Saskatchewan Geological Society Lecture

Wednesday, May 24, 2017

LIFE BEFORE IMPACT: PALEOBIODIVERSITY DYNAMICS IMMEDIATELY PRIOR TO THE END-CRETACEOUS MASS EXTINCTION IN CENTRAL CANADA

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Artful Dodger, 1631 – 11th Avenue, Regina

Lunch: 11:45 am

Meeting Talk: 12:15 to ~1:00 pm

For lunch, the cost is:

S.G.S Members: $15.00

Student Members: $5.00

Non-members: $20.00

For those members not having lunch, the talk is free.

Please contact Mike Thomas at mike.thomas@sasktel.net or 306-457-7002 by 12:00 pm, Monday, May 22 if you plan on having lunch.

ABSTRACT

LIFE BEFORE IMPACT: PALEOBIODIVERSITY DYNAMICS IMMEDIATELY PRIOR TO THE END-CRETACEOUS MASS EXTINCTION IN CENTRAL CANADA

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Paleomacroecology, the study of large-scale ecological patterns in the fossil record, is an important interface between neobiology and paleontology. Research in this field seeks to resolve biodiversity patterns in the fossil record, and applies modern biodiversity theory to understand the processes that created these patterns on geologic timescales. Studies of this nature become critical when assessing the ecological response to large-scale biological disturbances such as mass extinctions. The fine-scale, multidisciplinary studies we are currently undertaking in southern Saskatchewan's latest Maastrichtian (66Ma) Frenchman Formation explore these paleobiodiversity trends. The formation preserves a complete and continuous record of terrestrial vertebrate ecosystems in the half-million years prior to the end-Cretaceous mass extinction event.

Data collected from 31 lithostratigraphic sections in study area of Grasslands National Park's (GNP) East Block were used to designate seven lithostratigraphic units, each of which represents a discrete period of geologic time. Paleoclimate estimates were derived from x-ray florescence analysis of paleosol samples collected from two of the stratigraphic sections. No significant temporal trends in mean annual temperature or precipitation were recovered, although other sedimentological indicators (e.g. bauxite deposits) imply that small-scale or seasonal climate fluctuations did occur. A second set of paleoclimate estimates was derived from plant macrofossil (leaf) physiogamy found in two Frenchman Formation paleofloral sites, one from GNP and the other from Chambery Coulee, 200km to the northwest. When the Climate Leaf

Analysis Multivariate Program (CLAMP) was applied to the two fossil leaf assemblages, the resulting climate estimates were not significantly different from those derived from the paleosol analyses. Based on the presence of inertinite (fossil charcoal) in one of the paleofloral sites, the marked disparity in floral diversity between the two sites was suggested to be reflective of secondary ecological succession following a disturbance by fire.
Fossil material collected from 38 vertebrate microsites in GNP, comprising of some 7800 specimens, was used to quantify biodiversity trends across time. Fossils were collected, along with the lithostratigraphic information necessary to place them in a chronological context, and were sorted, identified and catalogued. Temporal variations in alpha (within-site) and beta (among-site) diversities were explored. This study found that, 1) overall alpha diversity was relatively stable prior to the mass extinction, although two sudden, temporally distinct declines were detected, 2) temporal diversity trends varied among different vertebrate groups (fish, turtles and dinosaurs), 3) faunal turnovers in certain groups were indicative of changing environmental conditions not directly linked to climate, and 4) local factors were just as important in creating paleobiodiversity patterns as regional or global drivers. These results have important implications for our understanding of the timing and cause of the Cretaceous mass extinction on local scales, and demonstrate the benefits of assessing paleodiversity patterns on multiple ecological levels.

Emily Bamforth - Biography

Dr. Emily Bamforth is a vertebrate paleontologist with the Royal Saskatchewan Museum. She works primarily out of the RSM's T. rex Discovery centre in Eastend, SK, where she currently lives. The Royal Saskatchewan Museum's (RSM) vertebrate palaeontology is the only vertebrate palaeontology research program in the province. Although the T. rex Discovery Centre is open only seasonally to the public, the work in the vert palaeontology lab there goes on year-round. Dr. Bamforth's research in Eastend focuses mainly on palaeoecology, which involves studying plant and animals fossils, as well as geology, to understand ancient ecosystems.

Dr. Bamforth received a BSC in evolutionary biology from the University of Alberta in 2005, with an undergraduate thesis that involved 38 million-year-old fossil snake hibernacula from Wyoming. She went on to do a MSc in Precambrain Invertebrate Paleontology at Queens University with Dr. Guy Narbonne, exploring Ediacaran taphonomy and paleoecology at Mistaken Point in Newfoundland. In 2008, she began her PhD at McGill University under the supervision of Dr. Hans Larsson, exploring pre-extinction biodiversity trends immediately prior to the K-Pg extinction in Saskatchewan. She received her doctorate in 2014, the same year she began working for the Royal Saskatchewan Museum. Dr. Bamforth has published several papers and numerous conference abstracts of Ediacaran and Cretaceous paleontology. She was a recipient of an NSERC CGS-D Scholarship, as well as a two-time winner of the Geological Association of Canada - Paleontology Division's Thomas E. Bolton Best Student Paper award.