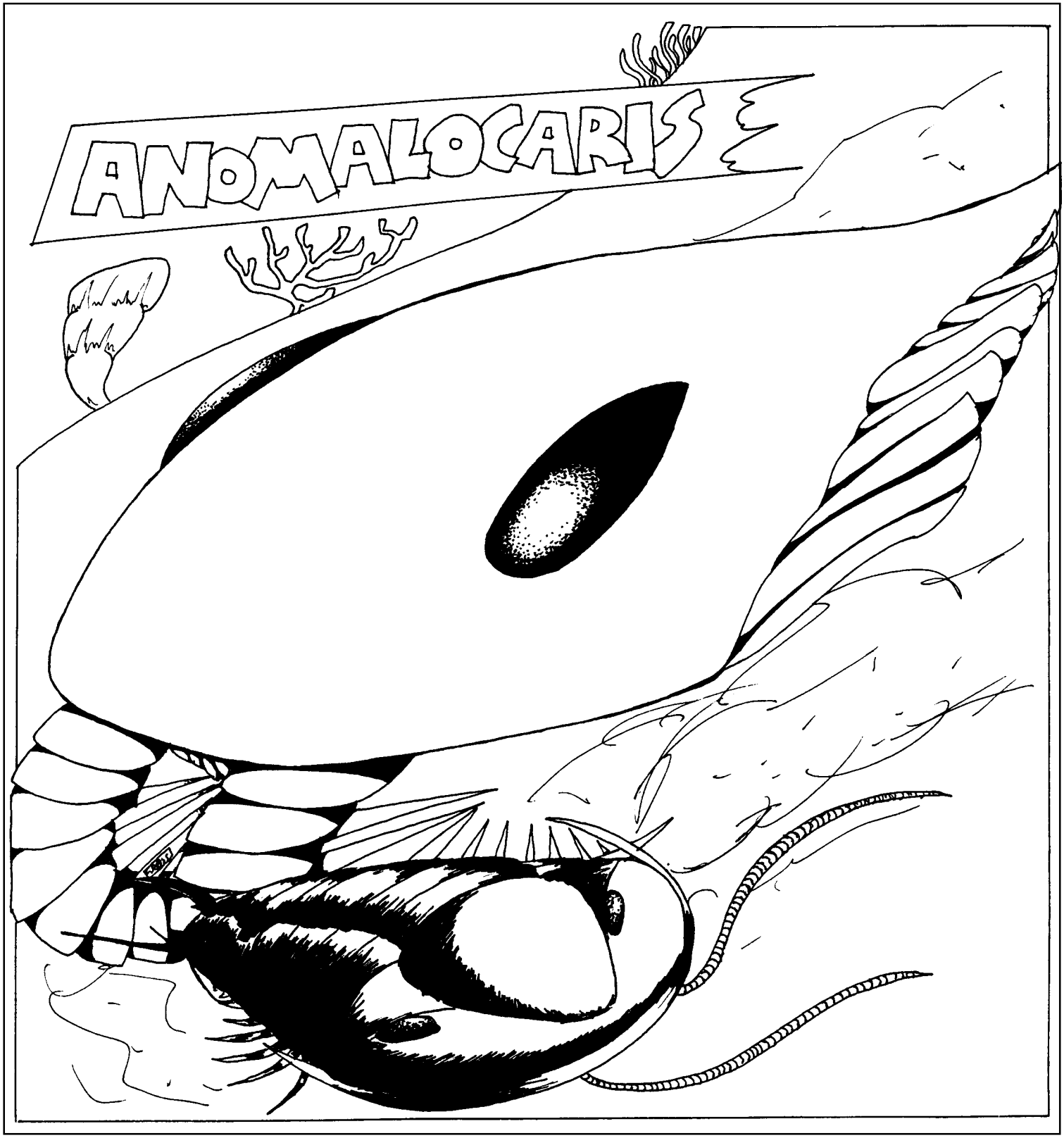
ALBERTA • PALAEONTOLOGICAL • SOCIETY

BULLETIN

VOLUME 10 NUMBER 2 JUNE 1995



ALBERTA PALAEONTOLOGICAL SOCIETY

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

a. Promote the science of palaeontology through study and education.
b. Make contributions to the science by:
   1) discovery
   2) collection
   3) description
   4) education of the general public
   5) preservation of material for study and the future
c. Provide information and expertise to other collectors.
d. Work with professionals at museums and universities to add to the palaeontological collections of the province (preserve Alberta's heritage)

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

Single membership	$10.00 annually
Family or Institution	$15.00 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.

Society Mailing Address:
Alberta Palaeontological Society
P.O. Box 35111, Sarcee Postal Outlet
Calgary, Alberta, Canada T3E 7C7

Material for *Bulletin:*
Howard Allen, Editor, APS
7828 Hunterslea Crescent, N.W.
Calgary, Alberta, Canada T2K 4M2
(E-mail 75272.1316@compuserve.com**)**

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

UPCOMING APS MEETINGS

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

June, July, August—No meetings…see you on the field trips!
Friday, September 15—"Show and Tell"—bring in your summer finds and other interesting items
Friday, October 20—Les Adler—Fossil update & overview
Friday, November 17—Dr. White, Geological Survey of Canada: Fossil seeds
Friday, December 15—Three mini-talks by APS members

****

ON THE COVER: *Anomalocaris*, the Cambrian Period's largest predator, attacks a trilobite; by APS member Cory Gross. ©1995. Reproduced by permission.

President's Message

by Les Adler

This is my last message as president—the next one will come from our new president-elect, **Wayne Braunberger**, who has had experience in this position about seven to ten years ago.

During the past ten-year period, costs were held to a very low level due to a lower cost of materials used and by donations and a number of deals. We can no longer provide the level of services at the current contribution level. This is what we have been providing: a monthly meeting nine months of the year, mostly with a featured volunteer speaker at university doctorate level; in the summer, field trips with an oilfield or academic geologist, with professional field notes and productive fossil locations; a good quality academic library; coffee and cookies; a very high quality *Bulletin* with news of fossil finds, book reviews, Dinotour notes, a few original investigations, and news from the Internet. Some of the increases include a very sharp rise in paper costs, increases in postal rates, and coffee prices have doubled.

Consequently, I am thanking some of the people who helped to keep our costs under control: Mount Royal College Earth Sciences Department and their security people, who allowed us use of labs, storage spaces and the use of audio-visual equipment, and paid for utilities; the field trip directors who enabled us to visit and collect fossils across the southern portion of western Canada after bearing expenses out of their own pockets; oil companies which carried printing costs; editors and contributors to the *Bulletin*; **Mike Skrepnick**, the T-shirt designer and producer; librarians; the ladies who donated and prepared food and coffee; the speakers who educated us; the people who brought specimens in for us to handle and examine; the donors to the Society fossil collection…

For myself, I would like to see subscription rates increase, but at a moderate rate until finances stabilize.

Here are some forthcoming activities: Summer 1995—voluntary assistance to the Alberta Science Centre at the Calgary Planetarium, providing a speaker and some displays; three field trips (phone Les Fazekas at (403) 248-7245 or (403) 640-4499 (daytime) for last-minute scheduling and updates).

Upcoming meetings will include our September Show-and-Tell, where members are encouraged to bring in specimens from field trips and the summer's collecting season; October's fossil update and overview (with Les Adler); in November, Dr. White of the Geological Survey with a talk on fossil seeds, and, in December, our second, three-part set of mini-talks by APS members.

If you examine the list of officers and directors you will find a group of dedicated volunteers, highly qualified and experienced, who meet before regular meetings to produce highly effective general meetings. Once again, thanks! ❑

Upcoming Events

May 27–September 4

DinoMania at the Alberta Science Centre, 701 11th Street SW, Calgary (at the Planetarium), open 7 days a week, 10 AM to 8 PM. Admission: adults $6.75, children/seniors $4.75. Robotic dinosaurs, displays, hands-on paleo. activities.

September 29–October 2

Fifth Canadian Paleontology Conference and International Symposium on the Paleobiology and Evolution of the Bivalvia, Joint Meeting, Drumheller. A professional conference at the Tyrrell Museum; includes field trips, oral and poster presentations and round-table discussions. Registration fee: $30, Field trips $20–$25. Contact Paul A. Johnston, Royal Tyrrell Museum of Palaeontology, P.O. Box 7500, Drumheller, AB, Canada T0J 0Y0, phone (403) 823-7707, fax (403) 823-7131 ❑

Welcome New Members!

Jorge Boldt, Calgary, AB
Greg Bracken, Calgary, AB
Kathleen Filas, Glen Ellyn, IL
Drusilla Flowers, Gurnee, IL
Barry Fortier, Calgary, AB
Ron Fortier, Calgary, AB
Harry Gluth, Edmonton, AB
Patricia Halliday, McGregor, ON
Virginia A. Hammond, Granada Hills, CA
Darlene Hill, Calgary, AB
Marion Snyderman, Philadelphia, PA
Bob Stiles, Bassano, AB
Marie Strom, Calgary, AB
Doug Woodsworth, Calgary, AB

Material for the Bulletin

The editor gratefully accepts material in any form: handwritten, typewritten, faxed or digital (preferred). Floppy disks (3.5" only, any density) should be accompanied by a printed hard-copy. I can accept most Macintosh and IBM-compatible formats: if in doubt, call me at home: (403) 274-1858 *–Howard Allen, editor* ❑

Program Summary

by Howard Allen

March 15, 1995: ***Modern Reptiles and Amphibians, with Greg Bracken***

If the volume of oohs and aahs from the audience was any indication, the presentation by Greg Bracken of the Alberta Reptile and Amphibian Society was one of our most enthusiastically received talks.

From an assortment of picnic coolers, Greg produced several representatives of the reptile and amphibian classes, on the hoof (so to speak). Included in his menagerie were a huge, sleepy-looking African bullfrog, whose fellows survive long droughts on the edges of the Sahara desert by burrowing into the mud of their ephemeral ponds, secreting a water-tight covering to protect themselves from dehydration and hanging tough until the next rainy season.

A Tokay gecko, representative of the lizard group, was shown clinging to the smooth sides of a clear plastic terrarium—a trick made possible by the animal's toes, which are covered by a multitude of ultra-fine hairs, fine enough to find pores in something as apparently non-porous as plastic and plate glass. This tenacity of foot is apparently matched by the gecko's obstinacy in holding onto potential food items: Greg related an instance in which his pet refused to give up the hand that fed it!

Representing the turtle and tortoise group was an amicable, 18-year old (i.e. still a toddler) red-footed tortoise from the jungles of South America.

The *pièce de résistance* was produced from a large cooler, ominously tied with heavy nylon rope, evoking images of the cartoon Tasmanian devil. To the goggling eyes and gasps of the audience, Greg produced a 3.4-metre (11-foot), banana-yellow, albino Burmese python, which he showed off, lovingly draped across his shoulders.

After the lecture, members were invited to examine the animals close-up, which they did with obvious enthusiasm.

April 21 1995: ***The Mount Stephen Trilobite Beds, with Howard Allen***

This, the first of three short talks presented by club members, was a travelogue of a guided tour, attended by the author in 1993, of the famous Middle Cambrian fossil occurrence in the Rocky Mountains near Field, British Columbia.

A series of slides illustrated highlights of the trail leading to the fossil beds, high on the upper slopes of Mount Stephen, an area now under strictly enforced prohibition to all but specially registered attendees of a guided tour.

Our guide for the hike, sponsored by the Canadian Society of Petroleum Geologists, was Dr. Desmond Collins of the Royal Ontario Museum, Canada's foremost expert on the nearby Burgess Shale fossils.

Despite the fact that huge numbers of trilobites were removed from the locality by unrestricted collecting for nearly 100 years, nearly every slab of shale at the site still has one or more complete or fragmental trilobites visible on its surface. "Collecting" is now limited to rubbings, which may be made with heavy pencils or crayons, on paper [see cover of the *Bulletin*, Sept. 1993].

By far the most abundant species is *Ogygopsis klotzi*, which reaches a length of about 10 cm. Many, if not most of the fossils represent moulted exoskeletons, indicating that the site was occupied by living trilobites, who lived, moulted and died in the same area. The somewhat younger Burgess Shale fauna, across the valley, is thought to represent a "death assemblage": animals lived in shallower water on top of a reef-like structure, and were carried over the edge into deeper, stagnant waters by mud-slides, where they died and were preserved in exquisite detail.

Other fossils are found at the Mount Stephen site, including some that also occur in the Burgess Shale: sponges, brachiopods and the feeding appendages of the Cambrian Period's largest predator, the "weird wonder," *Anomalocaris.*

An Introduction to Ichnology, with Wayne Braunberger

Ichnology is the study of trace fossils, markings and structures left in or on sedimentary rocks by the various animals and plants that lived in.the ancient sediments.

Using overhead transparencies, slides and many remarkable hand specimens from western Canada, Wayne illustrated some of the many kinds of trace fossils that can be found, and the value that they have to geologists and palaeontologists in interpreting sedimentary environments, and the lifestyles of many types of fossil organisms, some of which left few or no body fossils.

The two main classes of trace fossils that Wayne concentrated on are "bioturbation" structures—caused by organisms burrowing through unconsolidated sediments (sand, mud)—and "bioerosion" structures, which include borings in various hard substrates, such as wood, shells, rock, and partly-consolidated sediments.

Studies have revealed that certain traces are often found together in associations that have

been termed "ichnofacies." These ichnofacies tend to reflect the type of environment that existed when the sediments were deposited and reworked by the organisms that lived in them.

For example, some suites of trace fossils indicate ancient rocky shorelines…rocks showing various types of borings by pelecypods. Another ichnofacies that might include a preponderance of large, vertical burrows might indicate a sandy shelf or near- shore environment, with high wave or current energy, that required burrowing animals to anchor themselves deep in the sand, and to periodically move upward to keep pace with high rates of sediment input. Horizontal traces in or on the surfaces of finer grained sediments may indicate deeper, quieter water where animals crawled about on the seabed searching for food. Root traces indicate that a sediment was overgrown by plants, and probably deposited in a shallow, non-marine environment.

Some body fossils (shells, wood, bones) show traces that indicate predation by other animals: oyster and clam shells often show a dense network of tiny pinholes caused by boring sponges. Larger, circular holes in pelecypods indicate predation by carnivorous gastropods. Petrified wood found in marine rocks often shows holes bored by small pelecypods, similar to the "wormwood" found on ocean beaches today.

Dr. Dave Mundy: What's Inside Fossils?

With his lively and entertaining talk, Dr. Dave Mundy proved that something as apparently unimportant as a bit of silt that collected inside a fossil shell can tell remarkably fascinating stories and be a source for much professional research.

The focus of Dave's presentation was *geopetal* deposits—literally, "earth-seeking"—the small deposits of mud, silt or sand that collect inside and settle to the bottom of cavities, such as the shells of dead molluscs. These geopetal deposits are useful in that they act like a carpenter's spirit-level, showing which way was originally "down."

Geologists find these deposits very useful in determining the tops of beds, which may be overturned by folding and faulting. Using as an example his research on Carboniferous reef rocks in the north of England, Dave showed how geopetal deposits prove that forereef beds were originally laid down on a relatively steep slope into the offshore basin: the tops of geopetal deposits in fossil shells were *not* parallel to the tops of beds, as would be expected if the beds were originally flat-lying (see figure 1a). One remarkable specimen, when sawn open, revealed *four* geopetal deposits, all at different angles, indicating that the shell had lain in four consecutive positions as it tumbled down the forereef slope (figure 1b). As well, some of the geopetal deposits were shown to be interbedded with cementing minerals, proving that the minerals had progressively crystallized out of seawater, rather than been deposited later by percolating groundwater. The fact that all four geopetal structures were intact further proved that the sediments had hardened rather quickly, between tumbles, as opposed to long after burial.

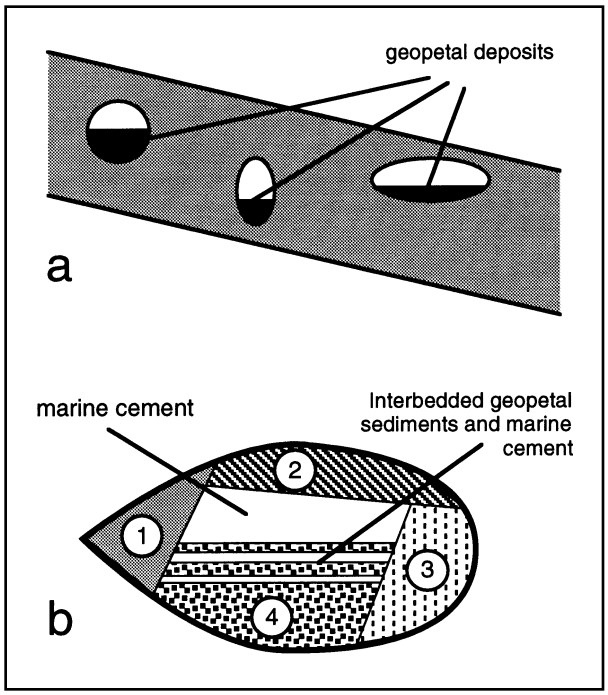


Figure 1: (a) Relation of geopetal deposits to an originally sloping bed. **(b)** Four consecutive geopetal deposits indicating different positions of shell and interbedding of geopetal and marine crystalline cement.

Another fascinating aspect of the deposits inside shells was revealed when Dave examined some of the geopetal deposits found in nautiloid shells under a microscope: it turned out that some of the deposits consisted entirely of the accumulated shells of ostracodes, tiny marine arthropods. This, of course, invites more speculation…just how did these empty cephalopod shells come to be filled with ostracodes, often all of the same species and growth stage? (Ostracodes go through several stages, or instars, moulting their shells prior to new growth.) Several possibilities were offered: maybe the ostracodes entered the shell cavities to live full-time; or just to feed; to mate; to moult…

Another startling discovery came from examining these geopetal ostracodes: Dave discovered that some nautiloid siphuncles (the tubes that join shell chambers together) contained a bizarre, spiny ostracode that had never been

described by science; to date, this variety has *only* been found in the siphuncles of nautiloid shells!

In summing up, Dave encouraged club members to open up some of their extra fossils and look inside; a little detective work can reveal secrets in even the crummiest specimens. ❑

May 19 1995: ***Review of the evolutionary history and diversity of the vertebrates: part 1, with Dr. Gerry Morgan***

Gerry Morgan has generously agreed to present the Society membership with a series of talks on aspects of vertebrate evolution, which he will present about once a year, for the next few years.

His first presentation introduced us to the basic characteristics of the phylum Chordata, a group that includes—among others—the Vertebrata, the subphylum to which we humans hold a more than sentimental attachment.

All chordates share a number of common features: presence of a notochord—a stiffened internal rodlike structure, in our case represented by the backbone; a dorsal, hollow nerve chord, parallel to the notochord; gill slits; and a post-anal tail (ours is very short). The chordates can be subdivided into three subphyla, including the Urochordata, or sea-squirts, an aptly-named group whose chordate features are seen only in the larval stages; the Cephalochordata, represented by the worm-like *Amphioxus*; and the Vertebrata, which includes all the "higher" vertebrates.

Basic vertebrate characteristics include: a notochord represented by a segmented spine; a skull structure to protect the brain; sense organs that are almost always paired; and most forms have two sets of paired limbs, attached to the skeleton by a girdle structure (shoulder blades and pelvis). Gill slits, though present in all forms, may be lost in the adult stages (like us). Vertebrates are further subdivided into about nine classes.

Gerry discussed the earliest class of vertebrates, the jawless fishes of the class Agnatha, represented today by the eel-like lampreys and hagfishes. Fossil agnathans, the Ostracoderms ("shell-skin"), first appeared in the Late Cambrian, reaching their greatest abundance and diversity in the Silurian and Devonian. Earliest forms are known only from scattered tiny, scale-like bony plates, which presumably covered much of the animals' bodies. Later types developed more robust armour, especially around the head, and also various types of fins, becoming more fish-like in appearance. The work of the Swedish palaeontologist Stensiö, who made stunningly detailed examinations of the skull of *Cephalaspis*, a small ostracoderm, added much to our understanding of this group. ❑

Fossils in the News

Calgary Herald, March 18, 1995:

Girl's discovery beats dinosaur museum pros

EDMONTON—Tess Owen, a 12-year-old amateur fossil hunter, exploring with her father and younger brother, made an important find near Edmonton. Poking around the rocks near the site of a partial tyrannosaur skeleton, examined earlier by palaeontologists from the Royal Tyrrell Museum, Tess spotted a peculiar pattern of symmetrical, raised bumps on a rock surface. Her father photographed the find and contacted the museum. Technicians eventually examined the specimen, confirming that it was the skin impression of a tyrannosaur, one of the group of carnivorous dinosaurs including *Tyrannosaurus* and *Albertosaurus.* The specimen was cut out and removed to the museum for further study.

Dr. Phil Currie, of the Tyrrell Museum stated that the specimen was "by far the best" of only three known specimens of tyrannosaur skin impressions. As for the find having been made by a 12-year-old amateur, Currie suggests that his crew must have overlooked it, because they had their minds set on finding bones: "Not having the same prejudice that everyone else had in terms of looking at the bones, she found the skin impression. "It was one of those things that is a humbling experience for the rest of us."

MAPS Digest, March, 1995:

Fossils stolen from US college

CINCINNATI, Ohio—Greed has struck once again, this time in the Geology department at Carleton College, in Northfield, Minnesota. Thieves entered the college on Saturday, Sept. 23, 1994, and made away with 133 museum-quality mineral crystal specimens and 522 fossils, valued at over US$50,000. The specimens were removed from hallway display cases, and from an adjacent lab. Fossils included several good quality mammoth and mastodon tusks, teeth and jaw bones and several hundred marine shell fossils from Miocene deposits in Florida. Specimens were identified with a catalogue number (black pen on white paint). A complete inventory is available from the Carleton Geology Department at (507 663-4407 or (507)663-4401.

Calgary Herald, May 19, 1995:

Dormant bacteria awakened

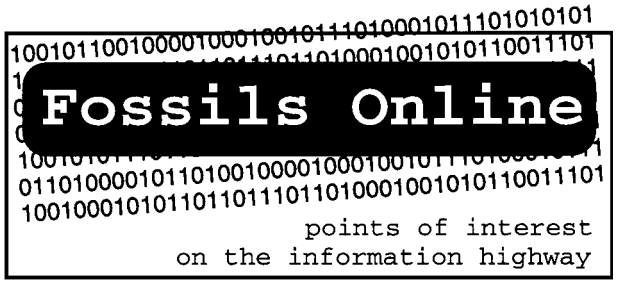
WASHINGTON (AP)—Scientists at California Polytechnic University have reported the revival of 25- to 40-million-year-old bacteria from the gut

of a fossil bee, trapped in amber.

Researcher Raul J. Cano says the bacteria were revived from spores formed by the organisms in the bee's internal organs:"Some bacteria make spores as a means of survival…these spores are very resistant to chemicals, heat and pressure. They enable a bacteria to withstand long periods of dormancy."

The awakened bacteria are producing a natural antibiotic that the team is investigating for possible medical applications. ❑

[*Thanks to Brian Allen, Trudy Martin, Harvey Negrich, Sam Richter and Evelyn Wotherspoon for handing over clippings –ed.*]



CompuServe:

Bunglers destroy *Albertosaurus* bones (April 20)
An article in the April 14, 1995 issue of *Science* reports that a group of irresponsible amateurs discovered the remains of an *Albertosaurus* near Egg Hill in Montana. The fossils hunters wandered onto private land, found the *Albertosaurus* bones, and in attempting to recover the fossils, destroyed them—possibly beyond use. The resulting uproar has created a dispute over access to the site which may not be excavated for some time, if ever. There is a moral here for amateur fossil hunters who think they can dig up their own dinosaur skeletons.

Hot fossils from the Gobi (March 29)
The March 23 edition of *Nature* has a paper documenting the recent discovery of a fabulous fossil site in Mongolia. American Museum of Natural History researcher Michael Novacek reports that, in an area of about a mile square, his team has found over a hundred partial and complete dinosaur skeletons, and the skulls or skeletons of over 400 small mammals and lizards from Upper Cretaceous rocks. The site is thought to be an area where many animals were killed and buried by sandstorms. The most spectacular find was a nest of five small shrew-like mammals in exquisite condition, with even the tiny inner ear bones preserved.
The article contains a summary of all finds made at the site so far, including these fossils (found last summer) and another set of finds from an expedition to the same site in 1993.

WANTED: Fresh dinosaur bones (March 2)
Dr. Charles Pretzman, molecular and evolutionary geneticist at Ohio State University is seeking dinosaur bone fragments about the size of a large pea from digs in the northern hemisphere. He has a new DNA extraction technique and is attempting to isolate dino DNA fragments for genetic analysis. He is especially interested in theropod material. Dr. Pretzman would like to obtain bone fragments of the same (identified) theropod from different locales; that is, digs at least 200 miles apart. If you can help, please reply by mail, or e-mail on the internet at cpretzman@magnus.acs.ohio-state.edu, or call 1-800-837-2473 eves., 1-614-292-7609 days. If you make a significant contribution to this project, you may be acknowledged in print or share authorship.

Chip Pretzman
Dept. of Molecular Genetics
The Ohio State University
484 W. 12th Ave.
Columbus, OH 43210

Giant dinosaur egg from China (March 15)
Archaeologists in Central China's Henan province have discovered the largest and best preserved dino egg ever found in China. The egg is 55 cm (21 inches) in circumference.

"Cultural bureau archaeologist Zhang Weihua and Henan museum photographer Yan Xinfa were walking past some farmers shovelling soil near Henan's Lingbao city when the egg…rolled out in front of them." (quoted from a Reuters new dispatch)

The egg was dated as Late Cretaceous, about 70 million years ago. A search of nearby soil revealed a nest of smaller eggs. In a follow-up Reuters story, Chinese scientists said they had extracted fragments of DNA from the dinosaur egg. Dr. Zhang Jun of Beijing University discovered some organic substances, including amino acids, in a "cotton-like" layer on the inner surface of the egg's cavity. Scientists succeeded in extracting gene fragments from the egg. This is apparently the first time DNA has been found in a dinosaur egg.

Meanwhile, a team of Chinese and German scientists working with eggs from southern Guangdong province said they may have found a clue to the end of the dinosaurs' reign 65 million years ago. Excavations in Guangdong have yielded a total of 305 almost complete dinosaur eggs, thousands of fragments, and many good skeletons and footprints.

Chemical analysis of the eggs shows contamination by a number of trace elements, including manganese, cobalt, nickel, and zinc. The researchers believe that the eggs were diseased as a result of excessive amounts of those elements in the dinosaurs' diet. This may have led to a decline in the number of successful hatchings and eventually to the extinction of many kinds of dinosaur in the Chinese region.

Pterosaur bonebed discovered in Chile (May 4)
A UPI article reports that British geologists have uncovered a huge bonebed of Early Cretaceous pterosaurs (flying reptiles) in the Atacama Desert. The locality, about one square kilometre in area, is thought to contain several thousand pterosaurs. It apparently represents a rookery of hatchlings, juveniles and subadults that was inundated by a flood. A full report on the discovery appears in the British journal *Geological Magazine*. ❑

An Evening with Stephen Jay Gould

by Vaclav and Mona Marsovsky

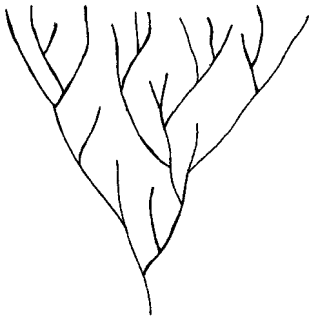
Dr. Stephen Jay Gould, a professor at Harvard University and author of *Wonderful Life* and other palaeontological works, entertained a large crowd of about 1000 on April 29, at the Calgary Convention Centre, with his theory on "Decimation and Diversification." The lecture was sponsored by the Yoho-Burgess Shale Research Foundation and the Canadian Society of Petroleum Geologists (CSPG).

Stephen Gould described how there have been major revolutions in the way mankind has thought about itself. The first was Earth's insignificant place in the solar system as proposed by Copernicus. This revolution required both the acceptance of the theory and the smashing of the pedestal that mankind had placed for itself at the centre of the universe. The next revolution was the concept of "deep time". Only recently have we learned of the great age of the Earth and the very short age of mankind. The next revolution was the theory of evolution. Although this theory has been accepted by "all thinking humans," the common belief is that the goal of evolution was to produce humans. The popular icon of the "ladder" of human evolution from monkey to man was illustrated with numerous cartoons and advertisements. The standard depiction of the evolution of life on Earth always concentrates on the evolution of humans, neglecting other evolutionary developments (e.g. fish evolution during the Cretaceous).

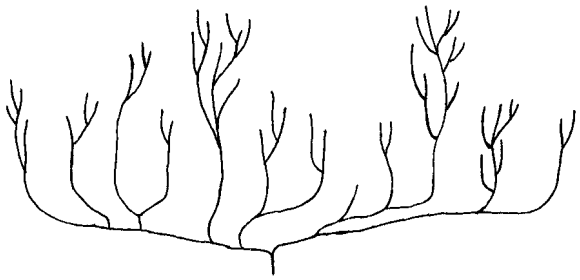
Stephen Gould believes that the sequence of life is an unrepeatable sequence of events not ordained by the laws of nature. He described as an example a fish which might become highly evolved to outcompete other species in a pond, but which would still be wiped out if his pond dried up. During the "Cambrian Explosion" about 535 to 530 million years ago, nearly all of the phyla had emerged, as shown by the record of the Burgess Shale. Over the ages many of these phyla became extinct, and no new phyla have appeared. About twenty different basic arthropod body plans emerged during the Cambrian Explosion; now there are only three.

Stephen Gould does not think that these other kinds of arthropods died out because of the survival of the fittest, but rather because only the survivors received a "winning ticket." He described the standard icon of the "Cone of Diversity" in which evolution works toward more advancement and specialization and the ultimate goal, humankind.

The Cone of Diversity representing progress of species over time is a "spin-doctored" view. Steady, predictable rise in complexity is only popular theology. Why do mammals occupy the top of the cone (which is where the most diversity occurs) when there are only 4000 species of mammals and over one million species of insects? He proposed the alternate model of "Decimation and Diversification" in which initially there was a great diversity of body plans, some of which have since become extinct.



Cone of Diversity



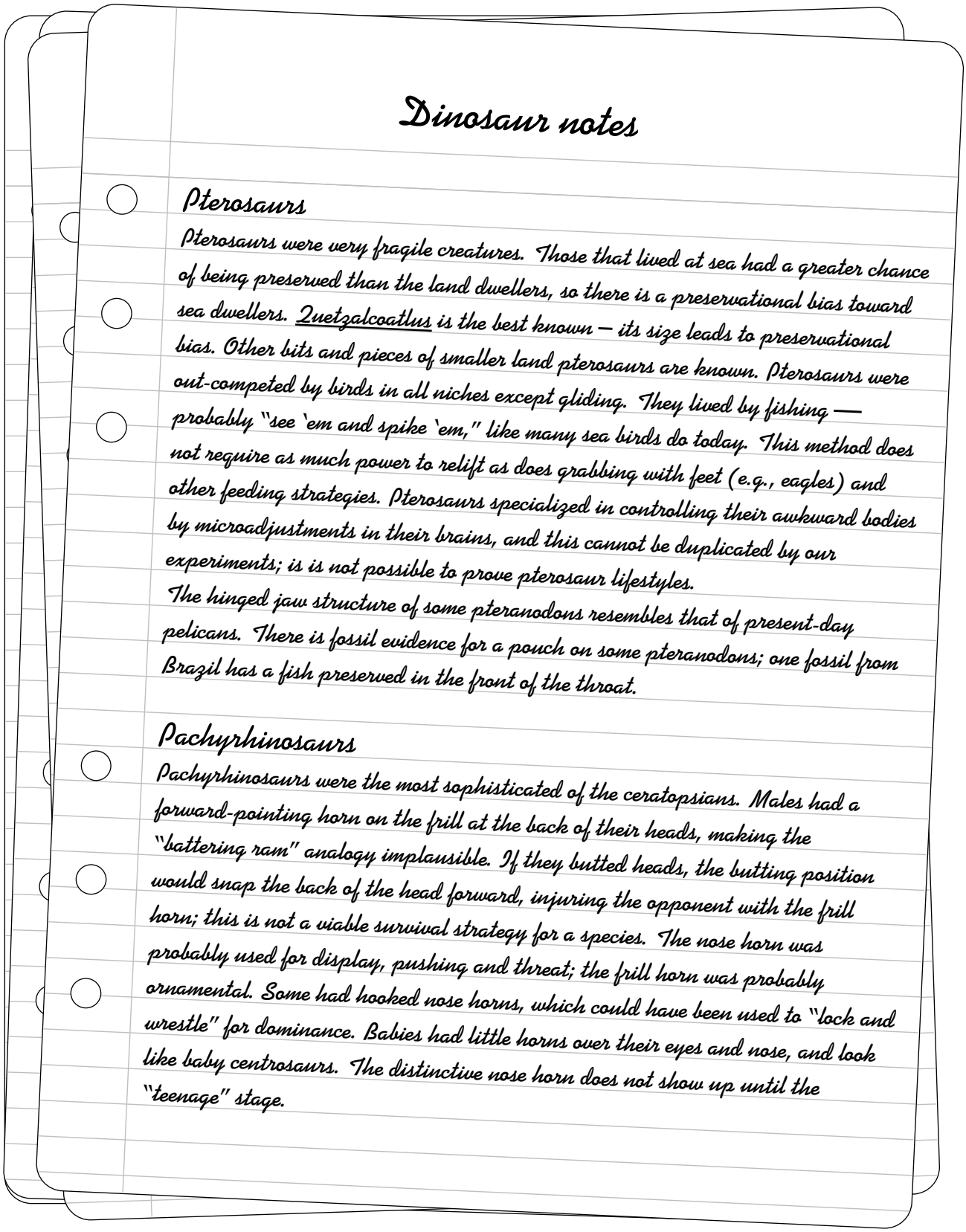
Decimation and Diversification

Rather than the reason for extinction being attributable to Darwinian survival of the fittest (natural selection), extinction may be due to a series of unpredictable events, such as environmental changes. This was what Dr. Gould called the lottery interpretation; only the surviving species have received a winning ticket. The most successful species are often the least advanced; e.g. 80% of the species on Earth are arthropods.

To complete Darwin's view of evolution he believes it is necessary to smash the pedestal of thinking that the goal of evolution was to produce humans and recognize that much of human evolution was simply due to luck. A replay of the tape of life with subtle changes would mean that humankind may never have come to be. ❑

DINOTOUR Field Notes by Heather Whitehead

During DINOTOUR's 1994 tour of southern Alberta and Saskatchewan, on-board scientific leader Dr. Phil Currie of the Royal Tyrrell Museum of Palaeontology gave talks in the field, and helped pass the miles on the bus with question-and-answer sessions. What follows is a summary of some of my notes from these sessions…



Dinosaur notes

Pterosaurs

Pterosaurs were very fragile creatures. Those that lived at sea had a greater chance of being preserved than the land dwellers, so there is a preservational bias toward sea dwellers. Quetzalcoatlus is the best known – its size leads to preservational bias. Other bits and pieces of smaller land pterosaurs are known. Pterosaurs were out-competed by birds in all niches except gliding. They lived by fishing — probably "see 'em and spike 'em," like many sea birds do today. This method does not require as much power to relift as does grabbing with feet (e.g., eagles) and other feeding strategies. Pterosaurs specialized in controlling their awkward bodies by microadjustments in their brains, and this cannot be duplicated by our experiments; is is not possible to prove pterosaur lifestyles.

The hinged jaw structure of some pteranodons resembles that of present-day pelicans. There is fossil evidence for a pouch on some pteranodons; one fossil from Brazil has a fish preserved in the front of the throat.

Pachyrhinosaurs

Pachyrhinosaurs were the most sophisticated of the ceratopsians. Males had a forward-pointing horn on the frill at the back of their heads, making the "battering ram" analogy implausible. If they butted heads, the butting position would snap the back of the head forward, injuring the opponent with the frill horn; this is not a viable survival strategy for a species. The nose horn was probably used for display, pushing and threat; the frill horn was probably ornamental. Some had hooked nose horns, which could have been used to "lock and wrestle" for dominance. Babies had little horns over their eyes and nose, and look like baby centrosaurs. The distinctive nose horn does not show up until the "teenage" stage.

Extinction and evolution

- There is more than one iridium spike! Devil's Coulee eggs and sediments give an Ir spike, and it is 10 million years before the K-T boundary.
- Fundamental questions of extinction: 1) Was it the same time worldwide? 2) Was it rapid and catastrophic, or longer term and gradual?
- Dinosaur bones have been reported above the K-T boundary, but so far these are not skeletons, just bits and pieces. Real evidence above the boundary would include eggs in nests, skeletons, footprints. There is an idea that teeth should show wear if they have been redeposited, but rock tumbler studies show it can take a long time to show wear; also, teeth can be carried in suspension and not necessarily abraded or tumbled in transport.
- Although finds above the boundary are still single bones, Phil Currie is willing to bet a few dinosaurs crossed the boundary (especially small theropods that ate mammals, etc., & were warm blooded and relatively intelligent).
- In Alberta and Montana, there is no real evidence that dinosaurs survived until the K-T boundary, let alone beyond it. At Huxley on the Red Deer River (latest Cretaceous, 65 million years old), there were only 6 dinosaur species left. Earlier, diversity was 20-25 species near Drumheller and 35 species at Dinosaur Provincial Park (75 million years old).
- In Alberta and Montana we are seeing evolution and replacement of species, not just extinction. The fossil record is complicated by dropouts due to habitat/climate change, and by invasions of newcomers that evolved elsewhere. For example, there is a shift in Lower Cretaceous to Upper Cretaceous theropods that is being studied. The turnover is toward much more sophisticted animals and appears suddenly as a brand-new evolutionary radiation (tyrannosaurs, troodontids, elmisaurids, oviraptors, ornithomimosaurs, etc.). These new animals tend to be closer to each other than to older types, e.g., tyrannosaurids are closer to troodontids than either is to allosaurids.

Your Society Collection

by Joe LeBlanc

[*This is the first appearance of a new regular feature in the* Bulletin *dealing with aspects of the Society's fossil collection –ed.*]

Want to see a brachiopod or graptolite, or handle an ornithomimid bone? These fossils and many others can be found in our Society collection.

Harvey Negrich, the Society's curator, has carefully identified and documented dozens of fossils. We do, however, have lots of gaps and are asking members to donate specimens to make our collection even better.

The collection has recently been transferred to my residence and I am establishing a room where members can come and examine specimens at their leisure. The accumulation and display of a quality collection will:

- provide specimens for identification
- educate members on taxonomic groups (phylum, class, etc.)
- match typical fossils with their formations
- provide information on collecting sites
- inspire ideas for rock shows and displays

No book, slide or description can make up for the knowledge obtained by holding a fossil in one's hand. How many times have you been surprised by what a fossil actually looks like? An example of this is graptolites which often photograph poorly in books but are much more noticeable when viewed close up in a black shale matrix. How many fossils have you passed by because you didn't know what to look for at the time? Have you heard yourself groaning, after a field trip: "Oh, that's what those were!"

The Society's collection is incomplete in even some common specimens and we are asking all members to contribute to expanding our fossil resources. Why not go through your own collection and donate duplicates? Why not pick up an extra specimen or two on your next collecting trip? Think of the quality of the collection if each member donated a few specimens each year. Does the Society already have the fossils you wish to donate? Fossils are like pens and socks: it's impossible to have too many. Size, matrix, colour and other variables often vary from specimen to specimen. Wouldn't it be great to have a collection to consult when trying to identify that puzzling brachiopod? A selection of Banff Formation corals to study before heading out to the Rockies? How about dinosaur teeth to make sure you have your species identified correctly? And let's all admit it—fossils are just great objects to enjoy for their own aesthetic value.

How about our members in the rest of Canada, and the USA? This is your collection also. Even the most common fossils from your area would be appreciated. Not many Alberta members get overly excited viewing a dinosaur vertebra, but how would out-of-province members react? Albertans would be equally excited over your "common" crinoids, bivalves, shark teeth or other fossils.

We gladly accept inquiries about our collection and hope to have all specimens listed on computer disk so that out-of-town members can receive fossil listings. Photographs can be made available, within reason. Remember to arrange to view the collection when visiting Calgary. Fossil donations can be brought to our meetings, sent to the Society address or we will arrange pick up if possible (call 246-7601).

When donating your fossil, please provide as much information as possible. This would include species, formation, age, etc. Do you have "anonymous" fossils lingering in boxes? If no information is available, we will call on the skills of our curator and members to help with identification.

New additions to the APS collection

1. Scollard Formation: Upper Cretaceous/ Paleocene, Huxley, Alberta (non-marine molluscs). Donor: Joe LeBlanc

Physa sp. (snail)
Viviparus sp. (snail)
Sphaerium sp. (clam)
Unio sp. (clam)

2. Horseshoe Canyon Formation: Upper Cretaceous, Morrin, Alberta (non-marine clam). Donor: Joe LeBlanc

Unio sp., cf. *U. stantoni*

3. Mississippian: Moapa, Nevada, productid brachiopod (unidentified). Donor: Joe LeBlanc.

4. Selection of small Eocene vertebrate fossils from Morocco. Includes dental plates and stingers from rays, and small vertebrae of fish and possibly amphibians. Donated by Harvey Negrich, currently being sorted by Don Sabo. ❑

The 35th annual Calgary Rock and Lapidary Club Mineral, Rock and Fossil Show—May 6 and 7, 1995

by Les Adler

This show was successful from both a financial and aesthetic point of view. It was held at the usual location—the Hillhurst Community Centre—with support from dealers and the general public, and the enthusiasm and high quality of displays provided by dependable club members.

The Alberta Palaeontological Society supports this show as it enables us to show the general public the extensive collections that we have built up over the years. This year we supplied displays for two booths, provided one show case which won an award, while **Wayne Braunberger**, **Harvey Negrich** and **Les Adler** supplied five cases of fossil displays. **Don Sabo** was competition chairman, while Wayne was special displays chairman. **Vaclav Marsovsky**, **Joe LeBlanc** and his friend **Nora**, **Howard Allen** and Wayne Braunberger helped to man booths.

The majority of displays at the show were concerned with jewellery, lapidary work, museum quality minerals, demonstrations, equipment, and books from the Geological Survey of Canada. Following is a rundown of what you would have seen if you were interested in fossils:

L. and C. Dwyer, owners of the Three Rivers Fossil Museum in southern Alberta displayed a case of twenty trilobites ranging in size from one-half inch to ten inches, representing geological periods from Cambrian to Devonian, from Morocco, Tanzania, and South and North America, with each specimen complete and specially prepared.

Les Adler provided three cases, the first being a collection of Precambrian stromatolites from Elko, British Columbia, assembled from several forays through the scrub and scrambling over rocks carrying out heavy loads of rocks. The second case contained trilobites: several of the specimens were casts made from plastic or plaster, coming from British Columbia, Ontario and the United States. The third case contained prints, drawings and postcards illustrating mostly the work of Ely Kish on dinosaurs.

Paul Van Ende of Washington state displayed 21 limb casts and a second case of twelve cut-and-polished wood sections (Miocene) from his home area. John Burrell of Victoria, B.C. displayed about 50 specimens of polished fossil woods from many geological periods—including maple, bamboo, eucalyptus, ginkgo, palm, cedar, sycamore, cottonwood, walnut and pine.

Jim and Dot McGowan showed polished Washington wood made into a pen and calendar set. Ruth Scott had a large complete gastropod steinkern and a polished limb cast.

June Sjulstad displayed a portion of the mandible of a hadrosaur with batteries of teeth from both the upper and lower jaws.

Wayne Braunberger's display was a demonstration of etching solitary rugose corals from the Mount Head Formation southwest of Calgary, with professional photographs, specimens and equipment.

The award-winning Alberta Palaeontological Society case consisted of Rocky Mountain Palaeozoic fossils to the left and spectacular badlands fossils to the right This collection was accompanied by a map of Alberta indicating where the fossils came from. Joe and Nora had set up this display, which showed *Albertosaurus* teeth, champsosaur vertebrae, ornithomimid toe bones, ankylosaur and crocodile scutes,jaws and teeth, a hadrosaur skin impression, a ginkgo leaf, and *Metasequoia* wood. From western Alberta were Carboniferous corals such as *Siphonodendron, Syringopora and Turbophyllum*, spiriferid brachiopods, a Jurassic *Pleuromya* clam and a Cretaceous *Scaphites* ammonite.

Harvey and Steffie Negrich showed 22 caudal hadrosaur vertebrae, as well as phalanges, tendons and jaw fragments; crocodile scutes; rib fragments; teeth; and turtle shell fragments, mainly from *Aspideretes.*Marjorie Dever and Gavin Palmer—a pebble pup—included fossils in their display.

The APS booth had a map of Alberta with our society logo, cut-outs of fossils and fossil specimen displays. The identification booth was mostly manned by Harvey Negrich, Geoff Barrett and Don Sabo, who showed off specimens from our Society collection and had available many pamphlets from the United States including the Mammoth Hot Springs site, South Dakota, and the dinosaur footprint site at Dinosaur Valley, Glen Rose, Texas.

The Fossil Shop at Drumheller provided several Miocene Moroccan sharks' teeth at low cost (thanks to Harvey Negrich) and had for sale a large collection of fossil books, Eocene Wyoming fish, *Baculites* sections, Pleistocene Los Angeles tar-pit beetles, ammonites, and a *Triceratops* skull priced at $70,000. Ancient Sea Gems sold "ammolite" pieces, while several other dealers were selling ammonites, dinosaur bone, gastropods and fossil shark teeth. The next show takes place during the first week of May, 1996. ❑

Sulphur: The "Smoking Gun"?

[*This article, reproduced more-or-less verbatim, appeared on the JPL/NASA Bulletin Board, for release by the Public Information Office, Jet Propulsion Laboratory, California Institute of Technology, National Aeronautics and Space Administration, Pasadena, California. For those interested, the internet address is: http://www.jpl.nasa.gov/news. Thanks to Dr. Charles I. Pretzman of Ohio State University, who uploaded the article to Compuserve. –ed.*]

FOR IMMEDIATE RELEASE Dec. 28, 1994:

Dinosaurs may have already been in decline on Earth some 65 million years ago, but a team of NASA scientists now believes it was the sulphur-rich atmosphere created in the aftermath of an immense asteroid collision with Earth that brought about a global freeze and the demise of these giant Mesozoic creatures.

The impact of this large asteroid—perhaps the largest since life evolved—hit a geologically unique, sulphur-rich region of the Yucatan Peninsula in Mexico, according to planetary geologist Adriana C. Ocampo and atmospheric scientist Dr. Kevin H. Baines, both of the Jet Propulsion Laboratory's Earth and Space Sciences Division. They estimate the impact was 10,000 to 50,000 times more powerful than the comet Shoemaker-Levy 9 impact on Jupiter last July and kicked up billions of tons of sulphur and other materials.

The researchers and colleagues Dr. Kevin O. Pope of Geo Eco Arc Research in La Cañada, California. and Dr. Boris A. Ivanov of the Russian Academy of Sciences in Moscow have co-authored a paper detailing the global atmospheric impact of this asteroid collision at Chicxulub, Mexico in the latest issue of Earth and Planetary Science Letters.

"We estimate that this asteroid was 10 to 20 kilometres (6 to 12 miles) in diameter and its collision on Earth brought about total darkness around the world for about half a year," Ocampo said. "But more importantly, persistent clouds generated by the impact on this geologically distinct region of sulphur-rich materials [*evaporite minerals: anhydrite ($CaSO_4$) and/or Gypsum ($CaSO_4 \bullet 2H_2O$) –ed.*] caused temperatures to plunge globally to nearly freezing."

"These environmental changes lasted for a decade and subjected organisms all over the world to long-term stresses to which they could not adapt in such a brief time span," Pope added. "Half of the species on Earth became extinct as a result."

The researchers based their work on computer models of the impact and atmospheric effects, studies of the crater geology and extensive fieldwork at a rock quarry located 360 kilometres (223 miles) south of Chicxulub at Albion Island in Belize, where fragments bearing the unique characteristics of the impact were found.

In studying the sites and modelling the resulting changes in the biosphere, the scientists discovered that it was the specific geological location of the impact in a region that is rich in sulphur materials that created catastrophic climate changes and led to the downfall of the dinosaurs.

"If this asteroid had struck almost any other place on Earth, it wouldn't have generated the tremendous amount of sulphur that was spewed into the atmosphere to create such a devastating, worldwide climate change," Baines said. "In fact, we human beings owe our existence to the uniqueness of this impact region." On impact, the asteroid hurled some 35 billion to 770 billion tons of sulphur high into the atmosphere, along with other materials. The NASA team, in collaboration with Dr. Alfred Fischer of the University of Southern California, recently discovered rocks—some the size of a Volkswagen bug—that were blown out of the crater and landed 360 kilometres (223 miles) south of the Chicxulub site in Belize.

The boulder deposit in Belize also contained fragments of glass that were created by the melting of rock when the asteroid crashed into Earth, Ocampo said. And spherical fragments, known as "tektites," were scattered about and formed as the molten glass flew through the air and cooled. The tektites have been found in other regions near the crater, such as Haiti, Mexico, Texas and Alabama, but never in association with large boulders. As the researchers continued to excavate, they found spherical pieces of calcium carbonate, some of which have an unusual radial structure. The formation of these "spherules" remains a mystery, Ocampo said, but the scientists speculate that they could have formed from the residue of vaporized sulphur-rich rocks. Another important find at the Belize rock quarry was limestone with fossils dating to the early part of the Cretaceous.

"Fossils of this age don't belong in northern Belize," Ocampo said. "Early Cretaceous fossils have been found deep below the surface near the crater during drilling by the Mexican Petroleum Company. We think the limestone found in Belize was excavated by the impact, which probably blew a hole more than 15 kilometres (9 miles) deep in the Yucatan Peninsula."

Since 1980, when University of California-

Berkeley geology professor Walter Alvarez and his colleagues first proposed the theory, researchers have been searching for impact sites that would explain the sudden disappearance of the dinosaurs. The main evidence to support the theory came from finding a substance called iridium in a layer of clay in Italy. The concentration of iridium, an element found on Earth in very small quantities, was quite large. However, a high concentration of the element is found in asteroids and comets.

It took another decade for researchers to find an actual impact site. In 1989, Pope and Charles Duller of NASA's Ames Research Center in Mountain View, California. discovered a semi-circle of sinkholes at Chicxulub. Ocampo studied gravity and magnetic data from the crater and correlated them with the sinkholes. She concluded that the area had the classic characteristics of an impact crater, indicating that Chicxulub was, in fact, the place where a colossal asteroid had smashed into Earth millions of years ago. Current estimates of the crater size range from 180 kilometres to 300 kilometres (112 miles to 186 miles) in diameter, making it one of the largest craters known on Earth.

The researchers used sophisticated atmospheric models of the sulphur-rich atmosphere of Venus to paint their doomsday scenario. "Initially, thick sulphur clouds, combined with soot and dust generated by this impact, would have spread worldwide and blocked out the sun," Baines and Pope said. "Night-like conditions probably existed all over Earth for at least six months and wiped out many species of plants because the blackout essentially brought photosynthesis to a halt. Unlike the aftermath of typical impacts, the skies remained murky for at least a decade, due to chemically generated clouds of sulphuric acid high in the stratosphere."

The reflection of sunlight back into space from these high-altitude clouds caused surface temperatures to drop to nearly freezing for many years all over the planet, even over normally balmy islands in once-tropical seas.

These atmospheric conditions occur in Venus' perpetually cloudy atmosphere, Baines said, where ultraviolet sunlight and water in the high atmosphere can convert sulphur dioxide into sulphuric acid clouds. Sulphuric acid clouds like those that cover Venus may well have continued to blanket the Earth for more than a decade after the initial impact of the asteroid, causing a secondary and more long-lasting effect—the *coup-de-grâce* or final knockout blow—which killed much of life on Earth. "The entire ecosystem of Earth, including plants and animals, was subjected to extreme environmental conditions, which a large number of well-established species, such as the dinosaurs, simply could not cope with," Baines said. Six months of total darkness and 10 years of global freezing ultimately destroyed the dinosaurs and many other organisms, Pope added. Miraculously, many species survived the catastrophe and evolution took a new turn, ushering in the era of mammals and, eventually, humankind.

Results of the Belize research are scheduled to appear with other works in an upcoming Special Paper of the Geological Society of America, which will feature recent research on major catastrophes in Earth's history.

The research was sponsored by the Exobiology Program in NASA's Solar System Exploration Division. Fieldwork in Belize was supported in part by the Planetary Society in Pasadena, CA. ❑

Reviews

by Les Adler

Hunting Dinosaurs by Louie Psyihoyos with John Knoebber. Random House, 1994. (Hardcover, 270 pp., CDN$60) (Also reviewed by Tracy Staedter in *Earth*, Feb. 1995, pp. 61, 63.)

This delightful book is of special interest to our members because of the direct contributions of **Mike Skrepnick** and **Dr. Phillip Currie**. Mike

provided some of the dinosaur paintings, while Phil provided accommodation and took the authors on an expedition to photograph dinosaur tracks.

A large portion of the book deals with the Marsh-Cope arguments with the result that Louie was able to get Dr. Bob Bakker to complete the process of establishing Cope's remains as the type specimen of *Homo sapiens*.

Louie met many dinosaur specialists and took many photographs. In the final section, 35 contributors ponder the causes of dinosaur extinction with even a few of them admitting that they aren't quite sure. Whatever the reason(s), the dinosaurs overstayed their welcome.

Lizzie the Lizard by William A. Shear and W.D. Ian Rolfe. *Earth*, December 1994, pp. 36-43.

This article is concerned with the finds in early Carboniferous rocks near Bathgate, Scotland. Stan Wood makes his living selling fossils at Edinburgh and worked this quarry, which has now been taken over by the National Museums of Scotland. The specimens include fish, early tetrapods, scorpions, horsetails, lycopods, eurypterids, ancestors of frogs and toads, and "Lizzie the lizard" (*Westlothiana lizziae*). A diagram is provided to show the possibilities of where this specimen might fit in as a precursor of the main reptile line leading to lizards, snakes, birds, dinosaurs and crocodiles at the 350 million-year time slot. The Scottish authorities were able to come up with almost CDN$450,000 to keep the specimen at home. Lizzie is about 40 million years older than a prehistoric lizard specimen from Nova Scotia.

This View of Life: Evolution by Walking by Stephen Jay Gould, *Natural History*, March 1995, pp. 10–15.

This article contains a cladogram (a diagram showing the possible directions of evolution over time, of biological structures of a featured group) with a matching floor plan of the American Museum of Natural History's new fossil mammal halls in New York City. You would follow signs and visit a set of displays and learn the sequence by walking through the exhibits in the order that the palaeontologists think that mammal structures developed. This is not the order that you will follow in other major museums where humans are placed at the end or on the top. Usually you will find a linear array or sequence starting with some life form according to the museum's bias and ending with a form from what is understood to be a set of increasingly complex creatures with most forms being left out and being ignored. Sometimes the structure is supposed to be a tree with branches, often narrowing from a wide base.

Many museums ignore what palaeontologists believe to be the most important event in vertebrate evolution—the rise of the Teleostei or the so-called higher bony fishes which arose while the dinosaurs developed on land. Many museums show dinosaurs before mammals although both groups arose at the same time.

Ned Colbert in his textbook,*The Evolution of the Vertebrates* treated primates as the fifth of twenty groups rather than the twentieth. The palaeontologists at New York have arranged the mammal halls following Colbert's idea in terms of branching order, not in the order of "success." Scientists who prefer cladistics classify organisms in nested hierarchies based exclusively on the order of branching. the exhibits walk visitors through the following six features that define a genealogy of branching, not a ladder of success or putative advance:

(1) **The synapsid opening.** Late in the Palaeozoic era more than 250 million years ago, a group of reptiles—extinct relatives of mammals—developed an opening in the skull behind the eye socket. All mammals possess this feature: muscles that close the lower jaw attach to the skull around this opening.

(2) **Middle ear bones.** The two bones that articulate the reptilian jaw decreased in size and moved into the middle ear in mammals were they joined the stirrups in reptiles to become the hammer and anvil of a mammal's middle ear. Monotremes and marsupials branch off here because they evolved the three ear bones but not the placenta.

(3) **Placenta.** Edentates (sloths, anteaters, armadillos) branch off here because they have placentas but not feature (4).

(4) **Stirrup-shaped stapes.** In reptiles and early mammals the stapes is a simple rod. At the fourth bifurcation a hole developed in the stapes with an important blood vessel going through. Amongst the groups diverging here are carnivores, rodents, bats and primates.

(5) **The hoof.** Later, toes coalesced to form hoofs in subsequent mammalian groups: horses, rhinoceroses and tapirs amongst perissodactyls or odd -toed hoofbearers; and cows, pigs, sheep, goats, giraffes, deer and antelopes amongst artiodactyls or even-toed hoofbearers; included are extinct South American forms and whales.

(6) **Eye sockets moved forward on the skull to near the snout.** This development is seen in elephants and sea cows.

Gould praises a delightful attempt to stir our mental machinery and suggests that we make use of the changes that made human evolution possible and walk upright on two legs through this museum's display. ❑

Field Trips 1995

Three field trips are planned for this summer. The dates are firm. For more information, contact Les Fazekas, field trip coordinator: (403) 248-7245 or (403) 640-4499 (daytime)

NOTE: Non-members and unaccompanied minors will not be allowed to attend field trips.

Trip Participant Responsibilities

It is understood that risk is inherent to some degree in all outdoor activities. Please ensure you understand the risks involved and are prepared to accept them.

- As a participant, you are responsible for your own safety and equipment at all times.
- Trip co-ordinators are not professional guides. They are simply club members who have volunteered their time for your enjoyment.
- Contact the trip leader prior to the trip and again if you cancel. The leader will be able to answer questions about the trip and required equipment.
- Inform the trip leader of any medical conditions they should be aware of in an emergency, for example: diabetes, bee-sting reaction, asthma.
- Ensure that your previous experience, ability and fitness level are adequate for the trip.
- Stay with the group. Wait for other group members frequently and at all route junctions.
- Tell the trip co-ordinator if you must turn back.
- Contribute to car pool expenses
- Enjoy!

Trip 95-1: Saturday & Sunday, June 17–18

Manyberries area, Alberta—Late Cretaceous marine fossils (Bearpaw Formation) are common in the Manyberries area. The Dinosaur-bearing badlands (Judith River Formation) near Irvine may also be visited.

Meeting place: Manyberries Hotel at 11:00AM, Saturday, June 17. (Consult a road map for directions to Manyberries.**Allow at least 4.5 hours driving time from Calgary**)

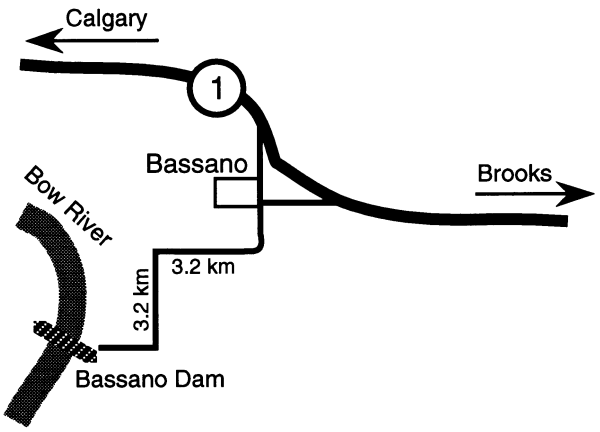
Potential hazards: Rattlesnakes

Clothing and equipment: sunblock, hats, rainwear, mosquito repellent, **LOTS** of water, sturdy hiking shoes or boots, food.

Trip 95-2: Saturday, July 22

Bassano, Alberta—Marine fossils of the Late Cretaceous Bearpaw Formation occur along the Bow River at this locality southeast of Calgary.

Meeting place: viewpoint parking area at the Bassano Dam, at 9:00AM (**allow 2 hours driving time from Calgary**).



Potential Hazards: Steep slopes, Bow River

Clothing and equipment: sunblock, hats, rainwear, mosquito repellent, water, sturdy hiking shoes or boots, lunch.

Trip 95-3: Saturday & Sunday, August 19–20

Macabee, B.C.—This region in south-central British Columbia is well known for Tertiary (Eocene) fossil plants and insects.

Meeting place: gas station at Monte Creek, B.C. (Monte Creek is 26km. **east** of Kamloops, on the Trans-Canada Highway, at the junction with Highway 97. Consult a road map for directions.) Meet at 12:00 noon local time. **Driving time from Calgary is about 7 hours.** Participants would be well advised to drive part-way on Friday.

Potential hazards: Steep slopes, falling rocks, rattlesnakes

Clothing and equipment: sunblock, hats, rainwear, mosquito repellent, water, sturdy hiking shoes or boots, food. ❑