Alberta Palæontological Society Bulletin

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THE SOCIETY WAS INCORPORATED IN 1986
as a non-profit organization formed to:

1. Promote the science of palaeontology through study and education.
2. Contribute to the science by: discovery; responsible collection; curation and display; education of the general public; preservation of palaeontological material for study and future generations.
3. Work with the professional and academic communities to aid in the preservation and understanding of Alberta's heritage.

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

Single membership $20.00 annually
Family or Institution $25.00 annually

SOCIETY MAILING ADDRESS:
Alberta Palaeontological Society
PO Box 68024, Crowfoot PO
Calgary, AB, Canada T3G 3N8
www.albertapaleo.org

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Howard Allen, Editor, APS
7828 Hunterslea Crescent, NW
Calgary, AB, Canada T2K 4M2
editor2@albertapaleo.org

Requests for missing *Bulletin* issues should be directed to the Editor. Back issues are available at **www.albertapaleo.org/bulletinarchive.html** Send changes of contact information to the Membership Director.

Upcoming APS Meetings

Held in webinar format until further notice.

Friday, April 8, 2022—Tako Koning, Professional Geologist.
Quarrying of the Ordovician Tyndall Stone, Garson, Manitoba. (See Page 3.)
and Keynote Speaker,
Alexander J. Lowe, University of Washington.
Evolution of temperate vegetation in North America. (See Page 4.)

Friday, May 13, 2022—Dr. Jason Pardo, Field Museum, Chicago
and **Ramon Nagesan,** University of Michigan.
The earliest known dinosaurs from western Canada. (See Page 4).

COVID-19 has affected our operations. Watch the APS website for updates!
www.albertapaleo.org/meetings.html

ON THE COVER: Alberta fossils—or sedimentary structures, if you prefer! Stromatolites in lower Morro Member, Palliser Formation (Upper Devonian), Loder Peak, Rocky Mountain Front Ranges, Alberta. Boot tip for scale is 11 cm wide. Photo by Howard Allen.

Upcoming Events

April

Friday, April 8, 2022, 7:30 P.M.

WEBINAR—APS members will be notified by email how to register. Or visit **cspg.org**, navigate to ***Upcoming Events/Division E-talks/Palaeontology/*** and follow the instructions. **REGISTER EARLY! Registration ends at 9:00 A.M. Friday, April 8.** APS and CSPG members may register for free. Non-members will be charged $10.00.

Tako Koning

Professional Geologist, Senior Geologist/Consultant

[*This 15-minute presentation will precede our main speaker,* ***Alexander J. Lowe****.*]

Quarrying of the Ordovician Tyndall Stone, Garson, Manitoba

According to records of the Manitoba Historical Society, the Tyndall limestone was first discovered in the mid-1800s when a local farmer was digging a water well and encountered an impenetrable layer a short distance below the surface. In the early 1890s the first small commercial stone quarry was established. The first large quarry was established in 1898 by William Garson. The village of Garson, 40 km northeast of Winnipeg, was named after him. Already at that time, the Tyndall was regarded as one of Canada's premium ornamental building stones. Indeed, even today it is still regarded as one of the most beautiful ornamental stones in the world.

Three large quarries were in operation in Garson by 1914 with 250 men employed to cut stones in the quarry and move them to the mill. At the mill site the blocks were cut and shaped to the specifications of architects, contractors and builders. The stone was called Tyndall Stone after the nearby town of Tyndall where rail shipments of the stone were sent Canada-wide and also into the USA. In 1915 the Gillis family established the Gillis Quarry which is the only remaining operation that still quarries the Tyndall Stone.

Many prominent buildings in Canada feature the limestone quarried in Garson. This includes some of the grand hotels such as the Rimrock Hotel in Banff, Chateau Lake Louise and the Empress Hotel in Victoria. Also clad by Tyndall is the Parliament's Interior Block in Ottawa, the Canadian Museum of History in Gatineau, Quebec, the Canadian Museum for Human Rights in Winnipeg and the exteriors of the Provincial Legislative Buildings in Winnipeg and Regina. Buildings clad by Tyndall Stone in Calgary include the historic Bank of Montreal on Stephen Avenue, the southern exterior of the Eaton's Centre and the John J. Bowlen Building which is the former Calgary Court House at 620 – 7 Avenue SW. Tyndall Stone also clads Canada's High Commission facing Trafalgar Square, London, England.

I became very interested in the Tyndall Stone three years ago and I was inspired to write a paper titled *Tyndall Stone: Hunting Ordovician Fossils in Downtown and Inner-City Calgary.* This was published in the December, 2020 issue of the APS *Bulletin*. In 2020 and 2021, I led downtown Calgary and inner-city field trips to show the Tyndall to members of the APS. My ongoing interest in the Tyndall resulted in a trip to Garson in October, 2021 to visit the Gillis Quarry. This presentation to the APS and to the Canadian Society of Petroleum Geologists' Paleontology Division will review the local geology at the quarry, discuss some of the opera-

Figure 1. The historic Gillis Quarry, Garson, Manitoba, in October 2021. Photo by Tako Koning.

tions and highlight slabs of Tyndall Stone which are available to the public at the "rubble pile."

Biography

Tako Koning is Holland-born and Canada-raised with degrees in geology from the University of Alberta, and economics from the University of Calgary. He worked as a petroleum geologist, manager and VP exploration in Canada, and lived and worked in Indonesia, Nigeria and Angola for thirty years. He has been an APS member since 2015 when he moved back to Calgary from Africa.

Figure 2. The author collecting fossiliferous Tyndall Stone at the rubble pile in Gillis Quarry. Photo: Tako Koning.

Alexander J. Lowe

University of Washington

Evolution of temperate vegetation in North America

Plants dominate the surface of our planet's continents, and in doing so, greatly influence the exchange of energy and matter between the biosphere, lithosphere, atmosphere, and hydrosphere. In order to dominate the huge variety of climates and environments found across the continents, plants have evolved particular forms and strategies that allow them to prevail in the conditions in which they live.

At a broad scale, the spatial patterning of these plant forms and strategies can be summarized by the classification of biomes. The biomes present today are only one example of how plant forms and strategies coalesce across our planet. Luckily, we can look to the geologic record for countless other examples, and in doing so, can begin to answer questions like: when and how did the biomes present today form, how have they shifted through time, and how might they look in the future?

In this presentation, we explore the story of the development of three important biomes in North America—temperate deciduous forests, conifer forests and grasslands. To do so, we will focus on the storytellers, the fossil plant sites that showcase these ancient biomes, and the stage this story took place on, considering changes in global climates and regional landscapes. We will start from the flowering plants' (angiosperms) rise to dominance in the Cretaceous and up to modern times. With this story at hand, we can consider lessons learned that may be informative regarding what our planet's future holds—because ultimately, how do you know where you are going if you don't know how you got here?

Biography

Alex Lowe is a Ph.D. student of palaeobotany at the University of Washington, working with **Dr. Caroline Strömberg**. Alex's dissertation research focuses on how plant communities in Washington, Oregon and Idaho responded to environmental changes happening in the Miocene, including global warming (the Mid-Miocene Climatic Optimum; ~17 – 14 Ma), cooling (the Middle Miocene Climatic Transition; ~14 – 13 Ma) and the eruption of the Columbia River Basalts (~17 Ma). Prior to this, he did a Master's degree at Brandon University in Manitoba working with **Dr. David Greenwood** at the early Eocene McAbee Fossil Beds, near Kamloops, British Columbia. He has a Bachelor's in geology from the University of Utah, where he was involved in research on low temperature geochemistry, including stable isotope geochemistry and bulk elemental composition of paleosols.

May

Friday, May 13, 2022, 7:30 P.M.

WEBINAR—APS members will be notified by email how to register. Or visit **cspg.org**, navigate to ***Upcoming Events/Division E-talks/Palaeontology/*** and follow the instructions. **REGISTER EARLY! Registration ends at noon Thursday, May 12.** APS and CSPG members may register for free. Non-members will be charged $10.00. There are NO meetings at Mount Royal University until further notice.

Jason D. Pardo and Ramon S. Nagesan

Field Museum, Chicago and University of Michigan

The earliest known dinosaurs from western Canada

Western Canada has one of the best records of Late Cretaceous dinosaur fossils worldwide, and the study of these fossils (and similar faunas in Montana, Wyoming, Utah, and New Mexico) has given us a uniquely detailed look into dinosaur faunas from the Mesozoic. However, the origins of these faunas remain less well known, particularly in the period before the uplift of the Rocky Mountains. We here report a new fauna in the earliest Cretaceous Pocaterra Creek Member of the Cadomin Formation that includes the earliest Canadian dinosaurs from outside of the Maritimes. The rocks containing these fossils are high in the Canadian Rockies and present unique difficulties for field palaeontology. Although the fauna is represented by isolated bones in channel lags, we have found strong evidence for the presence of a "polacanthid"-grade ankylosaurian as well as some smaller fossils. Preparation of this material is still ongoing. The Cadomin Formation provides an opportunity to learn about the origins of the iconic dinosaur faunas of the Late Cretaceous of Alberta.

Biographies

Originally from Pittsburgh, Pennsylvania, **Dr. Jason Pardo** received his B.A. in Organismal Biology from the University of Colorado Boulder. His Masters research, conducted at the University of Calgary, focused on the anatomy and phylogenetics of a group of snake-like early amniotes from the early Permian of the United States. His Ph.D., completed at the University of Calgary in 2021, focused on the evolutionary and developmental basis of tooth loss in modern amphibians and in tetrapods across the fin-to-limb transition. His research combined 3D imaging, quantitative methods and molecular biology to ask fundamental questions about vertebrate evolution. He is currently a Banting Fellow at the Field Museum of Natural History in Chicago studying the evolution of the nasal passage in mammalian precursors. In addition to palaeontology, Dr. Pardo is an avid mountaineer and climber with a passion for the Canadian Rockies.

Ramon Nagesan completed his BSc at University of Toronto in 2012. He completed an M.Sc. at the University of Calgary in 2017, studying ways to infer neck function in plesiosaurs using micro-CT in the iconic Alberta plesiosaur, *Nicholllssaura*. He has also been a long-time fixture of the Alberta museum community, serving as a preparation and field technician at the Royal Tyrrell Museum from 2012 – 2014 and as an Education and Preparation Liaison from 2016 – 2017. He has seen much of the province's fossil resources as a Palaeontological Resource Consultant. As of 2019 he is the manager of the CT Lab at the University of Michigan Museum of Zoology. In addition, Ramon loves the outdoors, running, and biking, especially in the Canadian Rockies. ❑

Protect Your Fossils for the Future

By Georgia Hoffman

You may have some excellent fossils that you've collected yourself or purchased over the years. Have you ever thought about what will happen to them after you've gone on that "Final Field Trip"? Vital information about where they were found could be lost, or someone who doesn't understand what they are might throw them out. Don't let that happen! Make sure that your fossils (and other collections) will be preserved for the future.

Step 1. Make sure that all information is clearly recorded and kept ***with*** your fossils. **Location information is vital!** The person who collected a specimen and the date when they collected it may also be of interest.

Step 2. Decide who you want to have them. You might want to leave them to a friend, or a university, or a museum, or a high school.

Step 3. Contact the recipient and make sure they will be able to accept the donation. Regrettably, the APS has run out of storage space and can't accept new donations at present, but APS members may be able to suggest other suitable recipients.

Step 4. If the collection is especially valuable, a university or museum can have them appraised, give you a tax receipt for the donation, arrange for them to be picked up when the time comes, and help with any required paperwork.

Step 5. Specify the recipient in your will, or at least write down their name and address and keep it with the fossils.

Your fossils have survived for tens or hundreds of millions of years, so make sure they continue to survive for others to enjoy and learn from. ❑

Notice of Annual General Meeting of Members

To the Members of the Alberta Palaeontological Society:

Take notice that the Annual General Meeting (AGM) of the Members of the Alberta Palaeontological Society (hereinafter called "The Society") **will be held by webinar**, following the main guest presentation on **Friday the 13th day of May**, 2022, at the hour of 7:30 o'clock in the evening, local time, to deal with the following business to be brought before the Meeting:

1. **Adoption of agenda.**
2. **Minutes of 2021 AGM.**

Members will be asked to adopt the minutes of the 2021 AGM, which may be reviewed at the APS website: **http://www.albertapaleo.org/agm.html**.

3. **Treasurer's presentation of the audited statement of the financial position of The Society.**
4. **Appointment of the auditors.**

Auditors nominated by the Treasurer for appointment are **Gilles Fournier** and **Anita Reilander**.

5. **Election of Officers to the Board of The Society.**

All APS members 18 years and older are entitled to vote. Officer positions are 1 year terms and directorships are 2 year terms. Nominations are being solicited for the following positions:

Officers	President
	Vice-President
	Secretary
	Treasurer

Continuing directorships are Program Coordinator (**Harold Whittaker**), Membership Coordinator (**Howard Allen**), Editor (**Howard Allen**) and Field Trips Coordinator (**Keith Mychaluk**). These positions are entering the 2nd year of a 2 year term.

In addition to the elected positions the APS has a number of committee chairs which are appointed by the board. Terms for these chairs are unlimited:

Committee	**Current Chairperson**
Fossil Collection	Howard Allen
Library	Georgia Hoffman
Public Outreach	Cory Gross
Social	Virginia Goodman
Website	Vaclav Marsovsky

Terms for all positions begin September 1. If you would like more information about Board positions or are interested in chairing or participating on a committee, please contact Past President **Wayne Braunberger** at **(403) 278-5154** or by e-mail, **pastpres@albertapaleo.org**. All inquiries will be kept confidential if requested.

6. **New Business.**

If you have any items of New Business to be brought forward contact Society President **Cory Gross** at **(403) 617-2079** or by e-mail, **president1@albertapaleo.org**.

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Moratorium on fossil donations

By Howard Allen, APS Collection Curator

As the current Curator of the APS fossil collection, I must advise members that we are no longer accepting donations of fossil specimens, until further notice. The Society has been in receipt of two large collections in as many years and we are facing a serious storage issue. Up to this point, the APS collection has been stored in the Curator's home basement (and garage). Formerly housed in a single 8-drawer steel cabinet, the collection is now overflowing into extra wooden drawers and stacks of cardboard and wooden boxes. With the aging of many collectors (myself included), the likelihood of more large donations being offered as a means of estate disposal is almost certain and the situation has become untenable.

We need to discuss many questions, including: Does APS have a duty to store members' unwanted collections? If so, are we willing to spend money on third-party storage? What is the purpose of keeping these fossils? I hope to discuss this issue more in a future *Bulletin*. Meanwhile, see **Georgia Hoffman**'s relevant article on Page 5 of this issue. ❑

Travels With The Truches

A small town palaeo museum; three caverns; and a visit to "Dee." Featuring palaeontology, geology and a touch of archaeology.

Article and photos by Pete Truch (except where noted).

Our favourite stop in Buffalo Wyoming beckoned us back—the bar in the Occidental Hotel.

The restored 1880s décor of the entire hotel sets a true Wyoming mood. As we eat our delicious beef dips, washed down with local suds from the long oak bar, Doreen recalled meeting "Dee," the 11,600 year old mammoth in the Tate Geological Museum in Casper, on a previous trip: "Did you do any more research on places to stop around here?" She asked. "No, we'll play it by ear," I replied between mouthfuls. We were actually on another baseball tour, making our way to Denver and eventually heading to

Figure 1. Barbara Reynolds (L) and Doreen Truch (for scale) in the Paleon Museum preparation area, Glenrock, WY. Three overhead magnifiers visible are often fully in use by volunteers.

Map 1. Western United States, showing travel stops. 1: Paleon Museum, Glenrock, Wyoming. 2: Caverns of Sonora, Texas. 3: Carlsbad Caverns, New Mexico. 4: Grand Canyon Caverns, Arizona. 5: Tate Geological Museum, Casper, Wyoming. Base map from Google Maps, © 2022 Google, INEGI, used under terms of licence.

Houston for my youngest brother's 60th birthday back in 2013.

Sure enough, travelling south on I-25 east of Casper, we spot a small sign: "Deer Creek & Dinosaur Museum." Intrigued, we turn in to the small town of Glenrock Wyoming (Map 1: Stop 1), not knowing what to expect in a town whose total population is reported to be approximately 2,600. How many palaeo-people could there be?

Turns out the interest is strong, as it reminded me of the Drumheller I knew and frequently visited back in the middle '60s. The full name for the "Paleon Museum," according to a brochure pasted in my journal is *The Glenrock Paleontological Museum & Dr. Robert T. Bakker Educational Center.* Back in 2013, it was opened year round and in the summer season offered day and week-long digs. Like everywhere else, COVID-19 disrupted this, but at the time of writing this article, "things are slowly opening up."

Figure 2. *Apatosaurus* left forelimb.

A terrific person and museum volunteer, **Barbara Reynolds** (Figure 1), gave us a personal tour of the specimens on display and those in preparation. Although the building footprint is small compared to the giants such as the Royral Tyrrell, there is a surprising variety of specimens on display including a large size, full replica *Allosaurus* (Figure 3); *Apatosaurus* parts (Figure 2); parts and pieces of *Triceratops*, including a large metal sculpture; *Edmontosaurus* teeth; and several raptors including *Utahraptor*.

Both meat eaters and herbivores are therefore featured. *Allosaurus* (Wikipedia, 2022a) *. . . is a genus of large carnosaurian theropod dinosaur that lived 155 to 145 million years ago during the Late Jurassic (Kimmeridgian to late Tithonian). The name Allosaurus means "different lizard" alluding to its unique (at the time of its discovery) concave vertebrae.*

Apatosaurus . . . meaning "deceptive lizard," is a genus of herbivorous sauropod dinosaur that lived in North America during the Late Jurassic Period . . . and are now known from fossils in the Morrison Formation of modern-day Colorado, Oklahoma, New Mexico, Wyoming and Utah in the United States. Apatosaurus had an average length of 21 – 22.8 m and an average mass of 16.4 – 22.4 t (Wikipedia, 2022b).

I wasn't at all familiar with *Othnielia*. As per Wikipedia (2022h), the name is a junior synonym of *Nanosaurus* ("small or dwarf lizard") *. . . the name given to a genus of neornithischian dinosaur that lived about 155 to 148 million years ago, during the Late Jurassic age. Its fossils are known from the Morrison Formation of the southwestern United States."* Other specimens included locally-dug and expertly prepared items such as the maxilla of *Allosaurus*; turtles;

Figure 3. Fearsome *Allosaurus* with full display of awesome teeth.

many pieces of *Triceratops* including a left mandible; and *Velociraptor*'s feet and skull, to name a few.

With all the excellent narration provided by Barbara, we found ourselves in the museum long past its posted closing time of 4:00 P.M. She mentioned that a former volunteer is now (*i.e.* in 2013) with the Royal Tyrrell Museum. For some reason I didn't record this person's name in my journal. I have recently contacted the Paleon Museum about this matter on two separate occasions, but unfortunately have had no response. Efforts between **Howard Allen** and **Darren Tanke** (thank you both) to reveal the identity of this mystery person also drew a blank. That makes for a lesson on the merits of good note-taking at the time. Perhaps I may have misheard Barbara and this person is simply a figment of my imagination.

Figure 4. Good sized ammonities, specifically *Eopachydiscus marcianus,* found by Edward Ward in July of 2006. Dating back 100 mya to 65 mya, they are from the Washita Group, Duck Creek Formation, located in Tarrant County, Texas. Information from a display board.

And now for what may be described as a segue from fossils into a collective known as *speleothems*. For anyone who has toured a wet—or once wet—cave, this term includes more familiar features such as *stalagmites* (floor); *stalactites* (ceiling); *columns* (merged 'mites and 'tites); *soda straws*; *popcorn*; and *flowstones,* including *cave bacon* and *draperies*.

I have had the privilege of touring many such caves, and would like to share some of the experiences. Two visited on this trip were particularly outstanding—Caverns of Sonora and Carlsbad Caverns. A unique third cave, Grand Canyon Caverns, visited four years later, are featured for this article. They all have a semblance of palaeontology connections. Well, OK, that's maybe a bit of a stretch, unless one looks at the overall picture of an ever-changing world. Fossils, after all, are usually mineralizations of the original organisms and speleothems often contain remnants of previous fossil mineralization.

I guess I was just born lazy (retirement suits me well). I find it far easier to explore places where spelunkers have blazed the trail before me. Such is the case with Caverns of Sonora (Map 1: Stop 2), where, as a tourist, my fellow travelers and I viewed 3.2 km of the cavern's known 11.3 km, using 360 already-built stairs, reaching a depth of 47 m below ground, in amply-lit walkways—all at a comfortable temperature of 21° C, but with a sweaty 98% humidity.

Departing on an 11:30 A.M. tour, I left my wife Doreen to ponder two exquisite palaeontological specimens (a bit of a direct palaeo connection), on

Figure 5. The attractive pink flower of the oleander plant (*Nerium oleander*) belies its poisonous nature.

Figure 6. Stalactites, straws, and drapery are evident in this active area of Sonora Caverns.

display in the ticket area. It seems every cave we've visited has a fossil display and inevitably crinoids are featured. This may be due to their resemblance to the tentacles of a cave layout. I also admire but avoid the poisonous, pink flowered oleander plant (Figure 5) bordering the building's exterior.

Like a number of caves, Caverns of Sonora owes its formation to dissolved limestone (and any fossils present) due to acidic waters developed through various processes to first create the cavern. Details as per Wikipedia (2022d):

The cave is formed in 100-million-year-old (Cretaceous) Segovia Limestone, of the Edwards Group. The formation of the cave itself probably occurred between 1.5 and 5 million years ago. The cave is formed primarily along a fault, which allowed gases to rise up from depths of around 2.4 km to then depths of about 91 m. At this depth, the gases mixed with water in the aquifer. The resulting highly acidic water dissolved out the limestone, forming the cave. Between 1 and 3 million years ago, the water drained from the cave.

Further water actions resulted in the formation of speleothems, a number of which were outstanding examples to be viewed in the Caverns of Sonora. Thanks to Jim Papadaki's efforts a safe, well-lit, guided tour "maiden voyage" was conducted on July 16, 1960. I liked a reference I read about the cave in Wikipedia (2022d):

The founder of the National Speleological Society, Bill Stephenson, said of the cave after his first visit: "This is the most indescribably beautiful cave in the world, its beauty cannot be exaggerated, not even by a Texan."

On the way to an artificial entrance (and exit) we passed by a plaque indicating that the "Caverns

Figure 7. Sonora is not a deep cavern as evidenced by the close proximity of the ceiling. Note a few broken stalactites.

of Sonora" were declared a National Natural Landmark in 1966. (Wikipedia references a date of December 1, 1965). After a steep stairwell descent, one enters a low-ceiling, eroded cavern with a unique ceiling that could be the source of nightmares or useful in horror movies. Expectations run high and soon come to fruition with the ceiling now changing and revealing stalactites, straws, and draperies (Figure 6). Water dripping from the speleothems indicates that this is still an active area of the cave, changing its form one drip at a time. Apparently 90% of this cave is still active. Since the use of tripods was prohibited, I remember the challenge of holding my camera steady enough to get decent photos using the light provided.

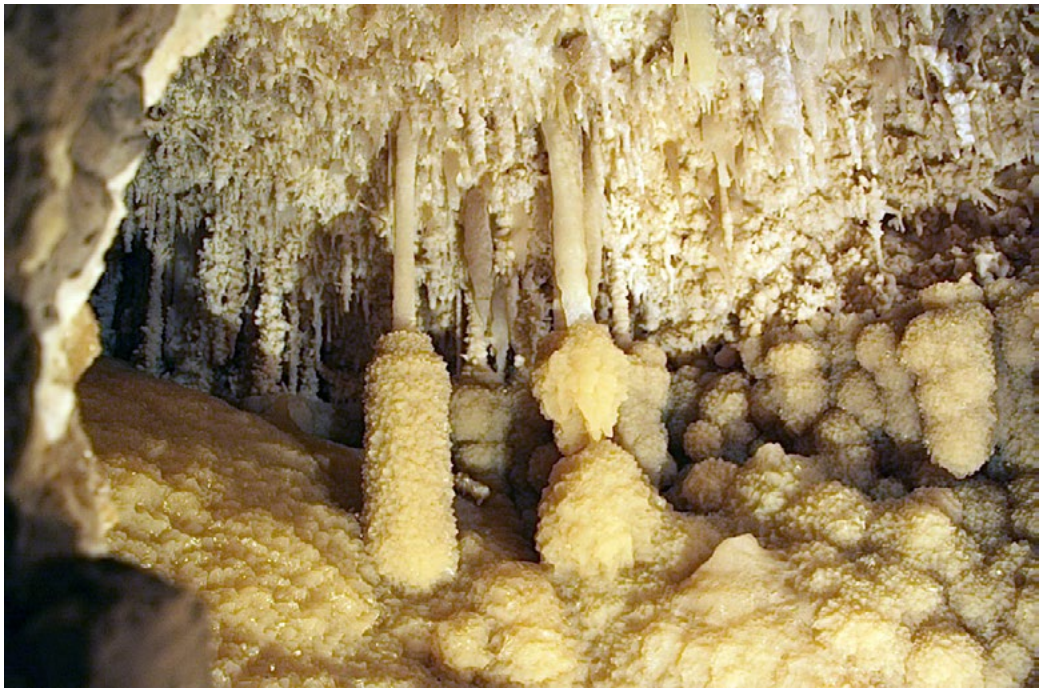

Figure 8. Soda can shape. I can only think of prolonged steady flow rates; then a sudden rate change on a linear decrease of dripping water to form such a shape.

Figure 9. Not taken in a butcher shop! Taken using my flash, this is the best example of cave bacon I have ever seen. It looks good enough to eat—probably would be a little gritty, though!

Figure 7 should give the reader a sense of the closeness of the speleothems to the visitor. One could almost describe this cave as "intimate"; something you can almost reach out and touch. Think of the processes that make the difference between stalactites and straws—capillary action through a central hollow (straws), versus external flow: draperies, columns and what appear to be flowstone/drapery hybrids. I don't remember ever seeing another stalagmite shaped like a soda can with a "feeding tube" stalactite feeding it (Figure 8). I have never, in any of the many caves I have visited, seen a better example of cave bacon, a type of flowstone (Figure 9). As per Wikipedia (2022e):

"*Flowstones are formed via the degassing of vadose percolation waters . . . These minerals are dissolved in the water and are deposited when the water loses its dissolved carbon dioxide through the mechanism of agitation, meaning it can no longer hold the minerals in solution. The flowstone forms when thin layers of these deposits build on each other . . .*"

I've saved the cave's best speleothem feature for

Figure 10. A fishtail shaped helictite, perhaps reflecting the essence of previous marine life

Figure 11. Doreen Truch and the official Park sign.

last. As per Wikipedia (2022d):

[Caverns of Sonora] is a world-class cave because of its stunning array of calcite crystal formations, especially helictites (Figure 10). These helictites are found in extreme abundance, often with a rare purity and complexity. One formation is so densely packed with them, it has been dubbed the "snake pit."

Helictites are defined and further described in Wikipedia (2022g) as follows:

A helictite is a speleothem (cave-formed mineral) found in a limestone cave that changes its axis from the vertical at one or more stages during its growth. Helictites have a curving or angular form that looks as if they were grown in zero gravity. They are most likely the result of capillary forces acting on tiny water droplets, a force often strong enough at this scale to defy gravity.

Helictites are, perhaps, the most delicate of cave formations. They are usually made of needle-form calcite and aragonite. Helictite forms have been described in several types: "ribbon helictites, saws, rods, butterflies, hands, curly-fries, and clumps of worms. They typically have radial symmetry. They can be easily crushed or broken by the slightest touch. Because of this, helictites are rarely seen within arm's reach in tourist caves.

A helictite starts its growth as a tiny stalactite. The direction of the end of the straw may wander, twist like a corkscrew, or the main part may form normally while small helictites pop out of its side like rootlets or fishhooks.

After hearing the story of how a careless visitor destroyed part of the rare helictite "butterfly," we emerge from the Cavern via a fork and a key-hole in the cave, leading to an artificial exit. I have an even bigger appreciation of spelunkers who are willing to go the extra mile in making the beauty of Nature's work available to the rest of us.

Our next stop (Map 1: Stop 3) was always on my "bucket list," and one palaeo connection is that it started as a marine reef that later in its life cycle transformed to limestone, containing many marine fossils. If, after reading this article, it wasn't on your "list" already, hopefully the photos and narrative prompt you to think about adding it. As beautiful as Caverns of Sonora are, they are only a National Natural Landmark. Carlsbad Caverns, on the other hand, are the mainstay of a full National Park (Figure 11). To paraphrase Bill Stephenson, one word comes to my mind—"spectacular"—the description of which "cannot be exaggerated, not even by an Albertan."

Mayans, as part of their religious beliefs, always held underground caverns as sacred sites of the mysterious underworld. No doubt Carlsbad Caverns played a similar role in local culture, judging from the Park pamphlet describing "mysterious drawings on cave walls near the natural entrance." I looked for these but couldn't find them and no else in the group had heard of them.

Perhaps the Park owes its very existence to Jim White, a local cowboy who became fascinated with exploring the cave. Not until 1915, with photos by Ray V. Davis, did White's claims of beautiful formations in a large cavern become believable. It took until 1923 (according to an official Park display board; October 25, 1923, signed by President Calvin Coolidge as per Wikipedia, 2022c) for the area to become a national monument, with Jim White becoming the Chief Ranger. In 1930 it became a National Park; in 1995 a World Heritage Site.

As its popularity grew, thanks to articles in numerous magazines including *National Geographic*, a new Visitor's Center was built in 1932. Accessibility was the key, as two freight-sized elevators were installed. A 230 m descent provides the visitor an option of using the elevators, or taking the approximately 2 km of cave passage, exploring from the original entrance to the rendezvous point with the elevators underground. In typical U.S. fashion, a subterranean cafeteria complete with washrooms was built there. And to answer a question that likely comes to mind: fresh water is pumped from the surface and waste water returned for treatment. All this development was undertaken to provide access to what is dubbed simply as "The Big Room." More on this later.

For years Doreen has suffered a touch of claustrophobia, causing other anxieties to form. The last cave I tried to talk her into visiting was in New Braunfels, Texas, a decade ago. She lasted about five minutes. Since I had read about and seen pictures of Carlsbad, I didn't want her to miss it. I also knew about all the facilities and amenities to be had, so rather than me do the talking, I tried a different tactic.

"Hon," I said, "Before you decide on not touring this place, when we go into the Visitor Center, talk to one of the Rangers about your claustrophobia. Ask him about any amenities they might have, and what you can expect on the tour, if you decide to take it." Five minutes later, we went and bought tickets, Doreen agreeing to take the elevator down in two hours, where we would rendezvous. This gave me time to get to the Natural Entrance (Figure 12) and hike the trail. As the Park's website states (Carlsbad Caverns National Park, 2022):

The 1.25 mile (2 km) Natural Entrance Trail is extremely steep. Depending on if you decide to hike up or down, you gain or lose about 750 feet (229 m)—equivalent to walking up or down a 75-story building. The hike takes about one hour (on average) to complete. This trail is not recommended for visitors with heart or respiratory conditions.

The time suggested doesn't account for time to get to the entrance from the Visitor's Center, nor time to gawk at the features and photograph them. Tripods were not allowed, so photos took extra time.

So what was I about to enter? As per a display board in the cave: "250 million years ago (Permian) marine plants and animals built a limestone reef (Capitan Reef Complex) along the edge of an inland sea." Think of all the bryozoans, sponges, corals, brachiopods, etc. that later fossilized. In a process similar to Caverns of Sonora, some "60 million years ago hydrogen sulfide gas (from deep oil and gas deposits) and water formed sulfuric acid which dissolved cavities within the limestone." Expanding this point (from Wikipedia, 2022c):

During cavern development, it was within the groundwater zone. Deep below the limestones are petroleum reserves (part of the Mid-Continent Oil Field). At a time near the end of the Cenozoic, hydrogen sulfide (H_2S) began to seep upwards from the petroleum into the groundwater. The combination of hydrogen sulfide and oxygen from the water formed sulfuric acid: $H_2S + 2O_2 \rightleftarrows H_2SO_4$. The sulfuric acid then continued upward, aggressively dissolving the limestone deposits to form caverns. The presence of gypsum within the cave is a confirmation of the occur-

Figure 12. A twisty-windey path to the base of the Carlsbad cave entrance. Although it may appear to be wheelchair accessible, it would merit a *Seinfeld* episode if actually attempted.

Figure 13. Huge flowstone formation in Carlsbad Caverns.

rence of this process, as it is a by-product of the reaction between sulfuric acid and limestone.

Caverns formed and drained about 3 million years ago. Ceilings collapsed in places, expanding the height of the cave. The speleothems of today resulted from the slow dripping of mineral rich ground water over the eons. What surprised me was 90% of the Caverns are now considered dry, so formations will not grow beyond what we currently see; an exact opposite of the Caverns of Sonora.

I made my way to the natural entrance. The large amphitheatre is used especially at twilight to view seasonal night-flying Mexican free-tailed bats (*Tadarida brasiliensis*). Since it was broad daylight, I sat for a while to observe the hundreds of swallows which have nested in the nooks and crannies above the cave entrance. Insect life in the desert at this time of the year must be plentiful indeed. On the descent, I looked for any evidence of glyphs and saw none.

The bats roost in a restricted area of the Caverns —they take a left turn and we take a right. Guano mining took place here starting in the late 1800s, but I don't think it continued after 1923. It is a steep descent as the outside world slowly disappears and I entered the twilight zone, that area just before total darkness (now artificially lit).

I passed many stalactites and 'mites and columns before I hit a pool of water called Devil's Spring Pool. Descending even deeper into the cave, the size of the caverns became more and more apparent, especially compared to Caverns of Sonora (*e.g.* Figure 7).

The temperature at this point in the walk was also cooler, approximately 13° C, with a relative humidity of 90% year-round. A prominent feature called Whale's Head was encountered at better than halfway to my rendezvous point with Doreen. I hoped she was there, as I realized what a challenge this would be for her. Descending even further, the next encounter was the ceiling of the Green Lake Room, but

Figure 14. The two stalagmites on the left (Twin Domes) are 58 ft (18 m) tall and the column on the right touches the ceiling at 62 ft (19 m) above the elevation of the trail.

the surprise encounter was around the bend.

Venturing beyond the elevator doors, Doreen got so excited by what she saw that she decided to walk up the trail to meet me. We explored onward from this point together and I don't think I've seen a bigger smile on her face as we viewed some spectacular sights on entering the Big Room that incorporates the Hall of Giants.

As described on the website (Carlsbad Caverns National Park, 2022):

The most popular route, the Big Room, is the largest single cave chamber by volume in North America. This 1.25 mile (2 km) trail is relatively flat, and will take about 1.5 hours (on average) to walk it. Actor and comedian Will Rogers called the cavern 'The Grand Canyon with a roof over it.' You will be rewarded with spectacular views, cave formations of all shapes and sizes, and a rope ladder used by explorers in 1924 [Figure 15]. *If you are seeking a shorter experience, the Big Room has a shortcut which reduces the walking distance to about 0.6 miles (1 km). The hiking time is about 45 minutes.*

Figure 15. Access ladder of 1924. Don't think I would want to use it!

Taking photos or simply admiring the features, you can easily double the time. As a display board states, the Big Room "is estimated at more than 600,000 square feet, an area comparable to 14 football fields." As per Wikipedia (2022c):

. . . almost 4,000 ft (1,220 m) long, 625 ft (191 m) wide, and 255 ft (78 m) high at its highest point. The Big Room is the largest chamber in North America and the thirty-first largest in the world.

As we walked, almost every direction we looked we saw spectacular views of all the forms of speleothems. While writing this article, I found it very difficult to cull the approximately 500 photos I had taken just here. Even the same feature taken from different angles would yield beautiful, natural views, let alone moving along the trail to each new feature.

And then there are the giants (Figure 14). The two stalagmites are called The Twin Domes and the larger column The Giant Dome. The size of these features is hard to fathom, much like looking into the Grand Canyon. Having seen both, I can see where Will Rogers drew his analogy. These features certainly reflect the name, Hall of Giants.

Nature's shapes are everywhere. Man-made relics can also be seen (Figure 15). As per a display board:

The wire ladder below was installed in 1924 during a six-month exploration and survey sponsored by the National Geographic Society.

Built by Jim White, a cave guide, the ladder descends 90 feet into Lower Cave. Explorers felt uneasy dangling in this dark pit on the swaying ladder.

Its value established by explorers and scientists, Carlsbad Cavern became a National Monument in 1923 and a National Park in 1930.

On a piece of wall, I spotted a natural artist's work. Streaks of different colours formed by minerals cover a natural canvas, making it look like a display in the Metropolitan Museum of Art. The display is near what has been termed The Top of the Cross, the highest point of The Big Room. Nearby is evidence of nature's brush, as the pool's smooth surface is rippled by drops of water, indicating this part of the Cavern is still active.

As noted earlier, a wall of gypsum can be seen. As per the Park's display board:

The massive slab . . . in front of you is hydrated calcium sulfate or gypsum. Deposits here measure up to 15 ft. (4.6 m) thick.

How the gypsum originated is not fully known. Deposition involved a chemical reaction between surrounding rock and sulfuric acid-rich water that may have partially filled this room.

When exposed to acidic water, gypsum dissolves easily. Note the vertical holes 'drilled' by dripping water. Deposits are best preserved in dry locations.

Looping back, we encountered different views of some now familiar features and the new view of straws and draperies of the beautiful Painted Grotto (Figure 16). Doreen couldn't help but smile as we approached her starting point, as she had just experienced a new world perspective. To celebrate, we used the underground cafeteria and had our meal amidst

Figure 16. Painted Grotto

the features of the cavern walls. As per my journal entry of the following day:

I am very proud of Doreen— in fact, I pick out a pair of turquoise earrings for her as a surprise (and the traditional Xmas ornament). The earrings were the most expensive in the case—$100, but they look great. (Figure 17)

The guided tour I booked for the next morning is quite strenuous, so Doreen opted out. Parts of the Cavern are available only by guided tour, so if you decide to visit, book ahead. I just got lucky that there was a last-minute cancellation and I only needed one spot.

I arrived next morning before Park opening time, and spotted a snake slithering away from his warm-up rock. It immediately reminded me of a documentary about badgers I saw a number of years ago, that was shot in southern Alberta. The cameraman had been following one badger for weeks when, on one morning forage, the badger encountered a large rattler warming on a rock. The cameraman is heard to say that he thought the badger would detour around the snake. To his surprise, the badger immediately attacked the rattler; was bitten three times according to the footage, but managed to kill the rattler, before he laid down from the venom. The cameraman is then heard lamenting the loss of the badger and hence his documentary subject. He is still wondering what to do, when about 15 minutes later, he sees the badger stir. From that point on, he has his camera rolling. The badger gets up and eats the snake for breakfast—all caught on film! Amazing! Badgers, together with one species of gophers, have developed a tolerance to the venom. I hadn't, so I left my snake alone!

I had just enough time to go through The Big Room before joining the tour group and literally had the place to myself, with the exception of one patrolling Ranger. It is just as spectacular the second time around!

The tour started and followed a steep trail with lots of "up and down" walking involved. I'm sure it's nothing like what, the first spelunkers would have experienced! The first room is called the King's Palace. As per Wikipedia (2022c):

The first of four chambers in a wing known as the "scenic rooms," it is named for a large castle-like for-

Figure 17. The ubiquitous jewelry (silver/turquoise earrings locally made) that is a reminder of incredible travel experiences.

mation in the centre of the room.

I thought the Papoose Room deserved better coverage than Wikipedia (2022c) gave it: "Located between the King's Palace and Queen's Chamber." Perhaps it was the reddish tinges (likely from iron oxides) touching up many features that played on my mind. It was also here that I saw, at least from my perspective, Carlsbad's best bacon and most delicate drapery.

Of the Queen's Chamber, (Wikipedia, 2022c): *widely regarded as the most beautiful and scenic area of the cave. Jim White's lantern went out in this chamber while he was exploring, and he was in the dark for over half an hour.*

Fortunately for our group, the lights stayed on. The last room on the tour is the Green Lake Room. As described in Wikipedia (2022c):

The uppermost of the "Scenic Rooms," it is named for a deep, malachite-coloured pool in the corner of the room. In the early 1960s, when the military was testing the feasibility of Carlsbad Cavern as an emergency fallout shelter, the Green Lake was used to look for ripples caused by a nuclear bomb test many miles away. None appeared.

Figure 18 shows some local archaeology, a rock shelter, noted on a Park display board:

It is possible that this site has been used by many cultural groups, ranging back in time from the Mescalero Apache to prehistoric peoples.

Figure 18. Although it doesn't look like much, warmth from campfires, as evidenced from the abundant charcoal, warmed up the inhabitants sufficiently to protect them from the often freezing cold desert nights and kept away predators.

I took a short trail (200 m) to get to the shelter, coming across the odd plant description sign, including one I had never heard of. Always something new to learn.

The final cave stop (Map 1, Stop 4) is one we ran into four years after touring Carlsbad. It is a dry cave but has a link back to Carlsbad, a palaeontological twist, and a connection to the Tate Museum, our final tour stop in this article.

We had been following Route 66, a trip that has already been recounted in *The Petrified Forest National Park, Arizona More than just wood!* (*Bulletin*, June 2021) and a 10-minute talk (20 minutes, actually) on "Ashfall Fossil Beds State Historic Park Nebraska" in the "good-old pre-COVID days" of October, 2018.

"Grand Canyon Caverns" sounded different and it was—starting with a presentation at the entrance to the site (Figures 19 and 20). I didn't expect the whimsical giant dinosaur models. Each stop on Route 66 had featured something to catch the motorist's attention—nothing better than giant dinosaurs! Of course the attraction's lobby had a fossil display featuring the ubiquitous crinoids.

Inside, we found a likeness to Carlsbad—two, actually: both have elevators; and a sticker on the elevator door shows that Grand Canyon Caverns doubles as a fallout shelter. Just like Carlsbad, Grand Canyon Caverns was assessed in the 1960s for its potential use as a fallout shelter.

The uniqueness of Grand Canyon Caverns is shown in Figure 21: it doubles as a hotel. Doreen made the executive decision and we passed on this experience. I think she would have had a tough time with total darkness. The subterranean bar, some 70 m below the surface looked like an interesting "cave" feature. If we had spent some time there first, total

darkness might not have become an issue.

Right after we stepped off the elevator, a sign proclaimed a year-round temperature of 56° F (13° C).

Because it's a dry cave, there are only a few speleothems: some in an area called Snowball (featuring some cave popcorn), and another called Chapel of the Ages, "206 ft. (63 m) below surface—largest known deposit of selenite crystals." The trails are well lit and an emergency exit stairwell is in place. Survival supplies, in the event of a need for a fallout shelter, are stored in a room of the cave (Figure 22).

Figure 19. A large sized sauropod model, reminiscent of "Dinny" of Calgary Zoo fame. I'm not sure of the accuracy of the head on this model.

Our guide had indicated there would be a bit of a surprise "visitor" near the end of the tour. It turned out not to be the mummified corpse of a bobcat that had fallen into the cave circa 1850. Instead, several scratch marks on the wall, about 3 m above us, were pointed out and the critter that made them was around the bend (Figure 23). One can only imagine the last hours of this poor creature's life, having survived a fall into a pitch-dark cave and trying to claw its way out. This giant ground sloth of the last Ice Age, identified as *Glossotherium*,[1] gave itself up to the field of palaeontology.

Creatures from the end of the last Ice Age connect Grand Canyon Caverns to the Tate Geological Museum at Casper College, Casper, Wyoming (**www.caspercollege.edu/tate-geological-museum/**; Figure 24; Map 1, Stop 5; not to be confused with the Tate Museum of Modern Art in London, UK!)

From a giant ground sloth we connect with "Dee," a Columbian mammoth. (Figure 26).

We revisited the Tate on the 2013 trip, this time armed with a digital camera. I really liked the layout and variety of

Figure 20. Dino crossing with a rusty *Triceratops*! Photo by Doreen Truch.

1. This identification is suspect. The Wikipedia article on *Glossotherium* gives its range as "South America and Mexico," and further states that "It is closely related to *Paramylodon* of North America, whose specimens have often been confused with it and assigned to *Glossotherium* . . ." (Wikipedia, 2022f).

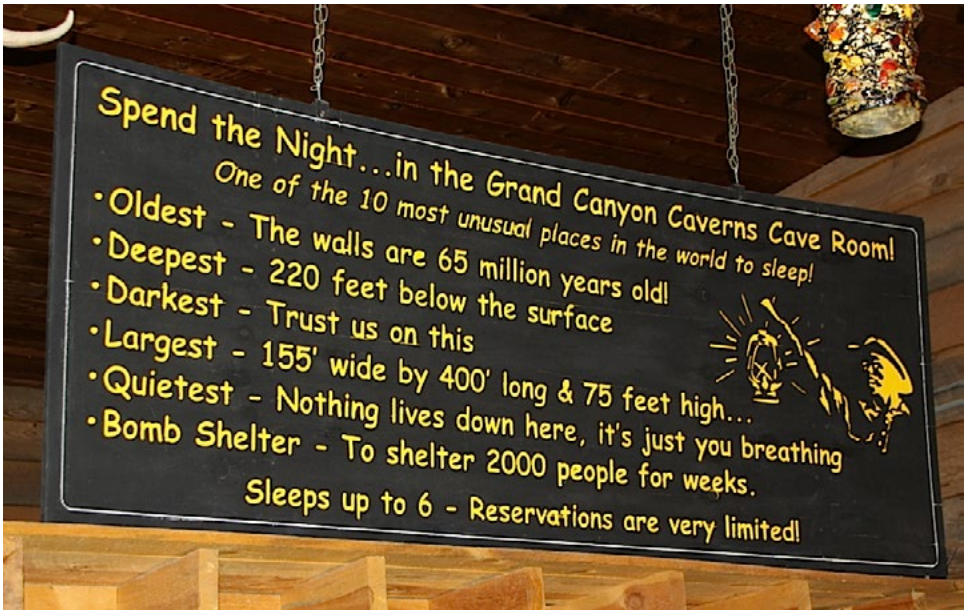

Figure 21. Sign describing the attractions of a very unique hotel.

exhibits on display at the Tate. A cast specimen was always identified as such, which is not the case in all museum displays.

Dee, of course, is the star of the Museum and the numerous display panels were modelled after a highly-rated TV show at the time, *CSI*. Three hypotheses for Dee's demise are presented to visitors and then evidence such as "Victim Analysis" (Figure 25) and a "Palaeo Lab Report" are detailed.

"Hunted by humans" was the first hypothesis offered and reference is made to the Colby Mammoth Kill Site (Worland, Wyoming), dated to the Clovis culture of 12,000 to 14,000 years ago. Had that been the case, the bits and pieces of Dee's skeleton would not have been semi-articulated, and cut marks would certainly have been evident.

A second hypothesis, "killed/scavenged by animals" falls short as there is no evidence of gnawing or teeth marks of any kind on the skeleton. Again, predators would likely have scattered parts everywhere.

The third and most likely scenario is that Dee died of "old age" or, as per a display board, "Neutralized by Nature." Further from the boards:

He was an extremely old mammoth, and had severe arthritis in his lower back, which can be seen today; the last five vertebrae (immediately in front of the pelvis) have odd looking bony growths on them.

The medical term used for these bony growths or bone spurs is spondyloarthropathy which is a type of reactive arthritis. This is a result, or side effect, of osteoarthritis. Additionally, Dee had a bone tumour (a pigmented villonodular synovitis or PVS) on his lower back, between two of his vertebral spines (the tall part of the vertebra). The PVS was an effect of old age and probably made movement uncomfortable, adding to his back pain.

Other indicators of old age include his fused radius and ulna on both front legs, which is characteristic of spondyloarthropathy. There is also evidence of spondy-

Figure 22. Emergency fallout shelter supplies.

Figure 23. Giant sloth replica at Grand Canyon Caverns.

loarthropathy on the right condylar process at the top of the jaw (where the jaw meets with the skull). This would have made it uncomfortable to chew.

Reading about this process brought back strong memories of my Zooarchaeology and Osteology courses, which, fortunately, I didn't sleep through. Lesson learned: if you can't eat properly, you could starve!

The final noteworthy indicators of Dee's advanced age were his teeth. They are his last set and are about one-third the size they would have been when they first erupted.

The fact that there was not another set of teeth in his mouth tells scientists that this was his sixth and final set. He used them until they lost their effectiveness. Dee's two upper teeth were found mixed in with his ribs and vertebrae. This odd placement and their poor preservation indicates that he may have swallowed them. If that is true, then it is safe to say, without his teeth, Dee died of starvation.

It is possible that Dee stumbled into an arroyo that was covered in snow, camouflaging it, and once in, he could not get out. Combined with his already weak state from malnutrition, he died and was eventually buried. It is also possible that he simply grew weary, laid down in the arroyo to rest and died. Either way, the arroyo sheltered his bones for the last 11,600 years.

Dee's demise was palaeontology's gain. So where was this arroyo that served as Dee's final resting place? Reading through details I discovered where, but only as I was preparing this article. It turns out that our travel story has come full circle: the arroyo where Dee was found is not too far north of Glenrock Wyoming!

The inside of Dee's tusk at the distal end looked like the cross section of a tree. There were many more panels of detailed info on Dee, ranging from his head to his toes. I wanted to present the readers with a sobering photo of Dee (Figure 26), since I had mentioned the Clovis culture earlier. Can you picture yourself standing there with a six-foot long wooden spear, tipped with a nine-inch knapped rock, with this almost 4.5 m-tall beast towering above you? Personally, I think squirrel would taste pretty good from this perspective!

Of course, there were many more interesting spec-

Figure 24. Exterior of the Tate Museum in 2013. Shrubbery around it has grown up a lot since then, judging from more recent website images.

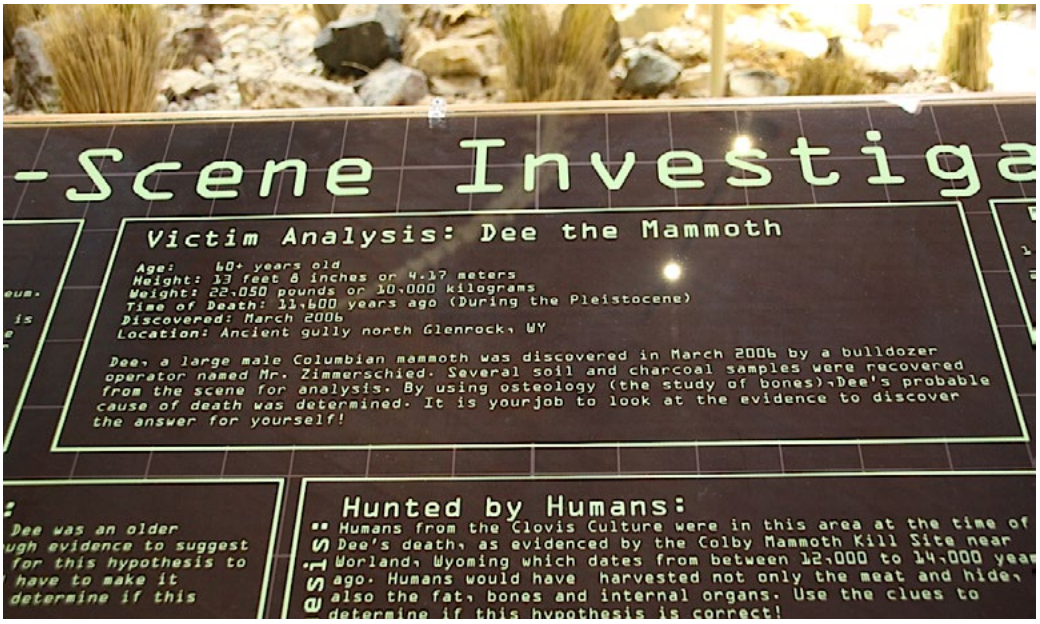

Figure 25. Victim Analysis data.

imens in the Tate, a small sample of which we will now examine, starting with Figure 27. At first glance, I thought it might be some weird sort of crocodile, but no—the teeth weren't quite right. As per a plaque descriptor:

*Ancient Whale (*Basilosaurus cetoides*). Cast.*

Basilosaurus *grew up to 20 m long. Near the end of the Eocene. 35 million years ago, it was the world's biggest animal. This predator has been found in states bordering the Gulf Coast. Age: 39 to 34 million years ago. Locality: Louisiana. Period: Eocene Epoch of the Tertiary Period. Stage: Chadronian (Priabonian).*"

Being also a mineralogical museum, many mineral specimens were to be found. There were plenty of display pieces, such as thinly-sliced Wyoming nephrite jade (Figure 28), back-lit in a light box, and donated meteorite samples, to name just a couple. It was, however, quite disconcerting to open many sample drawers where the descriptors read that you could see the samples if they hadn't been stolen. Fortunately, Palaeo pieces would be a little harder to walk out with.

There were plenty of fish fossils on display. Take the Green River Shale example of Figure 29, "*Diplomystus dentatus*—The upturned mouth indicates this fish was a surface feeder, preying on smaller fish and insects. Whole eggs of *Diplomystus* are a common find in the Green River shale," reads the description plaque.

A beautiful freshwater stingray is shown in Figure 30. "Freshwater stingray (*Heliobatis*)—Fine-grained layers deposited every year preserved the delicate details of this stingray."

Thinking back to our visit to Carlsbad Caverns and its Mexican free-tailed bats, I spot a long-lost relative of theirs (Figure 31). "*Icaronycteris index* (Fossil Bat)—This fossil bat, from 45 – 50 million years ago, was possibly a fish eater. It had a 12 inch (30 cm)

Figure 26. Up-close and personal perspective of a full-size mammoth: would you stand up to the living animal armed with nothing but a stone-age spear?

wingspan. You can still see remnants of the delicate wing membranes that were preserved along with some cartilage and bones as thin as human hair."

I had to include Figure 32 for all of us involved in the APS microfossil sorting sessions over the years. Who hasn't found a gar scale among the screened sediment? I also liked the descriptor:

Lepisosteus *(Gar). Gar are not as common as other fish in the Green River Formation, but can still be found in all of the main localities. Modern gar prefer to live in shallow weedy areas, swampy areas, and streams or rivers. This may help explain why fossil gar are more commonly found in the deltaic and stream channel deposits of Lake Uinta. These fish have long, cylindrical bodies covered with an armoured 'shell' of diamond-shaped ganoid scales. The surface of the scales is covered with a layer of ganoin, an enamel-like substance that takes on a high polish. This is what gives these fossilized scales*

Figure 27. Bearing some resemblance to a giant crocodile, *Basilosaurus*—a distant relative of today's toothed whales—reveals itself.

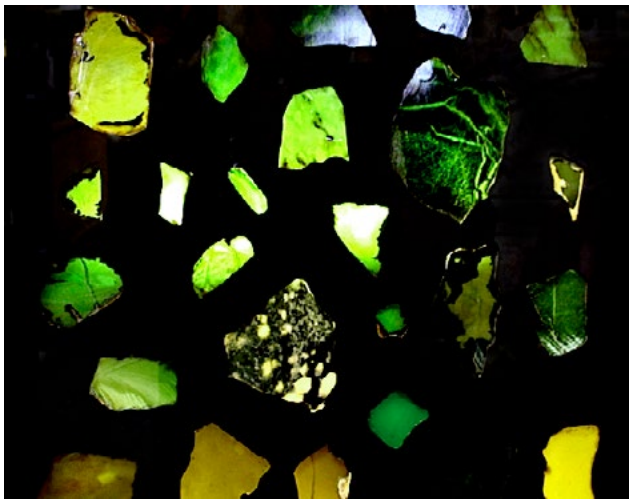

Figure 28. Display of thinly-sliced Wyoming jade specimens.

Figure 29. One of many fossil fish on display from local formations, *Diplomystus dentatus* of the Green River Shale (Eocene).

Figure 30. Incredibly preserved delicate parts of a fresh water stingray.

Figure 31. A carnivorous bat vs. the Carlsbad insectivores.

found. Scientists think that skeletons of the ancient fish were made up almost entirely of cartilage, like modern sharks. No one is sure what these buzz saw tooth whorls were for, but they have been the subject of much speculation . . .

Helicoprion *may have grown to just over 3 m (10 ft) long and would have been a formidable predator. Serrations on the teeth indicate that it was carnivorous, feeding on shelled creatures or possibly fish.*

This specimen has 131 teeth, but others have been found with up to 180 teeth. This cast was made from the species holotype (the original specimen that was used to define the species), which was found in the Arta Beds in the Ural Region of Russia in 1899. Tooth whorls have also been found in the western United States, including Wyoming.

Age: 250 to 300 million years.

Locality: Arta Beds, Ural Region, Russia.

their shiny appearance . . ."

Neither are plants ignored; fossil leaves were on display, with an emphasis on the local Wyoming flora: "Fossil palm leaf (*Sabalites*). Palm leaves found in the Fort Union Formation show that Wyoming was much warmer during the Paleocene."

Although a cast, Figure 33 was very captivating, especially as I had never seen this specimen before. Even more surprises awaited as I read the caption:

*Whorltooth Shark (*Helicoprion bessonowi*). Cast.*

These sharks first appeared in the late Carboniferous (280 million years ago) and survived until they went extinct in the early Triassic (225 million years ago). No evidence of Helicoprion *other than the strange tooth whorls, has ever been*

Figure 33. Spiral tooth battery of an ancient shark, *Helicoprion*.

Figure 32. A humble gar fish scale, familiar to Alberta fossil hunters, achieves glory on display at the Tate Museum.

Period : Permian Period.

Of course, we can't leave the Tate palaeontology specimens without mentioning the ubiquitous crinoid (*Gilbertsocrinus dispansus*) which is featured in a 3D cast as seen in Figure 34. We will, however, leave the specimens with yet another critter I had never run across before, as seen in Figure 35, "Twinkle Toes," (*Merycoidodon culbertsoni*):

This specimen is an oreodont, and lived during the early Oligocene Epoch. Four toed, hoofed mammals, oreodonts are distantly related to camels, but make

up their own family, due to their dissimilarities with other hoofed animals. These herbivores had four large caniform teeth in their strong jaws for chewing and processing plant material. Oreodont fossils are commonly found in the White River Formation here in Wyoming.

Age: 38 to 23 million years. Locality: White River Formation near Douglas Wyoming. Period: Oligocene Epoch of the Tertiary Period.

Figure 34. The ubiquitous crinoid.

Yet another new art form, at least to me—Copper Splash—presented itself at the Tate. As described on a plaque:

Molten metal in its raw form.

This Coppersplash is a by-product of the copper smelting process. As the molten copper is being poured into molds, it spills, drips and splashes on the mould and floor, allowing these unique shapes to be formed. The cooled copper is then heated with a torch to create vibrant color patterns.

I found and bought a unique, critter-shaped one which later hung on my den wall, a daily reminder of the incredible sights at the Tate. When Doreen wears her earrings from Carlsbad, it further reminds me of all the beautiful sights we were able to share with you, the reader.

Figure 35. "Twinkle Toes," an extinct oreodont mammal, *Merycoidodon culbertsoni*.

And so our short story made long is coming to a close. Due to my ALS affliction, rather than presenting "10 minute" presentations, I find combining them into an article/photo mode the easiest way to try and contribute to our Society. This article is probably worth three or more "10 minute presentations." Once again, I'm indebted to Howard Allen for his fine editorial work on this article, so many thanks are due him. Any errors or omissions are strictly mine. May you all fulfill your Bucket Lists!

Enjoy more of Pete Truch's photos from this article at **https://tinyurl.com/36wkb984**

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_____ 2022g. Helictite. **https://en.wikipedia.org/wiki/Helictite**

_____ 2022h. *Nanosaurus*. **https://en.wikipedia.org/wiki/Nanosaurus**

❑

2022 Field Trips

Bugs, Bones and Brachiopods!

By Keith Mychaluk

Have the winter blues? Sick of the pandemic and want to get outside to enjoy fresh air, wide open spaces and view amazing fossils in the field?

This is a common reason to be involved in palaeontology and we are planning a diverse array of trips that should have something for everyone.

First, the disappointing news. We had hoped to travel cross-border this year to Kemmerer, Wyoming but that seems too optimistic and we'll push that idea off once again. Similarly for our plan to visit the Devil's Coulee, Alberta dinosaur egg-site; both field and museum restrictions make that trip impossible for this year.

Now the good news! We are blessed with a tremendous array of fossil localities in Alberta so let's talk about what we can do! For June we will revisit the Grassy Lake (Taber) insects-in-amber locality (**Dr. Ryan Mckellar** spoke on this topic at our March Symposium). For July we have a double treat; a tour to an active quarry excavation of a hadrosaur near Morrin, Alberta, coupled with a look at the Cretaceous-Paleogene boundary near Dry Island Park. Our August trip will take us to into K-country near Bragg Creek to view the classic invertebrate fossil sites in Canyon Creek/Moose Mountain. Finally, **Tako Koning** will once again offer his walking tour of fossiliferous Tyndall building stone within Calgary.

We feel these trips can be properly conducted obeying current physical distancing guidelines. Please watch the *Bulletin* for further updates as these plans may change. **Remember, you have to be a member to participate in a Society field trip.**

Trip 2022-1, June 25, 2022
Grassy Lake coal mine, Grassy Lake, Alberta

Last visited by the APS in 2010, we will venture out to this abandoned coal strip mine that contains fragments of amber scattered about the mine dumps. We all know how the wind blows in southern Alberta and that is constantly exposing new pieces of amber from the coal. Some of these small pieces contain entrapped insects from the Cretaceous. Located on a provincial government grazing lease with easy road access and a short, level walk, we should be able to spread out and find lots of material to inspect later under magnification. We will be encouraging participants to share their discoveries with **Dr. Ryan Mckellar** of the Royal Saskatchewan Museum for further analysis. Grassy Lake is a small town east of Taber and about a 3 hour drive from Calgary. There is a municipal campground in Grassy Lake, within an hour of both Lethbridge and Medicine Hat. This is a single day trip. Note the **registration deadline is June 1**.

Trip 2022-2, July 9 and 10, 2022
Morrin Bridge & Huxley, Alberta

Mark Powers and **Dr. Greg Funston** of the University of Alberta have been actively studying the Horsehoe Canyon Formation near Morrin Bridge, upstream of Drumheller, for the past several years. They are advancing our knowledge of this classic field area. Mark will guide us on a tour of an active quarry for a hadrosaur dinosaur and other sites of interest in the immediate area.

On the following day, **Tako Koning** will lead us to the famous Cretaceous-Paleogene boundary ("K/Pg," formerly the "K/T" boundary) site on Knudsen's farm. This site is located a short distance eastward of the hamlet of Huxley near the west side of the Red Deer River valley and just south of Dry Island Provincial Park. The boundary marks the end of the dinosaurs and this particular site has contributed materially to our knowledge of what happened to the world at that time. July in the badlands can be HOT and these hikes are through rugged terrain. Morrin Bridge is about 1 hour 45 mins from Calgary with plenty of camping and motel options nearby. The drive to Knudsen's farm is another hour further north. The **registration deadline is July 1**.

Trip 2022-3, August 20, 2022
Canyon Creek-Moose Mountain, Alberta

The mountains west of Calgary expose fossiliferous rocks from the Mississippian and Jurassic periods, full of corals, brachiopods, bryozoans, crinoids and ammonites along with rare trilobites and plant roots! Moose Mountain is actually a dome structure which pushes up the beds exposing these rocks—and creating a trap for natural gas, which literally seeps from the mountain and has been tapped by the oil & gas industry for production. In the past this was a very popular day-use area but due to safety concerns the private road access is now restricted. We hope to gain vehicle access for our group; otherwise it will be a long walk to the productive localities. About a one hour drive from Calgary, this is a single day trip. The **registration deadline is August 1**.

Trip 2022-4, September 10, 2022
Tyndall building stone tour, Calgary, Alberta

Once again, **Tako Koning** has agreed to conduct his popular tour of Calgary buildings and structures adorned in Ordovician-aged Red River Formation limestone originally quarried in Tyndall, Manitoba. See impressively preserved fossils of corals, gastropods, orthocones and even algae at Calgary landmarks like the historic Bank of Montreal building. This will be a walking tour of several buildings in downtown Calgary, the community of Kensington and the SAIT campus and is suitable for all ages. **Registration deadline is September 1**.

For more information please contact Keith Mychaluk at (403) 809-3211 or by email at fieldtrips@albertapaleo.org. A field trip registration form is included with this issue of the *Bulletin* and is available on the APS website (**www.albertapaleo.org/fieldtrips.html**). All fees are due at the time of registration. Fees for trips are $10.00. **Non-members and unaccompanied minors will not be allowed to attend field trips**. All participants are required to have their membership in good standing. Any membership applications received after May 1, 2022 will not be reviewed and voted on by the Board of Directors until September, 2022. Therefore, if you are a non-member and would like to join be sure your application is received prior to May 1, 2022.

All participants will be required to read and sign a release form (waiver). Detailed information will be provided to all those registered shortly after the registration deadline. After the registration deadline no refunds will be given; however, you will receive the field guide for the trip. Registrations are accepted on a first-come-first-served basis, so sign up early to avoid disappointment. For the 2022 field trips I will be sending you the waiver and medical forms along with the trip information. This information will be sent to you via email or Canada Post. Please ensure that your address is correct and legible when sending in registration forms. When you arrive at the meeting place please have all the forms completed. All participants are required to have fully completed the waiver and medical forms in order to attend the trip. **There will be no exceptions**. All personal information is held in confidence and ultimately destroyed.

Trip Participant Responsibilities

It is understood that risk is inherent to some degree in outdoor activities. Before registering for a trip 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.
- Inform the trip leader of any medical conditions they should be aware of in an emergency.
- Ensure that your previous experience, ability and fitness level are adequate for the trip. ❑

Thank you!

Thanks to **Peter Meyer** for including a financial donation with his annual dues to help defray *Bulletin* production costs.

Thanks to **Harvey Negrich** for his time and efforts in transporting, temporarily storing, documenting and saw-trimming specimens in a collection donated by former member **Boris Markhasin**, whom we thank for the donation! ❑

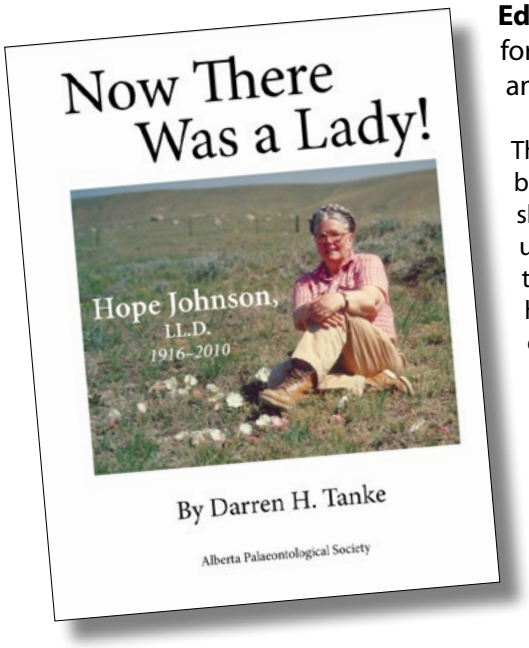
Free online talks

Alberta's two major palaeontology museums offer online palaeo talks by scientists on a wide range of topics. For **The Philip J. Currie Dinosaur Museum**'s *Virtual Speaker Series*, visit **https://dinomuseum.ca/events/virtual-speaker-series/**. The **Royal Tyrrell Museum**'s *RTMP From Home* page links to a large collection of YouTube videos: **https://tyrrellmuseum.com/whats_on/rtmp_from_home** ❑

Now There Was a Lady!

Hope Johnson, LL.D. 1916–2010

By Darren H. Tanke



Edited and published by the Alberta Palaeontological Society with forewords by palaeontologist Dr. Philip J. Currie, artist Allan C.J. Jensen and geologist, museologist, naturalist and writer, David A.E. Spalding.

The 2010 passing of Hope Johnson marked the end of an era for Alberta's vertebrate palaeontology communities. Her death affected other disciplines, too, as she travelled in many circles within the province for 65 years. How many among us can truly say they never knew her personally, saw her art work, or learned to identify Alberta prairie plants, or Late Cretaceous bones and teeth through her fossil identification books? During much of her middle and later life, and especially during the late 1950s to 1980s, Hope was a well-known and respected powerhouse in the Albertan amateur and professional vertebrate palaeontological communities. She was also heavily involved in the naturalist and visual arts communities as well as charitable organizations. This book focuses on her extensive activities in Alberta vertebrate palaeontology and provides examples of some of her fossil and botanical drawings and paintings.

Coil bound, 283 pages; extensively illustrated in black and white, with 30-page colour section showcasing Hope Johnson's art. Includes index.
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Guide to Common Vertebrate Fossils from the Cretaceous of Alberta

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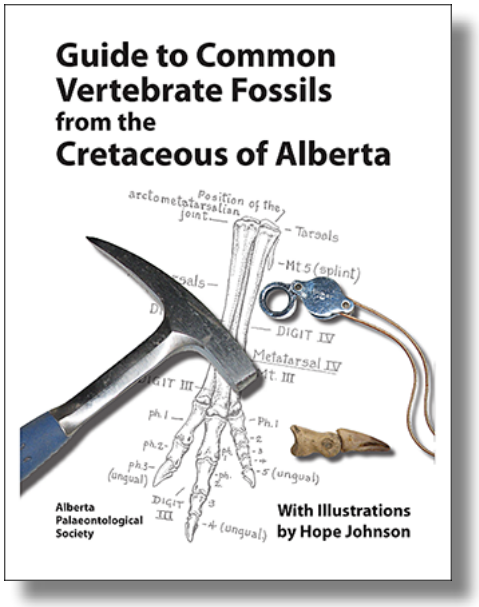
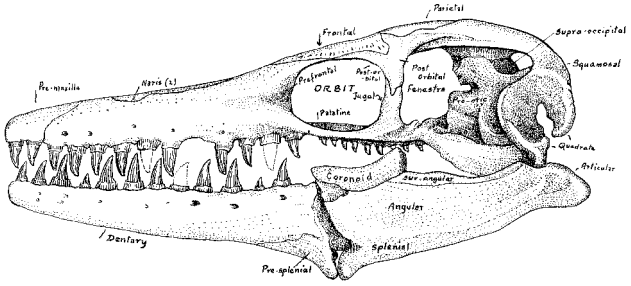


Hope Johnson's illustrations are the inspiration for this publication. Her passion for nature and contributions to the science of palaeontology have brought Alberta's natural history to life.



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