods is lamp-shells, as many of them have the shape of an Aladdin's lamp. These marine animals, when alive, have a lophophore, an organ consisting of two arms covered with hairs that agitate the sea water, filtering out bits of plankton and directing them towards the mouth. These animals are simple organisms with a central mouth, a heart, a rudimentary nervous system without sensory organs and a shell similar to that of the bivalves. There are dorsal (brachial) and ventral (pedicle) valves, in contrast to mollusks which have valves on each side. The ventral valve, which is larger than the dorsal valve, has a foot, or peduncle, with which the animal can attach itself to a rock in the sea water. Brachiopods have existed for about 600 million years and have been divided into two classes : "Articulata" and "Inarticulata".

Close to the Ice Caves parking lot, Canyon Creek is joined from the north by Moose Dome Creek. About 1km downstream, fossils occur on both sides of Canyon Creek. Here I find three kinds of brachiopods : Rhipidomella, a chonetid type and a spiriferid type. On consulting references, these are most likely Rhipidomella sp., Subglobosochonetes norquayensis, and Podtsheremia ? albertensis. After examining the specimens you then label and catalogue them for future reference. By climbing the slopes above the parking lot it is possible to find several more kinds of brachiopods, for example : Cleiothyridina lata, Macropotamorhynchus insolitus, and Axiodeaneia usheri. I have selected these six brachiopods because each one looks quite different from the other five and there is no possibility of mistaking one for another. Each one of these brachiopods comes from a different family, of which there are many. At this locality there are many other types of brachiopods to be collected.

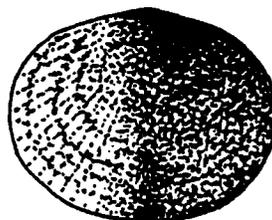
Also present are bryozoans, crinoids, corals and worm tracks, these will be discussed further in a future "Bulletin".

Some Canyon Creek brachiopods

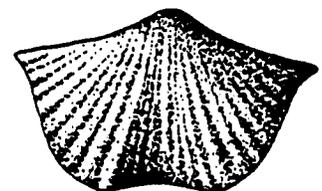
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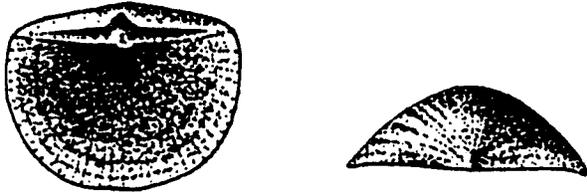


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Canyon Creek brachiopods (contd.)

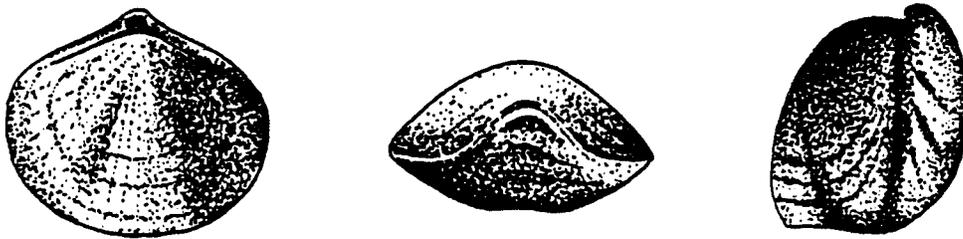
4.



5.



6.



J. Barrett

1. Axiodeaneia usheri      2. Rhipidomella sp.      3. Podtsheremia? albertensis  
4. Subglobosochonetes norquayensis      5. Macropotamorhynchus insolitus  
6. Cleiothyridina lata      (All figs. approx. actual size)

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Due to an unfortunate misunderstanding, an article published in the September "Bulletin" (Vol. 3, No. 3) was incorrectly credited. The article in question appeared under the heading "Field Trip #2" by Jonathon Greggs, part of which included a detailed measured section of the Jura Creek Valley. This portion of the report was not the original work of Jonathon but was taken from the C.S.P.G. Guide Book, 1987, "Geological features of the Jura Creek Valley, S.W. Alberta", by Rien De Wit.

Apologies are extended to Jonathon for any embarrassment this error might have caused him. As a result of this error the text was published without the prior consent of the author, Rien De Wit, to whom profuse apologies are also extended.

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The recent article "Her Majesty Owns The Fossils, But We Own The Documentation", by August Bolvikoski (Bulletin, Vol. 3, No. 3), has proved (not unexpectedly) to be one of the most controversial issues ever to appear in the "Bulletin". The article elicited an immediate response from the staff at the Tyrrell Museum and also prompted comments from our own membership, two viewpoints being presented below.

Following these letters is a further contribution from the pen of August Bolvikoski, in the form of a brief review of the paper "The unpublished fossil record: implications", Teichert et al. (1978). As will be apparent, this paper is open to varying interpretation, anyone wishing to draw their own conclusions can find a copy of this publication in the library at the University of Calgary.

Editor.

### **ARE MUSEUMS YOUR ENEMY?**

**ANON**

I read with interest the article of August Bolvikoski, (A.P.S. Bull 3 (3) : 8, Sept. 1988) in which he expressed his outrage at the totalitarian powers the Province sees fit to grant itself with respect to ownership of fossils of Albertan origin. As a zoologist, amateur palaeontologist, member of A.P.S. and museum curator, I find myself in the middle and would like to comment.

First :- I share Mr Bolvikoski ' s dismay at the apparent arrogance of the Province. Regrettably this tendency is all too prevalent in Canadian Governments and I can neither justify it nor have I a solution for it. Proclaiming blanket ownership without qualification is grossly insensitive, offensive and intimidating. A certain amount of paranoia has no doubt resulted.

Second : - This kind of action has happened before (in respect to Indian artifacts) with unfortunate results for the province involved. Therefore, I don't think we have as much to fear as it may appear at first.

This kind of "confiscatory" legislation tends to arise as a consequence of looting; - the collection and exploitation of cultural and natural history objects for trophies and profit rather than for preservation and knowledge. As regards looters, the interested amateurs and museum specialists are in agreement. The main reason for this kind of legislation is to provide a tool to fight looting, - you may not improperly dispose of her majesty's fossils. A gray area arises under this kind of legislation as to the role of amateurs and here there is a wide variation of opinion.

Sane professionals (especially archaeologists) ardently believe that amateurs should be excluded from archaeological and palaeontological work as they can mess up a site, albeit unintentionally. These are the people that would like to enforce the draconian laws to the letter. Although a minority they do rise to positions of power occasionally but usually for short periods only.

Experience (in another province) has shown that the application of this type of law (registration of collections was required) was a failure. Quite simply, the collectors kept collecting. They only ceased to report their finds. Their documentation was masked, details omitted or written in code. New sites were no longer reported and the amateur collectors ceased to watch (ie. police) sensitive sites.

Artifacts deemed to be Crown property migrated to other provinces where they could be privately owned. The province suddenly found itself in the dark and watched helplessly as provincial material evaporated. It discovered how much it needed the amateurs. Finally the province backed down, replaced the man at the top and matters have settled to an uneasy truce. It is unlikely Alberta will wish to have a similar experience.

The majority of museum specialists are realists. They recognize that professionals can't do it all, that amateur collectors will always exist and in fact, many do good work. They regard responsible amateurs as useful and valuable partners in science and like to encourage their participation and interest in scientific works.

Museums are not interested in amassing vast collections of arrowheads or fossils for the sake of possession. They are concerned only that they not be lost. To this end they provide a repository where collections may be placed if the owner can no longer handle them and they provide a place where artifacts/specimens may be registered so as to be on record. This author's museum stores a significant amount of ethnological material for private owners. It is officially recorded as on loan to the museum and remains the property of the collector who may reclaim it at will. Both the museum and the collector are comfortable with this arrangement. Museums are opposed to the disposal of such material when it is in a manner that results in diminution of scientific value, and regard the removal of material from the province for profit as immoral.

An amateur who conscientiously collects, preserves and documents a collection, reports important findings to specialists, allows specialists to borrow material for study and ensures that his/her collection is disposed of in a manner that perpetuates its value to science is the most valuable friend that archaeology and palaeontology has. Most professionals respect, value and encourage this kind of amateur collector and regard him/her as a colleague. The last thing we wish to do is confiscate or loot their collections. The alienation of responsible amateurs is a disservice to science.

These laws are aimed at the looter and the improper disposal of specimens. It is improbable that they will be used for any other purpose, although it is irksome to have such a gun aimed at ones head.

The laws don't work when applied to the letter on a broad scale. In reality, there is little the province can do. The amateurs go "underground" and continue business as usual. Collections can become invisible or evaporate too easily. The province and science are the losers and the museum specialists know this. There is no profit in having a big gun if you only can shoot yourself in the foot. In short, it is unlikely these laws will be applied except to stop a looter now and then.

So instead, - don't get mad or frightened. Seek to have guidelines issued or the law written so that its intent is more obvious. To this end, I would advocate an amendment that recognizes and defines a responsible collector, grants him/her perpetual custody of his/her collection, establishes standards of care and access, prohibits improper disposal and bars arbitrary seizure (confiscation). This might require registration of collections but this should only be permitted if (and only if) the custodians are legally protected from arbitrary seizures.

Don't regard your museums as enemies. They (and the province) need you more than you need them. It is not in their interest to alienate the conscientious amateur.

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**RESPONSE TO: HER MAJESTY OWNS FOSSILS, BUT WE OWN THE DOCUMENTATION**

**ANNA B. CURTIS  
RESOURCE MANAGEMENT PROGRAMME  
TYRRELL MUSEUM OF PALAEOLOGY  
ALBERTA CULTURE AND MULTICULTURALISM**

Bill 11, which became an amendment to the Historical Resources Act in September of 1987, has clarified the position of amateurs in Alberta by defining ownership of fossil resources in the province. Prior to Bill 11 the legislation stated only that palaeontological resources were the property of the Province of Alberta. The amendment to the Act in 1987 clearly stated, through the Disposition Regulations, that the Crown did not have a vested interest in any fossils collected prior to July 5, 1978. As a means of defining which fossils the Province has jurisdiction over, a registration programme was developed whereby persons who have collections made prior to July 5, 1978 can register them as such and receive a document from Alberta Culture and Multiculturalism stating that the Province has no vested interest in those fossils.

Palaeontological resources collected after July 5, 1978 are the property of the Province of Alberta. Bill 11 allowed for certain fossil resources collected after July 5, 1978 to be owned by individuals through an application process. Surface collection of fossils in Alberta is legal and fossils collected may be retained by individuals who act as custodians of those collections for the Province. In other words, the status of collectors has not changed since the implementation of Bill 11. Rather, their position has been clarified, allowing them to own certain resources which previously were not available for ownership.

Unfortunately Mr. Bolvikoski appears to be under the impression that the Province will confiscate fossils, irrespective of when they were collected, in order to enhance museum collections. This is not the case. The Province cannot retain any fossils collected before July 5, 1978 but may offer to buy any specimens, at fair market value, that may be of scientific value. Fossils collected after July 5, 1978 are the property of the Province and it is hoped that if any specimens of scientific interest are found, they will be shown to a professional palaeontologist

The relationship between amateur and professional has, in the past, proved beneficial to both parties. The Government of Alberta wishes to continue this cooperative effort by dispelling any misconceptions regarding the intent of the Historical Resources Act. To date fossils have only been retained from persons wishing to commercially exploit palaeontological resources collected since July 5, 1978. As amateurs, your contributions to the palaeontological data base is considerable, and appreciated. Under no circumstances will the government ever "raid" your fossil collections. All that is asked is that the cooperation you have shown in the past be continued by your desire for the furtherance of knowledge.

Mr. Bolvikoski's interpretation of the Historical Resources Act is incorrect. He has failed to understand the intention of the Act otherwise he would realize that fossils will not be "confiscated" before or after they are registered. Mr. Bolvikoski's reference to Teichert et al. (1987) and the "horror" stories told therein are also misguided. The thrust of Teichert's paper deals with differing scholarly approaches to the study of palaeontology Teichert compares the use of broad-based theoretical studies in palaeontology, such as the study of diversity in animals through time, with systematics, in which palaeontologists collect, study, describe and interpret fossils within the context of their formations. Teichert laments the unpublished palaeontological record, although this is not to say that these fossils are not properly catalogued, only that they have not been described in monographic format.

To properly study many questions in palaeontology large collections of fossils are required. Ultimately, the results of such studies provide all of us with an enriched understanding and appreciation of past life. Scientifically significant specimens held by private collectors do little to enhance such study because they are largely inaccessible, both to scholars and the public.

Preserving and protecting the past ensures future access. As Teichert points out in a quote from Nicholson, "Museum collections of today, properly maintained, documented, and conserved for long-term use, will be the jewels of scientific research in the 21st century".

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## ARTICLE REVIEW

AUGUST BOLVIKOSKI

'**THE UNPUBLISHED FOSSIL RECORD: IMPLICATIONS**', by Curt Teichert, Walter C. Sweet & Arthur J. Boucot. Published in Senckenbergiana Lethaea, Volume 68, pages 5 to 19.

This article appeared in a German scientific periodical but is written in English. The University of Calgary library carries this journal, but the average collector is unlikely to see it. This is a pity because of the shocking stories it tells.

Museums and government institutions like to operate on the "we know best" principle. Amateur collectors are being hamstrung by restrictive laws and regulations, based on the belief (unfortunately occasionally justified) that collectors do more harm than good to fossil localities. What is not mentioned is that museums are not without sin either. This article puts into print some of the horror stories that have been circulating behind the scenes. It explodes a number of fallacies that museums like to circulate.

FALLACY #1 - Private collections are ephemeral, but institutional collections can be preserved indefinitely for future study.

FACT - The third greatest known collection of Permian crinoids in the world has been lost by the Australian university responsible for it. Most of the crinoids are new to science and never published.

FALLACY #2 - Major new species, genera, or families of fossils are rare. Most of the families and orders of plants and animals have already been described and all that remains is to fill in the details.

FACT - Numerous undescribed fossils, some collected as much as a century ago, sit in museums in Denmark (Greenland brachiopods), Sweden (Silurian invertebrates), Washington, D.C. (Devonian bivalves), Oregon (Tertiary mammals), and countless other universities. The worst story is that of the conodonts, a mysterious group of animals whose remains caused numerous articles and expensive research to be done over the last century. The problem of the conodonts was solved with a fossil collected in the early 1920s and which sat undescribed in a Scottish museum for sixty years.

FALLACY #3 - Institutional fossils will be studied by graduate students and researchers. The published record of these fossils will make the information available for everyone, not just a few private collectors.

FACT - About half of all theses are never published. Valuable information produced at great expense to university-supporting taxpayers is wasted. It should be required that no one can receive a MSc or PhD unless they have published their thesis.

Entire faunas sit undescribed in storage crates. Paleobiologists move from one institution to another every few years and leave uncompleted work behind. The current fad in paleobiology is cladistics and statistics to determine how various groups of species evolved. Since about half of all museum collections represent undescribed species, these studies are worthless and a waste of taxpayer's money because they omit the undescribed fossils which could dramatically alter the conclusions of the studies.

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**PRESERVATION AND DEFORMATION OF Placenticerias intercalare**

**DAVID SPRAGUE**

The ability of a sedimentary unit to produce and preserve a fossil specimen, is related to that unit's reaction to particular geologic events. The initial preservation is dependent on conditions during fossilization. One such condition is the nature of the sediment, fine or coarse grained particles. The example of an ammonite deposited in sand will differ from one deposited in an iron-rich environment.

Pressures resulting from consolidation and low grade metamorphism create the graded sedimentary units such as sandstone, bentonite, shale and coal. These pressure points, in time, inflict secondary structure into the sedimentary package. Selenite and calcite crystals will be created, and the same events can cause fossils to deform and aragonite to re-crystalize.

At specific horizons in the Bearpaw Formation, fossil-bearing iron-rich concretions (usually elliptical in shape) contain gem-quality ammonite. The horizon is packaged by bentonite, proof of synorogenic volcanism before, possibly during, and after deposition of the unit. This event may possibly be the source of iron-rich horizons.

Sandstone on a sandy shale unit contain generally well formed fossils, with internal structure and suture lines well preserved. Calcite is the dominant mineral and shell material is poorly preserved and never reaches gemstone status.

From : Austin Paleontological Society "Paleo Newsletter", September 1988.  
Jean Wallace, Editor.

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## CRETACEOUS CRITTERS

### No:2 STEGOCERAS

DARREN TANKE

Of all the Pachycephalosaurids (Dome-Headed Dinosaurs) known from the Late Cretaceous of Western North America, Stegoceras (Latin for "Horned Roof") is still the best known, albeit incompletely, based on one partial skeleton (Gilmore, 1924; Sues, 1977; Sues and Galton, 1987), several incomplete skulls (Brown & Schlaikjer, 1943; Galton and Sues, 1987 and others), and hundreds of isolated cranial elements, most of which are the easily recognized thickened skull roof (see drawings in this article) or "Skullcap".

Stegoceras was a small, bipedal, relatively primitive plant-eating Dinosaur. Most adult specimens would have had body lengths of about 2 metres and stood not much higher than a 5 year old child. Stegoceras was a small dinosaur, especially so when compared to the contemporaneous Ankylosaurs, Hadrosaurs, Ceratopsians and Tyrannosaurs. Some of the best preserved and most complete Pachycephalosaur material comes from the Late Cretaceous rocks of Mongolia (see Maryanska and Osmolska, 1974) and much data on the osteology (especially postcranial) of these forms is based on the published accounts of the Mongolian material. A comparison of the postcranial anatomy of North American and Asian Pachycephalosaurids shows them to be nearly identical.

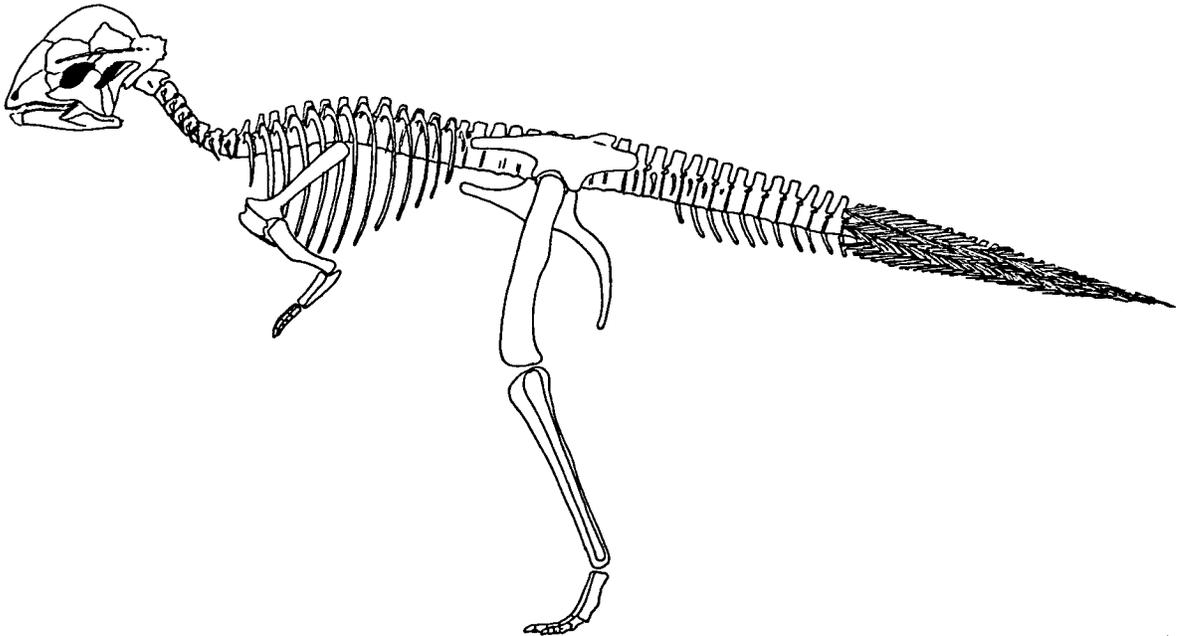
Two groups of Pachycephalosaurs are recognized, those that have a flat-headed skull roof and those that have a thickened "Domed" skull roof, Stegoceras belonging to the latter. The "Dome" in Stegoceras is usually about 4 cms thick. Broken specimens are immediately recognizable as they show a characteristic tight arrangement of tall, hollow columns of very small diameter. An average sized Stegoceras skull cap would have thousands of such columns. The function of the thickened dome in Stegoceras has long been a subject of much debate. The significance of the dome was not understood at first but the general consensus today (see Sues, 1978) is that Pachycephalosaurs would have charged at each other and Knocked heads like modern Bighorn sheep (Geist, 1971) during territorial disputes, or possibly as part of some elaborate pre-mating display. If so, the columnar arrangement of air pockets in the skull roof might have made good "shock absorbers". While the idea of head-butting Dinosaurs is an exciting one, there are some problems with it. Thickened, protruding ridges of bone over the eyes would have blocked the animals vision when the head was lowered. The domes present a small, rounded target. If the two animals collided even slightly off-centre they would rake and gouge each others faces with the numerous small hornlets present on the sides and back of the skull. In the dome-headed dinosaur Stygimoloch these horns were very long (see Anonymous, 1988 for a reconstruction) and a glancing blow would have caused horrific damage with gouged out eyes, a possibility that immediately comes to mind. One would expect pathological skull caps if Stegoceras butted heads but no such specimens have been reported.

The variable ornamental features on the skulls of different Pachycephalosaurid genera would suggest possible different approaches to the idea of head-butting. Perhaps some types stood end to end and harmlessly butted each other's flanks. Head-butting in Pachycephalosaurids has gained acceptance over the years, more so because there is no other good explanation for the greatly thickened skull. The dome might have been used as a defensive weapon against the numerous predatory dinosaurs that lived at the same time. That Stegoceras was preyed upon by theropods is known, Brown and Schlaikjer (1943:125), note a tooth-marked skullcap.

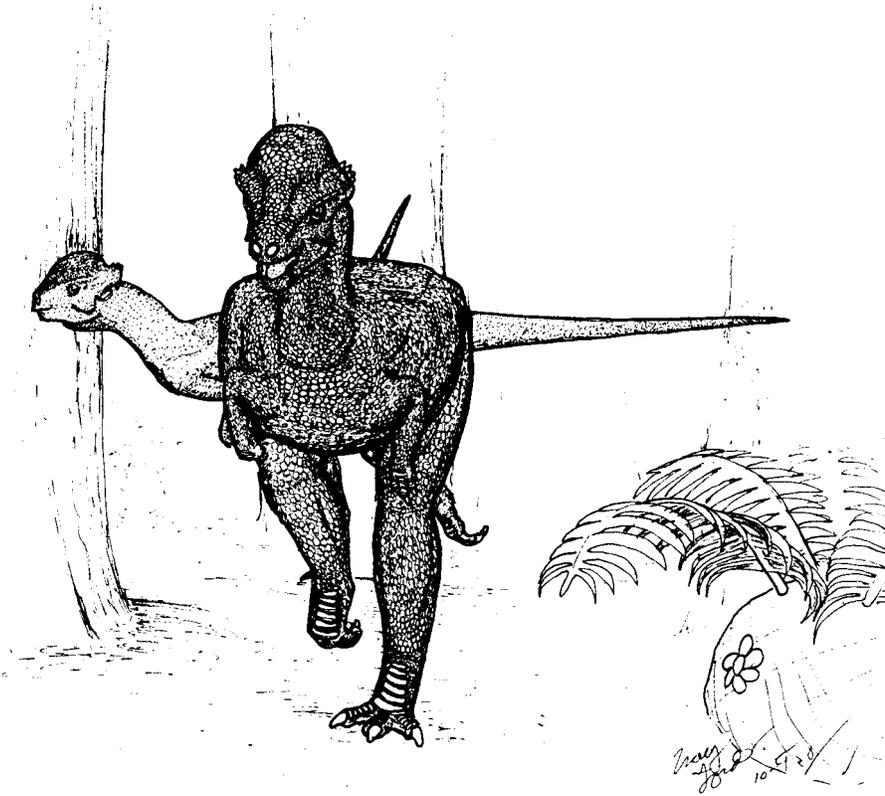
All Pachycephalosaurids had small, simple leaf-like teeth that are surprisingly similar to those in armored dinosaurs. The limbs are of simple design. One of the more unusual aspects of Pachycephalosaur anatomy is the lower back, hips and basal tail region are greatly expanded, probably to house the massive gut (see Paul, 1987). A complex basket-like array of ossified tendons was present on the distal half of the tail (see diagram in this article). This was possibly used for balance when running.

Little of the biology and habits of Stegoceras are known. Most of the skull caps found in Alberta were heavily waterworn prior to burial and seem to have been tumbled great distances. Perhaps most individuals lived in the upland areas hundreds of kilometres to the west in what is now central British Columbia. No Pachycephalosaur bonebeds are known so they probably did not live in large herds like Hadrosaurs and Ceratopsians Stegoceras probably travelled in family units or small groups like modern deer. Whatever their habits were, they must have presented an ungainly if not comical appearance as they roamed the late Cretaceous of Western North America.

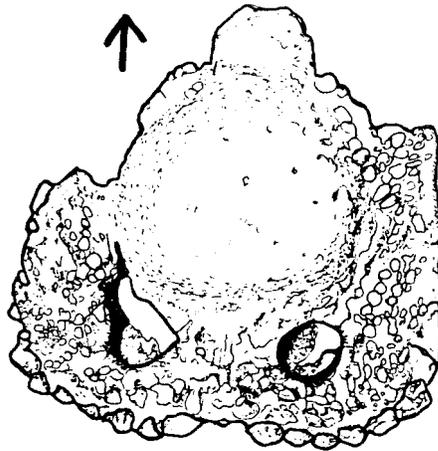
All the drawings in this article are by APS member Tracy Ford of Poway, California.



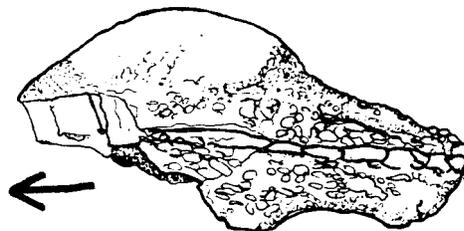
Skeletal restoration of Stegoceras in lt. lateral view.



Life restoration of  
Stegoceras



TMP specimen of Stegoceras  
skullcap in dorsal view (top)  
and lt. lateral view (bottom);  
arrow points to anterior.



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## BOOK REVIEW

LES ADLER

**SCIENCE YEAR, 1989.** ISSN-0-7-166-0589-9. Chicago, Illinois 60654  
ISSN 0080-7621. Library of Congress Cat. No. 65-21776.

This volume of 400 pages is the World Book annual review of Science and Technology for the current school year. It contains a 36 page feature, "Changing Views of Dinosaurs", divided into two sections, the first section dealing with "New Discoveries About Dinosaurs", whilst the second discusses "Dinosaurs and the Artist". There are 14 pages of text and 22 pages of brilliant photographs and paintings depicting nests, eggs, hatchlings, juveniles, herds of ceratopsians and hadrosaurs, fighting theropods and dinosaurs crossing flats. The discussions concern blood temperature, camouflage, extinction, social habits, motherhood, disease resistance and speed of locomotion.

Another 12-page section is entitled; "Finding Out How Old Things Are" and discusses creating a fossil-time index; dating fossils with atomic clocks, radiocarbon dating and stellar clocks.

"Science File" reports on the year' s major developments in geology and palaeontology There are further reports on the discoveries of dinosaur eggs, the Alberta finds being omitted. In February, 1988, Martin Sander of the Palaeontological Institute and Museum of the University of Zurich, in Switzerland, reported the discovery in southern Switzerland of a tiny fossil embryo of a nothosaur, a Triassic aquatic reptile of about 225 million years ago. A long report follows of a study of 26 dinosaur embryos found in their shells in Montana in the mid-1980's. This was written by John R. Horner and David B. Weishampel. Other reports include evolutionary studies of trilobites and the discovery of fossil lampreys of 470 million years ago. There is a report on an archaeopteryx and a fossil bird found in rocks in Spain with an age of 125 million years.

There is plenty to report on palaeontology for the last twelve months!

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