Palæontological Society
Alberta Bulletin

VOLUME 14 • NUMBER 3 SEPTEMBER 1999

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	$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

September 24, 1999—Annual "Show-and-Tell" meeting: bring your specimens, field trip photos, slides, etc. from the summer season.
October 15, 1999—Program to be announced.
November 19, 1999—Mike Getty, Royal Tyrrell Museum Field Station, Dinosaur Park.
December 17, 1999—Dr. Gerry Ross, GSC (Calgary): Precambrian/Ediacaran faunas (tentative).

Mark your calendar! Dates for Year 2000 meetings:
January 21, February 18, March 17, April 14, May 26

ON THE COVER: The Late Cretaceous short-necked plesiosaur *Trinacromerum* sp., of Alberta's inland sea. Art by APS Member Cory Gross © 1999.

President's Message

by Vaclav Marsovsky

I would like to welcome all of you to another season. I trust that those of you who attended enjoyed our summer field trips. They certainly were attended in record numbers. A summary of the trips will be included elsewhere in a future issue.

Our annual elections took place in May. I welcome **Cory Gross**, who has moved from the Social Director's position to that of the Vice President. As the Social Director, Cory handled food, raffles and supplies to turn our monthly meetings into a social activity and make them more enjoyable. Also, Cory needs to be recognized for his initiatives in promoting our Society's objective of educating the public in the past year. These initiatives are ongoing. **Harold Whittaker** has been elected to the position of Secretary and **Cindy Evans** to the Treasurer's position.

Our Past President, **Les Adler**, is retiring from the executive, although I am sure his days of contribution to the Society are not over. **Don Sabo** leaves the post of Secretary after six years. Don has been on the board since the Society started in 1986 and has held various positions including those of the Vice President and President. Don's term on the Alberta Palaeontological Advisory Committee (APAC) also comes to an end this year. Don has been our voice representing the amateur palaeontological community in the province for the past three years. Thanks, Don.

Wayne Braunberger now becomes our Past President. This does not mean Wayne will be put out to pasture. The Past President oversees the individuals and committees responsible for curation, library, and nominations. Like Don, Wayne was one of the original founding members of the APS. Wayne has held the President's position for six years: 1986 to 1989 and 1996 to 1999. Besides running the business of the Society and running most of the general meetings throughout the year, Wayne has usually been the one-man show on organizing our seminars. The seminars and the seminar course notes took a lot of preparation. Wayne also has a big hand in putting together the summer field trip guides. I know our membership finds them very educational and informative. I am hoping Wayne will continue to help in these areas.

Kris Vasudevan and **Geoff Barrett** have been re-elected as Program Director and Membership Director, for another two-year term. Kris is again lining up great programs for the winter season with speakers from far and wide, from both the professional and amateur communities. Kris has promoted and advertised our Society in many places including the University of Calgary and CBC radio, which has led to two CBC interviews. The interviews were aired on a CBC morning program. This promotes our Society to make it better known to the general public. Our membership continues to grow, with nearly 100 members. Word of mouth and personal contacts continue to be our most productive ways of attracting new members.

Communication is ongoing with **Michael Ryan** and the professional community about APS members' assistance with vertebrate fossil preparation in Calgary. The latest news is that this program may commence sometime next year.

Some of the initiatives we are working on and hoping to finalize in the coming year include:

- Setting up our own web site.
- Going through the Society's fossil collection to ensure that the listing is up-to-date and available to the membership; and identifying ways to improve the collection. Remember: this is *your* collection for you to use as a resource and identification tool.
- Completion of an APS *Bulletin* index. This tool will be useful for those doing a search of particular subjects, names, or authors that have been published in the *Bulletin*. No longer will you need to flip through back-issues to find what you are looking for.
- Education through permanent or temporary displays at various venues and participation at exhibits and shows. Possibly some seminars.
- Putting together a fund-raising strategy for the Society. Selling our T-shirts was the first step. What's next?
- Evolution and growth of the APS annual workshop/poster session.

All of these initiatives take time. Time given by APS officers and directors is a limited resource. Our first task will be to prioritize these initiatives. I hope you support what the APS is doing and where the APS is going. I would like to think our increasing membership is a good indicator. If you have any suggestions about improvements to the Society or would like to become involved in the activities of the Society, please contact me at (403) 547-0182. We would like to hear from you. ❑

Program Summary

by Howard Allen

May 28, 1999
The Hominid family tree: a fossil perspective, with Dr. Kris Vasudevan, University of Calgary

Kris Vasudevan was born in India. He took his B.Sc.(chemistry/physics) and M.Sc (chemistry) at the University of Madras and the Indian Institute of Technology in Madras, respectively. He received his Ph.D. (chemistry) from the University of Calgary. He did his post-doctoral research in Germany before returning to Canada. His employment history includes a lectureship at the University of New Brunswick in Fredericton and East Kootenay Community College in Cranbrook as well as the position of Senior Geophysicist at Gulf Canada, in Calgary. Since 1988 he has been the Manager of the Lithoprobe Seismic Processing Facility, located in the Department of Geology and Geophysics at the University of Calgary. He is an active member of the Canadian Society of Exploration Geophysicists and the Canadian Geophysical Union. He is an Alexander von Humboldt Fellow and a Professional member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta. He currently holds the position of Program Director of the Alberta Palaeontological Society.

[*Biographical notes provided by K. Vasudevan*]

Kris' presentation outlined the history of the scientific study of human evolution, and important episodes in that evolution.

The earliest discoveries of human ancestors occurred in Europe, in the 19th Century. The British Captain Brome uncovered ancient human bones in Gibraltar, which were later assigned to the subspecies *Homo sapiens neanderthalensis*, or Neanderthal man. Similar fossils were known from Feldhofer, Germany. The first fossils of the earlier species, *Homo erectus*, were discovered in eastern India, in 1891, by Dutch surgeon Eugène Dubois.

Exploration for man's earliest ancestors eventually focussed on Africa, with the discovery by Raymond Dart, in 1924, of the "Taung child" (*Australopithecus africanus*) in South Africa. Since Dart's discovery, the majority of important human fossils have been found in Africa, but discoveries made in Europe and Asia have filled gaps in our knowledge of human dispersal and evolution since our African origins.

The most important bones for interpreting human development are the skull, limb bones and pelvis. These bones have shown the greatest changes over time. Important features of the hominid skull include position of the foramen magnum (the hole in the back of the skull where the spinal cord enters—bipedalism requires the foramen to be placed at the bottom, rather than the back of the skull); the shape of the forehead (sloping, with brow ridges, or smoother and erect); size and wear patterns of the teeth; size and shape of the jaw, and size and position of the eye sockets. Some forms, such as *Australopithecus boisei*, had a sagittal crest running front-to-back along the top of the skull, for attachment of large, powerful jaw muscles; this feature was accompanied by robust teeth.

In his discussion, Kris used maps to point out a number of important African localities, such as the Turkana Basin of northern Kenya and Ethiopia, where reliable ages of fossils have been delineated, based on radioactive isotope dating of volcanic ash beds, and where large numbers of fossils have been found. He also reminded us of the often harsh field conditions experienced by workers: extreme heat, lack of water, and living hazards such as malaria, snakes, scorpions and lions.

Evolution of the hominids was driven by a number of factors, not the least of which was climatic changes, including the ice ages. Other factors included tectonics, volcanism and faunal and floral shifts. One of the most important events (for us!) was the splitting of the genus *Homo* from the ancestral *Australopithecus afarensis* stock (i.e. the famous "Lucy"), which occurred some 2.5–3 million years ago. The much later migration of *Homo erectus* from Africa to Europe and Asia coincided with the onset of the Pleistocene glaciation, and an increase in relative brain size. *Homo* spread rapidly after its expansion from Africa, and early fossils of this genus have been found throughout Europe, the Middle East, and eastern and southeastern Asia.

The relationship between the later form *H. sapiens neanderthalensis* and our modern subspecies, *Homo sapiens sapiens* is a subject of controversy: did *neanderthalensis* become extinct, or did they merge with their contemporaries, leaving us as their descendents? Our less than charitable attitude toward the neanderthals is based on a skull recovered from France, belonging to an old man who suffered from debilitating pathologies, leading to our false idea of a rough, brutish race. ❑

Digging Dinosaurs in South Dakota

by Brandon Haist

[*Brandon Haist is a first-year student at the University of Illinois, Champaign-Urbana, with whom the editor has carried on an email correspondence. Brandon is majoring in geology, with which he intends to pursue a career in palaeontology. Over the summer, he participated in a palaeontological field work program offered by the Grand River Museum, of Lemmon South Dakota.The following is an account of his adventures. –ed.*]

As you know, I went on a field experience dig in South Dakota for two weeks this summer. Here are some of the highlights that I experienced. For numerous reasons, various details shall be changed to protect the innocent and sites.

I first had a fun time setting up my tent in some slightly strong winds—something I had done without before! But with few troubles, I set up camp. Later, I would move under the trees when the rest of the expedition members arrived.

My first experience was exploring. As the leaders taught, exploring is the stage where small parties go out and simply look for fossils, bones, microsites (small areas of tiny fossils), and just plain anything of interest. The area is usually more arid, but I was told that they had recently experienced the most rain in 60 years! Prickly pear cacti were everywhere, and if you were to fall or sit down unwarily you would find how mean they are! As we searched, I would come to learn that there are tons and tons of fossil wood out there—so much that it isn't even worth looking at (unless it has something identifiable or unusual about it).

As I finished my first exploring day, I was climbing out of a small canyon when I put my hand down on top of a cactus! I still have a spine or two in my hand from that.

Fossils found would range from conifer cones to snails, teeth, scales, clams, ossified tendons, and fragments of bone. I found on the first day what Roger Stephenson (one of the dig leaders) would identify as an occipital condyle of a theropod, or a part of the back of a meat-eating dino's skull. We also found a buffalo bone bed—although modern, it was still fascinating!

The heat was intense the first week, often times getting up to 46 degrees (Celsius) in the sun and 40 degrees in the shade. Much of the week was over 38 degrees. We would get up early to go out before it got too hot, and then would spend the heat of the day sitting in the Grand River. That was quite a week! The second week felt like air conditioning —down to the twenties and low thirties. Each night the temperatures got extremely cool, which felt good, although I slept with blankets.

If it was a clear night, the camp would gather in a huge circle of chairs to watch the stars come out and catch meteors and satellites. I have never seen such an immense scene, and I can't even begin to describe it. The beauty was immeasurable! The Milky Way was like having a galaxy across the sky!

Many nights coyotes howled, and flies were out in force during the day only to give up so mosquitoes could come out at night. After a few days I didn't notice them anymore.

Part of the dig rules is that everyone is rotated around from site to site, so that everyone can experience as much as possible.

One of the sites I worked at was called the Hayfield Site. Here a few years ago a *Triceratops* leg bone was removed, and further digging revealed more bones. I worked here off and on, and eventually an articulated limb appeared, as well as a possible vertebra and some other pieces of *Triceratops*. Under the dino was a large amount of wood, a sign of a stream or river deposit. Looking at the strata you could see a dip in it, leading Russ Jacobson (another dig leader) to believe that it was a sand bar deposit.

A second site would become known as the Meadowlark Site. What started out as three little rib ends found by Howie (one of the participants) to be sticking out of the ground grew into eleven ribs, some vertebrae, a scapula (shoulder blade), humerus (upper arm bone), lower arm, and part of the hand (maybe); all articulated and belonging to a hadrosaur. This was quite a find, but the matrix was extremely muddy. This meant that the bones were really weak, and I used everything down to the dental picks. In a spot near a neural spine (spike off of a vertebra) I found a crocodile tooth, and later another member, Kari Baker, found some more croc' teeth, a *Tyrannosaurus rex* tooth, and an unidentified tooth. This was fantastic—I can only wish I had been there to dig! That is why palaeontology is a team effort—no one individual can be everywhere at once.

Unfortunately, the soft matrix came back to haunt us when the hadrosaur fossil was plaster jacketed—when it was turned over the contents all came out like a mudslide! This lost the articulation, but Roger can fix anything. Understandably all in the camp were disheartened at this turn of events.

At another site, called *Triceratops* Hill, we were exploring again and found several turtles, various fragments and bones, and microsite fossils. Then I got the idea to go over to a far wall and walked along it until I saw tons of fragments. I called Russ Jacobson over and he said it was most likely just some bones washed together, but then when I was looking through the fragments I saw the classic shape of the bony core of a theropod claw—groove in the side and all. Of course I didn't want to get my hopes up too high, so I just handed it to Russ and his eyes just about fell out of their sockets! "This a dromeosaurid claw," he said.

I said "you're kidding!"

"No—like a *Velociraptor* claw!…[colourful metaphor deleted]!"

Another dig member came over and said he thought it may be an *Albertosaurus* claw. Then it became a "general theropod" claw. The site became "Theropod Site, found by Brandon Haist," but whether or not it turns up anything depends on when it is excavated, if ever. I was just elated that I found a theropod claw!

At Dromeosaurid Site I helped Mark work on a perfect bone. It was a limb bone of a hadrosaur, and the bone itself was as solid as can be. The matrix surrounding it was as soft as could be! The work was so easy, I felt that it was like that ridiculous scene in *Jurassic Park* where the *Velociraptor* was dug out of sand. When Roger handed me a brand new Butvar container and a new brush, I had the most ideal palaeontology job there was!

Another session of exploring at an area called Turtle Hill turned up more fragments and small stuff. We collected single bones or small fossils in baggies and labelled where they were found.

This was when the heat started to get strong. All the first week the temperatures were over 38 degrees, and with no wind and no shade, the heat started to get up there. I had dropped my gear on the ground so I could pick up a fragmented bone and bag it, when I looked at the little thermometer on my camera case. It was maxed-out at 52 degrees! I looked at it for a few seconds before I realized what this meant: *it was on the ground and so was I!* I began to keep an eye on the thermometer and found that in the sun it was 46 to 48 degrees, and the shade was a cool 41 degrees. I have to admit the heat was beginning to get to me that day!

"Area 51" is a site where we spent some time looking, but not touching or digging. This is an incredible area and has the potential to provide fifteen years of research. I was apologizing to the ground for stepping on dinosaur bones, but it couldn't be helped. They were everywhere you could look! At the moment this site is wrapped up in so much red tape that I can only comment about it and that is about all. Next year when I go on this dig, I hope to be able to work at this remarkable site.

The roads to many of the sites were rather rough, though I did drive my Escort to the Hayfield site. On the way to one of the other sites I was in the back of another expedition member's truck (with topper) when a bump caused the truck to go onto two wheels! This was rather fun, and all the contents of the back of the truck including people flew to the one side.

I learned a lot about geology, palaeontology, field work, and all-around everything. This reinforced to me the concept that much of palaeontology, if not all sciences, must be learned through experience in the field. Working with experienced and knowledgeable individuals is the best way to get into a desired field.

These are the highlights, and I have had an awesome time! The experience I have gained and the knowledge I learned is irreplaceable. ❑

[*Brandon's email address is:* **haist@uiuc.edu**]

ALBERTA PALÆONTOLOGICAL SOCIETY

CALGARY, ALBERTA

Operating Statement for Twelve Months (unaudited)

PERIOD: JANUARY 1, 1998 – DECEMBER 31, 1998

Revenues		**Expenditures**	
Memberships	$1605.00	T-shirt expense	$1000.00
T-shirt sales	$1220.00	Printing	$570.37
Course receipts	$145.00	Lecturer expenses	$360.42
US Exchange	$121.23	Field trip expenses	$194.49
Field trip receipts	$120.00	Postage	$138.02
Coffee receipts	$92.29	Advertising (CSPG)	$107.00
Raffle revenues	$79.25	Coffee expenses	$89.70
Lapel pins (19)	$57.00	P.O. Box rental	$74.90
Donations	$5.00	Bank service charges	$60.00
		Depreciation	$60.00
		Stationery	$18.18
		US Exchange	$9.60
		Excess of revenues over expenditures	$762.09
	$3444.77		**$3444.77**

—Leslie Adler, Acting Treasurer

Fossils in the News

The Calgary Herald, May 11, 1999

That's one big mammal

KARACHI, Pakistan—Dr. Jean-Loup Welcomme, leader of a French palaeontological team, has announced the discovery of an enormous fossil mammal in the mountains of Pakistan, some 700 kilometres north of Karachi. A reconstruction of the animal, dubbed *Baluchitherium*, has it resembling a titanic tapir. Researchers estimate that the beast stood five metres tall, was seven metres in length and weighed up to twenty tonnes. This would make it the largest mammal known to have existed 35 million years ago (Oligocene).

The Calgary Herald, May 11, 1999

Running theory takes flight

LOS ANGELES—The controversy over whether birds learned to fly by a running takeoff from the ground, or by flinging themselves from trees, continues. Luis Chiappe (L.A. Natural History Museum) and Phillip Burgers (San Diego N.H.M.) have re-analyzed the anatomy of *Archaeopteryx*, concluding that the proto-bird had sufficient flapping strength and running speed to get airborne from the ground. Their report appears in the May 6 issue of the journal *Nature*.

The Calgary Herald, July 17, 1999

U.S. scientists excavating fossil forest

AXEL HEIBERG ISLAND, Nunavut—A palaeontological foreign invasion reminiscent of the Barnum Brown dino raids on Alberta early in this century may be developing in the high arctic. A fifteen person team of U.S. scientists, directed by Art Johnson of the University of Pennsylvania has commenced excavation of the world-famous Axel Heiberg Miocene fossil forest, which had been a target of consideration for World Heritage status [*Bulletin*, June 1991, p. 7; Dec. 1998, p. 8].

University of Saskatchewan palaeobotanist James Basinger, who had been working on the fossil forest for some fifteen years, was flabbergasted to learn that his "turf" had been encroached upon without any notice or consultation. And to no one's surprise, the Canadian Government's left hand was scrambling to explain how and why its right hand managed to issue permits for the work.

Nobody disputes the validity or competence of the U.S. scientists, who hope to reconstruct the climatic and environmental conditions that existed at the time. But Basinger is worried that the scale of the excavation—including long test trenches—could jeopardize the integrity of the site, which he feels deserves federal protection.

The National Post, August 13, 1999

Discovery adds a billion years to life on Earth: rocks prove "many molecular clocks wrong"

WASHINGTON—Australian researchers analyzing 2.7 billion year old rocks from the northwest Australia outback have discovered traces of chemicals they say shows that eukaryotes—organisms with nucleated cells—originated much earlier than previously thought. The rocks, unmetamorphosed sedimentary shales, were found to contain lipids—essentially organic fat molecules—that are characteristic of the eukaryotic cell.

Eukaryotes were previously though to have appeared much later (1.7 billion years, according to some molecular clock models) than the non-nucleated prokaryotes (bacteria, blue-green algae), which presumably do not contain lipids. The researchers made careful efforts to avoid sample contamination, but Andrew Knoll, of Harvard University, points out a couple of other possibilities for error: first, lipid molecules from younger rocks could have infiltrated the older rocks by way of groundwater; and second, it may also be possible that some unique form of prokaryote was capable of manufacturing lipid molecules, similar to eukaryotes. Nevertheless, Knoll calls the report "a pretty exciting paper. It really opens doors."

The Calgary Herald, July 10, 1999

Dino soars from military helicopter

DRUMHELLER—Disaster struck at a dig in Dry Island Buffalo Jump Provincial Park this summer, when a large hadrosaur fossil was dropped by a British military helicopter. The British army volunteered the use of their French-made Gazelle helicopter for lifting the 320-kilogram, plaster-encased specimen from the dig site to the Tyrrell Museum. Unfortunately the helicopter, working in "thin" air over the Red Deer River badlands was unable to handle the load, which began swaying dangerously. The chopper's pilot was forced to jettison the load, which plummeted 100 metres to the ground, pulverizing the fossil. "I just had to get rid of it," explained an apologetic Captain Justin King. Dr. Philip Currie, director of the excavation, declared the specimen a write-off.

The Calgary Herald, May 30, 1999

Scientists plan dino hunt

LONDON—Cryptozoologist Dr. Bill Gibbons is plotting an expedition in search of the legendary *mokele-mbembe*, an alleged latter-day brontosaur said to be skulking in the jungles of darkest Africa. Members of the Kabonga tribe, who call the vast Likouala swampland of west Africa home, reported recently that hunters had killed and attempted to eat a *mokele-mbembe*. Finding the meat unpalatable, they left the carcass to rot…but the skeleton remains, presumably for Dr. Gibbons and company to find. Says Dr. Gibbons, who plans to hire pygmy guards against "the risk of attack by Africans": "I am sure this animal exists. The main problem, aside from the inhospitable terrain, is that it mostly lives underwater in areas with very few people and in countries which are politically very unstable." The expedition will employ sonar, infrared and video equipment, and is set for October of this year. Stay tuned.

The National Post, August 5, 1999

From moss to redwoods to seaweed; it all came from Eve

LONDON—A major, five-year, international project has concluded that all plants descended from a common ancestor. The team of 200 scientists from twelve countries reports that all plants are ultimately related to one another, their common ancestor probably being a freshwater green alga that lived some 450 million years ago, in Ordovician time. Prior to this study, it was generally believed that several lines of plants had arisen independently, leading variously to mosses, ferns, and flowering plants. It was also believed that land plants evolved from sea-living plant ancestors.

As a further result of their research, the team has delineated five kingdoms of complex, "nucleated" (*i.e.* eukaryotic) organisms: "green plants," "brown plants," "red plants," fungi, and animals. The fungi are apparently more closely related to animals than to plants.

The Calgary Herald, July 10, 1999

Garden unveils 60-million-year-old leaf

BALZAC—Are you a Calgarian itching for that fifteen minutes of fame that Andy Warhol promised you? Why not pop over to the nearest pile of sandstone, grab a leaf fossil, then phone the *Herald*? One hates to rain on an innocent citizen's parade, but the only "news" imparted by this 3/4-page feature article is the amazing flood of ink that has been expended lately on the non-event of finding a leaf fossil in Calgary's leaf fossil-studded Paleocene bedrock [*Bulletin*, Dec. '98, p. 7]. This time, it's an almost-complete *Cercidiphyllum* (Katsura tree) leaf, found by a local couple in a block of sandstone removed from an Airdrie construction site. As the article accurately reports, "the fossilized leaf is not a rare find in Alberta; *Cercidiphyllum* is one of the best understood extinct plants of the area."

The Calgary Herald, April 23, 1999

Bones of African creature believed linked to humans

WASHINGTON—A possible "missing link" between the modern human genus *Homo* and its presumed predecessor, *Australopithecus*, has turned up in the Afar desert of Ethiopia. 2.5 million-year-old bones belonging to the new species, named *Australopithecus garhi*, were reported by a team led by Berhane Asfaw of Ethiopia and Tim White of the University of California, Berkeley. A male skull from one individual and arm and leg bones of another were found in close proximity. It appears the hominid had large teeth and projecting face, along with long forearms, like "Lucy," the *Australopithecus afarensis* ancestor, but it also had long legs, like the modern genus *Homo*. Associated with the hominid bones were antelope and other animal bones showing cut marks from tools, evidence of early tool use by *A. garhi*.

Other researchers have different interpretations of the find. Bernard Wood of George Washington University thinks the new bones may merely represent a variety of *Australopithecus* that existed at a time when there was much variation in hominids; that it doesn't necessarily indicate a direct link between *Australopithecus* and *Homo.*

The National Post, April 29, 1999

Transatlantic dinosaur find challenges geology theory

LONDON—The discovery in Portugal of dinosaur bones identical to those found in rocks of the same age in Colorado have raised questions about connections between North America and Europe during the Jurassic Period, some 200* million years ago. A nearly complete pelvic girdle, both femurs and several vertebrae of an apparent *Allosaurus fragilis* were unearthed in west-central Portugal. Plate tectonic models for the Late Jurassic*, following the breakup of the supercontinent Pangaea, have the Atlantic Ocean already separating Europe

and North America, which would prevent any migration of dinosaurs between the two land masses. If the new bones are proven to be those of the Colorado *Allosaurus*, this would necessitate some sort of land bridge at a time when none was thought to exist.

[**Something in this article doesn't compute: the 200 million years figure would place the fossil closer to Late Triassic, or very Early Jurassic at the latest, which is a good 50–60 million years earlier than the Late Jurassic time cited for the plate tectonic models of the configuration of the Atlantic Ocean. –ed.*]

The Calgary Herald, May 1, 1999

Plant revealed as ancestor of trees

LONDON—Plant fossils uncovered recently in Morocco appear to represent the earliest member of the modern seed plants, leading to today's trees. This first modern tree, called *Archaeopteris*, had a woody trunk and branches, lateral buds, leaves, and an extensive root system. All this at a time when other plants were smaller, leafless, and vertically branched. When it lived, some 360 million years ago (Middle Devonian), it comprised 90 percent of the world's forests, and had a profound influence on all later ecosystems. It is thought to have made a major contribution to atmospheric oxygen levels, and its leaf litter in the streams may have spurred the evolution of freshwater fishes. Its extensive root system also impacted soil chemistry.

"*Archaeopteris* made the world almost a modern world in terms of ecosystems that surround us now," says Stephen Scheckler of the Virginia Polytechnic Institute, member of a team that also included French and German researchers.

The Calgary Herald, September 3, 1999

Giant reptile unearthed in B.C.

DRUMHELLER—The skull of an enormous new ichthyosaur excavated from a Triassic site in northeastern British Columbia [*Bulletin*, Dec. 1998, p. 4] has been transported to the Royal Tyrrell Museum for preparation. The remainder of the skeleton is to be removed next summer. Dr. Betsy Nichols expects preparation of the skull —hand chiselling, followed by an acid bath—to take two years. The fossil represents by far the biggest ichthyosaur known to science.

Funding for the recovery project was provided by a Tokyo museum; the Royal B.C. Museum, Victoria; West Coast Energy; Discovery Channel Canada, and Northern Mountain Helicopters. ❑

[*Thanks to: Les Adler, Trudy Martin, Sam Richter.*]

Society Member Preparing New Localities Book

by Philip Benham

I am in the process of writing a book on fossil localities in Western Canada. The book is set up as a series of "weekend" excursions that interested amateurs and their families might make. These excursions include museums, available guided tours (such as the Burgess Shale, Puntledge River near Courtenay, B.C. and Dinosaur Provincial Park), fossil collecting sites and interesting diversions along the way. The trips will be described in terms of basic local geology but more of a focus will be placed on the palaeontological side. It is very important to me to emphasize the ethics of collecting, the scientific value and the provincial and federal laws that apply to these sites.

In that regard I will be strongly encouraging amateurs to contact my compiled list of professional specialists and organizations should they find anything of significance. I further plan to urge readers to join the various palaeo and mineral clubs in their area as this is the best venue for them to learn about Western Canada's geo-history in an organized way.

I have made a lot of progress in the last two years researching and visiting many of the sites I have written about. I can't, however, visit them all. What I am looking for is information on any collecting sites (that club members are willing to share) that I can incorporate into my book. I intend to credit contributors appropriately and would be happy to exchange information, share reference material or discuss any issues members may have. In fact I have some sites that might make good APS trips in the future.

As a member of APS (albeit an infrequent attendee of meetings due to other commitments), I am sure the preceeding will stimulate lots of discussion. I am happy to talk via email, phone or during whatever meetings I can attend. ❑

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Strange Prairie Rattlesnake Behaviours: Part I

by Samuel Richter

[*Sam's eclectic interests in natural history are well known to* Bulletin *readers. In this, the first of a two-part article, Sam describes aspects of an animal many of us have met on fossil-hunting trips. Part II will touch on the fossil record of snakes, and will provide a list of references for further reading. –ed.*]

Prairie rattlesnakes searching for sex or food show strange, unexpected behaviour. Ron Ellis discovered this behaviour at close-quarters, where he could not get away from a snake. We had set up our overnight camp near the junction of the Panther and Red Deer rivers and were sitting around talking, when Ron described his snake encounter.

Ron said: "I especially enjoy canoeing alone during the warm sunny days of early summer. These are ideal days for a leisurely trip through the badlands, examining the stream bank for the colourful wildflowers, with their different perfumes wafting my way. Sometimes newborn wildlife is seen playing around, rambunctious and enjoying life, and there's always the possibility of being the first one to find freshly exposed fossils.

"Suddenly, a rattlesnake appeared, crawling into the canoe just ahead of my feet. It slithered across the canoe bottom, got to the other side, but couldn't get more than its head past the lip of the gunwale extending into the canoe. This is a big canoe with the sides sloping in as they near the gunwale. The Indians developed this inward slope long ago to help keep water from splashing into the canoe on rougher river waters. Now this overhang was trapping the snake near me inside the canoe!

"Realizing I was in a confined space with a trapped rattlesnake gave me an uneasy feeling. I do not like any snakes, but they must have some purpose and deserve respect for what they are. My first reaction was to reach out and grab the snake, throwing it into the water. But canoes are unstable and reaching over to grab a wet snake and not be bitten is risky. Last year, before canoeing the Milk River, a local rancher gave me directions and advice. He warned me that all rattlesnakes, long or short, have potent venom. Once, while he was getting fence posts from a pile, a rattlesnake bit him on the thumb. This minor bite resulted in the permanent paralysis of his entire left hand. The pleasure of canoeing would end for me if this happened, so I intended to do nothing that might antagonize this snake into biting me.

"Hoping the snake would stay focused on getting out, I gently—very gently—eased the paddle under it to act as a ladder, thinking this might assist it to get past the lip. It worked. The snake immediately swam straight for the river bank and disappeared. It looked like a good swimmer, so why didn't it swim around the canoe instead of crawling inside?"

This behaviour of Ron's snake is normal for the prairie rattlesnake—*Crotalus viridis viridis*. These snakes are far more complex in many ways than is apparent. Snake researchers living among these rattlesnakes for the summer find that being surrounded by them is scary and exhilarating. These fascinating snakes are generally on the edgy side and can easily be provoked into aggression. They can assess the degree of threat and react accordingly. One test found that 67 out of 72 immediately struck when provoked. They do not behave in the lethargic manner of the western diamondback favoured in the Sweetwater, Texas Jaycees Rattlesnake Roundup. Three men in work boots and camouflage-coloured nylon leggings are seen shuffling through a pen full of hundreds of these snakes, pushing them aside with their boots; but this doesn't get any of the snakes annoyed enough to strike. To date (1997), over 105,289 kilograms of western diamondback rattlesnakes have been bagged there.

Over many summers, hundreds of tiny lightweight radio telemetry devices were implanted in the gut cavity of prairie rattlesnakes emerging from hibernation. Studies of these snakes near the limits of their range, at high altitudes and at their northern limit in southwestern Canada, found they are immediately occupied with finding something to eat. They stay below the frost line hibernating for at least seven months. Those that don't go deep enough don't survive. The cold weather drives them underground sometime in September to October. The peak exit in spring comes in the last half of May. Ground temperatures determine how mobile they can be. At 10°C they are sluggish; the preferred ground temperature is at least 16°C , which allows for reasonable mobility. They can't properly digest food when their body is 10°C or lower. At their range limits there are often less than 90 frost free days in a summer. Snow has occurred

in every one of the summer months, causing death to any snakes exposed to the freezing cold of snow. Daytime ambient air temperatures can exceed 41°C , while night-time temperatures can fall to the low of 5°C. These temperatures are outside the optimum body temperature range of 24–30°C. Critical thermal maximum is 38°C. A body temperature over 41°C is quickly lethal. Ground temperatures in the sun can far exceed this, stopping searches for anything other than shade. These constraints may allow for only a few hours of daily activity, giving them little time to reproduce and get fat enough to survive the coming hibernation. We can pretend that Nature is benign, but at this range limit the difference between death and survival is paper thin.

Leaving the winter dens, the snakes scatter in all directions. Males go in a straight line each day, typically moving 100 to even 1000 metres per day. Some have moved out for 11 to 15 kilometres, then made a big loop and gone straight back to the winter den. They only go around something like boulders that cannot be crawled over and soon get back on the original straight line. This is why Ron's snake didn't go around the canoe. Snakes operate by instinct and aren't known for intelligence, but how they know that zigzags reduce the outer limit of a daily search is a mystery.

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Computer models found that straight line foraging is an optimal behaviour for finding isolated food areas and female scent trails. Their personal positioning system keeps track of where they are and where the summer and winter den is, but it is unknown how the trail for that day is kept straight, whether in the daylight or dark. Stopping if a fresh rodent trail is found, they go into ambush mode, unless the trail goes into burrow systems which may be actively investigated underground. Females travel less than the males and not in nearly as straight a line; the pregnant ones remain near the winter den to put their energy into the young. Most female rattlesnakes breed only once every two to five years in this climate, with the litters being born in late summer, generally from a mating in the previous summer. Females have the ability to store and keep the male sperm viable for long periods, like two or more years.

Mating behaviour is complex and competitive, with mating likely being a high point in the life of a male. Upon finding a female scent trail he will soon determine whether he is going toward or away from her. Arriving at the female, he is likely to find other males already there waiting for her to become receptive. The right to mate with her is done through ritualized combat. Two males will size each other up, lifting their bodies up as high as they can, eyeball to eyeball. Then they coil around each other, making like wrist-wrestlers, trying to force the other to the ground. They may break for rests to gather strength, but eventually one will concede defeat when his head and neck is forced to the ground. He will leave, but only for a short distance unless chased. The idea is to wait until the winner has mated and then try his luck with the female. Winners are generally the bigger of the two. Females have their own tests and may attack the approaching overall winner and drive the surprised male away. At northern range limits, the mating season is short and could be as little as one week in the first half of July, with the female only becoming receptive two days after shedding her skin. Males keep checking the females all summer just in case one might be found receptive. The National Geographic documentary on the king cobra has an amazing sequence of two 3.6-metre cobras wrestling, and of the winner mating with a reluctant female.

As they mate, the male lays his chin on her body and slides forward. He then wraps his tail around hers and brings their cloaca together; she must assist by raising her tail off the ground. The male has paired reproductive organs, called hemipenes (singular is hemipenis), normally retracted into pockets at the base of his tail, that open into the cloaca. Attached to the tip of each hemipenis is a retractor muscle, connecting at the other end to a series of vertebrae, keeping the hemipenes inside the body. When not in use, each hemipenis is turned inward like a finger of a glove turned outside in— the outside surface of the hemipenis is inside. As the male everts one of his hemipenes into the female's cloaca, it unfolds. The base emerges and enters the cloaca first; when the tip emerges, it is deeply positioned in the female's cloaca. The sperm duct is now on the outside of the hemipenis. The sperm is stored by the female in special chambers at the bottom of the oviduct that leads to the eggs; for use immediately, or up to several years later. Copulation can last many hours with some rest periods. A coupling of over 28 hours has been recorded in a captive pair. One must remember, this may be the only opportunity for sex in his lifetime, and he is making the best possible use of it! ❑

[*To be continued in the December issue*]

Reviews

by Les Adler

Field Guide to the Grand Staircase, Utah, USA by Robert Anderson. *Natural History*, February 1999, p. 66–70.

This report includes maps, a list of formations and a wide variety of fossils, with a cross-section of the Cretaceous and Jurassic formations of the Grand Staircase-Escalante National Monument, located in the southernmost part of central Utah.

Mr. Eaton, a geologist at Weber State University, Ogden, Utah, has been studying microvertebrate fossils from this region for sixteen years, including many mammal types such as marsupials and placentals. He expects to continue his studies with little loss from intruders due to the remoteness and harsh summer climate.

Beauty and the Bees by David Pilcher. *Natural History*, May 1999, p. 6

In this issue of *Natural History*'s flower project, David provides a summary of flower evolution:

a) 145 million years ago petals had not yet made an appearance.

b) Showy flowers evolved approximately 125 million years ago. At that time all petals and reproductive organs were arranged spirally and, from above, would have looked like the spokes of a wheel. Many modern species retain this form.

c) About 90 million years ago, dependable pollinators appeared (most notably bees) and flowers made their next big move, evolving new shapes, nectars and symmetries. The distinctive shapes of the earliest symmetrical flowers attracted bees but excluded insects blind to their allure. Only long-tongued bees and lepidopterans (butterflies and moths) could get at the nectar of species with long floral tubes. Pollination was less of a hit-or-miss affair than it was in most radial flowers.

d) By about 55 million years ago diverse, nutritious, attractive fruits and seeds became an important part of the reproductive plan of flowering plants.

e) Plants and animals co-evoloved while humans recently have modified fruits, seeds and shapes of flowers for our own purposes, enriching and benefiting our lives.

Early Bloomers by William Crepet. *Natural History*, May 1999, p. 40, 41.

This is a report on the New Jersey, USA site which holds the world's richest trove of fossil flowers and the nearby amber deposit. Using a scanning electron microscope, Bill Crepet has found a variety of flowers related to such modern-day plants as hydrangeas, azaleas, pitcher plants, oaks and the tropical mangosteen. The fossil flowers from this 90 million year old marsh deposit show pollen grains and ovules in detail and some of the insects that pollinated the flowers. More than 200 species of angiosperms (flowering plants) have been identified from the deposit. The history of various flower organs is being studied in conjunction with a computer program created by Kevin Nixon of Cornell University to correlate both extinct and living species.

The two fossil deposits provide compelling evidence that the close relationship between bees and flowers dates back to the days of non-avian dinosaurs. This rich collection of fossils suggests that the plants and their pollinators went through nearly simultaneous bursts of speciation and that insects were a driving force behind the tremendous diversity of the flowering plants. Bill is now looking for older deposits which contain fossil angiosperms to provide further use for his computer and his scanning electron microscope.

Fire, Ice, Fossils by André Wyss, John Flynn and Reynaldo Charrier. *Natural History*, June 1999, p. 38–41.

This report concerns the finding of new fossil mammal sites in the Chilean Andes during the last ten years. These fossils provide clues vital to deciphering the geological history of the Andes and also to fill in a key gap in the fossil record consisting of a 20 million year period during which South America was a great island continent, separated from all other land-masses. South American physiography and the evolution of its mammals have been shaped by plate tectonics and volcanism. A 9.5 kilometre thick layer of rock and debris has accumulated, accounting for the spectacular scenery. Mud flows buried wildlife, creating fossils.

This group's field work started near Termas del Flaco, Chile, along the Tinguiririca River, deep within the main Andean range, near 145 million year old dinosaur tracks. Two sets of rocks were known at the 100 million year old level and at the 2 million year old level. Unexpectedly, the Abanico Formation which runs for hundreds of kilometres along the central spine of the Andes, produced

fossil mammals at the Eocene-Oligocene contact, at a 37–31 million year level. The mammals include marsupials, a sloth, armadillos, rodents and notoungulates, indicating a grassy environment.

In 1991, west of the Tinguiririca site, a completely distinct older assemblage of fossil mammals was found. These were also notoungulates, but were not adapted for grazing. Also, no predators were found. If there were predators they might have been large terrestrial birds which left no remains. Other deposits have yielded a monkey skull, "*Chilecebus,*" the first complete skull of an anthropoid primate from the New World. The best guess is that the mammals migrated from elsewhere, over water. The authors are grateful to Charles Darwin for leaving discoveries in this area for them.

Night of the Giant Ammonites by Kirk R. Johnson, art by Ray Troll. *Natural History*, July/August 1999, p.14–17.

Ray Troll has drawn the scene on a moonlit night near the present-day town of Kremmling, Colorado, 73 million years ago. Four mosasaurs attack swarms of invertebrates including *Baculites*, jellyfish, sixty-two *Placenticeras meeki* specimens and two *Anaklinoceras gordiale* specimens.

There is evidence of a mass death of giant ammonites on a sagebrush slope about 21 kilometres north of Kremmling, northwest of Denver. Visitors to the site are not permitted to remove the fossils, which include crabs, lobsters, nautiloids, clams and snails. Rocks left from fossil digs are the empty halves of concretions that once enclosed fossilized ammonites. In the ancient seaway thousands of ammonites met their end and drifted to the bottom, where scavengers fed on the unexpected bounty. The site was close enough to the shoreline that mud from nearby river mouths sifted over the shells and rapidly buried them. A chemical reaction precipitated calcium carbonate in the mud around the shells, forming the rock-hard concretions, while the surrounding mud was flattened into soft shale and the ammonites were fossilized.

A group from Denver led by palaeontologist Emmett Evanoff prospected the area in August, 1998. They found many of the huge female ammonites and only a few of the small male ammonites. Kirk Johnson surmises that this was the site of a mass spawning and that after the males had fulfilled their role they left the scene; and like living squid, the females reproduced just once, producing planktonic embryonic ammonites and then perished *en masse.*

Fossil Farming in Java by Roy Larick, Russell L. Ciochon and Yahdi Zaim. *Natural History*, July/August 1999, p. 54–57.

The importance of this area, 64 kilometres east of the Sangiran Dome on the island of Java, first came to the attention of the scientific world in 1893 when the Dutch surgeon and geologist Eugène Dubois excavated a skull cap and thighbone of *Homo erectus*. He was followed by Ralph von Koenigswald in the 1930s. Only two significant finds came to light between 1942 and 1960. Scientists now expect to average two significant finds each year.

Java holds key evidence that some populations of *Homo erectus* migrated to East Asia from Africa at an early date. New evidence suggests that this happened about two million years ago; the species vanished about 120,000 years ago.

The Sangiran Dome is now a depression whose steep flanks and internal hummocks yield many fossil mammal bones. Since the 1960s local farmers have found some seventy cranial and jaw fragments. In contrast, planned scientific excavations have yielded only a few teeth and a fragment of thighbone. Events of the last twelve months have caused a reassessment of the situation. Who has the right to Indonesian fossils? The discoverers, traders, scientists, or government? Government philosophy has changed from socialist to free enterprise. Farmers who once relied on barter are being drawn into the cash economy, and fossils are expected to become an important commodity, with prices increasing rapidly. One of several agents keeps track of farmers—some have set up kiosks to sell specimens and run human evolution tours. Without these people the scientists would not have been able to get their specimens.

Scientists have advised the agents as to what specimens they require. This will cause changes to collecting in the new millennium, with the production of human body bones as well as skull fragments. Scientists are also on the lookout for a site that was used for butchery—some large mammal bones have been found that have stone cut marks on them.

The current Indonesian government does not have the means to enforce its strict regulations (the government owns all fossils), so the trade arrangements that have prevailed over the past seventy years can be expected to continue. The local residents collectively inspect a great quantity of earth and are essential to palaeoanthropological research in Java. ❑

Sereno.
African Dinosaurs.
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