Palæontological Society
Alberta
Bulletin

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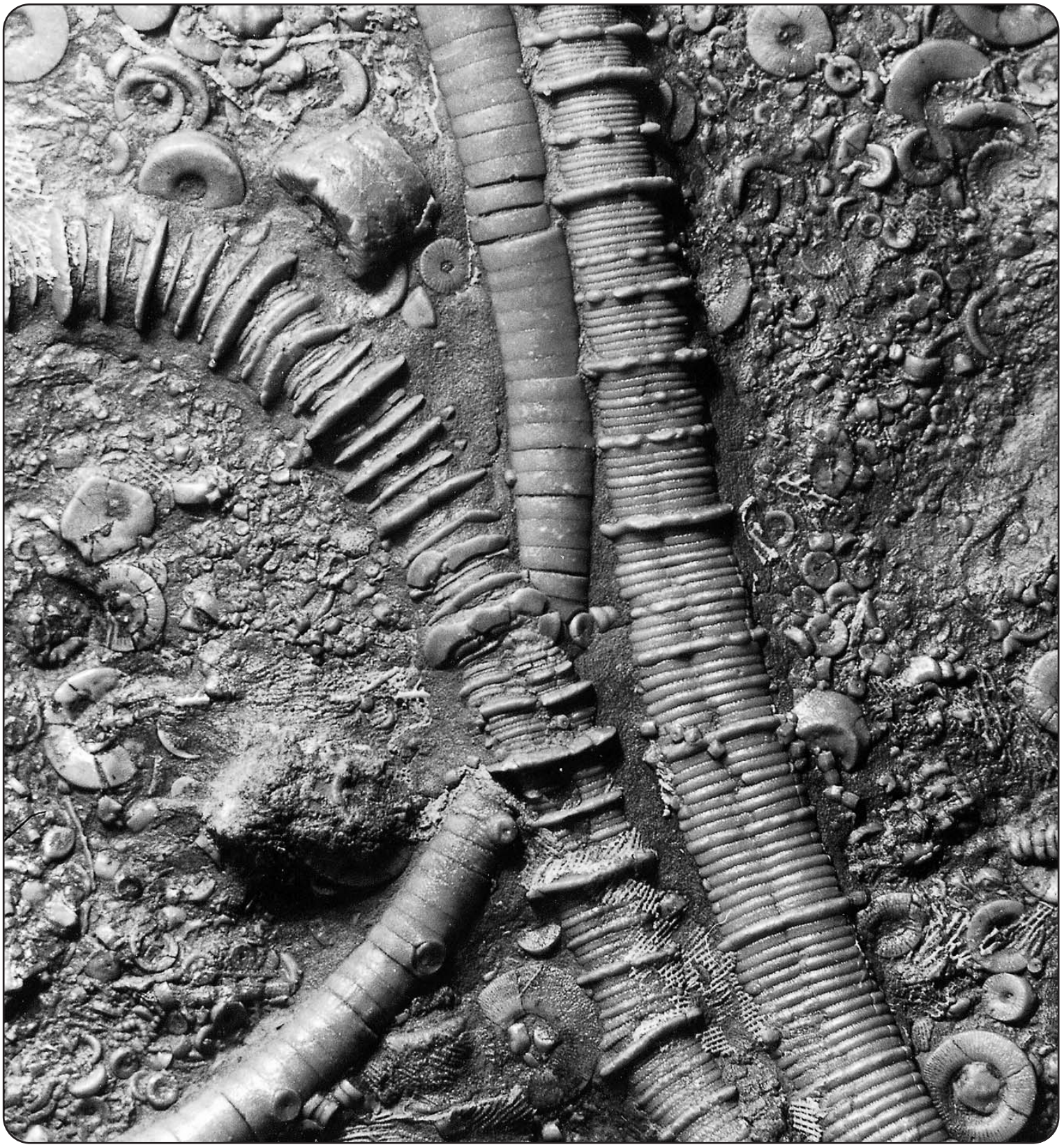

ALBERTA PALÆONTOLOGICAL SOCIETY

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	$20.00 annually
Family or Institution	$25.00 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** (or **B101**, across the hall)
Mount Royal College: 4825 Richard Road SW, Calgary, Alberta

Friday, April 25, 2003—"The Drumheller Marine Tongue fauna" Speaker: Wayne Haglund, Mount Royal College. See Page 5 for details.

Friday, May 23, 2003—"Ammonoid faunas of the Cardium Formation, Alberta Foothills and adjacent subsurface" Speaker: Wayne Braunberger, APS.

ON THE COVER: Mississippian (340 million years old) crinoid stems and ossicles from Crawfordsville, IN, U.S.A. Magnified approximately 1.7 times. Photo by APS member Fred Lewis, Carmel, IN. (Copyright ©)

From the President

by Dan Quinsey

First, I would like to thank all members for their involvement and contributions they have made to the Society this year. You should be proud of the achievements we have made. Recently the Tyrrell Museum conducted their first Research Day. For most of you who do not know, the success of APS Symposiums over the past years helped to inspire the Tyrrell in this project (which, I might add, was a great success).

In another area, we have not forgotten the issue of third-party liability insurance. The Board has been carefully investigating our options regarding this issue. As you can well imagine, this can be a costly process and endeavor and we are not going to rush into things blindly. When we have found the option that is the best fit for our Society, we will make a presentation and recommendations.

Advance congratulations go out to **Wayne Braunberger** and **Phil Benham** for their work organizing our March Symposium. Many hours spent by many people go into preparing this evolving event. Congratulations to everyone!

Mona Marsovsky has done a great job as Treasurer and Librarian this year. The financial books have been in the best order ever and the library is well stocked and organized. Good work, Mona. Once again, I would also like to thank **Dale Speirs** for his generous donation of books from the estate of **Betty Speirs**.

One fabulous resource commonly overlooked by members (myself included) is our Society fossil collection, organized by our curator, **Ron Fortier**. Contact Ron any time to arrange to view our collection.

Behind the scenes, **Howard Allen** puts together our *Bulletin* and keeps the membership records in order. When asked, Howard will say it is no big task—but don't believe him. Howard does such a good job he just makes it look easy.

Wayne Braunberger and Phil Benham both deserve a big "atta-boy" for their work on the Symposium, Events and Programs. They both bring a degree of enthusiasm to the APS that inspires us all.

Steffie Negrich, our newest member of the Board, has done a wonderful job as Social Director. Many successful changes have been implemented, increasing the satisfaction of our members while at the same time reducing our expenses in this area.

Many members of the Society on and off the Board make considerable contributions that make the Alberta Palaeontological Society a great success. If I have left out a name here and there, it is not because we do not appreciate your involvement; it is because our *Bulletin* is not big enough to list everybody. Thanks go out to everyone. Keep up the good work. ❑

Library Notes

Books Donated by the Estate of Betty Speirs

by Mona Marsovsky, APS Librarian

On December 7, 2002, **Dale Speirs** kindly donated palaeontology literature from the estate of his late mother, Society member **Betty Speirs**, [*see* Bulletin, *Dec. 2002, p. 2*] to the APS Library . The Society thanks Mr. Speirs for his generous donation of the following books and periodicals:

Periodicals—

Palaeontology, journal published by The Palaeontological Association, London, UK. Quarterly issues from Feb. 1978 (Vol. 21, Part 1) to May 1980 (Vol. 23, Part 2) contain 10 to 12 articles per issue on vertebrate, invertebrate and plant fossils.

Plants—

The following publications include plates and photos of identified plant specimens:

Uppermost Cretaceous and Paleocene Floras of Western Alberta by W.A. Bell, Geological Survey of Canada, Bulletin No. 13, 1949.

Lower Cretaceous Floras of Western Canada by W.A. Bell, Geological Survey of Canada Memoir 285, 1956.

Paleocene Flora of the Rocky Mountains and Great Plains by Roland W. Brown, U.S. Geological Survey Professional Paper 375, 1962.

Lower Cretaceous Floras of Western Canada by W.A. Bell, Geological Survey of Canada, Paper 65-5, 1965.

Betty Speirs on a field trip at the Burbank/Blind-man River outcrops, during the 1984 meeting of the International Organization of Paleobotanists in Edmonton. (Photo courtesy of Georgia Hoffman)

Upper Cretaceous and Paleocene Plants of Western Canada by W.A. Bell, Geological Survey of Canada Paper 65-35, 1965.

Common Fossil Plants of Western North America by William D. Tidwell, Brigham Young University Press, 1975. (Also includes a description of each plant group and the ages that they lived in.)

Stratigraphy and Paleobotany of the Golden Valley Formation (Early Tertiary) of Western North Dakota by Leo J. Hickey, The Geological Society of America Memoir 150, 1977.

Upper Carboniferous Fossil Flora of Nova Scotia in the Collections of the Nova Scotia Museum, with Special Reference to the Sydney Coalfield by E.L. Zodrow and K. McCandlish, published by The Nova Scotia Museum, 1980.

Paleobotany and the Evolution of Plants by Wilson N. Stewart, Cambridge University Press, 1983. (Traces the origin and evolution of plant groups.)

Field Trip Guide, Second International Organization of Paleobotany Conference, August 19-22, 1984 by Thomas N. Taylor and Ruth A. Stockey. (Pictures of plant species and their localities from the field trip that traveled to sites in Dinosaur Provincial Park, Horseshoe Canyon, Joffre Bridge, Burbank-Blindman, Saskatchewan Crossing, Jasper and Genesee.)

Vertebrates—

A Fossil Ray, Possibly Myledaphus *(Elasmobranchii: Batoidea) from the Late Cretaceous Oldman Formation of Western Canada* by Wann Langston Jr., National Museums of Canada Publications in Palaeontology No. 6. (Detailed description of the specimen plus photos of its vertebrae.)

Palaeontology of the Swan Hills Area, North-Central Alberta by Loris S. Russell, Royal Ontario Museum, Contribution 71, 1967. (Contains detailed description of the localities and their fossils.)

The White River Badlands by Cleophas C. O'Harra, South Dakota School of Mines Bulletin No. 13, 1920, reprinted 1976. (Pictures of the mammals and their localities.)

Invertebrates—

The Dawn of Life in Full Colour—A Collector's Introduction to the Forms and Classifications of Fossils of the World by Giovanni Pinna, The World of Nature, Orbis Publishing, London 1972. (Photos of invertebrates.)

Fossils of the Burgess Shale, A National Treasure in Yoho National Park, British Columbia by S. Conway Morris and H.B. Whittington, Geological Survey of Canada Miscellaneous Report 43, 1985. (Pictures of the Burgess Shale and the fossil animals found therein.)

General Palaeontology—

Fossils: An Introduction to Prehistoric Life by William H. Matthews III, published by Barnes & Noble Inc., 1962. (How to collect fossils, main divisions of fossils and ages of fossils.)

The Elements of Palaeontology by Rhona M. Black, Cambridge University Press, 1972. (Includes pictures of invertebrate, vertebrate and plant fossils.)

Fossils for Amateurs, A Handbook for Collectors by

Russell P. MacFall and Jay C. Wollin, published by Van Nostrand Reinhold Company, 1972. (Includes nature of fossils, where they occur, where to look, practical field tripping, preparing and cleaning fossils, and state maps showing fossil localities in the USA.)

Fossils, Paleontology and Evolution, 2nd edition by David L. Clark, WM.C. Brown Company Publishers, Dubuque Iowa, 1976. (Describes the evolution of plants, invertebrates and vertebrates.)

Fossil Collecting: An Illustrated Guide by Richard Casanova, published by Faber and Faber, London, 1974. (Includes history of fossil collecting, how fossils are preserved, collected and classified, geological time scale, and where to look in the U.K. for fossils.)

Geological Highway Map of Alberta published by The Canadian Society of Petroleum Geologists, 1975.

Fossils of Alberta by Leonard J. La Casse and James Roebuck, published by Hallamshire Publishers, Edmonton Alberta, 1978. (Includes maps of fossil localities in Alberta.)

An Illustrated Guide to Fossil Collecting, 3rd Revised Edition by Richard Casanova and Ronald P. Ratkevich, Naturegraph Publishers, Inc, 1981. (Includes classification of fossils, history of life, how to collect, catalogue, prepare and display fossils, fossil collecting localities in North America and lists museums with major fossil exhibits.

Dinosaur Hunting—

Hunting Dinosaurs in the Bad Lands of the Red Deer River, Alberta Canada by Charles Hazelius Sternberg, NeWest Press, Edmonton, 1917, republished 1985. (Details C. Sternberg's adventures.)

The Dinosaur Project by Wayne Grady, published by Macfarlane Walter & Ross, Toronto, 1993. (Describes the Royal Tyrrell Museum's dinosaur hunting forays in China and Alberta.) ❑

2003 Symposium Abstracts

Our 90+ page, illustrated Abstracts Volume was so popular it sold out! We are considering a second press-run if there is sufficient interest. Contact the editor (see Page 1) prior to May 15 if you are interested in purchasing a copy. Price will be $10.00 plus P&H. All proceeds to the Society.

Program Summary

February 21, 2003

Charles Darwin—Geologist!

Speaker: **Dr. Russell Hall**
University of Calgary

Abstract:

Charles Darwin's fame and notoriety are deservedly based on his publication of *The Origin of Species* in 1859, but in fact the young Darwin was an enthusiastic geologist. During his 5-year voyage around the world as naturalist on the H.M.S. *Beagle* he devoted most of his attention and time to collecting rocks and fossils, and on his return to London spent the first 10 years of his scientific career presenting papers and writing books on geological subjects.

"Geology is a capital science to begin with, as it requires nothing but a little reading, thinking, and hammering."

–Charles Darwin
Letter to W.D. Fox, 1835

He made significant, and often original, observations on topics as diverse as the significance and origin of cleavage, origin of volcanic craters, relation of lavas to intrusives, evidences for uplift of continents and subsidence of ocean basins, and proposed a hypothesis for the origin and distribution of coral atolls. Geological ideas played a significant part in his developing ideas about organic evolution, and to the end of his life (1882) he grappled with two major geological problems which impinged significantly on acceptance of his theory of evolution: the nature of the fossil record, and the age of the earth.

Biography:

Dr Hall teaches at the University of Calgary. His avenues of research are the taxonomy, biostratigraphy and biogeography of Jurassic ammonites in western Canada and the circum-Pacific. ❑

Upcoming Programs

Friday, April 25, 2003, 7:30 P.M., Room B108

The Drumheller marine tongue fauna

Speaker: **Dr. Wayne Haglund**
Mount Royal College, Calgary

Abstract:

Allan and Sanderson (1945) originally described the Drumheller Marine Tongue, as it occurs in Horseshoe Canyon, as consisting of a lower 1 metre of arenaceous limestone characterized by *Crassostrea subtrigonalis*, a middle 6 metres of siltstone and an upper 1 metre of arenaceous limestone characterized by *Corbicula ventricosa*. Current field studies suggest that it can be found 35 kilometres north of Drumheller and south to near Scabby Butte, Alberta within the Horseshoe Canyon Formation. My emphasis will be on the occurrence along the Red Deer River Valley south to the Rosebud River.

Coquinas occur above coal bed #9 in the south and below coal bed #11 in the north. The well-cemented coquinas consist of approximately 40 % shell material and approximately 60% clay and volcanic ash. In the north they occur as a single bed nearly a metre thick. In the extreme southern portion of the study area several coquinas occur stacked; the vertical distance between coquinas ranges from 0.5 to 6.0 metres.

The oyster *Crassostrea subtrigonalis* dominates the fauna of the Drumheller marine tongue. *C. subtrigonalis* appears to be very responsive to local environmental conditions and is thus manifested in the form of several ecophenotypes: a relatively small, thin-shelled ecophenotype representing supratidal environments; a moderate sized, thick-shelled ecophenotype representing intertidal environments; and a relatively large, thick-shelled ecophenotype representing subtidal environments. Modern ecophenotypes of *Crassostrea virginica* appear in brackish water environments, such as estuaries, salt marsh tidal channels and some bays.

Associated with *Crassostrea subtrigonalis* are the bivalves *Mya (Arenomya) simulatrix*, *Corbicula ventricosa, Corbicula occidentalis, Modiolus galpinianus, Brachidontes dichotoma, Anomia perstrigosa*, the gastropod *Euspira obliquata* and the bryozoans *Eokotosokum bicystosum* and *Villicharixa lintonensis*.

The distribution of the various faunal members and the nature of their valves varies as follows:

Crassostrea subtrigonalis—scarce, relatively small, worn, disarticulated valves in the northern portion of the study area; very abundant, relatively large, unabraded, disarticulated and articulated valves in the southern portion of the study area.

Corbicula ventricosa—abundant, unabraded, articulated valves in the northern portion of the study area; scarce, relatively larger, unabraded, disarticulated and articulated valves in the southern portion of the study area.

C. occidentalis, M. galpinianus, B. dichotoma, A. perstrigosa, the gastropod *E. obliquata*, and the bryozoans *E. bicystosum* and *V. lintonensis* are generally found associated with the larger ecophenotypes of *C. subtrigonalis.*

Based on the composition and conditions of the faunal material I interpret the Drumheller Marine Tongue to represent a series of local coquinas that are dominated by *C. subtrigonalis* and are the result of several marine transgressions of short duration into the Drumheller Estuary. The absence of any fully marine fauna in the Drumheller marine tongue suggests (to me) that the reworking and redistribution of the shell material was by storm waves within the Drumheller Estuary and not by any transgression of marine waters (and fauna) into the estuary.

Biography:

Wayne Haglund has been teaching geology at Mount Royal College for nearly 35 years. He obtained his bachelor degree from Portland State University, Masters degree from the University of Kansas and is completing a Ph.D. from the University of Queensland. His interests in Palaeontology are eclectic; currently they are Cretaceous brackish-water bivalves and gastropods. ❑

Friday, May 23, 2003, 7:30 P.M., Room B108

Ammonoid faunas of the Cardium Formation, Alberta Foothills and adjacent subsurface

Speaker: **Wayne Braunberger**
Alberta Palaeontological Society

Research Day at the Royal Tyrrell Museum

by Dan Quinsey

I was very happy to see many members of the APS attending Research Day at the RTMP on January 25, 2003. Word has it that approximately 150 people attended the function, making the endeavor a success.

The day began at 10:30 with three morning presentations. First, Dr. David Eberth gave an informative lecture titled *The Beginning of the End: Declining dinosaur diversity, climatic changes from 72 to 65 million years ago.* Many tables and slides were presented establishing strong evidence for changing climates and the possible influences these changes may have had on the dinosaur communities of Western Canada prior to the extinction event 65 million years ago.

The next lecture, *Turtle distribution and climatic change*, by Dr. Don Brinkman, looked at the variation in diversity and abundance of turtles from Alberta to Mexico. Views were presented on why changes to distribution patterns of turtle fossils are an indicator of significant changes in the Late Cretaceous climates.

The last lecture of the morning, by Dr. Philip Currie, discussed *The next chapter in the bird-dinosaur connection*. The idea that dinosaurs are not extinct, but are alive today in the form of birds is a hot topic that is becoming widely accepted in palaeontological circles. Fantastic images of specimens were presented and discussed, strengthening this theory. Also discussed were the research connections between the Tyrrell Museum and institutions in China.

During the lunch break (supplied by the RTMP), we were able to chat with the Museum staff and view the many posters on display. A number of fantastic fossil specimens were also on display in a separate room. Many participants also took advantage of the gallery during the break.

The afternoon began with a slide presentation titled *Scenic Dinosaur Provincial Park* by Hilary Tarrant. Spectacular images of the badlands faded in and out while set to music.

The fourth lecture, by Dr. Dennis Braman, was titled *The end of an era: The Cretaceous plant biotic crisis.* Using examples from Western Canada, Dennis Braman summarized the evidence focusing on how changes marked by a moment in time represented by the Cretaceous-Tertiary boundary impacted plant communities.

Next, Dr. Betsy Nicholls presented her lecture, *Comparing New Zealand's marine reptiles to their counterparts of the Western Interior Seaway.* Dr. Nicholls presented her findings from a recent study of fossil collections from the Western Interior Seaway, the Pacific coast and New Zealand, establishing Mesozoic marine reptile distribution.

Finally, Dr. Paul Johnston gave a thought-provoking lecture on *Mudmounds, microbes and hot rocks: New Burgess Shale discoveries*. Recent discoveries in today's oceans have changed the way we are looking at the Burgess Shale. Vents in the earth's crust at the bottom of the ocean attract communities dependent on bacteria that thrive on toxic substances around these vents. Evidence was presented linking the Burgess Shale to changing ideas about the earliest beginnings of animal life and even directing the search for life beyond Earth.

Congratulations to the Tyrrell Museum staff for a successful event. ❑

2003 Field Trip Updates

by Wayne Braunberger

- **Trip 2003-1**
  Red Deer River badlands, Drumheller, Alberta

Meet Saturday, June 21 at the Hoodoos Recreation Area which is located on Highway 10, east of Drumheller (between Rosedale and East Coulee). Sunday's meeting place will be announced on Saturday.

Itinerary has not been confirmed, however stops will be made at the following locations: East Coulee, Willow Creek, Hoodoos, Airport Road/Highway 9, Horsethief Canyon, Horseshoe Canyon as well as a number of other sites that have not been confirmed. Stops are both palaeontological and geological in nature and will allow members to examine a variety of features.

Due to limited parking space at many of the sites we will be carpooling.

Remember! The registration deadline is June 14, 2003.

- **Trip 2003-2**
  Nordegg Area, Alberta

Watch for updates in the June *Bulletin*.
Registration deadline is July 12, 2003.

- **Trip 2003-3**
  Canyon Creek-Moose Mountain, Alberta

Watch for updates in the June *Bulletin*.
Registration deadline is August 1, 2003.

If you are registered you will be contacted before the trip by email or phone. **Late registrations will not be accepted.**

At this time a "final" version of the proposed field trip guidelines [*Bulletin*, December 2002, p. 20] has not been completed. I have received very few responses to date. In addition, the content of the Society's waiver is under review and will incorporate many of the field trip guidelines. ❑

Education Project

by Dan Quinsey

A pilot project was undertaken by the APS last month to communicate with grade 3 and 4 students of McKenzie Lake School in Calgary. It is very difficult to have members go out to talk to students during a weekday. As an experiment, I asked the teacher, Becky Graham, to get her students to handwrite a letter to the APS asking one question about palaeontology, fossils, or dinosaurs. Not only would this give the APS a chance to get involved, it would also give the students practice writing a letter. They would also get practice presenting their reply to the class at a later date. The APS also donated fossil kits and a classroom collection to the School, thanks to a generous donation of fossils from **Les Adler**.

I received 50 letters and after much research, managed to answer them all. Some of the spelling in the letters was creative but the kids managed to ask quite a variety of questions about fossils, dinosaurs, palaeontology, fossil fuels, extinction, the ice age, and much more. I was so touched by the charm of some of the letters that I took time off work to present the letters to the kids in person. The afternoon was full of happy faces, lots of questions, a little show and tell, and dinosaur puzzle activities.

The best quote from one of the students (Whitney, 8 years old): "Did you know that you can find a fish inside a fish and it doesn't need to be a fish, it can be all sorts of animals?" ❑

A Note of Thanks

Longtime members, the **Quon Family—Betty, Sing** and **Randall** recently donated an assortment of material to the Society, including wooden dinosaur models, books, dinosaur-motif commemorative coins, postage stamps, computer software and a number of other items that will be used for fundraising at the silent-auction table and raffles. The Society thanks the Quons for their generosity! ❑

Ruminations on Apatosaur Physiology

by Sam Richter (copyright © 2003)

Apatosaurs lacked the type of teeth so necessary for slicing, dicing, and chewing, yet grew to an immense size. The lack of these teeth is a bird characteristic that has been very successful for many millions of years. Apatosaurs required large amounts of succulent, highly nutritious, easily digested, low in fiber, plant material daily. Think of plant equivalents to chocolate, ice cream and candy—no processing in the mouth required or possible. Transit time through the digestive system would be short. They likely felt hungry all the time no matter how much was eaten, maximizing the daily amount of nutrients processed.

Our birds also lack these types of teeth. The swan has 28 bones in its neck, 15 more than an apatosaur, allowing for graceful flexibility. The ridges of horn-like material on the bill and tongue grasp plants securely (Burkhead and Perrins, 1986). Tactile sensors in the ridges indicate how succulent the grasped material is, and whether it should be swallowed or not.

Watching a toothless bill in action close-up is interesting. Wild geese, those which like being around humans, soon learn that a source of tasty raw barley seed is in the palm of a hand. The seeds are swallowed as soon as they are picked up. No need to "come up for air" to handle a bill-full of seeds. Their bill movements are quick and slightly ticklish. Overall, a pleasant experience.

Plant material contains cellulose, a fiber, which is difficult to break down to a digestible form. It is the main structural component of plants. Bacteria and protozoans can ferment this fiber to short-chain fatty acids, which are then metabolized to usable energy. As plants mature, much of the cellulose is replaced by lignin, which is hard, woody, and indigestible. Some mammals, like cows, have a special stomach containing the bacteria that need some time to break the cellulose down. This means a large, heavy stomach. Birds could not fly with such a heavy organ.

Small stones (gastroliths) in the birds' gizzard are there primarily to help mix the plant material, keeping it from layering and settling out. Any pulverizing of plant material by the stones is incidental. The small intestine, which receives the output of the gizzard, determines whether the material is processed enough for digestion. If not, it is returned to the gizzard for further batch-processing. The lining of the gizzard is made up of a horn-like material with ridges. The gizzard acts like a coffee grinder, breaking plant cells down using separate blocks of muscle opposite each other to put the squeeze on the contents.

Spring-time, with its adequate moisture and long hours of sunshine, grows succulent plants. Think of bean and alfalfa sprouts. These are very digestible. When the digestive system has finished with these plants there is little residue left. Grass at this time is low in fiber and high in nutritious sugars and starches. This is high energy nutrition, with a short transit time through the digestive system, resulting in fast weight-gain in cows and calves. Total daily energy intake is maximized and this energy is what makes meat and muscle. Checking on cattle at this time can have some surprises. Most cows lift their tail to indicate what they are about to do, giving time to move to a safer place. Others, like the black on white Holstein cow "Stinky"move the tail slightly to the side and immediately squirt the residue some distance. Being too close means a surprise package of wet, greenish, foul smelling material, filling pockets and rubber boots.

As plants grow to maturity, energy in the leaves is put into seeds and roots. Leaves now become low in nutrition and high in tough fiber, unacceptable as apatosaur food. From this maturity, plants go dormant. In areas of low moisture, like the short grass prairie, the time from dormancy to maturity, then back to dormancy, is under three weeks. These plants have been selected by evolution for their toughness in surviving unexpected severe weather and climate changes. Should rain occur after this dormancy, the plants will sprout and go through maturity again. If the plant is kept from reaching maturity by being eaten regularly, it will stay succulent. In the dinosaur world, some plants might be kept succulent, but most would mature. At this time those rod-like teeth at the front of the mouth would likely be utilized in a rake-like fashion to strip seeds from mature plants.

A number of sauropod groups had rod-like teeth at the front of the mouth: diplodocids, dicraeosaurids, camarasaurids, brachiosaurids, and titanosaurids. These range in size from small to the largest ever

found—*Argentinosaurus* with its 90-tonne, 37 metre-long body. From the numbers of gigantic adult sauropods found, it is evident that major quantities of their proper food was readily available. What was it about this climate that grew the immense quantities of succulent high energy plants needed by these sauropods?

Sauropods could eat anything that caught their fancy, from the ground level up to as high as they could reach. No need to stand up on the back legs to reach higher. Do as the African elephants do: lean on the tree until it is pushed over and then everything of interest is within easy reach.

Reference

Burkhead, M.E. and Perrins, C.M. 1986. The mute swan. Croomhelm Ltd, London. ❑

May Election of the Board

by Vaclav Marsovsky, Past President

Our annual election of the Board is coming up at the May 23, 2003 meeting. Officer positions are held for a period of one year. Director positions are held for two years.

Officers up for renewal:

President	Vice President
Secretary	Treasurer

Directors up for renewal:

Programs (Monthly meetings and symposium)

Directors mid-way through their term and not up for renewal:

Editor (Bulletin)	Membership
Events (Field trips)	

Appointed director positions which become open from time to time through the year (these aren't usually part of the formal annual elections):

Social	Fund raising
Curator	Librarian
Education	Webmaster
APAC Representative	

Of these, **the Social position is open. We are looking for volunteers to step forward to fill this position.**

If you are interested in running for any of the Officer and Director positions, please speak to any current member of the Board (see Page 1 for names and contact information). If you wish to nominate someone (providing you have their consent), please do so before May 13, 2003.

If you would like more information about what each position is all about and the time commitment required, please ask **Vaclav Marsovsky**. (Ph. 547-0182).

Where more then one candidate is running for a position, there will be a formal election held by the members at the May meeting. Therefore it is important that you attend.

Our Society can only be successful if members are willing to make the contribution of time. So I encourage you to take interest in the affairs of your Society. ❑

Fossils in the News

A Note from the Editor

Readers will have noticed the increasingly sporadic appearance of "Fossils in the News" columns in recent issues of the *Bulletin*. I have continued to receive large volumes of newspaper and magazine clippings, for which I offer my sincerest thanks—especially to the likes of **Les Adler, Georgia Hoffman, Sam Richter** and *Calgary Lapidary Journal* Editor **Trudy Martin**. However, due to increasing demands of my out-of-town job (witness the lateness of this current issue), I regret that I am no longer able to give this part of the *Bulletin* the time that it requires.

If anyone comes forward to act as "News Editor"I will be more than happy to continue publishing news items. An alternative might be for someone to start a clipping archive for the APS library.

Otherwise, "Fossils in the News" may resurface occasionally, as circumstances allow, but to be fair to my faithful contributors, whose efforts I appreciate, and whose clippings have lately fallen into neglect, I must ask you to give your scissors a rest, and please accept both my apologies and heartfelt thanks for your past efforts.

– Howard Allen ❑

Mammoth Stories

An Appreciation of Jack London's *A Relic of the Pliocene*

by Philip Benham (copyright © 2003)

An extract from work in progress tentatively entitled "Trips Through Time: Western Canadian Roadside Companion for the Paleontological, Geological, Historical and Just Plain Weird."

Yukon's Top of the World Highway (Hwy. 9) leads west from Dawson City to Tok, Alaska. The locality of Sixtymile lies at the westernmost point of the route, prior to passing into Alaska and the east of the Coast Mountain Range. The rivers here dissect the Neogene Klondike Plateau, uplifted by the mountains rising to the south and west.

The vicinity of Sixtymile River is one of the regions that were never covered by glacial ice, although even today patches of permafrost dot the land. It is a storied area, history written in the hard labours of mostly nameless hordes that eked out a living working the gravels for gold. Nearby, the Klondike Schist (possibly Permian in age) is intruded by Eocene basalt and andesite. Within this setting the gold was deposited by superheated waters sourced from the intrusion.

The early days of Yukon gold prospecting (1874–-1884) yielded little gold to the few who were looking. Finally, significant gold was discovered on the Stewart River in 1885 and the next year Fortymile River was the focus of several finds. By the early 1890s a series of discoveries along the banks of Sixtymile River brought it to the forefront. Gold is associated with four main creeks (Miller, Glacier, Little and Big Gold), all of which drain into the Sixtymile River. The Klondike gold rush was on with the Bonanza Creek discovery in 1896, but Sixtymile remained prolific to a variety of hard scrabble characters during Yukon's heyday.

By 1946 gold extraction was more of a company concern and Yukon Explorations Ltd. transported a huge bucket-line dredge up from Oregon. This diesel-powered monstrosity consisted of seventy buckets on a big chain that would shift the extensive gravels lining the river valley to a point where they could be washed and the gold extracted. The introduction of machinery didn't result in the elimination of jobs. On the contrary, thirty men were employed to defrost and dig the ground that the dredge would work. The dredge operation lasted until 1954, when, due to low gold yields, it was shut down. The equipment, which had originally taken a year to assemble was too much bother to move anywhere else and so it sat until 1999. In that year its remains were gathered up and transported south to Skagway, where it could be put on display for the tourist hordes who had come in the easy way, by cruise ship.

The processing of the muck uncovered gold of a different variety. The miners frequently uncovered bones and mummified remains of ice age mammals.

Chuck and Lynn McDougall currently hold active claims at Sixtymile and have been processing the site for gold over the years. While they wash away the muck they keep an eye out for bones. The site has yielded hundreds of specimens. C.R. Harington of the Canadian Museum of Man and Nature recounts the following list:"woolly mammoth, steppe bison, large and small horses, American mastodon, caribou, mountain sheep, helmeted and tundra muskoxen, caribou, moose, wapiti, wolf, wolverine, scimitar cat, American lion, ground squirrel (with ancient nests and droppings), a bird and a virtually perfect carcass of a black-footed ferret, fur and all."

The Sixtymile site is also known for yielding abundant bones from a distant relative of the llama, the western camel (*Camelops hesternus*). The camel might be thought of as a warm climate creature but it has done quite well weathering out the Canadian winter—recall the importation of camels by goldrushers in BC which were unsuccessful for reasons other than the camel's ability to handle the climate[1]. Radiometric C14 dating of the *Camelops* bones from Sixtymile and nearby sites in Alaska has yielded a range of 40,000–23,000 years BP, during the peak of the last Ice Age.

The Yukon Beringia Interpretive Centre in Whitehorse displays many of these specimens. This modern museum is primarily dedicated to recreating a lost land that spread west from the Yukon through Alaska, across the Bering land bridge and into Siberia.

[1] See text notes, p. 15.

This land existed during the height of the Ice Age, and, in spite of its northern position, it remained relatively ice free. Over a kilometre of ice coated North America and high latitudes on other continents. This had the effect of lowering global sea level as much as 150 metres. The shallow Bering Strait, once a barrier to land animals and highway to ocean going creatures, was now exposed, connecting Siberia with North America.

The cold dry climate of eastern Beringia supported a large population of mammals feeding from the grassy steppes. Harrington notes that the western camel was likely well adapted (with a long neck and limbs) to the scrublands and steppe environment where it could feed on both grasses and bushes. Like the horse, the camel originated in North America during the Late Eocene. Rabbit-sized *Protylopus* appeared 40 million years ago and gave rise to the llamas of South America and modern camels which reached Europe, Asia and Africa via the Bering Land Bridge. Most people envision the bridge as the route by which animals colonized "isolated" North America, but it was clearly a two-way street.

Another one of those animals recovered from the muck at Sixtymile is the short-faced bear (*Arctodus simus*), the largest carnivore stalking the Canadian landscape during the ice age. The bear had a wide, solid skull, well adapted for crushing bones to get at the marrow. This bear was 1.5 m tall at the shoulder and a terrifying 3.4 m in height when standing up. The short-faced bear first appears in the fossil record about 1 million years ago in the Mississippi plains. Its nearest living relative is the spectacled bear. It has been recovered from ice age deposits from Sixtymile to Old Crow to Saskatchewan and south at the La Brea Tar Pits. Towards the end of the last glaciation it went extinct; perhaps due to the loss of large herbivorous prey or due to competition from the smaller brown bear (*Tremarctos ornatus*) which first crossed the Bering land bridge 150,000–200,000 years ago (Harington, 1996).

Every dog has his day and the megafauna of Beringia had theirs. Between 11,000 and 9,000 BP—coincidentally the end of the Ice Age—most went extinct. Occasionally they lingered on in remote pockets in North America but ultimately these islands of survival proved too small for their long-term existence. For example, woolly mammoths survived in a dwarf form on Wrangel Island until about 3700 years ago—around the time that the first pyramids were being built. Today Wrangel Island still contains an unusual assemblage of plants, typical steppe that the mammoth would have browsed upon (Lister and Bahn, 1994). These "mini-me" mammoths had been missed by the hunters travelling through the Bering Straight and hung on as a small population, shrinking in size and numbers due to lack of food and inbreeding. Dwarfism (as mentioned above) and giantism are common biological phenomena on islands. Often small animals may increase in size due to a lack of predation (as there is no need for small size to stay hidden as an evolutionary driver).

The mammoths of Wrangel Island were discovered in 1993 by Russian scientists who determined the last of the mammoths to be only 1.8 m high at the shoulder as compared to the usual 3–4 m (Vartanyan *et al*, 1993). Wrangel became isolated from the Bering land bridge about 12,000 years ago. Within 7000 years the mammoths had become dwarfed, thereby showing how rapidly changes in size and form can occur.

While mammoths died out in mainland North America about 9000 years ago, interest in finding a living one didn't. Countless frozen mammoths, often with their last meal intact in their guts, have been discovered in the arctic "wastes" of Russia and North America.

In 1901 a Russian expedition at Berezovka described frozen mammoth flesh thus:

> "…under the shoulder, fibrous and marbled with fat, is dark red and looks as fresh as well frozen beef or horse meat. It looked so appetizing that we wondered for some time whether we would not taste it. But no one would venture to take it into his mouth, and horseflesh was given the preference." (Baxter and Atkins, 1976)

The frozen flesh was fed to the discoverer's dogs with apparently no ill effects. I have to believe that 10,000 year freezer burn could not benefit the flavour any but admit I would still like to try rump of mammoth some day. This "abundance" of "fresh" remains led to speculation that mammoths still may exist in remote areas of the continent. The now obscure Count of Buffon, a French naturalist who literally lost his head in the French Revolution, proclaimed in the 18th century that North American animals were smaller than European animals due to a cooler climate. This annoyed the Americans and resulted in Thomas Jefferson instructing Lewis and Clark to search for living mammoths in the poorly explored reaches of the American west (Janvier, 1997).

Even today the search goes on, though not for live mammoths. In 1997 and 1998 Japanese scientists set off deep into the Siberian tundra in search of frozen mammoth remains, and specifically its sperm.

The leader of the expedition, Kazufumi Goto (Kagashima University, Japan), figures that if he can find viable frozen sperm, then its long dead donor species could be resurrected by artificially inseminating an elephant. Through decades of careful breeding he hopes to recreate something close to the mammoth. Clearly the expedition has a few roadblocks in its way. While frozen mammoths aren't exactly rare in the Siberian wastes, finding a whole one where decay due to exposure hasn't set in will be a challenge. There is also a question of whether sperm could be "revived" after such a long period of frost-induced stasis. Another problem is that until recently man had yet to successfully artificially inseminate a living elephant. (Apparently they couldn't manufacture a turkey baster big enough.)

With the recent success of cloning, other considerations are underway for a mammoth revival. Goto and his Russian and Japanese colleagues are now focussing their efforts on finding undamaged DNA. On February of this year it was reported they had discovered perfectly preserved cells in the frozen legs of a mammoth uncovered in the Siberian wastes of Yakutia (Leake, 2003). Other scientists have expressed scepticism that the DNA will have degraded to a level that is of no use for cloning. Time will tell.

On a related note, in early 1999 it was reported in the newspapers that a Russian ecologist by the name of Sergei Zimov had grand plans to create a Pleistocene Park in eastern Siberia. Unlike the *Jurassic Park* conceived of by Michael Crichton and brought to film by Spielberg, this proposal requires no science fiction. It would require, however, a lot of money.

Zimov's theory is that the large mammals roaming and grazing the Arctic landscape in the Pleistocene impacted the vegetation such that grasslands dominated. When ancient man became a big game hunter with new technology (stone-tipped spears and arrows) he exterminated all the large mammals. Over time, with out the influence of the mammals the grasslands reverted to mossy tundra that could support less wildlife. The Russian's plan is to bring 30 wood bison from Elk Island National Park near Edmonton to a huge reserve in Sakhalin (Thomas, 1999). The grazing activities of the bison and wild horses are hoped to change the tundra back to grassland over many years. Eventually muskox and Siberian tigers would be reintroduced and the reserve would be the closest one could get to actually visiting the Pleistocene. Perhaps ultimately he can collaborate with Dr Goto and introduce the neo-mammoths to complete the park! Another positive from the grand experiment is that the herds could be culled as a food source and the grasslands would contribute to the reduction of global warming.

As mentioned, the quality of preservation of the mammal remains is exceptional—even to the extent of mummified remains (a complete black footed ferret, horses, *etc*. at Sixtymile) being recovered from the frozen muck. It is easy to see how people might think these remains to be relatively fresh. In 1582 Cossack Ermak Timofeyevich was travelling among tribes on the Eastern side of the Ural mountains and heard stories about large hairy elephants. The natives used these for food, referring to them by the name "mountain of meat." In 1693 explorer Ysbrants Ides travelled the Siberian wastes at the direction of Czar Peter the Great and came back with this report on mammoths in the region (forgive him his run-on sentences and excessive use of capitals—it was 1693 and he has quite a tale to tell):

> "The Heathens of Jakuti, Tungusi, and Ostiacki say, That they continually, or at least by reason of the very hard Frosts, mostly live under Ground, where they go backwards and forwards; to confirm which, they tell us, That they have often seen the Earth heaved up, when one of these beasts was seen on the March, and after he was past the Place, sink in, and thereby make a deep Pit. They further believe, that if this Animal comes so near the Surface of the frozen Earth, as to smell or discern the Air, he immediately dies, which they say is the Reason that several of them are found dead on the high Banks of the River, where they unawares come out of the Ground. This is the Opinion of the Infidels concerning these Beasts, which are never seen. But the old Siberian Russians affirm, that the Mammoth is very like the Elephant, with this only Difference, that the Teeth of the former are firmer, and not so straight as those of the latter. They also are of Opinion, that there were Elephants in this Country before the Deluge, when this Climate was warmer, and that their drowned bodies floating on the Surface of the water of that Flood, were at last washed and forced into subterranean Cavities: But that after this Noachian Deluge, the Air, which was before warm, was changed to cold, and that these Bones have lain frozen in the Earth ever since,

and so are preserved from Putrefaction till they thaw and come to Light, which is no very unreasonable Conjecture; though it is not absolutely necessary that this Climate should have been warmer before the Flood, since the Carcasses of drowned Elephants were very likely to float from other Places several hundred Miles distant, to this Country, in the great Deluge which covered the Surface of the whole Earth." (Sutcliffe, 1985)

In 1918, in Vladivostok, Russia an old hunter told the French Consul how on one of his hunting excursions he followed enormous tracks in the snow for several days. Finally he caught up to the creature only to discover it was "a huge elephant with big white tusks, very curved. It was a dark chestnut colour. It had fairly long hair on the hind quarters, but it seemed shorter on the front. I must say I had no idea that there were such big elephants." These men could have been inspired by the remains of mammoths to tell a story that would bring them fame, but one wishes they saw the mammoth in living flesh[2].

With all this in mind let us recount the story of Henry Tukeman. Back in October 1899, an amazing article was printed in McClure's magazine. In it Henry Tukeman reported seeing living mammoths in the Yukon, along the Porcupine River near the border with Alaska. In 1890, so the tale went, a native named "Joe" mentioned that while hunting on the Porcupine he encountered a cave full of large bones, rifle-length tracks and a huge creature. Joe recounted:

"He is throwing water over himself with his long nose, and his two front teeth stand out before his head for ten gun-lengths, turned up and shining like a swan's wing in the sunlight. Alongside him, this cabin would be like a two-week boar cub beside its mother."

Henry knew a good opportunity was upon him and so, seizing his chance, he hired a guide and went straight to Porcupine River. Henry Tukeman figured that mammoths, for the most part, went extinct during a period of volcanism[3]. It only made sense then, that they would hate fire. He lit a fire near a big tree, climbed up and waited. The mammoth, attracted by smoke, came to stamp out the fire and was promptly shot for his troubles. The skinning of the beast took weeks. Later, Tukeman travelled to Seattle with the skin and tusks. There he sold them to a millionaire who donated them anonymously to the Smithsonian. When the story came out, interest in seeing the Smithsonian's fantastic specimen peaked to the point where a spokesman had to hold a news conference to deny they had such a thing. Finally the editors of McClure's announced that they thought that the tale was so obviously fiction that they hadn't bothered identifying it as such.

This story clearly inspired other writers. Jack London[4], of *White Fang* fame set a very similar story in the rugged St. Elias Mountain Range. In *A Relic of the Pliocene*, (published in 1901 in a collection of short stories called "The Faith of Man") he wrote the tale of a man's encounter with a rather angry mammoth. The tale begins with an encounter and exchange of tales by the author with a hunter named Thomas Stevens. The author begins with what may be the first account of what is commonly called today "the sidehill gouger":

The spirit moved me to repeat a tale told me by a man who had dwelt in the land too long to know better. It was of the great bear that hugs the steep slopes of St. Elias, never descending to the levels of the gentler inclines. Now God so constituted this creature for its hillside habitat that the legs of one side are all of a foot longer than those of the other. This is mighty convenient, as will be readily admitted. So I hunted this rare beast in my own name, told it in the first person, present tense, painted the requisite locale, gave it the necessary garnishings and touches of verisimilitude, and looked to see the man stunned by the recital.

Not he. Had he doubted, I could have forgiven him. Had he objected, denying the dangers of such a hunt by virtue of the animal's inability to turn about and go the other way, I could have taken him by the hand for the true sportsman he was. Not he. He sniffed, looked at me, and sniffed again; then gave my tobacco due praise, thrust one foot into my lap, and bade me examine the gear. It was a mukluk[5] of the Innuit pattern, sewn together with sinew threads, and devoid of beads or furbelows. But it was the skin itself that was remarkable. In that it was all of half an inch thick, it reminded me of walrus hide; but there the resemblance ceased, for no walrus ever bore so marvellous a growth of hair. On the side and ankles this hair was well-nigh worn away, from friction with underbrush and snow; but around the top and down the more sheltered back it was coarse, dirty black, and very thick. I parted it with difficulty and looked beneath for the fine fur that is common with northern animals, but found it in this case to be absent. This however, was compensated for by the length. Indeed, the tufts that had survived wear and tear measured all of seven or eight inches.

I looked up into the man's face, and he pulled his foot down and asked, "Find hide like that on your St. Elias bear?"

I shook my head. "Nor on any other creature of land or sea," I answered candidly. The thickness of it, and the length of the hair, puzzled me.

"That," he said, and said without the slightest hint of impressiveness, "that came from a mammoth."

"Nonsense!" I exclaimed, for I could not forbear the protest of my unbelief. "The mammoth, my dear sir, long ago vanished from the earth. We know it once existed by the fossil remains we have unearthed, and by a frozen carcass the Siberian sun saw fit to melt out from the bosom of a glacier; but we also know that no living specimen exists. Our explorers—"

At this word he broke in impatiently. "Your explorers? Pish! A weakly breed. Let us hear no more of them. But tell me, O man, what you may know of the mammoth and his ways."

Beyond contradiction, this was leading to a yarn; so I baited my hook by ransacking my memory for whatever data I possessed on the subject in hand. To begin with, I emphasized that the animal was prehistoric, and marshalled all my facts in support of this. I mentioned the Siberian sandbars that abounded with ancient mammoth bones; spoke of the large quantities of fossil ivory purchased from the Innuits by the Alaska Commercial Company[6]; and acknowledged having myself mined six- and eight-foot tusks from the pay gravel of the Klondike creeks. "All fossils," I concluded, "found amidst debris deposited through countless ages."

Then begins Stevens' tale, where he encountered the mammoth for this first time, and his dog team all scattered except for his beloved Klooch and her new pups:

"May my soul burn in a thousand hells if there was anything left of her! Klooch, the seven sturdy, blind little beggars—gone, all gone. Where she had stretched was a slimy, bloody depression in the soft earth, all of a yard in diameter, and around the edges a few scattered hairs."

I measured three feet on the snow, threw about it a circle, and glanced at Nimrod.

"The beast was 30 long and 20 high," he answered, "and its tusks scaled over six times three feet. I couldn't believe, myself, at the time, for all that it had just happened. But if my senses had played me, there was the broken gun and the hole in the bush. And there was—or, rather, there was not—Klooch and the pups. O man, it makes me hot all over now when I think of it. Klooch! Another Eve! The mother of a new race! And a rampaging, ranting, old bull mammoth, like a second flood, wiping them, root and branch, off the face of the earth! Do you wonder that the blood-soaked earth cried out to high God? Or that I grabbed the hand axe and took the trail?"

I personally think it unwise to chase mammoths with a hand axe but I suppose our ancestors had little more when they went out on the hunt. Stevens (equated with Nimrod, the hunter by the author) eventually tracks down the mammoth and finds him in a dead end valley. He defeats the mammoth by blocking off the valley with a boulder, and then using great tenacity and a hunter's strategy:

"It took me two months to do it, but I did it. And that's no beaver dream. Round and round I ran him, me travelling on the inner circle, eating jerked meat and salmon berries on the run, and snatching winks of sleep between. Of course, he'd get desperate at times and turn. Then I'd head for soft ground where the creek spread out, and lay anathema upon him and his ancestry, and dare him to come. But he was too wise to bog in a mud puddle. Once he pinned me in against the walls, and I crawled back into a deep crevice and waited. Whenever he felt for me with his trunk, I'd belt him with the hand axe till he pulled out, shrieking fit to split my eardrums, he was that mad. He knew he had me and didn't have me, and it near drove him wild. But he was no man's fool. He knew he was safe as long as I stayed in the crevice, and he made up his mind to keep me there. And he was dead right, only he hadn't figured on the commissary. There was neither grub nor water around that spot, so on the face of it he couldn't keep up the siege. He'd stand before the opening for hours, keeping an eye on me and flapping mosquitoes away with his big blanket ears. Then the thirst would come on him and he'd ramp round and roar till the earth shook, calling me every name he could lay tongue to. This was to frighten me, of course; and when he thought I was sufficiently impressed, he'd back away softly and try to make a sneak for the creek. Sometimes I'd let him get almost there—only a couple hundred yards away it was—when out I'd pop and back he'd come, lumbering along like the old landslide he was. After I'd done this a few times, and he'd figured it out, he changed his tactics. Grasped the time element, you see. Without a word of warning, away he'd go, tearing for the water like mad, scheming to get there and back before I ran away. Finally, after cursing me most horribly, he raised the siege and deliberately stalked off to the waterhole."

"That was the only time he penned me—three days of it—but after that the hippodrome never

stopped. Round, and round, and round, like a six days' go-as-I-please, for he never pleased. My clothes went to rags and tatters, but I never stopped to mend, till at last I ran naked as a son of earth, with nothing but the old hand axe in one hand and a cobble in the other. In fact, I never stopped, save for peeps of sleep in the crannies and ledges of the cliffs. As for the bull, he got perceptibly thinner and thinner—must have lost several tons at least—and nervous as a schoolmarm on the wrong side of matrimony. When I'd come up with him and yell, or lam him with a rock at long range, he'd jump like a skittish colt and tremble all over. Then he'd pull out on the run, tail and trunk waving stiff, head over one shoulder and wicked eyes blazing, and the way he'd swear at me was something dreadful. A most immoral beast he was, a murderer, and a blasphemer."

"But toward the end he quit all this, and fell to whimpering and crying like a baby. His spirit broke and he became a quivering jelly mountain of misery. He'd get attacks of palpitation of the heart, and stagger around like a drunken man, and fall down and bark his shins. And then he'd cry, but always on the run. O man, the gods themselves would have wept with him, and you yourself or any other man. It was pitiful, and there was so much of it, but I only hardened my heart and hit up the pace. At last I wore him clean out, and he lay down, broken-winded, broken-hearted, hungry and thirsty. When I found he wouldn't budge, I hamstrung him, and spent the better part of the day wading into him with the hand axe, he a-sniffing and sobbing till I worked in far enough to shut him off. 30 feet long he was, and 20 high, and a man could sling a hammock between his tusks and sleep comfortably. Barring the fact that I had run most of the juices out of him, he was fair eating, and his four feet, alone, roasted whole, would have lasted a man a twelvemonth…"

Perhaps in a tribute to the tale that originally inspired him, Jack London finishes his tall tale thus: With Stevens having given him the mukluks as a token of friendship the author takes them to a Professor Dolvidson of the Smithsonian who concludes the material of which they are composed is indeed mammoth.

TEXT NOTES

[1] There is no more intriguing tale of BC's Caribou gold rush than that of the Dromedary Express. In 1862, an agent by the name of John Calbreath of Lillooett, was sent to San Francisco to purchase 23 camels at a price of $300 each. The idea was that camels, being larger, could carry more than double the weight of a mule, travel 70 km a day and would be ideally suited to the hot and dry BC interior.

The concept was a grand one, big as the tales that are told of the gold rush days. The execution of the idea, however, revealed a number of problems. The disposition of a camel is at best ill-tempered and this was revealed as soon as the first camel stepped off the Steamwheeler "Flying Dutchman" at Port Douglas. It saw a mule and immediately kicked it to death. The camels were indiscriminate in their attacks and often the only trigger for their assault was the unfortunate fact that you were in their presence. This, in combination with their vile odour which caused other pack animals to flee and their inability to cope with rocky terrain resulted in principal investor Frank Laumeister abandoning the project two years later (Lyons, 1986). Some camels were lost in winter storms, some were shot for food, others kept on display as curiousities. The last one died over forty years later (in 1905) in Grand Prairie. South of Lillooet, the Bridge of 23 Camels commemorates this unusual event in BC history.

[2] For an even more far out tale, let us recall Marshall Gardner, author in 1920 of *A Journey to the Earth's Interior or Have the Poles Really Been Discovered?*

This fellow was convinced that the Siberian mammoths were so well preserved because they had died recently. And where were they living? Apparently the earth is hollow, its interior lit by a sun at the "core." Mammoths must have wandered out of the hole at the North Pole, died from the cold, froze solid and drifted to Siberia on an ice flow. Oh, yes—he also postulated an advanced civilization living in the interior of the Earth, apparently shunning contact with us "outsiders."

[3] The author isn't completely off the mark. This region has been volcanically active throughout the Tertiary. Extensive eruptions during the Pleistocene include some eruptions in the Fort Selkirk region of the Yukon that occurred under glacial ice causing catastrophic floods or *jökulhaups*.

A more recent eruptive event deposited the White River Ash over much of Alaska, Yukon and western NWT (and including the Porcupine river where Tukeman's tale is based). While the ash source hasn't been pinpointed with certainty, mapping suggests the volcano lay somewhere in the Wrangell Mountains of Alaska and may have been Mount Churchill. The

youngest of two ash lobes dates to about 860 AD, covers about 540,000 km^2 and represents an eruptive volume of up to 50 km^3. It is possible that the eruption caused great hardship for the Athapaskan peoples and triggered their migration southwards where they appear to have given rise to the Navajo and Apache. Athapaskan legends tell of a mountain exploding and collapsing, possible memories of this particular eruption. Furthermore, there is archaeological record of the Athapascans arriving in northern Utah as early as 885 AD, a mere 25 years after the last eruption.

[4] Jack London was born and raised in California. In 1897 he left the university at Berkeley to look for gold in the Yukon. He found no gold of note, barely survived scurvy and after one winter near Dawson City he returned to San Francisco.

[5] A mukluk is a high boot known for its warmth, comfort and durability. It should not be confused with muktuk, the northern delicacy, which is whale skin and blubber left hung for a few days to mature before being eaten raw. It is reputed to be both crisp and tender and to taste a bit like coconut but my tongue has yet to make the pleasure of its acquaintance.

[6] ACC is the American equivalent of the Hudson's Bay Company (buying furs, providing transport and merchandise and financial services in the absence of banks) and now plays the role of grocery retailer and general merchandiser—besides taking in gold from prospectors in Alaska.

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Reviews

Ground breakers of Patagonia

by Lowell Dingus, Luis M. Chiappe and Rodolfo A. Coria, illustrations by Nicolas Frankfurt. *Natural History*, July–August 2002, p. 40–47.

Lowell Dingus is the chief geologist of the American Museum of Natural History's ongoing expeditions to the Gobi Desert and the badlands of Patagonia. He is President of the InfoQuest Foundation which promotes scientific research projects; and he is co-editor with Timothy Rowe of *The Mistaken Extinction* (1997, W.H. Freeman & Co.).

Luis M. Chiappe is curator and chairman of the department of palaeontology at the Natural History Museum of Los Angeles County. He is a specialist in the origins and evolution of birds and has done field work in Mongolia, North America, Spain and Patago-

nia. Dingus and Chiappe describe their Auca Mahuero discoveries in *Walking on Eggs* (2001, Scribner).

Rodolfo A. Coria resides near the sauropod nesting grounds and is director of the Carmen Funes Museum in the town of Plaza Huincul, Neuquen Province, Argentina.

Illustrator Nicolas Frankfurt has excavated titanosaur nests in Patagonia and worked in Mongolia and China and also studied art at Yale.

Immediately Nicholas' amazing illustrations—mostly one to two pages across—are to be absorbed. They show colonies of giant sauropods attending to hundreds of nests with many spherical eggs, some being subject to attack by predators and the threat of flooding from the approach of a storm over the vegetation of horsetails and *Araucaria* pines. This scenario of an eighty-million-year-old event is possible due to the preservation and fossilization of eggs that occurred when floods wiped out the nesting attempts of thousands of dinosaurs.

In 1997 vast sauropod nesting grounds were discovered in the badlands of Patagonia about 1000 km. southwest of Buenos Aires, Argentina, with thousands of clusters of spherical, 15 cm diameter eggs strewn across several square kilometres of desert. Auca Mahuero is named in part after an extinct volcano, Auca Mahuida, that towers over the region and in part for a contracted version of the Spanish for "more eggs." Fossilized embryos have been found in some of the eggs, the first embryos of a sauropod ever uncovered.

The skulls are only about 2.5 cm long and similar to those found in a group of South American sauropods called titanosaurs. The identification is strengthened by the embryos' minute teeth, less than 2 mm long, also like those of titanosaurs. Where fossilized skin has been found it is covered with beads that form rows of large knobs and delicate rose-like patterns. It has been estimated that these youngsters would have grown to twelve or fifteen metre-long adults if circumstances had permitted.

Over the past eighty million years the sand and mud of the sauropod nesting grounds have solidified into sandstone and mudstone visible today as distinct bands or layers in the sites's ridges, buttes and ravines. Geological investigations indicate that the shallow streams occasionally overflowed onto the mud flats with mud blanketing the eggs, killing and entombing the embryos inside. Four stratigraphic levels are direct evidence that the sauropods returned at least four different times to lay their eggs—similar to "site fidelity" that exists in many modern reptiles such as turtles as well as in many birds. A three-dimensional map of some of the egg beds suggests that the clusters of eggs represent groups of between fifteen and thirty-four eggs, considerably more than the ten or fewer eggs reported for possible sauropod nests from Europe. In one area, there are seventy-four egg clutches within a 1500 square metre area and in another there are thirty-one clutches in about a 400 square metre area giving a distance of separation of about 2.75 to 3 metres, which is too small to have allowed the sauropods to care for the eggs after they were layed.

The edges of the depressions consist of tilted layers of sandstone called crossbeds, and the bowls within are filled with mudstone. The places at which the tilted crossbeds were sheared off indicate where an adult dinosaur dug a bowl-shaped space in the sand. The ridge or rim is the excavated debris piled around the hole. It appears that the task of digging the nest fell to the female, but this is not certain. The composition and structure of the eggshells suggest that the female may have placed vegetation on top of the eggs, as alligators and mound-building birds do today. The eggs would have been warmed by plant materials rotting in the heat of the sun.

In 1999 a new six-metre long bipedal meat-eater named *Aucasaurus* as well as fragmentary remains of a larger tyrannosaur-sized carnivore were found, suggesting that adult titanosaurs may have stayed in the area to keep predators away after the eggs hatched.

Many titanosaurs would have survived the flooding and the predators. After becoming a full-grown female a titanosaur would return, perhaps decades later, to her birthplace to carry on her evolutionary lineage by digging a nest and laying eggs in the soft mud.

– Les Adler

Extinction a boon to the dinosaurs?

Quirks and Quarks, CBC Radio One, May 18, 2002.

Host Bob MacDonald interviewed Dr. Hans Dieter Sues, Vice President of research and collections at the Royal Ontario Museum (ROM) and a Professor of Zoology at the University of Toronto.

Over the last few decades, scientists have focused on what caused the extinction of the dinosaurs 65 million years ago, at the end of the Cretaceous Period, and many support the catastrophic extraterrestrial impact theory. Dr. Sues is suggesting a similar mechanism may have been the reason why the dinosaurs became the dominant terrestrial animals at the end

of the Triassic.

During the Triassic, approximately 230 million years ago, many different groups had evolved and were competing. However at the Triassic/Jurassic boundary, approximately 200 million years ago, there is a sudden disappearance of many groups. The dinosaurs made it through this extinction event because they could adapt while the other groups could not.

The evidence for the extraterrestrial impact is that a fern proliferation ("fern spike") and iridium anomaly have been found at the TR/J boundary by fellow researchers. Although the Manicouagan impact crater site in Northern Quebec was mentioned during the interview, Dr. Sues suggested there are some discrepancies in the dates. The fern spike (an indicator of sudden climate change) and iridium (an extraterrestrial element) are the same markers that are associated with the K/T boundary. In this case however, the asteroid impact wiped out the potential competitors of the dinosaurs such as the 8 metre-long meat-eating rauisuchians.

Bob MacDonald asked Dr. Sues: "why then didn't the dinosaurs survive the K/T extraterrestrial impact?" Dr. Sues indicated that by the end of the Cretaceous, the diversity of dinosaurs had fallen well below earlier levels.

–Vaclav Marsovsky

Dodging mass extinction

by Rachel Wood. *Natural History*, December 2002–January 2003, p. 58–63.

Rachel Wood is a palaeontologist on the staff of Schlumberger Cambridge Research in England and a researcher in earth sciences at the University of Cambridge. Her Ph.D. was written on Mesozoic reef-building stromatoporoid sponges.

The steep limestone cliffs along the Lennard River at Windjana Gorge, northwestern Australia record a mass extinction of reef species that took place toward the end of the Devonian Period, about 370 million years ago. The cliffs also bear silent witness to the subsequent recovery of an entire marine ecosystem.

The idea that a collision of a giant meteorite with the earth wiped out the dinosaurs at the end of the Cretaceous Period some 65 million years ago has brought mass extinctions (with at least four such events available) to the fore of scientific and popular attention. In mass extinctions some species disappear immediately and a variety of ecological events then cascade through what remains, but there is little consensus about the scope and intensity of these cascading events. Rachel has spent several years at the Gorge considering these questions:

1) How rapidly do the effects unfold?
2) To what degree can they remodel ecosystems?
3) How important a role have they played in shaping the history of life?

In the Devonian Period the atmospheric levels of carbon dioxide were between twelve and twenty times higher than today's level so that tropical seas were considerably warmer and tropical forests had just begun to establish themselves; mammals, reptiles and birds were yet to appear. Modern corals had not yet evolved and two now-extinct groups known as tabulates and rugosans flourished in the reefs. Sponges possessed a solid skeleton made of calcium carbonate (present-day sponges rely on silicates). Ancient sponges provided much of the backbone of undersea reef structures. Algal-like microbial communities were also of far greater importance leaving behind mounds and columns built on the sea floor.

The mass extinction of the Late Permian Period killed off at least 57% of all species and was particularly severe on reef communities such as the one at Windjana Gorge. Worldwide, reefs shrunk from an area of 5 million square kilometres to a fifth or a tenth of their former size. Remains of reefs that grew after the extinction event are found in rocks that are now Canada, northeastern Russia, the northern Caspian Sea region and the Canning Basin of northwestern Australia. In most regions the reefs perished. At the time represented by the Frasnian-Famennian time boundary, sea levels began to fluctuate rapidly up and down by as much as 90 m, exposing large regions of the continental shelf, then plunged the regions back under the sea. There is no known phenomenon on Earth today that would explain them. Possibly the concentration of carbon dioxide in the atmosphere dropped precipitously causing an equally dramatic drop in global temperatures, so that a deep and rapid cooling event may have triggered the Late Devonian extinctions.

Few places on Earth can match the Canning Basin in northwestern Australia for its continuous record of reef succession in the Frasnian and Famennian Stages of the Devonian Period; being 350 km long and up to 50 km wide with Windjana Gorge at the north. The belt once extended 1000 km farther to the north with almost 15 million years of continuous reef building. The gorge shows a fringing reef with corals

and stromatoporoids.

Rachel describes her analysis of microorganisms and sponges. The stromatoporoid sponges range from thickets of small branching individuals to remarkably large and spectacular domes, columns and flowerlike whorls up to 6.4 m in diameter. In the post-extinction Famennian portion the stromatoporoids have almost disappeared, having been replaced by a variety of dense microorganisms between huge platy growths. The communities include twenty species of sponges, ostracodes and many species of brachiopods, bryozoans and crinoids. At this location the players changed, but the game remained the same.

The observations made here have overturned the assumption that reefs can only recover from mass extinctions slowly. The record of reef building at Windjana Gorge is virtually continuous. That conclusion reinforces current ecological thinking that communities are simply chance associations of species with similar ecological requirements rather than fixed networks of interactions. New communities can form by taking in new species from groups close at hand. The extraordinary resilience of the ecosystem shown in the Windjana cliffs was due in large part to the region's microbial communities and their contribution to reef building. Cyanobacteria and other microorganisms can't tolerate a wide range of stressful conditions while larger organisms such as plants and animals reconstitute more slowly and if a subsequent ecosystem were to develop it would take a radically different course.

Four photos and one illustration are provided. Eventually the communities have given way to today's landscape of wallabies and crocodiles, but nary a living sponge. *–Les Adler*

Correction

The June 2002 and December 2002 issues of the *Bulletin* both contain reviews of "The mammals that conquered the seas" by Kate Wong, *Scientific American*, May, 2002. The June review was inadvertently reprinted in the December *Bulletin*. As reviewer Les Adler has pointed out, your editor goofed not only in reprinting the same review, but in wrongly rewording the third paragraph: by changing a single letter ("now" was changed to "not"), the entire meaning of the paragraph was reversed! (The correct interpretation appears in the June version.)

The editor apologizes to reviewer Les Adler, to the readers, and to original author Kate Wong. ❑

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