Alberta Palæontological Society Bulletin

VOLUME 15 • NUMBER 1 MARCH 2000

ALBERTA PALÆONTOLOGICAL SOCIETY

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

a. Promote the science of palæontology 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 palæontological collections of the province (preserve Alberta's heritage).

MEMBERSHIP: Any person with a sincere interest in palæontology 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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UPCOMING APS MEETINGS

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

April 14, 2000—*Breaking symmetry: Phylogenetic patterns of asymmetry variation in animals and their evolutionary significance*; with Dr. Rich Palmer, University of Alberta.
(For a preview of this topic, see the "Asymmetry web site":
http://gause.biology.ualberta.ca/palmer.hp/asym/asymmetry.htm)

May 19, 2000—*A review of the Evolutionary History and Diversity of the Vertebrates, Part 4: Osteichthyes (the bony fishes)* with Dr. Gerry Morgan.

ON THE COVER: *Into the new millennium: First steps.* Art by APS Member Cory Gross © 1999.

Past President's Report

by Wayne F. Braunberger

In addition to acting as an advisor to the current President and Board of Directors the Past President is responsible for the nominating committee and the asset committee. The asset committee is composed of three parts: the library, collection, and equipment. The current librarian is **Mona Marsovsky** , the curator of the collection is **Ron Fortier**, and I am taking care of the equipment. If you have an interest in any of these areas your help would be appreciated.

Nominations

The 2000 elections for officers and directors will be held at the May general meeting. This note is to advertise those positions and call for nominations. Brief descriptions of the duties associated with each position follow. For further details please contact **Wayne Braunberger** (403) 278-5154.

Officers

All officers are elected in May for a one year term beginning September 1 and ending August 31 of the next respective year. The Society operates with four officers: President, Vice-President, Secretary, and Treasurer.

President

The President has the overall responsibility for the operation of the Society. Specific duties include presiding over the general meetings and being an *ex-officio* member of all committees except the nominating committee.

Vice-President

The Vice-President chairs the monthly executive meeting and the general meeting in the absence of the President and undertakes any duties that may be assigned by the President or Board. The Vice-President is expected, but not necessarily, to be the next President.

Secretary

Within the Society the Secretary serves two main functions. The first is to record and preserve the minutes of the general and board meetings and assist in the preparation of meeting agendas. Secondly the Secretary is responsible for correspondence.

Treasurer

The Treasurer manages the finances of the Society. This involves receiving all dues, payment of bills, and the maintenance of accounts.

Directors

Directors are elected at the May general meeting for a term of two years beginning September 1 and ending August 31 of the second year. Ideally half of the directors are elected each year. The Society currently operates with four directors: Events, Social, Bulletin/Membership, and Programs.

Events

The Events Director is responsible for any "events" that the Society sponsors or participates in. These include field trips and special displays that the Society may erect at shows. The Events Director is expected to chair the field trip committee and be a member of the others.

Social

The Social Director oversees the activities of the fund raising/advertising committee and the refreshment committee. The Director is expected to chair one the committees (usually the refreshment committee) and be a member of the other. As this position was not filled last election the initial term will be for one year.

Bulletin/Membership

The Bulletin Director is the Editor of the Alberta Palæontological Society *Bulletin* and is responsible for all aspects of the *Bulletin*'s production and distribution. In addition the Bulletin Director has also assumed the functions of the Membership Director. This change was made so the Editor can keep track of the current mailing lists, to better serve the Society.

Programs

Perhaps the most visible of the director positions, the Program Director is responsible for arranging the program for each monthly meeting. The current program director has resigned mid-term so the initial term will be for one year.

Committee chairs

In order to fully meet our goals and objectives as a society people are needed to chair three committees: General Chairman: 2001 Workshop and Poster Session, Fund Raising/Advertising Chairman, and Education Chairman.

2001 Workshop and Poster Session Committee

This committee organizes the annual workshop and poster session. It is anticipated that the next session will be held in the winter or spring of 2001 but a firm date has not been determined.

Fund Raising/Advertising Committee

The purpose of this committee is to raise funds for the Society to carry out its activities, such as the sponsorship of special speakers and to advertise the Society in the media.

Education Committee

Members of this committee organize educational seminars and study groups.

[*President's note…*]

The Officers' positions and Program and Social Directors' positions are all up for election in May. Please consider running, or nominating! ❑

Calgary Rock and Lapidary Club Annual Show May 6 and 7, 2000

Members of the Alberta Palæontological Society may participate in this show in two ways. The first is to volunteer to work in the Resource Center/Identification Booth; the second is to put in a fossil display.

Resource Center/ Identification Booth

The Alberta Palæontological Society will be officially operating this booth this year. Since 1986 members of the Society have staffed the booth in an unofficial capacity. The purpose of the booth is to provide information to the public at large and to identify rock, mineral, and fossil specimens. To volunteer or for further information contact **Wayne Braunberger** at (403) 278-5154.

Displays

Fossil displays from members of the Alberta Palæontological Society would be greatly appreciated at the show. Display cases are provided by the Rock and Lapidary Club and measure 2' x 2' x 4' with a glass front. All material on display is secure and 24-hour security is provided. Displays may be set up on Friday, May 5 between 2 P.M. and 9 P.M. and taken down between 5 and 6 P.M. on Sunday. For further details contact **Wayne Braunberger** at (403) 278-5154. ❑

Program Summary

November 19, 1999

Arctic Jungles and Rifting Continents: the Stratigraphy and Palynology of Bylot Island, Nunavut, with APS Member Philip Benham, Shell Canada Ltd.

[*The following biographical notes and program abstract were provided by Philip Benham. –ed.*]

Biographical Notes

At the age of seven I was a typical child, fascinated with dinosaurs and all things geological. My parents encouraged those interests by taking me to Drumheller before the Tyrrell Museum lured thousands of tourists, to Kilauea Volcano to see Earth in the making, and to many other places that shaped my desire to become a geologist. I graduated from the University of British Columbia in 1987. In four years I had great luck and pleasure to work along the shores of the Arctic Ocean near Tuktoyaktuk, the Tatshenshini Range in northeast BC and the Queen Charlotte Islands, all with the Geological Survey of Canada. One unique activity I had while working on the Mackenzie Delta was that of jet drilling pingos to study their unfrozen cores. It is only now I realize how it mirrors my current job of drilling sour gas wells in the foothills.

While at UBC, a palynologist by the name of Glenn Rouse got me hooked on fossil pollen. I worked for a year as a palæontological lab technician for Mike Orchard of the GSC, dissolving limestone for conodonts while I considered my post-graduate options. During this time I was contacted by Elliott Burden of Memorial University of Newfoundland to consider a Master's thesis on a remote Arctic Island that combined both palæontology and sedimentology.

I graduated from Memorial in 1992. The results of that thesis are my topic tonight. I have been working at Shell Canada Ltd. since 1994 in the Jumping Pound and Wildcat Hills areas. My main areas of focus are structural and reservoir geology but I still am an active proponent of the use of palæontology in the industry. My interest in fossils is undiminished from my childhood years and I now am warping my two young sons' minds to be the same. I am currently writing an excursion guidebook to fossil localities in Western Canada so that other families can encourage their children to have a fascination for the world around them.

Program Abstract

The remote, glacier-covered Bylot Island, situated in the high Arctic, contains Cretaceous and Tertiary sediments that hold clues to the rifting of Greenland away from North America and a surprisingly warm past Arctic climate.

The isolated and rugged nature of the island provide challenges for field work but also result in a "virgin" territory for exploring geologists.

Detailed field mapping in conjunction with a palynological study indicates three rift-related sedimentary packages. The Late Albian Hassel Formation fluvial quartzarenites were deposited in pre-rift sag basins here and across much of the Arctic. With the initiation of rifting in Baffin Bay and up the Lancaster Aulacogen marine strata of the Bylot Island and Sermilik Formations were deposited. The main tectonic phase, correlating with maximum rifting in this area resulted in lower to mid-Paleocene sandstone and conglomeratic sediments prograding out from the rising Byam Martin Mountains.

Three terrestrial palynomorph zones (and one subzone containing a high component of recycled spores) are established. The Late Cretaceous assemblages are of interest because they contain elements of both the *Aquilapollenites* and *Normapolles* floral provinces. *Aquilapollenites* is typically restricted to western Canada while *Normapolles* flora are common to eastern North America and Europe. The palynomorph assemblages also reflect the rise of angiosperms through the Cretaceous.

The recovery of scattered dinosaur bones from Campanian deposits on the south side of the island (the northernmost discovery of dinosaur remains in the world) gives rise to an interesting question: how warm did it get at 75° north in the Late Cretaceous? Palynomorph assemblages suggest a warm subtropical climate that existed even into the mid-Paleocene, as evidenced by the *Sequoia* (redwood) leaves and pollen.

Global warming is major concern these days but perhaps we should be more aware that the Earth's climate has on average been significantly warmer than it has been during man's short recorded history. ❑

Welcome new members!

Cy Ireson, Calgary, AB
Chris Marion, Whitehorse, YK
Elizabeth O'Hea, Coquitlam, BC
Al Rasmuson, Calgary, AB
Stan Stancliffe, Calgary, AB ❑

December 17, 1999
The Chicxulub Impact: The Dinosaurs Didn't Have a Chance. Dr. Alan Hildebrand, University of Calgary.

by Mona Marsovsky

The December APS meeting was held at the Nickle Theatre in Mount Royal College, to accommodate the large crowd (at least 90 people attended) that came to hear Dr. Alan Hildebrand of the University of Calgary describe the evidence for the comet impact that caused the extinction of the dinosaurs.

Dr. Alan R. Hildebrand graduated from the University of New Brunswick in 1977 with a B.Sc. in geology. After working in the mineral exploration industry, he returned to school at the University of Arizona to earn a Ph.D. in planetary sciences in 1992. After working with the Geological Survey of Canada, Alan joined the Department of Geology and Geophysics at the University of Calgary in 1999. He is working on present day large meteoroid impacts, impact processes, crater structure, and the Cretaceous/Tertiary (K/T) boundary event. His dissertation work revealed that the K/T crater is buried on Mexico's Yucatan Peninsula.

The first suggestion that a comet impact could cause species extinctions was made in 1750. In 1980 a paper was published that suggested that an impact occurred at the K/T boundary. All around the world, from Denmark to Austria to Canada to New Zealand, a 3 mm thick, rusty clay layer occurs at the K/T boundary. This layer contains about 50 ppb (parts per billion) of the rare element, iridium. Iridium is an element of the platinum family that tends to be attracted to liquid iron and thus is concentrated in the Earth's core. The Earth's crust contains only 0.02 ppb of iridium. In bodies too small to allow gravity concentration of elements, the iridium concentration is higher, 500 ppb in asteroids and 150 ppb in comets. Even lava from deep in the Earth has only a small amount of iridium. He showed that the Columbia River basalts from Washington state have a much lower iridium content than the clay from the K/T boundary. The K/T clay has the "cosmic fingerprint" of a comet.

Also found all around the world near the K/T boundary layer is shocked quartz. Shocked quartz consists of quartz crystals that have been deformed by shock waves. The only mechanisms that can form shocked quartz are an impact or a nuclear explosion. The largest grains of shocked quartz are in western North America. In North America (not Europe), immediately under the iridium layer

("fireball layer") is the "ballistic layer" consisting of material (tektites) thrown out by the impact. The tektites that are ejected from a crater usually settle within an hour. The dust from the fireball requires hours to months to settle and would be evenly distributed across the globe.

But where was the crater? The trace elements indicated an impact in the ocean. At the Brazos River in Texas, thick rip-up clasts are found immediately under the K/T boundary. A comet falling into the ocean would cause giant waves that would erode the sea floor and shore, producing thick layers of debris. The coarse layers under the K/T boundary were concentrated in North and South America, indicating the impact crater had to be close, perhaps in central America.

In southern Haiti, a 46 cm thick volcanic deposit of altered tektite glass at the K/T boundary was interpreted to be a thick layer of materials ejected from a crater. This glass has a high sulphur and carbonate content, similar to the carbonate rocks of Mexico's Yucatan peninsula.

A crater in the Yucatan peninsula, the Chicxulub crater, was first discovered by examination of a gravity survey done for the Pemex oil company. This 180 kilometre diameter crater is buried by sediments one kilometre deep and is near the city of Merida. A geologist in Tulsa recognized it as an impact crater in the 1970s. In a 1981 abstract, the Chicxulub crater was suggested as the center of the impact at the K/T boundary.

To support this theory, Dr. Hildebrand listed his evidence:

a) A circular basin.
b) Gravity surveys showing a 3-ring negative anomaly.
c) Magnetic surveys showing a 3-zone concentric anomaly.
d) Shock metamorphosed quartz grains.
e) Breccia (deposits of angular, broken rock).
f) A *cenote* ring around the outer edge of the crater which formed from the fracturing of the limestone during the impact and slumping of the crater walls back into the crater. Fresh water is deflected around the crater, supplying a ring of wells (*cenotes*) on the edge.
g) Composition of the K/T boundary material matches the crater composition.
h) A 1992 seismic survey of the crater indicating the types of formation expected in a crater.
i) Cores from wells drilled in the crater area which were dated at 65 million years of age and which showed a composition similar to that at the K/T boundary.
j) The greatest thickness of the "ballistic layer" is nearest to the site, with the thickness declining as one travels farther from the site.

Dr. Hildebrand painted a sobering picture of the comet impact: the comet, 15 km in diameter, travelled through the atmosphere in about 2 seconds. The comet hit the shallow sea off the Yucatan from the southwest at an angle of 60°. Waves several hundred metres high raced across the sea. One slide depicted a plesiosaur getting "the ride of his life" on the leading wall of water.

During the first hour after impact, there was fallout of white-hot and red-hot debris which set the forests on fire in North and South America. For the next three months, cold and darkness reigned as the dust cloud enveloped the earth.

Acid rain would fall from the skies for one year as the nitrogen which burned and the impacted evaporite minerals (calcium sulphate) formed an acidic soup. The greenhouse effect caused by liberated carbon dioxide from the limestone rocks would last about 1000 to 10,000 years. The ozone layer in the upper atmosphere would have been blown off by the impact resulting in about ten years of ultraviolet damage.

The Chicxulub impact would have released 1,031 ergs of energy in thirty seconds. This is equivalent to the normal output of Earth's volcanoes in 50,000 years or 1000 times the strength of all of our nuclear weapons combined. A short video clip helped to illustrate the damage.

Once every million years, a 2 kilometre large object is predicted to hit the Earth. We have a one in 500,000 chance of dying from an asteroid or comet impact, which is better than our odds of winning the lottery. Some astronomers suggest that money should be invested in mapping the paths of asteroids and comets to forewarn us of major impacts to allow mankind to make preparations. There is no evidence that other extinction events in Earth's history were caused by comet impacts.

When asked why he thought that it was a comet rather than an asteroid that hit the Earth, Dr. Hildebrand said that an asteroid, with its maximum diameter of 6.5 kilometres, would be 40 times too small to create the Chicxulub crater. A comet could hit the Earth at a higher velocity and thus would have enough energy to do the damage.

There are no definitive answers yet for why the impact caused the extinction of the dinosaurs and not the mammals or amphibians; that problem is left for other researchers to explore. ❑

[*Biographical notes provided by Dr. Hildebrand*]

4th Annual Workshop and Poster Session a Great Success

by Mona Marsovsky
photos by Les Adler

The January 2000 APS meeting was rescheduled from its normal Friday night to Saturday, January 22, to allow an expanded format for the Fourth Annual APS Workshop and Poster Session, which took place from 10 A.M. to 4 P.M. in the lower concourse of Mount Royal College. Posters and workshops were provided by amateur palæontologists of the Alberta Palæontological Society, and graduate students, researchers and scientists at the University of Calgary, University of Saskatchewan, Memorial University of Newfoundland, Mount Royal College, Royal Tyrrell Museum of Palæontology and the Geological Survey of Canada (Calgary), and representatives from industry. During that period, five half-hour talks were presented. The overall sentiment was that the event was a great success.

The following posters and workshops were presented:

APS—*Alberta Palæontological Society*
CUGB—*China University of Geosciences, Beijing*
GSC—*Geological Survey of Canada, Calgary*
IND—*Industry*
MRC—*Mount Royal College*
MUN—*Memorial University of Newfoundland*
RTMP—*Royal Tyrrell Museum of Palæontology*
UC—*University of Calgary*
USK—*University of Saskatchewan*

Les Adler (APS) ***Albertosaurus*, Death of a Predator.**

John Birrell (APS) **Petrification of wood.**

Leslie Eliuk (IND) **Big Bivalves, Algae and the Nutrient Poisoning of Reefs: A Hypothesis affecting Facies, Geometry and Termination of some Devonian Reefs.**

Jennifer Evans (APS) ***Spinosaurus.***

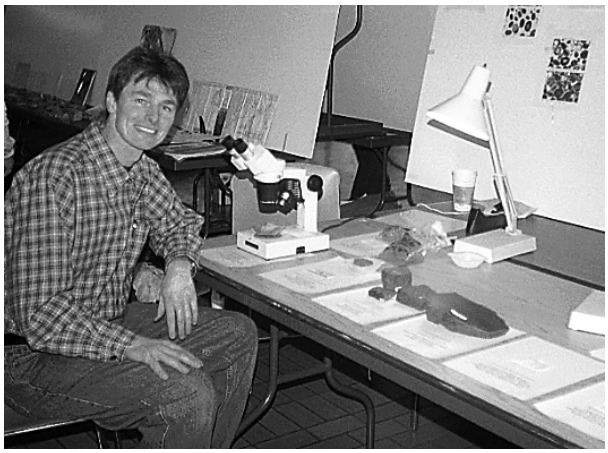
Jessica Evans (APS) **Plesiosaur—an Ancient Reptile (not a Dinosaur) or the Loch Ness Monster.**

Cory Gross (APS) **Palæo Art.**

Wayne Haglund (MRC) **Fauna of the Drumheller Marine Tongue and their Environmental Interpretation.**

Len Hills (UC), Paul McNeil (UC), Brian Kooyman (UC) and Shayne Tolman (UC) **First Reported Canadian Proboscidean Trackway, probably Mammoth, from the St. Mary Reservoir, Alberta, Canada.**

Paul Johnston (RTMP) and Chris Collom (MRC, APS) **Iron-rich Ooids in the Chancellor Group (Middle-Upper Cambrian) of Western Canada: evidence for hydrothermal seeps?**



On Duty—*Dr. Paul Johnston, Royal Tyrrell Museum.*

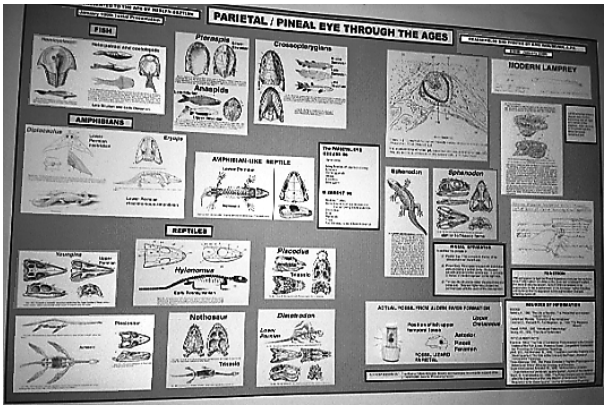
Erik C. Katvala (UC) and Charles Henderson (UC) **Conodont Sequence Biostratigraphy and Palæogeography of the Pennsylvanian-Permian Mount Mark Formation, Southern Vancouver Island.**

Richard McCrea (USK) and William Sarjeant (USK) **A Diverse Vertebrate Ichnofauna from the Lower Cretaceous (Albian) Gates Formation near Grande Cache, Alberta.**

Paul McNeil (UC) **Ossified Tendons in Ornithischian Dinosaurs.**

Shilong Mei (CUGB), Charles M. Henderson (UC) and Xiaoying Shi (CUGB) **Introducing a Chronostratigraphic Approach: the Natural GSSP—A Case Study on the Permian Guadalupian-Lopingian Boundary**

Wendy Morrison (APS) **Description and Identification of the Various *Myledaphus* Teeth.**



Extraordinary effort *went into the displays—APS member Roslyn Osztian's project on the parietal/pineal eye of vertebrate animals was just one example.*

Keith Mychaluk (APS) **Alberta Palæontological Society Field Trips: 1986–2000.**

Betsy Nicholls (RTMP and APS) **Mesozoic Marine Reptiles of Western Canada.**

Roslyn Osztian (APS) **Parietal / Pineal Eye Through the Ages.**

Dan Quinsey (APS) **The Jurassic Sea—Ours to Share.**

Anthony Russell (UC) and Eric Snively (UC) ***Tyrannosaurus rex*: Pokey Somnolent or Supernatural Dynamo? Comparative Locomotory Performance in Theropod Dinosaurs.**

More presenters from the Royal Tyrrell Museum— *Dr. Betsy Nicholls (left) and Susan Sommerville.*

Anthony Russell (UC) and Matthew Vickaryous (UC) **The Development of Cranial Ornamentation in the Ankylosauria: Towards Resolving an Architectural Enigma using the Comparative Method.**

Don Sabo (APS) **Ornithomimids—Dinosaurs with Beaks.**

Harold Whittaker (APS) **Fossils from Calgary.**

Henry Williams (MUN) **A Day in the life of a Graptolite.**

Darla Zelenitsky (UC) **Comparative Oology of Theropod Egg Remains.**

Darla Zelenitsky (UC) **Fossil Eggs and Eggshells of Alberta.**

The real stuff! *—Ichthyosaur bones (Triassic) from northern British Columbia.*

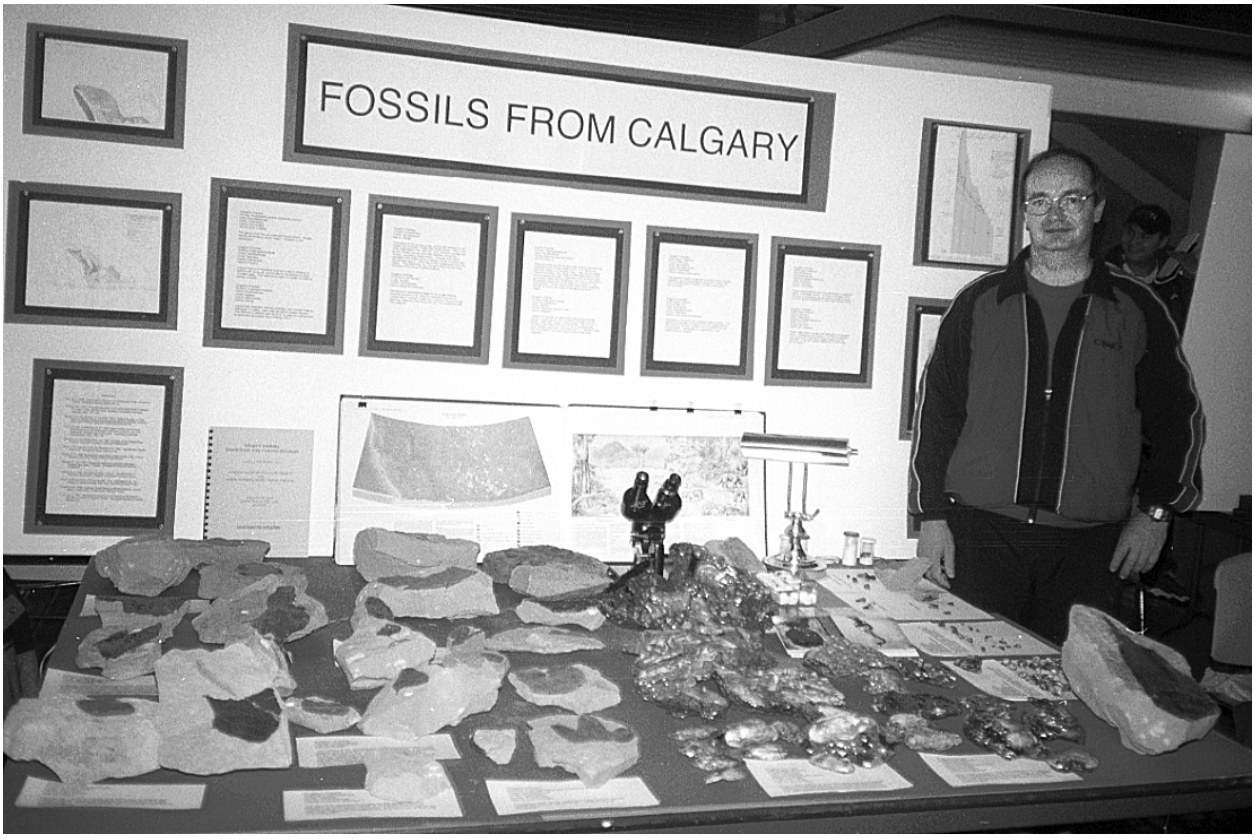
Display booths were provided by: Department of Geology and Geophysics, University of Calgary (Courtesy: Jon Greggs); Royal Tyrrell Museum of Palæontology (Courtesy: Susan Sommerville).

The following briefly outlines the half-hour talks that were presented. See the abstracts volume for full descriptions of these presentations.

Measuring the Consequences: Plants, the Yardstick for the Environmental Consequences of the Cretaceous Tertiary Impact

Art Sweet (GSC and APS)

Art Sweet described his work studying pollen and spores from the Cretaceous-Tertiary (K-T) boundary. Art has done research at several K-T boundary sites ranging from Police Island, near the MacKenzie River, NWT to Grassland National Park (Saskatchewan) to the Raton Basin at the New Mexico/Colorado border. The K-T boundary



APS Secretary *Harold Whittaker's display on the Tertiary fossils found within a stone's throw of our home base.*

event resulted in three distinct reactions in the plant communities:

a) A regional killing event. The gymnosperm forests were destroyed by the crown fires resulting from the heat flash of the impact. This effect was less intense at sites farther from the impact crater. The understory ferns prolifically broadcast their spores after the impact. The forest was not burnt to the ground.

b) Species extinction, especially plants that depended on animal or insect pollination. Not all exotic taxa became extinct. Some survived at the swamp margins in the eastern seaboard and Appalachian regions.

c) Changes in abundance of a species. Some species showed no change across the boundary whereas others actually prospered. There were abrupt changes in the amounts and kinds of pollen from layer to layer. Some species disappeared in some areas, but survived in others.

The pollens and spores indicate that the environment was not overwhelmed by the K-T boundary event. Art said that the plant evidence shows that the K-T impact did occur but the energy levels predicted by the current impact model are too high. The pollen evidence shows that North America was not denuded by the impact. In summary, Art Sweet quoted Alan R. Hildebrand [*see Page 4*]: "The K/T impact turned the Earth's surface into a living hell, a dark, burning sulphurous world where all the rules governing survival of the fittest changed in minutes. The dinosaurs never had a chance". Art's reply was a slide of a flower with the caption "surely he jests, the plants protest!"

Generous hosts*—Mount Royal College not only provided the venue, but contributed displays. MRC professor Wayne Haglund's poster on fossils from the Drumheller Marine Tongue.*

Satisfied customers! *APS members Dorothy and John Birrell; John presented a display on fossil wood.*

A Day in the life of a Graptolite
Henry Williams (MUN)

Graptolites are marine animals that existed from the start of the Ordovician Period until the early Devonian. They are found in Gros Morne National Park in Newfoundland, Dob's Linn in Southern Scotland, New Zealand, Argentina, Pennsylvania and other places, including western Canada.

Graptolites have been useful for dating formations and for correlating sea depths and palæolatitudes. New studies on graptolites are helping us to understand how they grew and lived. Dr. Williams described some of the theories on how graptolites formed their skeletons.

Recent Work on Turtles from the Dinosaur Park Formation of Alberta
Don Brinkman (RTMP)

Don Brinkman described the kinds of turtles that have been found in Dinosaur Provincial Park in the last ten years. Both freshwater and marine turtles have been recovered, including four species of Trionychides (soft shell turtle, the most diverse and abundant turtle in the park); the family Macrobænidæ (first evidence of this group in North America); *Plesiobæna*; and *Lophochelys* (marine turtle). Only a few fragments of snapping turtle have been found. An articulated skeleton would nicely fill the gaps. More material is still needed to fully describe all of the turtle species.

The St. Mary Reservoir Palæontological Site
Len Hills (UC), Paul McNeil (UC), Brian Kooyman (UC) and Shayne Tolman (UC)

In 1997 the reservoir level on the St. Mary River had to be lowered to allow the construction of a spillway. This uncovered a large vegetation-free sandy area at the shoreline, prone to wind erosion. Excavations have revealed Clovis projectile points, fire pits, a skull from an extinct bison (*Bison bison antiquus*), and bones of numerous other animals, including: extinct musk oxen (*Bootherium*), horse (*Equus conversidens*), elk (*Cervus*), caribou (*Rangifer tarrandus*), wolf (*Canis*), fox (*Vulpes*), badger (*Taxidea taxus*), rabbit (*Lepus*), Beaver (*Castor*), muskrat (*Ondatra*), several types of ground squirrels and three types of birds. The first known Canadian mammoth trackway was also discovered here, made by a mature female or immature bull woolly mammoth (*Mammuthus primigenius*). Trackways from camel, horse and bovids have also been uncovered.

The site was radiocarbon dated at 11,000 to 11,300 years old. The researchers are planning to do more excavations at the site, starting in mid-April, and working until the water level becomes permanently too high, this summer.

Visean (Late Mississippian) Reefs of Northern England—A Palæontological Treasure Trove. Dave Mundy (APS)

Dave Mundy described the great diversity of life (about 700 species) in the Cracoean Reefs of Visean age (Late Mississippian) in Northern England. These large reefs (up to 170 m high) were located at the margins of continental shelves. The reefs show a definite structure, with different animals preferring different locations on the reef. Preservation is excellent, even showing the colour bands. The structure and animals are similar to what is found in a Permian age reef, which challenges traditional thought on reef evolution.

We are very grateful to Mount Royal College for providing the venue and making all the arrangements for tables and chairs. A special thank you must be given to **Kris Vasudevan**, APS Program Director, for all of his hard work and dedication that made this event a success. Finally, all of the poster, talk and workshop presenters must be acknowledged for their hard work; a job well done!

The abstract volume of the Fourth Annual APS Workshop and Poster Session is available from APS for the cost of $5.00 (plus $3.00 shipping). Contact Vaclav Marsovsky (telephone: (403) 547-0182), if you would like a copy. ❑

Program Summary

February 18, 2000
From Japanese Monkeys in Texas to Howler Monkeys in Belize; with Dr. Mary Pavelka, University of Calgary

by Vaclav Marsovsky

[*The following biographical notes were provided by Dr. Pavelka and Kris Vasudevan. –ed.*]

Dr. Mary S. McDonald Pavelka is an Associate Professor of Primatology in the Department of Anthropology. She has worked for nearly two decades studying the social life of Japanese monkeys, and is the author of Monkeys of the Mesquite: the Social Life of the South Texas Monkey. *Dr. Pavelka has published several articles on aging, sexuality and menopause in a cross-species perspective, and is currently working to establish a research program on howler monkeys in Belize. Annual field schools which introduce students to the study of wild primates have contributed to her reputation on campus—she was identified as one of the University of Calgary's most popular professors in the* Maclean's 1998 Guide to Universities.

Dr. Pavelka's focus of research was on a group of Japanese macaque monkeys that were relocated to Texas. The population of monkeys became too numerous for their habitat in Japan, partly due to loss of predators. Certain males leaving the family group caused a natural split of the group, while still in Japan. This is typical behaviour. The splinter group was moved to Texas into a desert environment.

Dr. Pavelka showed a series of slides from the Texas location, allowing us to see a typical "day in the life" of a Japanese monkey. The study was long term and it followed the monkeys through their lives and generations. The study looked at aging and considered termination of reproductive ability (menopause) in monkeys and what impact it had on the lifespan of the individual and what effect menopause earlier in life may have on offspring survivorship.

About 95 female monkeys were available for the study, but this number was adjusted to 70 to include only those females that had three offspring or more. Of the 70, 50 died while they were still reproductive and the remaining 20 had reached menopause. The study seemed to indicate that the average age at death in the group of 20 was higher. The study did not document any significant effect of maternal age on offspring survivorship.

Other information : maximum lifespan of Japanese monkeys is about 30 years. The latest recorded birth was at 25 years, which is equivalent to an 83 year old woman in human terms.

Dr. Pavelka has recently begun a study on the howler monkeys of Belize. The study of this group will present new challenges because their jungle environment is so different from Texas; their facial features make it harder to distinguish individuals; also, their behaviour is very different. ❑

Biting the Hand that Feels it

by Roslyn Osztian

An article in *New Scientist* magazine warns against handling or even approaching a recently killed rattlesnake. The author reports a study by two doctors at a medical facility in Phoenix, Arizona, who describe five instances of bites from rattlesnakes that had been "fatally bludgeoned, shot, or decapitated." Apparently the head alone has been known to attack up to one hour after death.

There was no mention of this activity being confined to any particular variety of rattlesnakes and, according to the Audubon Society Nature Guides, the range of our prairie rattlesnake, *Crotalus viridis viridis*, does extend over much of Arizona to northern Mexico.

A recently published book, *Rattlesnakes: Their Habits, Life History, and Influence on Mankind*, by Laurence M. Klauber, repeats the warning.

Since I am personally aware of two incidents in Canada where a freshly killed prairie rattlesnake was handled with no adverse consequences, I checked for Canadian references. I found that as long ago as 1970, the *Illustrated Natural History of Canada*, published by Jack McClelland, reported a similar warning by the Saskatchewan Department of Natural Resources. Moreover, the Office Manager at Dinosaur Provincial Park assured me she planned to post the *New Scientist* article to alert staff.

As APS members are often in rattlesnake country we need to be aware of this potential danger.

Reference

Cohen, Philip. 1999.Revenge of the Undead. New Scientist, July 3, 1999. ❑

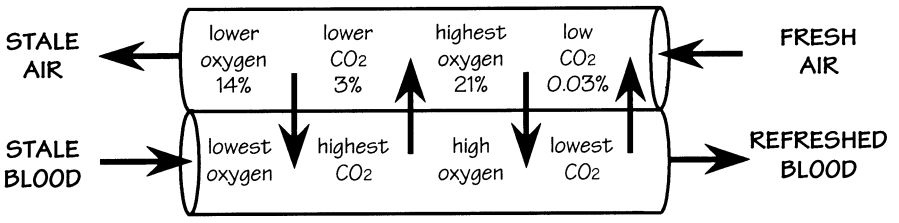
Giant Sauropod Physiology

by Samuel Richter

The normal, seemingly simple act of breathing actually involves hundreds of physiological feedbacks involving the always changing biochemical properties of blood, nerve signals, hormone balances and body temperature regulation by panting, as used by dogs and birds.

Those incredibly long sauropod necks contained large amounts of stale air, left there from the last exhaled breath. This stale air must be cleared before fresh air can make it to the lungs. Comparatively short-necked giraffes lose over 20% of their potential lung capacity by rebreathing their stale neck air (Dagg and Foster, 1982). This is like having emphysema.

The high air velocity respiration system used by long-necked birds of today could easily handle all the stale air in the longest of sauropod necks, without losing any effective lung capacity. The avian lung takes up less than half the internal lung space of an equal sized mammal and is over three times more efficient at blood gas transfers (Schmidt-Nielson, 1987). This system uses the almost rigid "flow-through" lung in which fresh air moves directly through the lungs on both inhale and exhale. Lung rigidity allows the membrane between blood and air to be very thin, allowing for rapid gas exchanges. The "flow-through" tubes (parabronchials) have tiny air capillaries, 3 to 10 micrometres wide, which extend from the inside of the parabronchials and are surrounded by blood capillaries. The equivalent to these capillaries in the mammal lung are alveoli air sacs of 10 to 1000 micrometres wide. Gas exchange in the bird is very rapid and in large quantities in comparison to the mammals (Schmidt-Nielson, 1997).



Imagine two old-style "honeycomb" automotive radiators, one on each side of the backbone, at right angles to it, suspended from the ribs and tight to the backbone. Where engine coolant would normally flow is where the blood flows. Fresh air passes through the radiator where air would normally flow, only from back to front on both inhale and exhale. No physical valves are used to direct the air. On inhale, when the abdominal muscles relax, air sacs external to the lungs act as bellows to capture all the stale air from the neck. Then the now incoming fresh air is sucked into air sacs at the rear of the lungs. When they fill up, incoming fresh air is then diverted through the lungs to air sacs at the front of the lungs. On the next exhale, when abdominal muscles contract, squeezing the guts, stored fresh air from the rear air sacs flows through the lungs to the air sacs at the front of the lungs, which are being exhaled along with stale air from the neck air sacs. Fresh air flows through the lungs from the rear to the front on both inhale and exhale (Schmidt-Nielson, 1997).

Those familiar with high efficiency heat exchangers used for cooling hot engine oil in race cars and tractors will recognize the "counter-flow" principle used in these lungs to maximize the exchange of blood gases to and from air. The principle is to keep the temperature difference between hot oil and cold air as high as possible, to maximize heat transfer, even as the oil cools and the cooling air gets heated. This means the hottest oil meets the warmest air and as the cooled oil is about to leave the exchanger it meets with the coldest air just entering the exchanger. In avian lungs, the lowest blood oxygen level meets with the lowest air oxygen level. The oxygen level in the lungs must be higher than the blood oxygen level, otherwise no transfer can take place. As the blood takes up oxygen it meets up with fresher air, higher in oxygen levels. Blood oxygen saturation level is high, 80% or more, with this system (Schmidt-Nielsen, 1972).

Commonality of body parts between sauropods and present day animals gives considerable insight into sauropod physiology. The use of the ball-topped thigh bone inserted into the hip socket of the pelvis has worked well for millions of years. This architecture allows for development of things

big and fast. Under evolution, the tendency has been for land animals to get bigger, not smaller. We can see how this hip joint works under dynamic conditions in many present day creatures. These observed dynamics can be applied to sauropods with confidence.

The openings for blood entering fossil sauropod bones look the same as the blood holes in bones of today. Blood is considered to be like a complex liquid tissue—containing many special cell types, transporting respiratory gases, nutrients, waste products, hormones, various antibodies and salts. The speed of the blood circulating through a body varies greatly, depending on what that body is doing. In adult human males sitting at rest, a package of blood takes seven seconds to go from the heart to a big toe and back to the heart (Eckert, 1988). With heavy exercise, the circulation rate jumps from 5 litres per minute to 35 litres per minute (Eckert, 1988). An average racehorse has 30 to 34 litres of blood in its body. At racing speed, with the heart rate near 250 beats per minute, this blood is circulated ten times in a minute; that is 303 litres per minute. To oxygenate this fast-circulated blood, over 2,270 litres per minute of air is breathed (Equus, 1998).

Each of us is in direct kinship with those sauropods of old.

Humans have between 8.5 and 9 percent of body weight as blood. In other vertebrates, 5 to 10 percent of body weight is made up of blood (Eckert, 1988). Therefore, a 27 tonne brontosaur would have 1.365 to 2.730 tonnes of blood. A litre of blood weighs about 1.01 kg, so this would be 1,345 to 2,670 litres in circulation. To move this massive amount of blood through the body rapidly takes a really huge heart. Formulas for heart size and heart rate in mammals and birds give a heart size in the range of 160 to 230 kg. The heart rate would be twelve beats per minute and the breath rate four per hour (Eckert, 1988).

Some palæontologists (e.g. R. Bakker, heard on television) speculate that the high pressures needed to push blood to a brain at the end of a long raised neck would cause serious brain and head damage when the head is quickly lowered to ground level or below. A reminder here that those sauropods were very successful, meaning they were well designed for their time and their activities. Actual measurement of pressures in present day animals (e.g. Dagg and Foster, 1982) shows that these speculations are invalid. Weight lifters who have a normal blood pressure of 120/70 millimetres of mercury (mmhg) at rest, have been measured at 480/350 mmhg during a lift (Kesterton, 1999). This short-term increased pressure is handled easily by the body and brain with no resulting damage. For unknown reasons, some birds have a resting blood pressure of over 250 mmhg (Schmidt-Nielsen, 1997). A sauropod brain 7.6 metres above the heart would need a minimum blood pressure of nearly 600 mmhg at the heart to just deliver blood to the brain. Another 100 mmhg or more, must be added to this pressure to ensure the brain is perfused with adequate blood, for a minimum blood pressure of 700 mmhg at the heart. Low blood pressure or a low supply of blood to the brain results in fainting, which would mean a horrible crashing fall for any gigantic creature. The neck artery delivering this blood will need check-valves along its length (as in giraffes, which have five), to stop blood from flowing back into the heart between heart beats. The single valve in the heart then isn't supporting the entire 7.6 metre column of blood. When the head is suddenly lowered to the ground, which is much below the level of the heart, rings of muscles squeeze the artery going to the head, restricting the flow of blood to the brain, which lowers the pressure to about 200 mmhg (Dagg and Foster, 1982). This is how the giraffe reduces this pressure at the brain. Returning blood to the heart is trapped by check valves in the return vein preventing backflow and buildup of blood in the brain. Raising the head quickly must not dump blood into the heart, overloading it. Ring muscles that surround the return vein squeeze down on the vein, restricting blood flow back to the heart, and keeping blood pressure in the heart down to acceptable levels. This returning blood is put through the low pressure, high volume section of the heart going to the lungs. High output pressure here would result in blood leakage into the air side of the lungs, with the possibility of drowning (Schmidt-Nielsen, 1997).

Naming convention has replaced *Brontosaurus* with *Apatosaurus*. However, "*Brontosaurus*" is such a good name ("thunder lizard") that it hasn't disappeared. Now "brontosaur" is used as a nickname for *Apatosaurus* and as a general name for the biggest of the sauropods.

Each of us is in direct kinship with those sauropods of old. Every day, we may be breathing in a molecule or two of oxygen that was previously breathed in by a giant brontosaur. Estimates have it that a specific molecule of oxygen may now have been recycled over 600,000 times (Sawkins, 1974). This must be nearly the ultimate in recycling!

References and Further Reading

Dagg, Anne Innis and Foster, J. Bristol. 1982. The Giraffe: its biology, behaviour, and ecology. Krieger. p. 164–169.

Eckert, Roger. 1988. Animal physiology: mechanisms and adaptations, 3rd ed. W.H. Freeman. p. 101–123.

Kesterton, Michael. 1999. Social studies, Globe and Mail, summer 1999.

Sawkins, Frederick J. 1974. The evolving earth: a text in physical geology. Macmillan. p. 323.

Schmidt-Nielsen, Knut. 1971. How birds breathe. Scientific American, 225(6), December 1971, p. 72–79.

_____ 1997. Animal physiology: adaptation and environment, 5th ed. Cambridge University Press. p. 47–52, 108–121. ❑

Member News

Robin Sweeten, one of our US members, and a contributor the *Bulletin* and the APS fossil collection, had a scary incident last November, when she came off her motorcycle. Thankfully, she suffered no worse than a badly sprained neck. We wish her all the best, and hope that by now she has fully recovered. (Hope you weren't looking at a fossiliferous road cut when you hit the dirt, Robin!)

If you want to see what she fell off of, log onto the Sweetens' new web page: www.geocities.com/Heartland/Arbor/4179/reshome.html.

Robin also has a new mailing address:

PMB# 667
3818 So. Western Avenue
Sioux Falls, SD 57105-6511 ❑

Palæo Internet Sites Part 1

by Philip Benham

Internet sites vary widely in quality, and addresses come and go. I have tried to provide a selection of the best sites that are likely to last and some that I hope will last. If the address changes try a keyword search. This list just scratches the surface. I will try to provide further instalments in future issues of the *Bulletin*. If you have some suggestions for interesting websites you can email me at **benhamp@cadvision.com**

www.geocities.com/SoHo/9094/aps.html
Home page for the Alberta Palæontological Society!—details on the APS, how to join, and a palæo chat line.

www-odp.tamu.edu/paleo/
Palæontologia Electronica—exceptional site, with high quality scientific papers and great graphics. Check out the item on how heteromorph ammonites floated (Volume 1, Issue 1). There are detailed book reviews, editorial commentaries and articles by well known palæontologists such as palæo-whale specialist Philip Gingerich.

www.dinosauria.com/index.html
Dinosauria Online—includes photo gallery (see Darren Tanke submissions, which include photos of Grande Cache dino trackways), dino dictionary, a writers' guide, dinosaur cladogram, a table detailing the geologic time periods, and palæotectonic reconstructions. One highlight is a compilation of topical palæontological discussions.

www.bekkoame.or.jp/~necrosis/
Cambrian Park website populated by wonderful images from a Japanese illustrator. Cambrian through Devonian organisms are displayed, with an emphasis on the Burgess shales.

www.cancaver.ca/paleo/bc/
BC Speleo-Paleo Resources—discussion of ice age mammal bones found in Vancouver Island caves.

www.sfu.ca/archaeology/museum/bc/clc_src/clp00110.htm
Palæoecological and archæological implications of the Charlie Lake cave fauna, British Columbia (10,500 to 9,500 BP). Text and pictures from a talk presented by Dr. J. C. Driver, Professor of Archæology at Simon Fraser University. This is an important ice age site from both archæological and palæontological perspectives.

www.ualberta.ca/~kbrett/Trilobites.html
Kevin Brett's Trilobite Home Page—subtitled, in palæohumour, the "Page of Death." Trilobite photos galore, directory of trilobite workers, links to many other palæo sites and much more. This is one of my favourite sites.

www.tyrrellmuseum.com/
The Royal Tyrrell Museum of Palæontology—museum hours, cyber-tour of museum, FAQ's, provincial rules for fossil collecting, numerous links to other palæo sites.

www.gov.ab.ca/env/parks/prov_parks/dinosaur/
Dinosaur Provincial Park home page provides in-

formation on how to get to the park, facilities, lists of hikes and tours available and travel tips.

iago.stfx.ca/people/paleodiv/pd.html
Paleontology Division of the Geological Association of Canada—lists their publications, how to join, and has a directory of Canadian palæontologists that you could contact with questions or finds.

ngp.ngpc.state.ne.us/parks/ashfall.html
Ashfall Fossil Beds State Historical Park—good summary of the 10 million year old mammal bone beds created when ash from a nearby volcanic eruption rolled across the Nebraska plains killing primitive horses, rhinos, four-tusked elephants, oreodonts, camels and other beasts. Includes a description of the park.

www.gorp.com/resource/us_nm/co_flori.htm
Florissant Fossil Beds National Monument Description of the diverse flora and fauna preserved 35 million years ago during a volcanic eruption in Colorado. Includes a description of the park.

www.geo.ucalgary.ca/ybsrf1.html
Yoho-Burgess Shale Research Foundation provides contact numbers and information on guided hikes to Mount Stephen and the Burgess Shale as well as educational resources. Picture gallery includes scenic shots and close-ups of the Burgess Shale fauna.

[*The following item was added by the Editor*]

www.diplomatsinternational.com
Former APS member Jacques LeBlanc reports in a recent email message that he has placed two of his fossil publications on his company's website, for free download. The publications are entitled: *Macrofossils, their Localities in Alberta* (184 pages; this was formerly published in print, and may be available in the APS library); and *A Guide to Macrofossils of Libya, Africa* (79 pages). Both include illustrations.

Note that the files are available only in MS Word 2000 (Windows) format. Thus, you must own the latest and greatest from Microsoft before you can open these files. And be aware that the files are rather fat (zipped sizes are 5.1 Mb and 2.3 Mb, respectively), so you will also need either a very fast connection, or a lot of time on an unlimited-access dial-up account. Too bad he didn't opt for a less restrictive file format, such as an older version of Word—or better yet, Adobe Acrobat PDF format, which would have resulted in smaller files, correct font formatting, and would allow users on different platforms to use a free reader application for viewing and/or printing. ❑

Reviews

by Les Adler

This view of Stephen Jay Gould: Celebrating 25 Years of Essays. *Natural History*, November 1999, p. 48–57.

Since January, 1974, palæontologist Gould has provided monthly essays in the tradition of Thomas Henry Huxley (known as "Darwin's bulldog") concerning philosophy, history, science, art and literature, all from the perspective of an evolutionary biologist. His title "This view of life" comes from the concluding sentence of Charles Darwin's *Origin of Species*.

Some comments by friends, fans and colleagues:

Niles Eldredge, Curator of Invertebrate Paleontology, American Museum of Natural History, and co-author with Stephen of the theory of punctuated equilibria: in 1981 Niles and Steve were flying from Little Rock to La Guardia after a creationist trial. On the flight, Steve introduced Niles to an out-of-office governor of Arkansas —one Bill Clinton—with a female political consultant (guess who!). Steve has eyes in the back of his head with his rare fossil finds and his contingency theory.

Alan Dershowitz, Felix Frankfurter Professor of Law, Harvard Law School, wrote on a blackboard: "Gould or God." Stephen defended God so brilliantly that William Jennings Bryan would be proud—Stephen would have made a good lawyer.

Dan Kevles, Director of Science, Ethics and Public Policy, California Institute of Technology: "Steve has recovered from one of the worst kinds of cancer, writing an essay which should give hope to other victims. In the 1980s he helped keep creationism out of U.S. public schools."

Michael Shermer, Publisher of *Skeptic* magazine: "Stephen provided the history of the word 'skeptic' for the book *Why People Believe Weird Things*. Gould's *Mismeasure of Man* has become a classic in skeptical debunking. Gould aided Judge William Overton in his clarification of creation science as thinly disguised biblical literalism." "Stephen Jay Gould—a skeptic in the finest sense of the word."

Ernst Mayr, Professor Emeritus of Comparative Zoology, Harvard University: "Whether right or wrong, Stephen awakens an interest in possibly millions of readers an enthusiasm for the secrets of this wonderful world of ours."

Oliver Sacks, M.D., author of *An Anthropologist on Mars*: "My favourite book is *Wonderful Life*.

Richard Milner, Senior Editor, *Natural History*: "I went to school with Stephen; I was called 'Dino' and Gould was 'Fossilface'. Stephen encouraged me to write the *Encyclopedia of Evolution.* Thanks, Fossilface!"

***T. rex* Reexamined:** articles in *Scientific American*, September 1999, p. 2, 42–55.

This issue features a 1999 update of ideas relating to studies of tyrannosaurid dinosaurs…

Breathing Life into *Tyrannosaurus rex*, by Gregory M. Erickson, p. 42–49.

In Spielberg's *Jurassic Park*, *T. rex* was presented as a killing machine whose sole purpose was aggressive, bloodthirsty attacks on helpless prey. A century of study and the existence of twenty-two fairly complete *T. rex* specimens have generated substantial information about its anatomy. Whether *T. rex* was primarily a predator or a scavenger is still the subject of debate. Palæobiologists are using fossil clues, some new and some previously overlooked, to develop fresh ideas. Bite marks on bones, wear patterns in teeth and coprolites are being examined. Earlier members of the family Tyrannosauridæ and *T. rex*'s cousins, *Albertosaurus, Gorgosaurus* and *Daspletosaurus* are being checked.

Philip Currie and his team from the Royal Tyrrell Museum have relocated a 1910 quarry and are making a detailed study of at least nine albertosaurs, indicating a social structure consisting of a large matriarch or patriarch with a herd. Darren Tanke, also of the Tyrrell Museum, studies ancient injuries and disease and has detected a unique pattern of bite marks among theropods, consisting of gouges and punctures on the sides of the snout, on the sides and bottom of the jaws and occasionally on the top and back of the skull. Tanke and Currie believe that the animals faced-off, but primarily gnawed at one another with one side of their complement of massive teeth, rather than snapping from the front. The peculiar bite marks found on the sides of tyrannosaur teeth imply that the combatants maintained their heads at the same level throughout a confrontation.

Gregory examined specimens collected by Kenneth H. Olson in Montana, of *Triceratops* and *Edmontosaurus*, which appear to have bite marks of *T. rex* on them. These confirm that *T. rex* fed on both animals. The bite patterns show two distinct patterns. Usually, *T. rex* used the "puncture and pull" strategy in which biting deeply with enormous force was followed by drawing the teeth through the penetrated flesh and bone, which typically produced long gashes. *T. rex* also employed a ripping approach in which the front (incisiform) teeth grasped and stripped the flesh in tight spots between vertebræ, where only the muzzle could fit. This method left vertically-aligned, parallel furrows in the bone.

In 1997 Karen Chin received a mass 44 x 16 x 13 cm found by Albertan Wendy Sloboda, working for the Royal Saskatchewan Museum. This *T. rex* coprolite contained pulverized bone partially digested with strong enzymes or stomach acids.

The reason why many clues had not been found earlier is that researchers did not systematically search for bite marks. Also, museums desire complete skeletons, not isolated parts. Mounting physical evidence leads to the conclusion that tyrannosaurs both hunted and scavenged. The above analysis shows the need for reexamining finds that were formerly ignored and also recognizing the biases in collecting practices which have clouded perceptions of dinosaurs. The *T. rex* of our imagination continues to evolve.

The Teeth of the Tyrannosaurs, by William R. Abler, p. 50, 51.

William studied steel blades whose serrations or sharpness could be altered mechanically and then compared these findings with the cutting action of actual tyrannosaur teeth. The details and photos of the equipment used are provided in this article.

He found that the serrated tooth of the fossil shark *Carcharodon megalodon* works exactly like a serrated knife blade, but the serrated edge of even the sharpest tyrannosaur tooth cuts meat more like a smooth knife blade. The serrations on a shark tooth have a pyramidal shape, while tyrannosaur serrations are more cube-like. There is a gap between serrations call a "cella," and the thin slot which the cella narrows to is called a "diaphysis."

William used albertosaur teeth to cut fresh meat, probably the first time that this event has happened in some 65 million years on this planet. He found that the cellæ trapped grease and other food debris, so that if bitten, prey animals could be fatally infected and might die close by. *T. rex* teeth functioned less like knives than like pegs. *T. rex* did not chew its food; pieces were probably swallowed whole.

Herpetologist Walter Huffenberg of the University of Florida studied the world's largest lizard, the Komodo dragon, whose teeth are remarkably simi-

lar in structure to those of tyrannosaurs and is known to inflict a septic bite. An infectious bite leads credence to the argument that these beasts were predators rather than scavengers.

T. rex's lips probably closed tightly and may have had thick, spongy gums that covered the teeth: its mouth would have run red with its own bloodstained saliva while it dined. William also has a section in the Encyclopedia *of Dinosaurs* (Academic Press, 1997).

This View of Life: What does the Dreaded "E" Word Mean, Anyway? A Reverie for the Opening of the New Hayden Planetarium by Stephen Jay Gould. *Natural History*, February 2000, p. 28–44.

First Stephen discusses a series of meanings for the word "evolution": Darwin used "descent with modification." Evolution comes from the Latin *evolvere*, literally "an unrolling." In English poetry the key meaning is the sequential exposure of prepackaged potential. Herbert Spencer is mainly responsible for the modern day meaning by referring to Darwin's process as genealogical "descent" of our own species, not our "ascent" to higher levels of consciousness.

Stephen grew up in New York City viewing the two exhibits of the *T. rex* skeleton and the star show at the Hayden Planetarium. Stephen became a palæontologist looking for fossils as he was close to the ground while tall Carl Sagan became a cosmologist. Stephen contrasts biological evolution against cosmological evolution in detail because of the confusion engendered by the differing uses of words. Both professions use the term "evolution" to denote change through time. Astronomers confine "evolution" to denote the historical sequences of predictable unfolding, shunning the biological meaning of unpredictability and lack of inherent directionality.

Gould next refers to two studies published recently:

1. Refutation of the idea that life has progressed in a stately linear manner through the ages: nearly all animal phyla made their first appearance at essentially the same time (bryozoa excepted), during an interval of some 5 million years (530 million to 525 million years ago), called the "Cambrian Explosion."

In *Nature,* November 4, 1999, for the first time there is a report of two well-developed vertebrate genera within the Lower Cambrian Chengjiang Formation of southern China, indicating that vertebrates existed in substantial diversity—thus vertebrates do not stand higher and later than invertebrates. The vaunted complexity of vertebrates did not require a special delay to accommodate a slow series of progressive steps predictable from the general principles of evolution.

2. The Mesozoa live as parasites within truly multicellular animals. Parasites often adapt by evolving an extremely simplified anatomy—the evolutionary degeneration of a complex free-living ancestor rather than the maintenance of a primitive state. In the October 21, 1999 issue of *Nature*, Japanese researchers located a Hox gene in *Dicyema orientale*, showing that the dicyemids are descended from a "higher" triploblastic animal and have become maximally simplified—this within the Cambrian explosion.

So there is the good fortune of our own evolution being contrasted with the inexorable evolution of our nurturing sun toward a spectacular climax that might make our own further evolution impossible. The contingency of our evolution offers no guarantee against the certainties of the sun's evolution. Gould excitedly continues to wonder and cogitate. ❑

2000 Field Trips… Important Update!

[*…continued from Page 17*]

August 20, 2000 (Sunday)
Mount Stephen Trilobite Beds

We will depart the Yoho Brothers Trading Post, in Field, BC at 10:00 A.M. **Please arrive early.** The Trading Post is at the corner of the Trans-Canada Highway and the main entrance to Field. Estimated return time is 4:30 P.M. **Do not attend this trip if you are not in good physical shape.** The elevation gain during this hike is 520 m (1700 feet), with a round trip distance of 6 km (3.6 miles). Although shorter in length than last year's Burgess Shale hike, the hike up Mt Stephen is extremely steep. **For more information check out www.burgess-shale.bc.ca on the internet.** ❑

2000 Field Trips… Important Update!

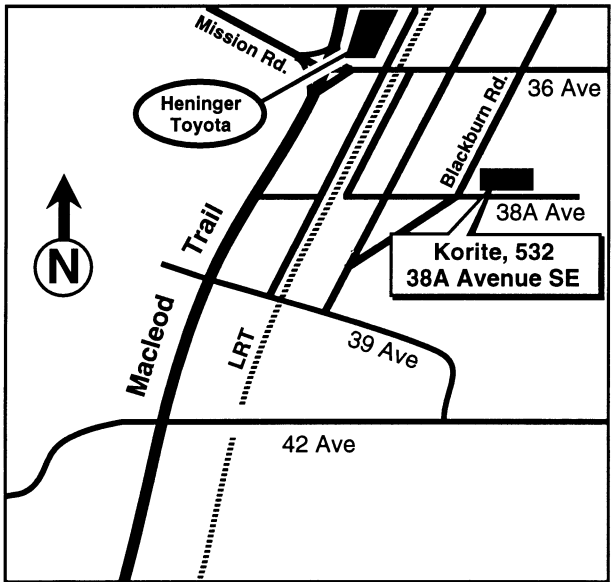
by Keith Mychaluk

Please note the following additions to the 2000 field trip schedule, which you should have received by email or post.

Important! Please make sure you have signed up for the trip before you attend. These trips have strict enrolment limits. Do not simply show up, unannounced, for any trip. If you want a schedule or sign-up sheet, or need more information, please contact Keith at (403) 228-3211, or email: mychaluk@telusplanet.net

April 15, 2000 (Saturday)
Korite and Canada Fossils workshops

Meet at Korite Minerals head office at 10:00 A.M. sharp. The address is 532 - 38A Avenue S.E, Calgary (behind Heninger Toyota off Macleod Trail south). The name "Korite" or "Canada Fossils" is NOT marked on the building. As such, give yourself plenty of time to find it. Parking is available only on the streets; you may have to walk a short distance. Car pooling might be recommended.



June 21–25, 2000 (Wednesday thru Sunday)
Hell Creek and Glendive, Montana

Meet at 7:00 A.M. in the parking lot of South Centre shopping mall near the lower west end entrance to The Bay (this is the side facing the Anderson LRT station). A valid Canadian passport is mandatory for participation in this trip (there will be no exceptions). If you are not using a Canadian passport please contact Keith Mychaluk. Further details will be published in the June *Bulletin*.

July 15 and 16, 2000 (Saturday and Sunday)
Onefour, Alberta

Meet in front of the Manyberries hotel, in Manyberries, Alberta, at 10:30 A.M. We will caravan out of Manyberries at 11:00 A.M. sharp. Further details in the June *Bulletin*.

August 19, 2000 (Saturday)
Canmore, Alberta

Meeting time and place TBA (details in the June *Bulletin*)

Field Trips continued on Page 16… ☛