ALBERTA • PALAEONTOLOGICAL • SOCIETY

BULLETIN

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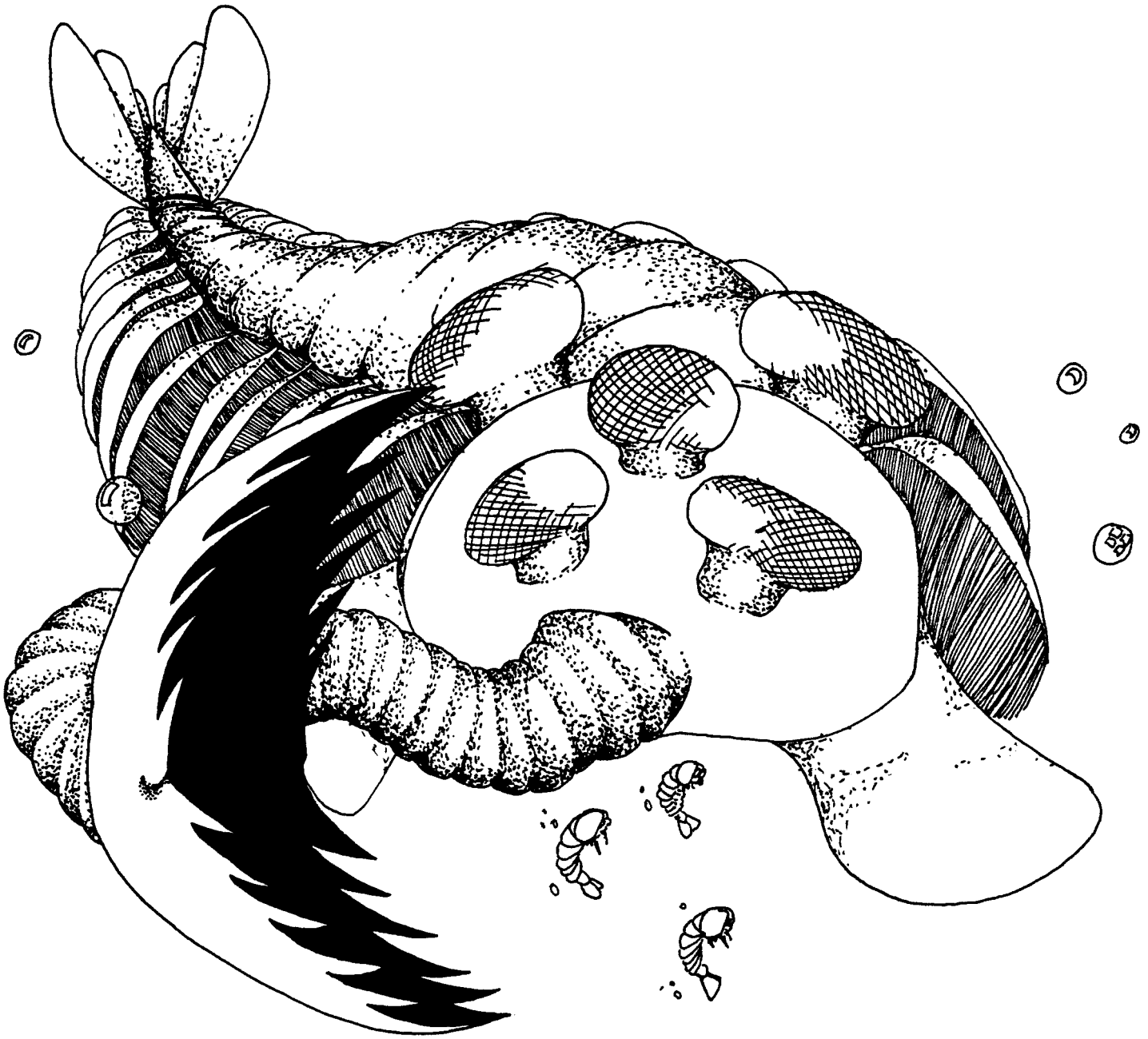

ALBERTA PALAEONTOLOGICAL SOCIETY

The Society was incorporated in 1986, as 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
   4) education of the general public
   5) preservation of 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. (Please enclose membership dues with your request for application.)

Single membership	$15.00 annually
Family or Institution	$20.00 annually

THE *BULLETIN* WILL BE PUBLISHED QUARTERLY: March, June, September and December.
Deadline for submitting material for publication is the 15th of the month prior to publication.

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Requests for missing issues of the *Bulletin* should be addressed to the editor.

UPCOMING APS MEETINGS

Meetings take place at **7:30** p.m., in Room **B108**,
Mount Royal College: 4825 Richard Way SW, Calgary, Alberta

Friday, December 15—Dr. Jim White, Geological Survey of Canada: Palynology
Friday, January 19, 1996—APS member Joe LeBlanc: Palaeozoic corals
Friday, February 16—Chris Collom, University of Calgary: Inoceramid bivalves (Tentative)
Friday, March 15—To be announced

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ON THE COVER: Burgess Shale "weird wonder," *Opabinia* sp. (Middle Cambrian).
Art by APS member Cory Gross. ©1995. Reproduced by permission.

President's Message

by Wayne Braunberger

Since I missed the deadline for the last *Bulletin* I'll have to write an extra long message to make up. In late summer I was still going out in the field and it totally slipped my mind. Anyway, enough of trying to make excuses.

I would like to thank **Les Adler** for serving as president for the last three years. Les, an enthusiastic supporter of the Society since its inception, has also served as vice-president and treasurer. As well, Les has taken (and continues to take) an active role in organizing programs, giving talks, and promoting the Society at various events. In his new role as past-president Les continues to help organize the programs.

Les is also an enthusiastic collector and this September, while showing some visitors around, he made a new fossil discovery. To my knowledge Les has made the first recorded discovery of plant material in the Mount Head Formation (Carboniferous) at Canyon Creek (west of the town of Bragg Creek in the southern Alberta foothills). Although not yet identified, some of the material resembles *Lepidodendron.* Over the years Les has made a number of unique finds and has donated a large number of specimens to the Tyrrell Museum and other institutions.

During the past number of years three other individuals have contributed to the success of our monthly meetings. **Marilyn Francis** and **Roslyn Osztian** have taken care of the coffee and snacks, and **Sam Richter** has handled the raffle table. Marilyn and Roslyn are retiring this year but Sam is continuing on. The efforts of all three are greatly appreciated.

On October 14 Les Adler, **Don Sabo** and myself represented the Society at the opening of Science and Technology week in Calgary. We advertised the Society and put on a small fossil display, which was very popular.

In other news the Canadian Paleontological Coalition is now a reality. This is a cross-Canada network of amateur and professional organizations dedicated to palaeontology. Although many of the details have not been worked out, the Coalition should be a benefit to all, particularly in bringing together amateur and professional palaeontologists.

Education seminars will be offered in the new year, starting with identification seminars in January. **Joe LeBlanc** has kindly made available his basement so we can use the Society collection for the seminars.

Some help is needed to keep things operating smoothly. In particular, a coordinator for the coffee at the meetings, an education coordinator and a director-at-large are needed. If you could help or be of assistance in any other way it would be greatly appreciated.

Education

Response to the informal survey at the October meeting was overwhelming. Thus, a series of education seminars will be started in January. We plan to make use of the Society's collection as much as possible: as such the seminars will be held at Joe Leblanc's home.

Tentative seminars are:

Introduction to identification

—January 11 and 18, 1996

Curation

—February (date to be announced).

Field methods

—May 9, 16, 23 and June 22/23, 1996 (in conjunction with the June field trip).

For March and April, topics on vertebrate and invertebrate paleontology are tentatively planned. All seminars will be held on Thursday evenings from 7:30 to 9:30 pm. Costs will be minimal. Registration forms will be available at the meetings.

Fund Raising

The Society does not have a designated fundraising director but we do hold raffles at the meetings. A progressive raffle of a trilobite replica set is currently underway, with the draw taking place at the December meeting. Raffle items are always needed so donations are gratefully accepted. ❑

Corrections & apologies…

A Dinophile's Summer Holiday (September, p. 6)

In the preface to this article by APS member **Tracy L. Ford** the pronoun "her" was used by mistake. The line should have read: "Tracy Ford originally uploaded this account of ***his*** adventures…" The editor apologizes to Mr. Ford for any embarassment this error may have caused.

DINOTOUR 5, 1995: The Triassic dinosaurs of Texas by Les Adler (September, p. 10)

The author neglected to mention the important contributions of **Heather Whitehead**, who designed and co-authored the DINOTOUR guidebook, along with Bill Carson, Mike Skrepnick and Corliss Moore. ❑

Welcome New Members!

Corliss Moore, Calgary, AB
Dr. Ludwig Rueffle, Berlin, Germany ❑

Reflections on the Carboniferous brachiopods of the Banff Formation at Canyon Creek

by Joe LeBlanc

Few fossil collecting trips can rival the rewards offered by an excursion to Canyon Creek in Kananaskis Country, just an hour's drive west of Calgary. The Lower Carboniferous fauna is rich in invertebrate fossils. A recent excursion yielded a trilobite, a crinoid calyx, two gastropods, a few dozen solitary corals, an equal number of blastoids and as usual, a "pocket full" of brachiopods of various species. As I added the pocket full of brachiopods to other pocket fulls collected on previous trips, I was soon sifting through several hundred specimens and trying to make some sense out of these "brachs."

To the rescue comes Geological Survey of Canada Bulletin 378, *Lower Carboniferous Brachiopods From The Banff Formation of Westen Alberta*, by J.L. Carter. This publication illustrates and describes 87 brachiopods from the Banff Formation, of which 27 are listed as being found at Canyon Creek. Like most works on palaeontology, however, Bulletin 378 should be used as an aid to identification and not as a definitive guide. Yes, most of my brachiopods are described in the publication but a few have eluded easy classification. Discussions with fellow APS members have reinforced some of my own observations of Canyon Creek brachiopods. Among these observations are:

• A variety of the genus *Eumetria*, order Atrypida, is found at Canyon Creek. Bulletin 378 lists *Eumetria osagensis* at other sites, but not at Canyon Creek. The Canyon Creek specimen, however, is more elongate than those I have collected at other Banff Formation localities.

• Bulletin 378 has only one representative of the order Terebratulida listed at Canyon Creek. This is the species *Beecheria chouteauensis*. There appears to be a second member of the order, a more slender, smaller terebratulid found in equal numbers.

• I have found a *Rhipidomella* sp., a punctate Orthid, at Canyon Creek. None is listed from Canyon Creek in Bulletin 378. Members of this genus are rare in the Banff formation.

• The genus *Composita*, of the suborder Athyrididina, is confusing. *Composita prolixa* and *Composita athabaskensis* are listed from Canyon Creek. As I sort out my *Composita* brachs however, it becomes obvious that, based on external characters, other unknown *Composita* specimens seem to be present.

• Specimens of *Schellwienella* sp., of the suborder Orthotetidina, are found at Canyon Creek but are not listed from this locality in Bulletin 378. Like most brachiopods of this genus found in the Banff Formation, my specimens are poorly preserved and not identifiable to species level.

• The Athyridid, *Cleiothyridina lata*, is listed at several localities in the Banff Formation. The Canyon Creek specimens are quite variable in the degree of folding in the sulcus and have a less pronounced "dorsal ridge" than some specimens found at other localities. All, however, are listed as *C. lata*. There may be more than one species of *Cleiothyridina* at Canyon Creek.

• The order Rhynchonellida is not well represented at Canyon Creek in Bulletin 378. There are certainly more species than the one listing—*Hemiplethorhynchus allani*. There are probable specimens of the genus *Macropotamorhynchus* and possibly another genus as well.

Snow now covers the slopes of the Rocky Mountains. The Spring melt will reveal new fossils and among them the usual vast assortment of brachiopods. New specimens will bring new questions. In this article I have purposely avoided observations on the Spiriferid and Productid brachiopods. Tackling these elusive groups takes more tenacity than clinging to the slopes of the Rocky Mountains. Then again, we do have a long winter ahead of us.❑

Don't forget: pay your dues!

Due to a miscommunication, the green renewal slip included with your September *Bulletin* erroneously indicated that 1996 dues paid prior to January 1, 1996 were subject to the old rate. We apologize for the error .

All dues for 1996 are subject to the new rates as of September 15, 1995. The new rates are: Single $15 Family or Institution, $20

The *Stegoceras validum* community of the Judith River Formation in Alberta

by Marilyn Fraser

[*This article has been adapted from a term paper Marilyn wrote as part of a continuing education course on dinosaurs at the University of Toronto –ed.*]

Locality

By Late Cretaceous (Campanian) time in what is now Alberta, Canada, the eastern part of the continent was separated from the western part by the Western Interior Seaway. Regression of the epeiric sea reduced coastal habitat and produced more dry land, forming two major clastic wedges. The Judith River and Oldman Formations were the result (Padian, 1989). A general cooling trend and a shift to a subtropical climate accompanied this regression (Archibald, 1989).

Weather

In Alberta the mean annual temperature was an equable 20° to 30°C. Rainfall must have been more abundant, but plant growth was subject to seasonal changes in sunlight and precipitation. The carbon dioxide levels were higher and there was possibly a greater atmospheric mass (Russell, 1989).

The environment: flora and fauna

We would hardly recognize the environment of Alberta during the Campanian. With the reduced effects of seasonality, conditions would seem very different. No modern counterparts can be found for the warm subhumid and polar deciduous forests of this time and place. Plants were indicative of the differences in climate. Smooth-margined leaves with drip-tips occur abundantly in warm, humid environments. In tree wood, vessels indicate the kind of climate at the time of growth and the rings record seasonally favourable growth conditions (Russell, 1989).

Flowering plants were likely abundant in the understory of open forests, and were the dominant vegetation in woodlands. Based on fossil pollen studies, there were many angiosperm species abundant in the Peace River area as early as the lower Cretaceous Albian age. (Herngreen and Chlonova, 1981). The *Stegoceras* and other herbivores would have browsed in rich, subtropical forests of small flowering trees among scattered tall conifers (Lessem, 1992). By the end of the Cretaceous, modern plants such as magnolias, buttonwood trees and the rose family flourished. There were some shorebirds at that time and bees would have been present to pollinate the angiosperms. Cretaceous bee fossils have been found in amber in New Jersey (Gallagher, 1992).

Stegoceras validum

Stegoceras shares features common to all ornithischians. It has an extra bone in the lower jaw: a "beak" called the predentary, that bears no teeth but seems to have been an aid to cropping plants (Padian, 1989). They were plant eaters, and are characterized by a bird-hipped pelvis in which the pubis bone, which points forward in other reptiles, has migrated downward and forward to lie alongside the ischium, which points backward (Padian, 1989).

Stegoceras validum was a goat-sized pachycephalosaurid, known from one partial skeleton and dozens of partial skulls, as well as one complete skull. It was about 2.5 metres long and lived in Alberta and Montana (Lambert, 1993). Named by Lawrence Lambe in 1902, *Stegoceras*, as other pachycephalosaurs, was bipedal. That implies that it had the energetic capability to be *habitually* erect and that it was using its hands with the offset thumb, for things other than support.

One of the most unusual features of the pachycephalosaurs is the woven mesh of ossified tendons that surrounds the distal half of the tail. The function of this feature is unknown (Maryanska, 1990).

Currie has found evidence of Asian-American dinosaur migrations in still-unpublished Alberta finds. At least two of the three kinds of pachycephalosaurs found in Mongolia and thought to be unique to Asia are found in North America as well. Osmólska is convinced there was an exchange of faunas between Asia and North America (Lessem, 1992).

Fossil remains are scarce over their wide geographic distribution; however the total number of isolated pachycephalosaurian skull fragments in the Judith River Formation suggest that they were abundant here and constituted at least 10% of the total dinosaur fauna of this Campanian formation. An intense taphonomic bias against preservation of articulated skeletons is responsible for the discovery of only water-worn, thickened skull caps being deposited in these fluvial sediments (Maryanska, 1990).

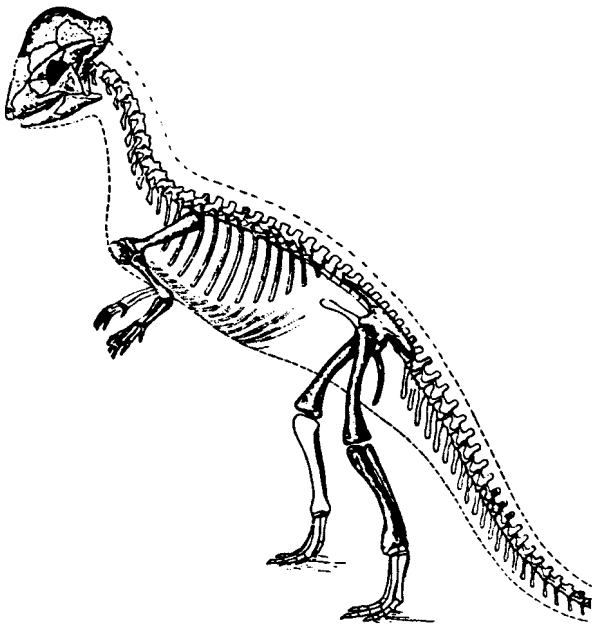
The Alberta Palaeontological Society *Bulletin*, March 1995, printed a report, dated February 8, 1995, stating that "The first known postcranial remains of a pachycephalosaur were found last summer in the Hell Creek Formation of South Dakota. It appears that the backbone contains three wedge-shaped dorsal vertebrae causing the animal's head to be held perpendicular to the rest of the back… therefore, head-butting behaviour, the most popular explanation for the animal's

thick, dome-shaped skull, would seem to be out of the question—the spine is not built like a battering ram." Dale Russell, who will be studying the specimen (pers. comm., 1995), confirmed that the fossil was found by a private collector and that the report is substantially correct: that is, the neck of this specimen is vertical with a U-bend in the backbone. It is, therefore, highly unlikely that this animal would be able to straighten its neck to engage in head butting.

The head

Pachycephalosaurs are particularly good candidates for the study of palaeoneurology. Their skulls were highly ossified with the brain being surrounded by a nearly complete bony capsule. The portion of the endocranial cavity filled with nervous tissue appears to have been influenced by adult body size (Griffin 1989).

There is a distinctive suite of traits that includes divergent olfactory bulbs, large olfactory nerves, short thick olfactory tracts, a moderately expanded cerebrum not separated from optic lobes and cerebellum dorsally, steep cranial flexure, and reduced pontine flexure. With a broad interorbital space between widely set eyes, there is ventral rotation of the occiput with changes of the skull presumably for head-butting according to Griffin (1989). In view of the new skeleton found, however, butting behaviour seems unlikely.



***Stegoceras validum* (Gilmore)**
Figure reproduced from Gilmore, 1924.

The senses: vision, smell

Endocranial anatomy is remarkably uniform in the suborder Pachycephalosauria. They typically had a well-developed olfactory apparatus. The distance between the orbits of the skull is so wide that it accommodates the olfactory bulbs anteriorly. Stark (1979) notes such divergence of the olfactory bulbs among snakes, only in those genera that possess large interorbital distances, indicating wide-set eyes. It would seem probable that *Stegoceras* had good binocular vision with the lateral distance between the eyes externally on the skull. It is probable, with such wide-set eyes that the animal would be able to see to the rear, somewhat like a horse. This would give an advantage to an herbivore with no great defence skills and not particularly speedy. It would be more aware of possible attack from the rear.

Behaviour

Evidence suggests *Stegoceras validum* typically held its back level, balancing the weight of its head and body with a heavy stiffened tail, much like a bird. The femur is longer than the tibia in one partial skeleton previously found and in other pachycephalosaurs. This pattern suggests that they probably could not run very fast (Lessem, 1992; Lambert, 1993). Alexander (1989) estimates the running speed of ornithopods, based on footprints and a leg length of 1.4 to 1.6 metres, to be about 4.3 to 4.8 metres per second or approximately sixteen kilometres an hour.

The huge bulge on the top of the *Stegoceras* skull is solid bone. Although the skull is only 28 centimetres long, its roof is eight centimetres thick. The thick skull roof looks like a battering ram that would take the impact of a head-butting fight. It may be that some skulls thinner than others are those of the female (Alexander, 1989).

The trunk vertebrae of pachycephalosaurs interlock in a way that seems likely to have made the spine rigid, and there were bony tendons or ligaments in the back as well as the tail. This has been interpreted to mean that pachycephalosaurs had very stiff backs. However, the forces of impact would be much smaller if the backbone buckled on impact (Alexander, 1989).

It seems probable that male *Stegoceras* fought rival males of the same species for females. Females would not put energy into fighting because they have to conserve their energy for producing an egg or embryo.

When a male deer or antelope challenges another, each puts on a display that enables the other to gauge its strength before they actually fight. It may be that *Stegoceras* engaged in a similar roaring contest or display before fighting in an attempt to intimidate the opponent.

Czerkas and Stephen (1990) suggest it is more

likely pachycephalosaurs would have engaged in intensive shoving matches such as is common among reptiles.

Sex and babies

Growth rate, sexual maturity and size are surely related. With sufficient food available, smaller ornithischians such as *Stegoceras* would probably mature in a much shorter time than larger herbivores such as *Maiasaura* for example. It is not likely that hadrosaurs would mature in less than five years and more likely 10 to 12 years (Dunham et al, 1989). Being a much smaller animal, it is a probable estimate that *Stegoceras* may have matured in five years or less.

Dinosaurs must have copulated differently than say, horses or elephants. Their big tails would get in the way. Reptiles do not have the sexual orifice separate from the anus, like mammals. The two are combined to form a single opening called the cloaca. This is on the underside of the tail, a short distance behind the legs. To copulate, a male must press his cloaca against the female's. Lizards manage by twisting their tails together. Dinosaurs may have copulated like this, with the male lifting one hind leg over the female's back (Alexander, 1989).

Most of the available data are from a few ornithischians, but evidence suggests dinosaurs were oviparous (egg-laying). Currie (1988) found a nesting site for the hadrosaur *Hypacrosaurus* similar to ones reported by Horner (1988). Jain (1989) has reported a nesting area of the sauropod *Titanosaurus* that covered 20 km^2 (Padian and Chure, 1989). Since no nests or fossil hatchlings have been found for *Stegoceras validum*, one cannot say if *Stegoceras* laid eggs or built nests. The degree of development of hatchlings is also unknown. If the tips of the babies' bones were masses of cartilage, they could not walk and would have to be fed in the nest similar to birds. If the hatchlings had smooth hard bone ends, they could have been out of the nest and running right after birth. In the case of maiasaurs, they remained in the nest until they grew twice as big, while protoceratopsians, judging from their fossil bones and their nesting sites, left the nest as soon as they had hatched (Horner, 1988).

Enemies and others

Stegoceras validum would have been the most common dinosaur in Dinosaur Provincial Park. Also found in the park were the species *Gravitholus albertae* and *Ornitholus browni*. Large theropods, spiny-shouldered nodosaurs, and hadrosaurs lived on the lands bordering the coasts.

There were carnivorous tyrannosaurids such as the 1000kg. *Albertosaurus* (Ex Terra Foundation, 1993). Ornithomimids lived in the neighbourhood and are believed to have eaten eggs as well as small animals. Lizards were present in great variety, and may well have eaten eggs from nests, as many do today. Snakes were small and rare. Freshwater fishes and salamanders were similar to living ones and there were a few shore birds. Among the other animals living in their neighbourhood were the turtle *Boremys pulchra* (Brinkman and Nicholls, 1991) and ceratopsians, young and old (Dodson and Currie, 1988).

In addition to dinosaurs, there were probably over 100 species of vertebrates (not including birds) in this environment (Archibald, 1989).

Diet

Pachycephalosaurs were most probably herbivorous as indicated by their dentition. The relative size of the simple, spatulate teeth and the pattern of wear vary from species to species implying they may have fed on different kinds of vegetation. The teeth are enamelled on both sides; they are subconical, slightly recurved with denticulate distal edges, and oval in cross-section. Tooth wear, when it exists, consists of nearly vertical facets that are continuous on adjacent teeth (Maryanska and Osmólska, 1974), suggesting at least some sort of puncture-crushing. It is probable that different species fed on different kinds of vegetation, based on different wear patterns on teeth (Maryanska, 1990). They may have eaten insects as well.

Gut capacity was moderately large due to the rearward extension of the ischium and pubis from the general condition seen in other ornithischians. The small *Stegoceras*' browsing height would have been within a 1-metre range of the ground (Weishampel and Norman, 1989).

Herbivorous dinosaurs, like chickens, swallowed stones called gastroliths to aid in processing coarse vegetation. Evidence for this habit is the many fossilized skeletons found with numerous highly polished stones in the region of the abdomen (Gillette, 1994).

Endothermic or ectothermic?

Endothermic birds keep their bodies at 40°–43°C and mammals at 36°–40°C, in all climates. Ectothermic reptiles adjust their temperatures on sunny days by moving back and forth between sun and shade. The metabolism in endotherms is pretty fast. Most of the energy released is heat that warms the body. Endotherms, because they have a high metabolic rate, must eat more. In most cases, endothermic animals, as we know them, have some insulation to aid in heat retention. This "coat" is in the form of fur or feathers. There is no evidence regarding the kind of skin that *Stegoceras* had. In some rare cases, skin impressions have been left in the rock with the skeleton of an animal. The skin impression of an hadrosaur from Dinosaur Provincial Park in

Alberta is distinctly like that of the reptile, *Iguana iguana* (Laframboise, pers. comm., 1993).

Horner (1988) has suggested the possibility that dinosaurs had to grow extremely fast and so were probably warm-blooded until they reached sexual maturity when their metabolism would slow down considerably. It has been suggested that advanced dinosaurs may have had an intermediate system of some type, somewhere between ectothermic and endothermic.

Summary

It is unfortunate that *Stegoceras* and the other pachycephalosaurs are so incompletely known. The new find of a post-cranial skeleton is important for the additional information it will give about these goat-sized herbivores. Their interactions with each other and their forest habitat must have been fascinating. As Sereno (1989) said, "we must keep in mind it is critical that we frame our hypotheses about dinosaurs in such a way that they can be rigorously tested; otherwise we will wander into debates that cannot be resolved."

Acknowledgements

The writer wishes to thank the staff of the Erindale library for their very helpful assistance with research. Special thanks to Dr. Dale Russell for discussing the new *Pachycephalosaurus* skeleton with me in a telephone conversation and for permission to use his unpublished information. Thanks also to Dr. Hans-Dieter Sues for taking time to discuss pachycephalosaurs in a telephone conversation. Thanks go to Phillip Dimitroff and the staff of the Writing Lab for their critique and helpful editorial advice. The writer also wishes to thank Dr. Rosemary MacDougall for her assistance in directing the research for this paper.

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Fossils in the News

The Western Producer, September 21, 1995:
Saskatchewan town has bone to pick over fossil removal

PONTEIX, Saskatchewan— Noses in this small southwestern town are out of joint after a plesiosaur skeleton, excavated locally by staff of the Royal Saskatchewan Museum [*see Bulletin, December 1993*] turned up in rival Eastend, where the bones are being prepared in the museum's Eastend field station —and, of course, subject to the gaze of money-spending tourists. "We've basically been ripped off, and we're not happy about it," says Ponteix Museum spokesperson Rita Fillion. Royal Saskatchewan Museum director Ron Borden explained that the skeleton was in Eastend because that's where the technicians —who happened also to be working on Scotty the *T. rex*—were stationed at the time, and that the skeleton would eventually be returned to the provincial museum in Regina.

Calgary Herald, October 15, 1995
Ostrich-like dinosaur focus of fossil hunt

Calgary Mirror, October 28, 1995:
Boy finds dinosaur tracks

CALGARY—Eight-year-old Stephen Hews of Calgary, while hiking with his father this past summer, spotted a slab of rock marked with half a dozen eight-inch dinosaur tracks along the Oldman River in southwestern Alberta,"near Longview." [*If the reporters had looked at a map, they'd have discovered that Longview is nowhere near the Oldman River—there are a dozen towns closer to the site than Longview— why they chose to credit Longview is anyone's guess. The site is probably nearest to Cowley –ed.*] Tyrrell Museum staff identified the find as a Late Cretaceous theropod (ornithomimid, or ostrich-like dinosaur) trackway. Darren Tanke and Laurie Barber of the museum subsequently found other tracks attributed to hadrosaurs. The slab was transported to the Tyrrell Museum for study and display.

Calgary Herald, October 21, 1995
Lump found in Mexico may be oldest fossil yet

Calgary Herald, October 27, 1995:
Blob may hold clue to evolution of life

Of the two articles, both reporting new finds of Ediacaran fossils, the second is probably the most important to students of this group of organisms, which predated the "Cambrian explosion" of animal life, some 540 million years ago.

The Mexican fossil shows a central, dome-shaped structure, with tubes radiating outward. It was found in rocks stratigraphically dated to about 600 million years, which would make it one of the oldest Ediacaran fossils known.

The second report, dealing with fossils from Namibia, suggests that, contrary to generally-accepted belief, the Ediacaran faunas may not have been extinct prior to the Cambrian explosion. Using new dating techniques, workers at MIT have found that the Namibian fossils are in fact of Cambrian, not Ediacaran age.

Calgary Herald, September 21, 1995
Tyrrell marks anniversary with spectacular display

DRUMHELLER—Coinciding with the Tyrrell Museum's tenth anniversary is the opening of a new section of the Palaeozoic Gallery, dealing with terrestrial life forms. Included are a huge diorama depicting changes in plant life "from pond scum to conifers," and a Permian Panorama, displaying skeletons of such critters as *Eryops* and *Dimetrodon.* Other displays include terrariums with live insects, and a wall of skulls demonstrating the diversity of amphibians and early reptiles. The second of three major new displays (a Devonian reef exhibit was opened in 1994), the Terrestrial Palaeozoic section will be followed by a major Burgess Shale (Cambrian) exhibit, scheduled to open in 1997.

Calgary Herald, September 21, 1995
Giganotosaurus bigger than T. rex

The Calgary Sun, October 27, 1995:
New fossils rival T-Rex

NEUQUEN Prov., Argentina—An Argentine auto mechanic and amateur fossil hunter has found the remains of a huge carnivorous dinosaur that may be bigger than the ever-popular *Tyrannosaurus rex* of North America. The newly discovered monster, found in the western province of Neuquen and named *Giganotosaurus carolinii,* lived about 30 million years earlier than *T. rex,* and was not closely related. Researchers recovered about 70 percent of the skeleton, and estimate the animal was 13–14 metres in length and weighed up to eight tonnes.

Calgary Herald, September 2, 1995
Fossil hunter strikes paydirt

OTTAWA—A Canadian-German team of palaeontologists working in the Canadian arctic 350 km. east of Inuvik has uncovered the world's most complete collection of Lower Devonian fish fossils. The find, in an area previously mapped as unfossiliferous, included complete or nearly com-

plete skeletons of a small shark, a lungfish, various armoured fishes, a small ray-finned fish and a coelacanth-like lobe-finned fish. "The real significance is that we have so many different kinds of fishes together," says Stephen Cumbaa, of the National Museum of Nature in Ottawa. Some of the fossils represent groups that were previously known only from single bones. Besides the fish fossils, workers found molluscs, plants and "bugs that look like water beetles," providing a good insight into the ecology of the area where the fishes lived.

Calgary Herald, August 23, 1995

Jaws 60 million years old

COCHRANE, Alberta—A local man, fishing the Bow River near the Highway 22 bridge in Cochrane, flipped over a rock on the riverbank and saw a set of teeth protruding from the lower surface. Egan Beyer took the specimen home to show his kids, then deposited it in a shoe box, where it remained for nearly a year, before he decided to take it to the Tyrrell Museum. Palaeontologist Gordon Youzwyshyn, a fossil mammal expert, identified the find as the jaws of a new species of extinct, mole-like mammal named *Aphronorus*, of Paleocene age (60 million years old). The specimen, believed to be the most complete jaws of *Aphronorus* yet found, will be displayed at the Tyrrell.

Calgary Herald, November 18, 1995

Big find: technician uncovers new mammal in Horseshoe Canyon Fm.

DRUMHELLER—This feature article, by technician Jean Thompson, is one in a series written by Tyrrell Museum staff. It documents the discovery and significance of a mammal jaw discovered by technician Clive Coy. The Late Cretaceous Horseshoe Canyon Formation, near Drumheller, while being famous for its dinosaur fossils, had never before produced a mammal jaw. Technician Coy spotted a small tooth projecting from the ground. When he tried digging it out, he discovered a second tooth, and called in museum director Bruce Naylor. Excavation turned up a third attached tooth, and confirmed that the specimen was a mammal jaw, belonging to a marsupial named *Didelphodon.* University of Alberta mammal expert R.C. Fox announced that Coy's specimen belongs to a new species, and sheds light on the development of the *Didelphodon* group. ❑

[*Thanks to Brian Allen ,Vaclav Marsovsky, Trudy Martin and Harvey Negrich for handing over clippings –ed.*]

Your Society Collection

by Joe LeBlanc

Our Society participated in Alberta Science Week with a display at Chinook Mall. Some of our fossil collection, a selection of 24 dinosaur specimens, received much attention from the public. The value of having a quality collection was once again proven. Let's work together to make our collection better than ever. Donations can be brought to our monthly meetings, sent to the APS address, or, if reasonable, picked up by your curator, **Harvey Negrich** (tel. 249-4497 or myself (tel. 246-7601).

Some of the collection is now being stored in "Plano" plastic cases. The cases not only make great storage compartments but the lids can also be opened for easy display. I have housed my personal collection in these cases and find my own specimens much more manageable. A variety of different cases with adjustable compartments can be purchased in the sporting goods section of Walmart Stores.

New additions to the APS collection

1. Mount Head Formation? Carboniferous. A beautiful piece of colonial rugose coral, probably *Acrocyathus* sp. This corallum is highly silicified and shows good external detail of each corallite. Collecting locality unknown. Donor: **Dot MacGowan** (of the Calgary Rock and Lapidary Club).

2. Mount Head Formation, Carboniferous. A Lycopod (club moss) specimen, probably *Lepidodendron* sp. It's rare to find plant fossils in the Rockies west of Calgary, but **Les Adler** has once again proven his resourcefulness. Thanks to **Sam Richter** for accompanying Les and donating the specimen.

3. Oldman Formation, Late Cretaceous. A selection of small ganoid-type fish scales of the garpike, *Lepisosteus* sp. The donor is **Roslyn Osztian**. Roslyn has an amazing ability to find lots of good stuff at microsites.

4. Thanks to **Don Sabo** for sorting and numbering our Moroccan Cretaceous marine vertebrate collection. Don has prepared 21 specimens (mostly teeth & vertebrae) for the collection. Also thanks to Don for his hint: when numbering pieces, use white paint, not typewriter whitener (as I have!) Whitener, even when coated, will eventually wear off a specimen. ❑

The Hadrosaur that came to Texas

by John P. Meyer

[*This article, originally published in* The Fossil Record*, June, 1995, was submitted by Carmel, Indiana member Fred Lewis, who notes that the Dr. Louis Jacobs of this article led part of the DINOTOUR '95 trip, which Fred and several other APS members attended this past summer*]

The hadrosaur remains found by Dallas Paleontological Society (DPS) member and invertebrate fossil hound, Gary Byrd, now reside in a drawer in the research lab beneath Dr. Louis Jacobs' office. And thereby, as they say, hangs a tale.

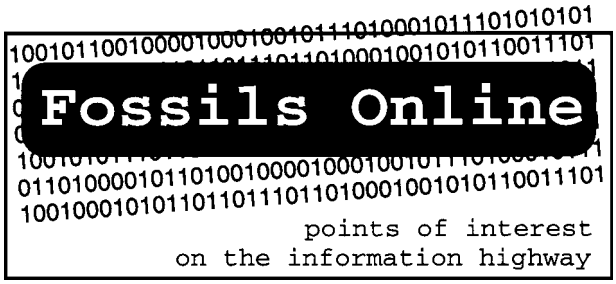
For those unfamiliar with this already famous discovery (it's made several newspapers), a bit of background. For many years, paleontologists have known that hadrosaurs roamed the environs of North Texas in Cretaceous times. Evidence for this includes trackways, bits of bone and teeth. But until the day before Thanksgiving, 1994, no classifiable (by genus) remains had been found. Then, the aforementioned *monsieur* Byrd was examining a road cut near Flower Mound when he came upon some rather large pieces of bone. Alerted to the possibility of an important find by long experience in the field and the finely-honed instincts of a master bone hunter, Gary removed a bit of the material and took it to the Dallas Museum of Natural History, where DPS member Bill Lowe examined the bone and decided to call on DPS honorary member, Dr. Louis Jacobs, for further analysis. One of the bones was immediately identified by Southern Methodist University paleontology student Yuong-Nam Lee as the toe knuckle of a hadrosaur.

Further investigation at the road cut turned up the "holy grail" —a skull. (With the skull at their disposal, dinosaur experts can generally identify the animal as to genus.) Since this is the first skull of a hadrosaur ever found in North Texas, great care is being given in analysis, but it appears certain that it represents a heretofore undescribed genus.

It is also one of the oldest hadrosaur fossils found in North America, clocking in at about 95 million years, and was found in the Woodbine Formation. The Woodbine is proving to be one of the most interesting and scientifically important layers in North Texas, with varying facies composed of marine, terrestrial, and marginal sediments. Since Woodbine sediments were laid down during a period of marine regression, by studying the fossils therein we are able to peer through a window into the distant past during a time when large, mobile creatures such as hadrosaurs were extending their range across briefly connected land masses. The hadrosaur fossil in question may represent the remains of a paleo-pioneer, a true Christopher Columbus of his species.

The specific bones recovered include upper and lower jaw segments as well as some cheekbone and premaxilla material that provide good evidence for the shape of the creature's bill. Unfortunately, the bones are extremely tough as a result of replacement by pyrite and gypsum, so it appears most of the "reconstruction" of this beast will be extrapolative rather than direct. The Dinosaur Society has commissioned SMU paleoartist *extraordinaire* Karen Car to complete an oil painting of the Flower Mound hadrosaur, which has yet to be officially named.

Please note the number of times DPS members have been referenced in the preceding paragraphs. I consider this a compelling testament to the importance of having accomplished amateur (and professional) searchers in the field and in the research lab. Without such enthusiastic support, the science of paleontology would come away woefully lacking. ❑



CompuServe:

Treasure-trove of Aussie fossils found (Sept. 13)
Scientists at Australian National University are working on dating a large number of fossil mammal bones from the Naracoorte Caves in South Australia. Included are bones from extinct species of giant kangaroos, marsupial lion and marsupial rhinoceros.

The bones have been roughly dated at over 200,000 years old. The fact that these finds were made in caves with various kinds of speleothems (cave rock formations) including stalactites and stalagmites, might allow researchers to date the bones with unprecedented accuracy.

Dinosaurs found in South Africa (September 13)
In a brief Reuter item from Johannesburg, South Africa, the discovery of several dinosaur fossils in the northern part of Kruger National Park is reported. The bones belong to *Euskelosaurus*, a Late Triassic prosauropod 8–10 meters long. The fossils are dated at about 210 million years old.

Longest dino trackways found (September 22)
The "Denver Dinosaur Trackers Team" has documented the five longest dinosaur trackways in the world. Among the members of the crew were Martin Lockley, Rebecca Schultz-Pittman, Jerry Forney and Christian Meyer (Switzerland). Other members of the crew were Russian geologist V. Korbatov and the multimedia specialist Andy Dillon (Texas A&M). Up to now the longest trackways recorded are from the Swiss site Lommiswil (Late Jurassic; 90 Ma) and the Portuguese site Fatima (Middle Jurassic; 140 Ma). The new site was poorly documented by Russian geologists in the early 1980's and lies in the border region of Turkmenistan and Uzbekistan. The surface measures 320m x 250m and yields more than 1300 individual footprints of theropods. The longest trackways are: 311m, 266m, 226m, 195m, and 184m long, respectively. They belong to a large "*Megalosaurus*"-like theropod that is almost identical to tracks found in Utah. A smaller morphotype has been detected: this genus, *Therangospodus*, was described last year from the Lower Cretaceous of Spain by J. Moratalla. In addition, the team was able to locate the first Late Jurassic sauropod tracks in central Asia and the first Lower Cretaceous theropod and sauropod tracks in this part of the world.

Hydrofluoric acid warning! (November 12)
Anyone who was thinking of trying to use hydrofluoric acid (HF, not to be confused with hydrochloric acid) for preparation of palynology samples or other uses, had better heed this warning, which appeared in a discussion on the use of this chemical:

Q: Now you've got my curiosity. Is it really that dangerous?

A: YES! HF is particularly nasty because it is strongly reactive with cellular calcium. Untreated exposure to HF can very likely result in a chemical burn that progressively moves up the calcium gradient to bone. Only intradermal, intramuscular and even intravenous administration of calcium gluconate can neutralize and arrest severe damage. POSITIVELY NO EXCEPTIONS! Do not attempt to use Hydrofluoric acid unless you have been properly trained in handling, personal protective equipment, and treatment of burns. I can not stress this enough. DO NOT USE HF unless you are trained! (This reply from Michael Sternberg, of Anacortes, WA, whose company produces HF.)

The Internet:

Check out these web pages! (Thanks to Jim Kirkland, Dinamation International Soc.; and Michael Sternberg, via *CompuServe*)

U. of Alberta Lab for Vertebrate Paleontology
http://gause.biology.ualberta.ca/wison.hp/UALVP.html

U. of Calgary, geology department
http://www.geo.ucalgary.ca/VL-EarthSciences.html

Royal Tyrrell Museum of Paleontology
http//www.cuug.ab.ca:8001/VT/tyrrell/

Geological Survey of Canada library catalog
http://www.emr.ca/gsc/gicd/cgic/catalog.html

Society of Vertebrate Paleontology News
http://cope.ummz.lsa.umich.edu/svp/

Natural History Museum (London)
http://www.nhm.ac.uk/

Electronic Fossil Shark Museum
http://turnpike.net/emporium/C/celestial/epsm.html

The Fossil Record Two online version
(in Macintosh Excel text format)
http://www.gly.bris.ac.uk/www/research/palaeo/frdata.html

Museum National d'History Naturelle, Paris
http://www.paris.org.:80/Musees/HistNat/
or... http://www.mnhn.fr/

The Paleontological Society
http://www.uic.edu/orgs/ paleo/homepage.html

The Field Museum of Natural History
http://www.bvis.uic.edu/museum/

The Palaeontological Association Newsletter
http://www.nhm.ac.uk/paleonet/PalAss/

Michael Sternberg's personal web-page (pictures of plant fossils from Washington State).
http://www.cnw.com/~mstern/

Review

Life in the Universe *Scientific American*, special issue. October 1994.

This issue has as its lead contributors Carl Sagan, Stephen Jay Gould, Marvin Minsky and Steven Weinberg, with another ten authors expressing their ideas on cosmology, the Big Bang, forces, particles, molecules, stars, galaxies, physics, chemistry, geology, biology, extraterrestrial life, intelligence and sustaining life on this planet.

There is a profile of Mary Leakey, archaeologist, on pages 37 and 40 by Marguerite Holloway, with her finds of *Proconsul* (16 million years old) and fossilized hominid footprints (3.6 million years old) in Africa. Pages 44 through 48 provide a 34-inch long time line from the Big Bang through microfossils to macrofossils to man's intelligence and mechanical aids to the present, by Steven Weinberg, cosmologist. There are other illustrations of fossils on pages 70, 71 and 83. Herewith is a summary of Stephen Jay Gould's comprehensive discourse on "The Evolution of Life on Earth," pages 84–91:

Charles Darwin in 1859 called his principle of evolutionary causality "Natural Selection" which located the mechanism of evolutionary change in a "struggle" amongst organisms for reproductive success, leading to an improved fit of populations to changing environments. (Struggle may mean a variety of non-martial activities such as earlier and more frequent mating or better cooperation with partners in raising offspring.) Natural selection is a principle of local adaptation, not of general advance or progress. Natural selection is not fully sufficient to explain evolutionary change, for two major reasons: (a) Many other causes are powerful at levels of biological organization above and below the traditional Darwinian focus on organisms and their struggles for reproductive success—such as random substitution in DNA, punctuated equilibrium and also the effects of mass extinctions. (b) The actual pathway of evolution is strongly undetermined by our general theory of life's evolution. Standard models of simple prediction and replication do not apply.

Three features of the palaeontological record stand out in opposition to the conventional view of gradually advancing complexity throughout life's history: (1) The constancy of modal complexity throughout life's history. (2) The concentration of major events in short bursts interspersed with long periods of relative stability. (3) The role of external impositions, primarily mass extinctions, in disrupting patterns of "normal times."

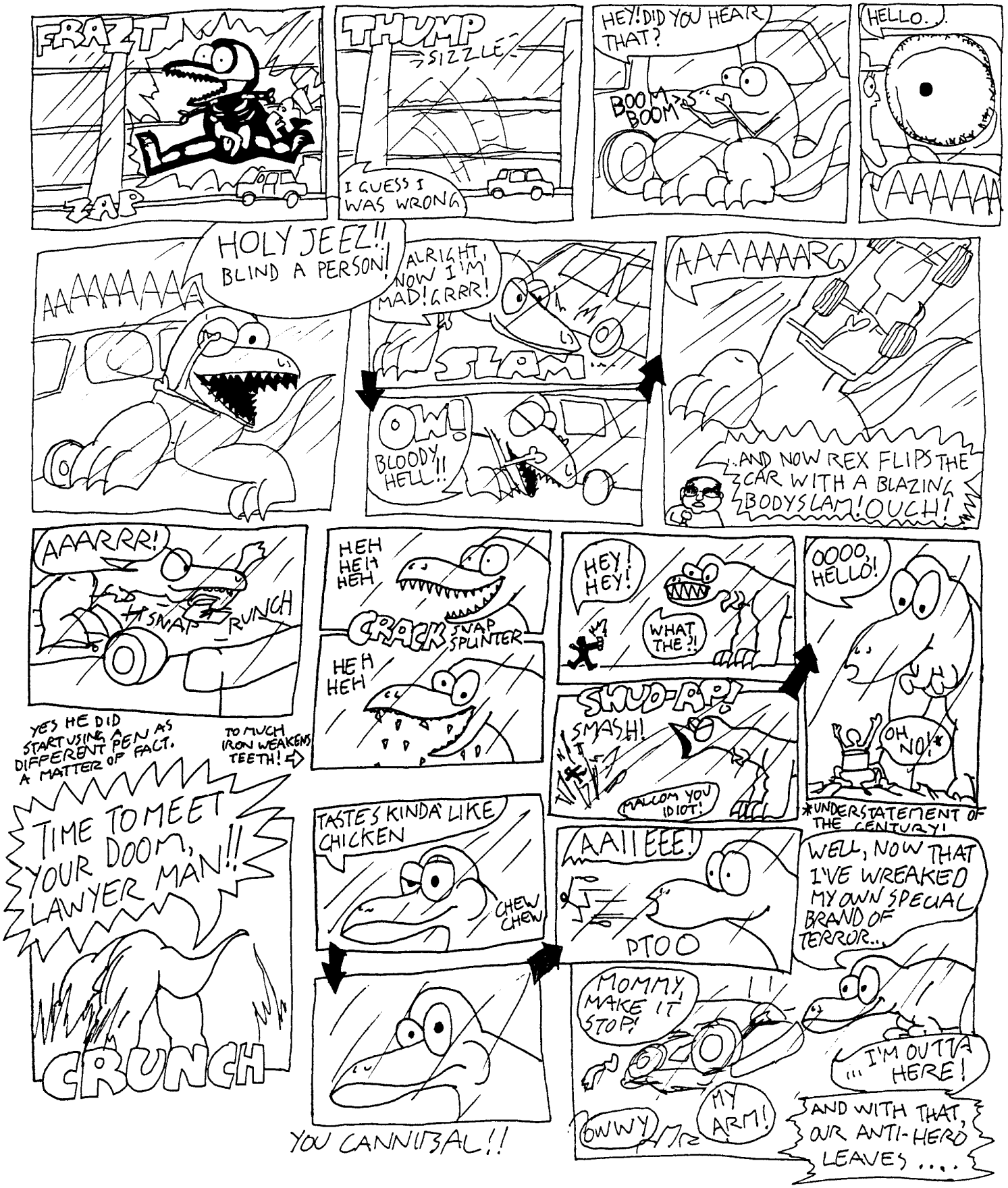
These three features with more general themes of chaos and contingency require a framework for a different iconography of evolution. Gould provides a diagram for this iconography.

Gould states that due to a fixation on ourselves, evolutionary diagrams are biased and, on reflection, are incorrect. The most salient feature of life has been the stability of its bacterial mode from some 3.5 billion years ago to the present. Studies show that there is no evolutionary tendency to favour complexity for mammalian vertebrae or ammonite suture lines. Life remained unicellular almost exclusively for the first five-sixths of its history from the first recorded fossils at 3.5 billion years ago to the first well-documented multicellular animals less than 600 million years ago. This delay speaks strongly against general progress as the main theme of life's history. All major stages in organizing animal life's multicellular architecture occurred in a short period beginning less than 600 million years ago and ending about 530 million years ago with the steps within this time sequence being discontinuous and episodic, not gradually accumulative.

Gould discusses the Ediacaran fauna which was possibly a two-layered organization of animals of which the modern corals and jellyfishes may be a small remnant. The Cambrian small shelly fauna followed and then came the 5–10 million year Cambrian explosion. The subsequent history of animal life amounts to little more than variations on anatomical themes established during the Cambrian explosion. This explosion was the most remarkable and puzzling event in the history of life. Gould presents sketches of 46 life forms found in the Burgess Shale of British Columbia, Canada.

Reinterpretation of mass extinctions as central to life's pathway has come with the Alvarez's presentation of data of an asteroid setting off the last great extinction at the Cretaceous-Tertiary boundary. Raup, Sepkoski Jr. and Jablonski, of the University of Chicago have shown that extinctions were more frequent, more rapid and more extensive than previously realized. Diatoms survived the Cretaceous-Tertiary extinction; many other single-celled creatures did not. Dinosaurs perished, many mammals survived possibly due to small size.

According to Gould, copiously and luxuriantly branching bushes rather than ladders and sequences hold the key to the history of life and that the subsequent history after the occurrence of multicellular life is for the most part a process of elimination and lucky survivorship of a few rather than the continuous progress and expansion of a growing multitude. – *Les Adler* ❑


FRAZT
ZAP
THUMP
SIZZLE
I GUESS I WAS WRONG
HEY! DID YOU HEAR THAT?
BOOM BOOM
HELLO..
AAAAAA
AAAAAAAA
HOLY JEEZ!! BLIND A PERSON!
ALRIGHT, NOW I'M MAD! GRRR!
SLAM
OW! BLOODY HELL!!
AAAAAAARG
..AND NOW REX FLIPS THE CAR WITH A BLAZING BODYSLAM! OUCH!
AAARRR!
SNAP
CRUNCH
HEH HEH HEH
CRACK
SNAP
SPLINTER
HEH HEH
HEY! HEY!
WHAT THE?!
SKUD-AP!
SMASH!
MALCOM YOU IDIOT!
OOOO, HELLO!
OH NO!
*UNDERSTATEMENT OF THE CENTURY!
YES HE DID START USING A DIFFERENT PEN AS A MATTER OF FACT.
TO MUCH IRON WEAKENS TEETH!
TIME TO MEET YOUR DOOM, LAWYER MAN!!
CRUNCH
TASTES KINDA LIKE CHICKEN
CHEW CHEW
YOU CANNIBAL!!
AAIIEEE!
PTOO
WELL, NOW THAT I'VE WREAKED MY OWN SPECIAL BRAND OF TERROR..
MOMMY, MAKE IT STOP!
... I'M OUTTA HERE!
OWWY
MY ARM!
AND WITH THAT, OUR ANTI-HERO LEAVES ....


...ONLY TO RETURN IN A GRATUITOUS "LET'S SHOW OFF OUR EXPENSIVE SFX" SCENE...
ARRRRR!!
MOMMY!
HO, CRAP!
TRIP
SPLAT
AND NOW, EVEN LATER IN THE FILM... (BOY, TALK ABOUT DISCONNECTED!)
WELL KID'S, WE ARE IN DEEP SH-
AAAAAAAAAA
SNORT
HEH HEH
IYYAAAA
TIME TO DIE YOU ROUGE LITTLE BEASTIES!
AAA
WOOSH
SUPER DINO NINJASAURS! THE MOVIE
WWAAAAAAA
THAT'S A BRUCE LEE IMITATION FOR THOSE OF YOU WHO DIDN'T GET IT.
HIYAAA
SMASH
AH!
MY EYES!
MR. REX KING OF THE DINO-SAURS... HOW DID YOU GET IN HERE?
HMMM
?
CAGH
WWAA
AARRRRR
SLIGHTLY IRONIC BANNER
DRAMATIC POSE TIME!
I DON'T KNOW!?!
!?!
NEXT...
SEEING AS HOW I MAY BE LYNCHED OUT OF THE CLUB, I AIN'T MAKIN' ANY PLANS!!!