

# The FOSSILETTER

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November 2020

## November Meeting

The November Fossil section meeting is on Tuesday, November 10, at 7:30 PM. This meeting will be conducted as a virtual meeting on Zoom. Details on how to login in to this Zoom Session are in the accompanying email.

Our speaker this month is Danielle Dufault, research assistant and scientific illustrator at the Royal Ontario Museum in Toronto. She will be speaking on "**Artwork in the Service of Science**".



Danielle Dufault in the field in Alberta (courtesy PBS)

Danielle is a professional artist and has a Bachelor of Technical and Scientific Illustration degree from Sheridan College Institute of Technology and Advanced Learning. At the Royal Ontario Museum, she is the Research Assistant and Scientific Illustrator in Dr. David Evans' lab for Vertebrate Paleontology and Evolution, and also works closely with the curator of Invertebrate Paleontology, Dr. Jean-Bernard Caron. With Dr. Evans, she works on the colossal Cretaceous era dinosaurs, and for Dr. Caron, she delves deep into

the faunal cornucopia of the ROM's amazing Burgess Shale collections. She has provided both technical illustrations and life reconstruction artwork for many of their recent papers, and collaborates on dinosaur research with the University of Alberta and the Royal British Columbia Museum. From the minuscule to the massive, you will hear about her work with lifeforms from across time.

Danielle is a co-author on the recent paper, "First case of osteosarcoma in a dinosaur: a multimodal diagnosis" published August 1, 2020 in *The Lancet Oncology*. She is also fascinated with unusual modern animals and hosts the weekly webcast on YouTube, *Animalogic, your field guide to the animal kingdom* (I especially like the episode at [youtube.com/watch?v=eXBkmlzBHZk](https://youtube.com/watch?v=eXBkmlzBHZk) on tardigrades from December 21, 2018). Emily Graslie featured her in week 2 of the recent PBS 3-part series, *Prehistoric Road Trip* (clips of her at [interactive.wttw.com/prehistoric-road-trip/detours/meet-the-rock-stars-of-paleontology-and-geology](https://interactive.wttw.com/prehistoric-road-trip/detours/meet-the-rock-stars-of-paleontology-and-geology)), at the site of a *Triceratops* skull which she had found while working on David Evans' team in the Hell Creek formation of southern Alberta. You can also see more of Danielle's art work at [ddufault.com/](https://ddufault.com/).

## President's Report by Dan Krisher

The Section held its October meeting on 10/6. The business portion of the meeting consisted of an update on how meetings will be handled until the "All Clear" is issued by the Brighton Townhall, a rundown on the slate of speakers for the season, and finally an update on the possible Science Olympiad in March. The speakers for the meeting were Bill and Kris Parsons who updated us on their ongoing work in the Early Cretaceous of Montana.

## December 1st Meeting

Unfortunately, we cannot hold our usual Show & Tell Pizza Party. The good news is that we have an outstanding speaker lined up in Dr. D. Jeffrey Over of SUNY Geneseo. He will be speaking on “*Devonian Mass Extinctions in New York.*” He has been working on a monograph with Carleton Brett (University of Cincinnati) and Gordon Baird (SUNY Fredonia) updating our knowledge of the Devonian strata of New York, Ohio, and the surrounding area.

## Annual Larry King Memorial Lecture

The annual Larry King Memorial Lecture was announced in the November RAS Bulletin and will be on the “Origin and Evolution of Dogs”. You should expect to hear about some Pleistocene paleontology on a subject close to home for many of us.

Our speaker is Dr. Abby Grace Drake from the Department of Ecology and Evolutionary Biology at Cornell University. She studies evolution in skull shape in canids, cetaceans (whales & dolphins), and other animals. She has worked extensively on dog origins, beginning with her Ph.D. thesis, and will speak to us on their evolution. This will be a virtual lecture on ZOOM on November 24th at 7:30PM.

Preregistration for this talk is required. Write to Michael Grenier at [paleo@frontier.com](mailto:paleo@frontier.com).



Dr. Drake

## Fossil News

The Middle Cambrian Burgess Shale (~508 MYA), discovered by Smithsonian paleontologist Charles Walcott in 1909 near the town of Field in

the Canadian Rockies of British Columbia, is world-famous for the exquisite preservation of soft bodied animals and plants. Excavating the site between 1910 and 1924, he amassed over 65,000 specimens which were placed into the Smithsonian Natural History Museum's collection. Working until his death in 1927, he published numerous papers on the unusual fossils. In 1930 Harvard professor of geology Percy Raymond re-excavated the Walcott Quarry and opened a new quarry about 20 meters higher. Raymond's extensive collections are now in Harvard Museum of Comparative Zoology.

In 1966 and 1967, the Canadian Geological Survey, realizing that these spectacular Canadian fossils were principally in American collections, collected specimens for Canadian museums, principally the Royal Ontario Museum (ROM) in Toronto. Collections continued to be made by the ROM in additional outcrops found near the Walcott Quarry. A major new find of fossilized Cambrian soft-bodied organisms was announced in 2014 at a nearby Kootenay National Park Marble Canyon site. Although of the same approximate age, many of the specimens are species not found in the Burgess Shale. Most of the recent ROM papers on new species have been based largely on Marble Canyon material.

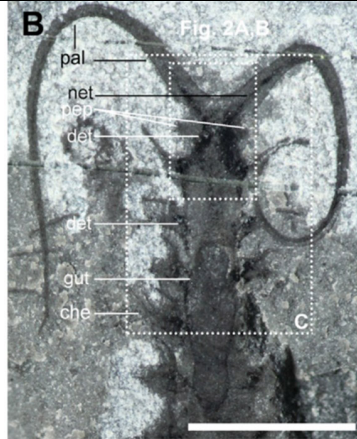
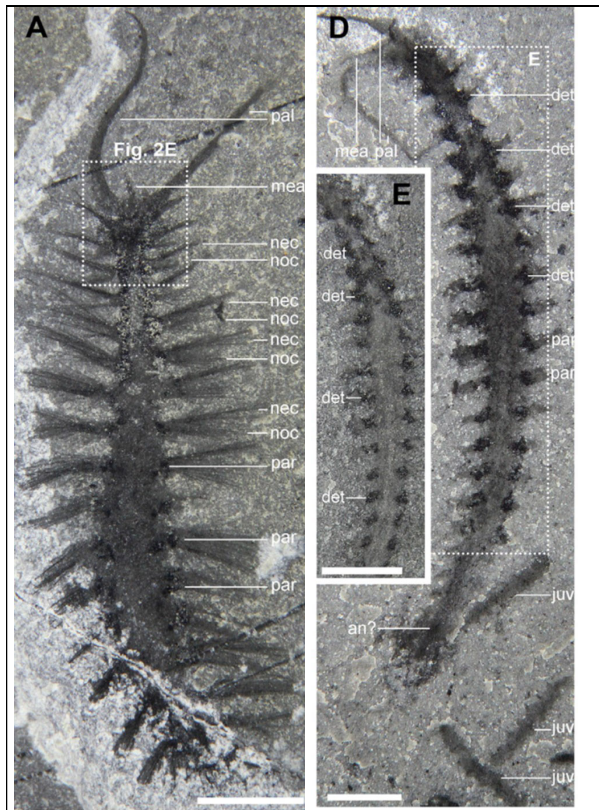
### *A New Burgess Shale Bristleworm*

There have been two more-recent papers by the paleontology team at the Royal Ontario Museum, but I wanted to feature this paper because it includes a delightful in-life reconstruction by this month's speaker, Danielle Dufault.

Bristleworm is the common name for the class Polychaeta in the phylum Annelida (annelid, ringed or segmented worms). These are mostly marine (with some rare freshwater species). Those that do salt water fishing frequently use “bloodworms”—a polychaete worm—as bait. The scientific term for the chitinous bristles is “chaetae” and they have many (“poly”).



Bloodworm, genus Glycera (from [allaboutworms.com](http://allaboutworms.com))



All images are oriented with anterior directed to the top of the page and were taken using cross-polarized light. (Acronyms: an?, anus?; che, chaetae; det, degraded tissue; gin, gut infill; gut, gut; juv, juvenile; mot, mouth; nec,

neurochaetae; nep, neuropodia; net, neural tissue; noc, notochaetae; nop, notopodia; mea, median antenna; pal, palp; par, parapodia; pco, prostomial coelom; pep, peristomial parapodia; pec, peristomial chaetae; pro, prostomium. Scale bars, 1 mm. (A) Holotype (ROMIP64388): nearly complete specimen (posterior missing) showing well-preserved palps, median antenna, and chaetae. (B) Paratype (ROMIP64389): anterior section showing well-preserved internal head features and sediment infill within the gut. A thin carbon line running from the front of the head to the palps represents putative neural tissues. (D and E) Paratype (ROMIP64390): paratype alongside putative *K. barbarensis* juvenile specimens (D); detail showing parapodia preserved in darker black (E).

In this paper, Ph.D. candidate Karma Nanglu with advisor Dr. Jean-Bernard Caron described an exceptionally well-preserved new fossil species of bristle worm they have named *Kootenayscolex barbarensis*. The study was based on 515 specimens from the Marble Canyon Quarry in Kootenay National Park, including the holotype ROMIP64388 reproduced next page. Eight other specimens come from the Walcott Quarry in Yoho National Park. These latter had previously been referred to as "*Burgessochaeta cf. setigera*".



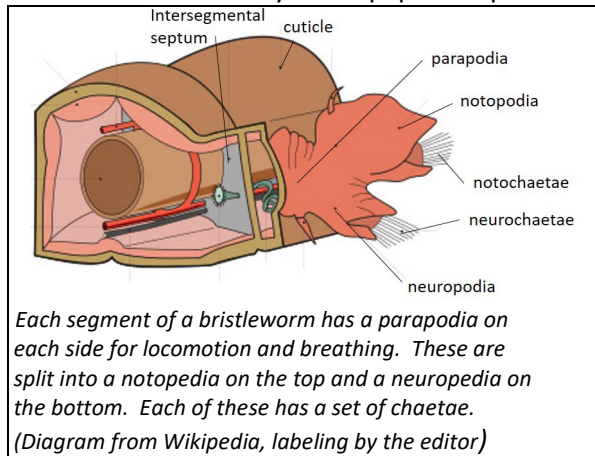
Life reconstruction of *Kootenayscolex barbarensis*. Image © Royal Ontario Museum, Danielle Dufault.

Specimens display a wide range of burial angles consistent with being engulfed in fast-moving bottom mudflow deposits and enabling three-dimensional recreation. Parapodia (legs) are identical in morphology on all segments and are large relative to the body width. All chaetae are of the simple capillary type, and notochaetae (upper) and neurochaetae (lower) are of similar morphology and length. They are extremely fine in comparison with other Burgess Shale polychaetes. The presence of a median antenna and the elongate sensory palps both suggest an active lifestyle. Like the majority of Cambrian forms, *K. barbarensis* was most likely an epibenthic (ocean floor surface) deposit feeder (supported by gut infills) that used its notochaetae for defense.

The phylogenetic analysis shows that *K. barbarensis* and the Cambrian taxa *Burgessochaeta setigera*, *Phragmochaeta canicularis*, and *Canadia spinosa* fall into a stem-group position to modern annelids, which one would expect. The Cambrian forms are anatomically simpler than most modern

forms in terms of body regionalization and specialization of chaetae.

Following is a diagram to help you with some of the unfamiliar anatomy in the paper's captions.



If you are not interested in the evolution of annelids, please admire the artwork and the spectacular detail in the preservation of these amazing fossils.

If you are interested, the paper is important in presenting two new theories on how the head of annelids originated, based on these fossils and those of other Burgess Shale/Marble Canyon annelids, although the fossils do not demonstrate this evolution. In the fossils, it is apparent from the chaetae on the head that the head segment is formed by the original head fusing with the first segment behind it. There is more than one way for this to happen and the theories take modern annelid embryonic and juvenile changes into account. For more detail (and a lot more fossil photos), you can get a copy of this paper from the editor. (Nanglu, K. and Caron, J.B., 2018. **A new Burgess Shale polychaete and the origin of the annelid head revisited.** *Current Biology*, 28(2), pp.319-326.)

### ***Origins and genetic legacy of prehistoric dogs***

Although there is little consensus regarding when, where, and how many times domestication took place, the archaeological record attests to a long-term and close relationship to humans. There is no consensus yet because every study seems to give a different answer.

For example, a SUNY Stony Brook team published a 2017 study noting that they analyzed

the DNA of two prehistoric dogs from Germany, and concluded that there was a single domestication event of modern dogs from a population of gray wolves that occurred between 20,000 and 40,000 years ago. Others note the differences between dogs and modern wolves genetically and postulate that the dog ancestor was a smaller now extinct wolf. Others find that dogs were first domesticated in Central Asia, or in East Asia, or in Western Europe. Another genetic study shows that dogs were domesticated twice, once in China and once in western Siberia or Europe, with the latter becoming extinct, though first breeding with the introduced China dogs. When looking at origin, researchers propose a number of distinct times from 10,000 years ago to 40,000.

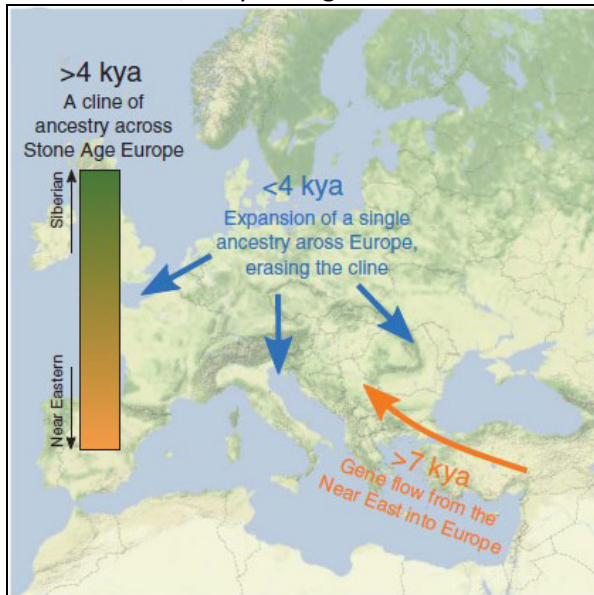
Our Larry King Memorial Lecture speaker in November, Dr. Abby Grace Drake, researched two putative dog fossil skulls (Goyet dated 31,680 years ago+/-; Eliseevichi MAE 447/5298 dated 13,905+/-) in 2015, and used 3D geometric morphometric analyses to compare the cranial morphology confirming new genetic studies, finding that both these specimens were wolves not dogs.

So, having forewarned you, here are the results from the latest paper, published just this past October 29th. In this study, led by Dr. Anders Bergström of the Francis Crick Institute, the research team sequenced ancient DNA from 27 dogs, some of which lived up to 10,900 years ago, across Europe, the Near East and Siberia. Until now, all prior studies relied on some of only six ancient dog and wolf genomes. The results—by about 11,000 years ago there were already at least five different types of dog with distinct genetic ancestries. These were Neolithic Levant, Mesolithic Karelia, Mesolithic Baikal, ancient America, and New Guinea singing dog.

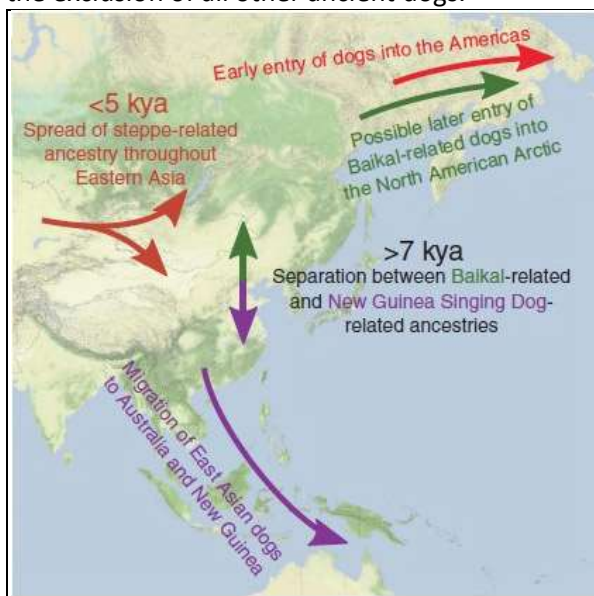
They report that all ancient and modern European dogs have greater affinity to eastern dog ancestry than to ancient Near Eastern dogs, suggesting that the history of Mesolithic and Neolithic European dogs was marked by a major mixing episode. Only one model fits the data, and features the Mesolithic Karelian dog (10,900 ago) as having received part of its ancestry from a lineage related to eastern dogs and part from the

Levantine lineage. The model can be extended to feature the earliest Neolithic European dog (7,000 ago) as a mixture of the Karelian and the Levantine branches supporting the dual ancestry model for European dogs.

However, the gene flow was likely largely one way from dogs into wolves, as they find wolves with dog genes but not dogs with wolf genes newer than 11,000 years ago.

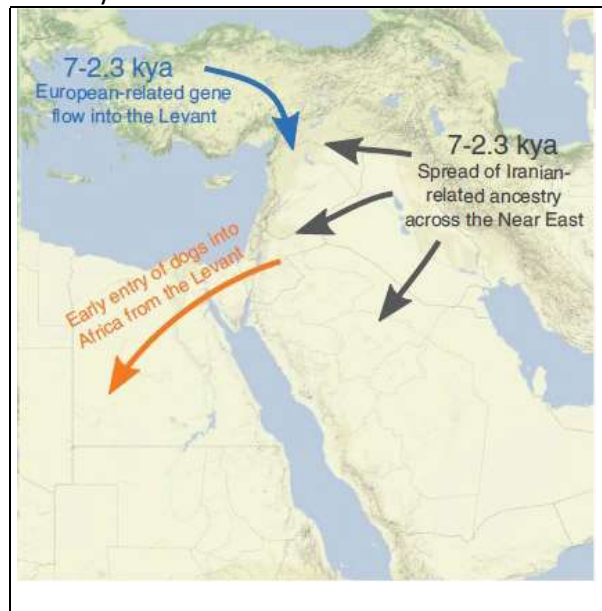


They found that a single dog from a Neolithic site dated to 5,000 ago at the Frälssegården site in southwestern Sweden accounts for 90 to 100% of the ancestry of most modern European dogs, to the exclusion of all other ancient dogs.



A second example is that all European dogs have a stronger affinity toward American and Siberian dogs than they have to New Guinea singing dogs, which likely represent a type of unmixed East Asian dog ancestry. This reflects a circumpolar affinity between humans in Europe and the America. Thus, shared circumpolar ancestry through northern Eurasia is an important feature of both human and dog population structures, though this likely did not result from the same migration episodes.

Their results suggest a single origin of sub-Saharan African dogs from a Levant-related source, with limited gene flow from outside the continent until the past few hundred years. In contrast to Africa, the 7-ka-old Neolithic Levantine population does not appear to have contributed much, if any, ancestry to present-day dogs in the Near East. Instead, 2,300-old dogs in the Levant can be modeled as having 81% Iran-related and 19% Neolithic Europe-related ancestry.



This paper, (Bergström, A., et al. 2020. **Origins and genetic legacy of prehistoric dogs.** *Science*, 370(6516), pp.557-564.) can be downloaded from *Science*: <https://science.sciencemag.org/content/370/6516/557/tab-pdf>

## CALENDAR OF EVENTS

### November

**Tuesday November 10 (NOTE 2<sup>nd</sup> Tuesday, not 1<sup>st</sup> Tuesday, due to election), FOSSIL MEETING 7:30 PM Virtual Meeting on Zoom.** Speaker: Danielle Dufault, Research Associate and Staff Artist at the Royal Ontario Museum on “**Art Work in the Service of Science.**” RAS members and guests welcome. Contact Michael Grenier at [paleo@frontier.com](mailto:paleo@frontier.com).

**Tuesday November 24, RAS ANNUAL LARRY KING MEMORIAL LECTURE 7:30 PM Virtual Meeting on Zoom. Advance registration required.** Speaker: Dr. Abby Grace Drake from the Department of Ecology and Evolutionary Biology at Cornell University on “**Origin and Evolution of Dogs.**” RAS members and guests welcome. Contact Michael Grenier at [paleo@frontier.com](mailto:paleo@frontier.com).

### December

**Tuesday December 1, FOSSIL MEETING 7:30 PM Virtual Meeting on Zoom.** Speaker: Dr. D. Jeffrey Over of SUNY Geneseo on “**Devonian Mass Extinctions in New York.**” RAS members and guests welcome. Contact Michael Grenier at [paleo@frontier.com](mailto:paleo@frontier.com).

For more information and the latest updates check the RAS Website ([www.RASNY.org](http://www.RASNY.org)). You can also contact Dan Krisher at [DLKFossil@gmail.com](mailto:DLKFossil@gmail.com) or John Handley at [jhandley@rochester.rr.com](mailto:jhandley@rochester.rr.com) for further information.

### ROCHESTER ACADEMY OF SCIENCE FOSSIL SECTION

Monthly meetings will be held on Zoom until at least February 2021. Meetings are held the first Tuesday of each month from October to December and from March to May at 7:30 pm. In person meetings, when they can be held again, are at the Brighton Town Hall, Community Meeting Room, 2300 Elmwood Avenue, Rochester, NY unless otherwise listed.

#### OFFICERS

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#### APPOINTED POSITIONS

Field Trip Coordinator: Dan Krisher	585-293-9033	DLKFossil@gmail.com
FossilLetter Editor: Michael Grenier	585-671-8738	mgrenier@paleo.com

The FossilLetter is published before each meeting month of the year. Please send submissions to [mgrenier@frontiernet.net](mailto:mgrenier@frontiernet.net), or by U.S. Postal Service mail to 692 Maple Drive, Webster, NY 14580. Deadline for submissions to the FossilLetter is the 15<sup>th</sup> of the month.

For scheduling changes and the latest updates please check the RAS Website ([www.rasny.org](http://www.rasny.org)) and click on the Fossil Section link. Last minute updates can also be found on the *General Announcements* page of the Academy Website.



Wapta Mountain, just north of Burgess Shale site, overlooking Yoho Lake in Yoho National Park, British Columbia