THE BRODIE CLUB

Established 1921

Website: http://thebrodieclub.eeb.utoronto.ca/

THE 1,073rd MEETING OF THE BRODIE CLUB

The 1,073rd meeting of the Brodie Club was held on Tuesday, 18 March, 2014 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Hugh Currie
Meeting Secretary: Ed Addison
Editing Secretary: Ricky Dunn

The meeting was called to order at 7:35 pm and was attended by 36; 26 members and 10 guests.

Roll Call:

Present: E. Addison, R. Addison, Beadle, Bertin, Carley, Crins, Currie, Dunham, Dunn, Eadie, A. Falls, B. Falls, D. Hussell, J. Hussell, Lumsden, Machin, Martyn, McAndrews, Obbard, Reading, J. Rising, T. Rising, Seymour, Sutherland, Tomlinson, Zoladeski

Guests: C. Darling (guest of the Club), J. Nishikawa, M. Schuster, S. Atkinson, R. Cheung, C. Hewitt, C. Carnovale (Seymour), V. Carley (Carley), T. Marescaux (Bertin), S. Hick (McAndrews)

Regrets: Abraham, Bryant, Curry, Daniels, Iron, A. Juhola, H. Juhola, Larsen, Pittaway, Slessor

Minutes: Minutes of the February meeting were accepted with revisions that had been emailed to the Editing Secretary.

Committee Reports:

Program Committee: Ed Bousfield will speak to the Club about amphipods at the April meeting, and Chris Zoladeski will speak at the March meeting about comparative flora of eastern Asia and eastern North America.

Field Trip Committee: The committee recommends a June field trip to the Carden alvar ecosystem. The club has not visited the area in about 10 years and the flora and fauna are unique. Discussion ensued as to whether to go the first versus the second Saturday of June. Similar numbers of attending members favoured each date. It was recommended to discuss the timing with Ellen Larsen, who has property on the plain. Kristin Martyn noted that the Carden festival will occur on one of the two weekends. The exact date of the field trip will be decided following further consultation.

Announcements:

R. Addison summarized, then passed around, a letter and photos from Reading (attached below). She also passed around a ca. 1946 photo of a Brodie Club member holding a Red-tailed Hawk and asked people if they could identify the 'mystery member' (also see below).

The Toronto chapter of the Conservation Biology Society and the Department of Ecology and Evolutionary Biology are co-sponsoring a fundraiser by showing "People of a Feather" which will occur at the Koffler House, 569 Spadina Crescent at 7:30 P.M. on March 24.

On March 25, Dr. Ian Sterling of the University of Alberta and Canadian Wildlife Service will speak on "Insights into the natural history of polar bears and the significance of global warming". This will occur at 3:30 P.M. in Room 1130 of the Bahen Centre, 40 St. George Street.

The Royal Ontario Museum will have an open house, including all labs and collections, on May 3-4.

SPEAKER: Bruce Falls introduced member Kevin Seymour. One of our members who "needs no introduction," Kevin is an Assistant Curator in Vertebrate Palaeontology at the ROM, and is Collections Manager for its famous collection of fossil vertebrates.

"The Five Great Extinctions: are we entering the Sixth?"

Kevin supplied a quick review of some geological concepts before discussing the details of the Five Great Extinctions.

Rocks are rocks worldwide, and geologists have been able to put them in a sequence of relative age only because of fossil inclusions. Both the upper and lower boundaries of all the time periods in the geological time scale (eg. Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous) are defined on their suites of fossils, and the changes (usually extinctions) that happen at about that time. The physical rocks, though, do give us evidence of periods of erosion, a convenient place to draw a line between time periods, or a dramatic lithological change or chemical change. An example is the end Cretaceous: dinosaur bones are not found right up to the point that is considered the end of the Cretaceous using the rock record. This line has been drawn where the iridium anomaly is found, thought to have been caused by a meteorite impact.

Although fossils can be locally abundant, overall they are rare, and certainly do not sample all habitats equally (e.g. uplands and tropics are rarely ever represented by fossils), need special conditions in order to form (something to prevent them from being recycled back into the ecosystem, usually by covering them up, often by active sedimentation, which only occurs in a few environments) and have parts that are tough enough to be preserved (such as shells or bones and teeth).

It has been estimated that more than 99% of all the species of plants and animals that have ever lived on this earth are now extinct, and the huge majority of them, including many whole living lineages, have never been found as fossils. So we have to make do with a sadly incomplete record. In addition, the dating methods we have at our disposal rarely have a resolution of less than a quarter or even a half million years (with the exception of carbon dating, usable only for the Pleistocene), so the timing of these extinction events is necessarily not as accurate as we would like.

Four main culprits (although there are others) are often discussed as possible reasons for the bigger, mass extinctions: sea level change, climate change, volcanism and impacts of extra-terrestrial objects, generally called bolides. Sea level changes are commonly seen in the rock record, which show sediments becoming finer as you move upward in rock sequences (transgression or sea level rise) or coarser (regression or sea level fall). Sea level changes often wreak havoc on shallow water marine systems, which are particularly biodiverse, and well-represented in the fossil record.

Extinctions are found at the end of all stages (subdivisions of geologic periods), but only five of these are thought to have witnessed 75% or more species extinctions – now singled out as "The Big Five." This is a relatively recent designation, and focusing on these five downplays the many other extinctions in the geologic record, which in total show that extinction is a normal and frequent occurrence.

The Big Five:

1. **End Ordovician ~443 million years ago** – Climatic change is suspected to be the culprit here, as the rock record shows evidence of episodic glaciations. There were repeated marine transgressions and regressions within a relatively short period of time, affecting the shallow water marine communities (remember there were no terrestrial communities to speak of at this time). Species with planktonic larval forms seem to have been particularly impacted. This mass extinction appears to have been stepwise and not sudden, taking between 3.3 and 1.9 million years, with an estimated 86% of species going extinct.

2. **Late Devonian ~359 million years ago –** For this extinction, a global cooling and then warming is suspected to be the culprit, with evidence for a large sea level drop and the spread of anoxic deep waters. Coral reefs were hit particularly hard, and again organisms with pelagic forms. Land plants first diversified, causing a global drawdown of CO_2. These extinctions took between 29 and 2 million years, with an estimated 75% of species going extinct.

3. **End Permian ~251 million years ago** – This is the mother of all extinctions! The last of the "Cambrian fauna" went extinct, including the trilobites. There appear to have been three phases, with a sea level drop, a large amount of Siberian volcanism and then a sea level rise. Global warming occurred, due to the large amount of CO_2 and H_2S pumped into the atmosphere by the volcanism, and this resulted in acidification of the oceans. The formation of Pangea at this time also further restricted the shallow water marine realm. The extinctions took between 2.8 million and 160,000 years, with an estimated 96% of marine invertebrates and 77% of terrestrial animals going extinct.

4. **End Triassic ~200 million years ago -** We know the least about this extinction, perhaps because it has been the least studied. There is evidence for a global sea level fall followed by an abrupt rise, with a "calcification crisis" in the oceans, where all reefs disappeared as well as most calcified planktonic zooplankton. Global temperatures increased due to an increase of CO_2, and there was a pronounced drying seen in terrestrial ecosystems. There is as of yet no evidence for a bolide impact at the end of the Triassic, although the Manicouagan crater in northern Quebec has been suggested as a culprit. The extinction took place between 8.3 million and 600,000 years, with an estimated 80% of the species going extinct.

5. **End Cretaceous ~65 million years ago** – This is probably the best known of the five and has had the most research attention, probably because the dinosaurs went extinct at this time, even though there were only 9 families of dinosaurs remaining during Late Cretaceous. It actually ranks as one of the Big Five primarily due to marine extinctions. The Chicxulub crater in the Yucatan of Mexico appears to be dated at just about this time, and it was a large bolide, perhaps 10 km across, which would have had a big effect on the world's ecosystems. The extinctions appear to be stepped, in that some groups (e.g. ichthyosaurs) disappeared well before the end of the Cretaceous. Other than the dinosaurs, almost all other reptilian groups (e.g. turtles, crocodilians, snakes, lizards, champsosaurs) were relatively unaffected, and continued into the Paleocene. The marine extinctions again appear to be random, other than the larger, ornate, tropical planktonic foraminiferans, which were hard hit. There is evidence of global cooling and then warming, probably due to extensive volcanism on the Deccan plateau of India. In North America there was

continental uplift, causing the draining of the inland seas. These extinctions took between 2.5 million and 1 year, and an estimated 76% of species went extinct.

Note that the End of Pleistocene extinctions do not come close to qualifying as one of the Big Five.

What are the common themes of these Five Great mass extinctions?

1. We rarely know whether they were fast or drawn out, due to poor resolution of dating methods
2. Shallow water marine areas were especially vulnerable
3. There seems to have been little selectivity, suggesting chance often plays a role in extinction
4. Multiple causes are indicated, meaning that ecosystems can take a certain amount of "insult;" but if two or three or more "insults" happen more or less concurrently, an ecosystem collapse may ensue, resulting in a mass extinction
5. Life is resilient. So far something has always survived.

Are we entering the Sixth Great Extinction?

There is no question that humans have and continue to affect the earth and its ecosystems, from the rise of global CO_2 due to the sudden burning (geologically speaking) of fossil fuels which also raises the acidity of the oceans, to the destruction of habitats, overexploitation of species and introduction of species to other habitats. In essence, WE can be considered the latest "insult" to the planet.

However, comparing fossil data from the Big Five mass extinctions with recent data is rife with complicating issues. For instance, rates are not independent of the measurement interval: the smaller the interval, the faster the rate. In addition, fossil data are usually assembled at the genus or family level, not the species level, so species level extinctions are always under-estimated. Fossil data use morphospecies, which usually under-recognise the number of phylogenetic species that we recognize as species today. Also, fossil data are very patchy, both geographically and taxonomically. If we scale extinction rates and use for comparison the lineages which are best known today (in terms of IUCN ratings, which would mean non-fish, non-reptilian vertebrates), we appear to see elevated rates of extinction today. However, marine gastropods and bivalves have the best comparative fossil data, and as only 3% of modern gastropods have been rated by the IUCN, and almost all are terrestrial, not marine, this leaves little comparability.

Another way of looking at it would be to say: how many more years would it take to reach a Big Five extinction if:

1. All endangered species went extinct in the next 100 years, and this rate continued? (Answer: between 1,200 and 2,690 years)
2. All threatened species went extinct in the next 100 years and this rate continued? (Answer: between 240 and 540 years).

So the Good News is that we are not there yet, with the caveat that we have no way of knowing how many undescribed species have gone, or are going, extinct. The Bad News is that we are poised at the edge. Humans are providing the multiple ecological "insults" to the planet which mimic the Big Five past mass extinctions.

For further reading, you might wish to consult:

Barnosky, A.D. et al 2011. Has the Earth's sixth mass extinction already arrived? Nature 471: 51-57.
Kolbert, Elizabeth. 2014. The Sixth Extinction: An unnatural history. Macmillan.
MacLeod, Norman. 2013. The Great Extinctions: what causes them and how they shape life. Firefly Books.

Questions following the presentation:

Eadie: When did the big mammals in Europe go extinct? Big mammals did not go extinct in Africa, and one proposed explanation is that they evolved to co-exist with humans, whereas those in North America and Australia did not, so were much more vulnerable when humans moved in. Europe is a different case, though, because humans were present before the big mammal extinctions there. Kevin acknowledged that climate change may also have been a prime factor in extinction in North America and Australia.

Bertin: With reduced genetic diversity as a result of the many monocultures of agricultural crops and animals, do we risk greater likelihood of extinctions? With greater biodiversity there has been less extinction.

B. Falls: To what extent are the definitions of geological time based on fossils? 100%. Some mass extinctions occurred during times of climate change, with the two factors likely being interrelated. The structure of the rock can in some limited numbers of cases also be indicative of geological time periods in cases where there are iridium layers arising from space objects hitting our planet.

McAndrews noted that some coal beds in western North America are intubated and others are 'flat lines' (not penetrated by tubes), which can assist in rocks being used to define time periods.

Zoladeski had copies of the books profiled in Kevin's talk. He was not particularly impressed with Elizabeth Kolbert's book "The Sixth Extinction," considering the book to be hyperbolic and alarmist, and noted that perhaps this was consistent with her being a 'New Yorker' journalist. On the other hand, he liked "The Great Extinctions, What Causes Them and How do They Shape Life," By Norman MacLeod (Firefly Books, 2013). MacLeod is with the Dept of Paleontology of the British Natural History Museum.

David Dunham thanked the speaker.

OBSERVATIONS

Currie: Turkey vulture in Toronto today.
Martyn: Has seen blue and white snow geese.
R. Addison: Turkey vulture in Aurora on March 13, the earliest date in 4-5 years.
Tomlinson: Because of our recent warm winters, the current one seems long and cold, but comparatively speaking it is quite similar to winters observed when he moved to Canada in the early 1970s.
T. Rising: When snowshoeing two weeks ago, she saw a chipmunk running across the encrusted snow.
Sutherland also observed chipmunks running across the snow, in Haliburton on March 15th.

The 'mystery member' in the photo passed around earlier was correctly identified by a few members as John Speakman. (More people identified the bird than its holder.) The photo was taken at an old McCrae lumber camp next to Lake of Two Rivers in Algonquin Park. The site was used as a research station (precursor of the current Wildlife Research Station) during the summers of 1945 and 1946.

Chris Zoladeski will make new name tags for members who did not previously receive them or for those requiring corrections.

The meeting was adjourned at 9:01 P.M.

NEXT MEETING: The next meeting will be on 15 April. Ed Bousfield will speak on Amphipod Crustaceans: Shrimp without shells.

CORRESPONDENCE: Bertin sent the article below, and notes that very interesting graphs showing long-term water levels in all the Great Lakes (1918 on) can be viewed here.

Water levels will bounce back as ice melts

AP March 06 2014

TRAVERSE CITY, MICH.--Water levels in the Great Lakes are expected to recover this year as widespread ice cover slows evaporation and snowfall reaches record amounts, U.S. government experts say.

On March 4, the ice cover reached 91 per cent of the Great Lakes, its highest point since the record of 95 per cent in 1979, said George Leshkevich, a physical scientist with the federal Great Lakes Environmental Research Laboratory in Ann Arbor, Mich.

Great Lakes levels dropped sharply in the late 1990s and have remained below normal since. Scientists blame a warming climate, which promotes evaporation and limits ice cover and occasional dry spells.

The drop-off was most severe on Lakes Michigan and Huron, while Superior, Erie and Ontario were well below average.

But water levels are rising again, fuelled by plentiful snow and rain. The snow's water content is the highest in a decade on Lakes Superior, Michigan and Huron. The snowpack holds the equivalent of 24 cm. of water around Lake Superior, 10 to 20 cm. of water in the Huron-Michigan basin, 10 cm. around Lake Ontario and five cm. around Lake Erie.

A short-term forecast prepared by the Army Corps of Engineers predicts water levels in Michigan-Huron will rise 23 to 36 cm. over the 2013 levels, but will remain 23 to 30 cm. below their long-term average.

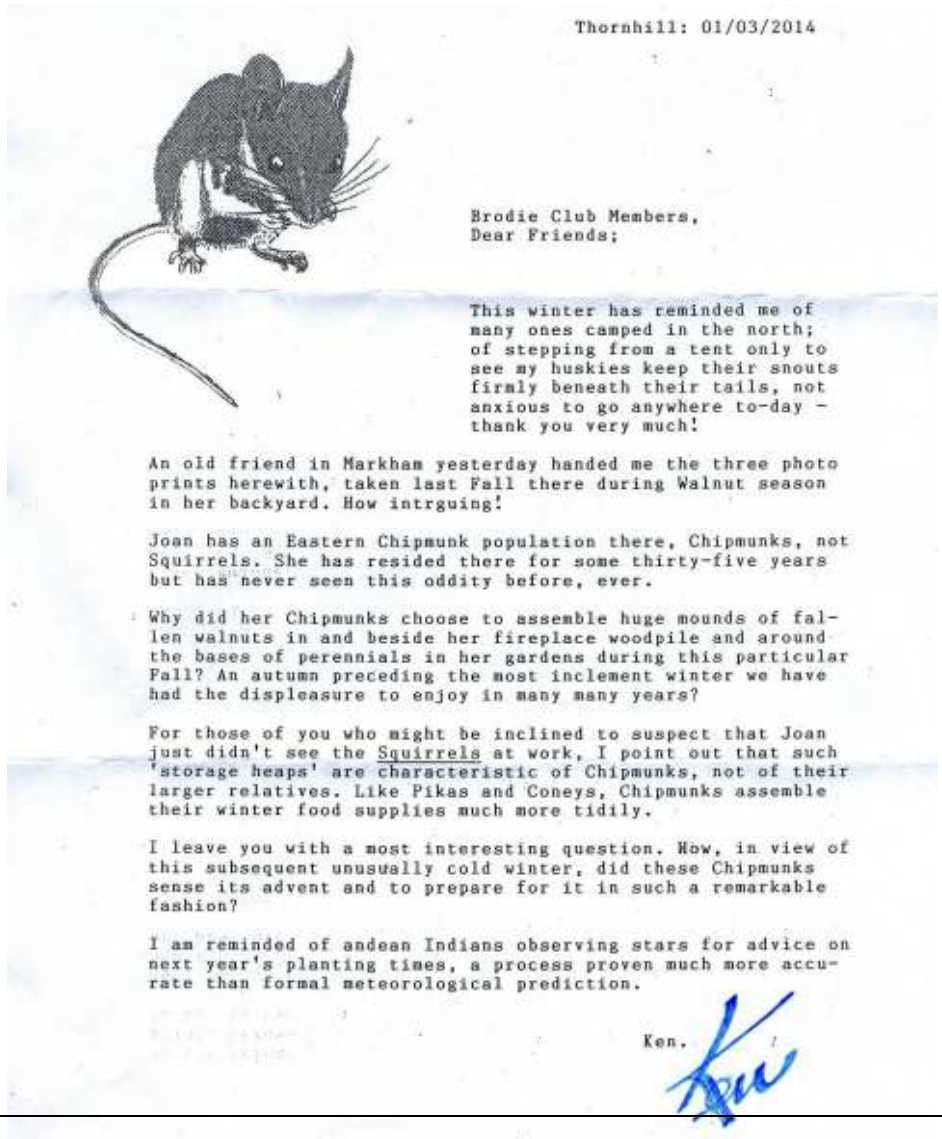
Superior is forecast to rise 33 cm. over year-earlier levels this spring and might edge above its long-term average for March. If so, it would be the first time the lake has topped its monthly average since 1998.

Lakes Erie and Ontario are expected to move above their long-term averages in the next few months but could dip below them as the summer wears on.

Correspondence from
Ken Reading

Cache of walnuts stored
by chipmunk

30-



Thornhill: 01/03/2014

Brodie Club Members,
Dear Friends;

This winter has reminded me of many ones camped in the north; of stepping from a tent only to see my huskies keep their snouts firmly beneath their tails, not anxious to go anywhere to-day - thank you very much!

An old friend in Markham yesterday handed me the three photo prints herewith, taken last Fall there during Walnut season in her backyard. How intrguing!

Joan has an Eastern Chipmunk population there, Chipmunks, not Squirrels. She has resided there for some thirty-five years but has never seen this oddity before, ever.

Why did her Chipmunks choose to assemble huge mounds of fallen walnuts in and beside her fireplace woodpile and around the bases of perennials in her gardens during this particular Fall? An autumn preceding the most inclement winter we have had the displeasure to enjoy in many many years?

For those of you who might be inclined to suspect that Joan just didn't see the Squirrels at work, I point out that such 'storage heaps' are characteristic of Chipmunks, not of their larger relatives. Like Pikas and Coneys, Chipmunks assemble their winter food supplies much more tidily.

I leave you with a most interesting question. Now, in view of this subsequent unusually cold winter, did these Chipmunks sense its advent and to prepare for it in such a remarkable fashion?

I am reminded of andean Indians observing stars for advice on next year's planting times, a process proven much more accurate than formal meteorological prediction.

Ken.