THE BRODIE CLUB

Established 1921

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

THE 1,133rd MEETING OF THE BRODIE CLUB

The 1,133rd meeting of the Brodie Club was held on Tuesday, 21 March 2023 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Tim Dickinson
Secretary: Rose Addison

The meeting was called to order at 7:37 pm and was attended by 23; 15 members and 8 guests.

Roll Call:

Present: E. Addison, R. Addison, Bell, Bertin, Coady, DeMarco, N. Dengler, R. Dengler, Iron, Kortright, Miller, Riley, Rising, Seymour, Thomas.

Guests: Peggy Haist, Nathan Mallia (guests of Bertin), Rachel Gottesman (Kortright), Maron Lord, Mary Kay Winter and Alan Hirsch (Rising), David LeGros (E. Addison), Tim Dickenson (N. Dengler).

Regrets: Abraham, Beadle, Bryant, Currie, Dunn, Eadie, Eckenwalder, Falls, Hussell, Lindsay, Martyn, McAndrews, Moldowan, Peter, Pittaway, Rapley

Minutes: Minutes of the February 2023 meeting were approved (moved by Riley, second by Seymour).

Committee Reports:

The next meeting, on 18 April, will be Jim Eckenwalder on "Writing *'A Field Guide to Trees of Ontario'* -- 512 pages of exquisite compromise."

New Business:

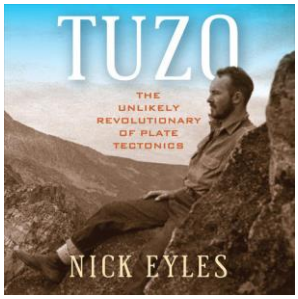
Katie Thomas reported on her canvas of members concerning their views on wearing masks during our meetings. Few responded, with 5 saying they supported wearing of masks if that was the club decision, and one against. However, the fact that few responded suggests that the remainder did not have strong enough feelings about it to make their views known. At the meeting itself about a third were wearing masks. Discussion ensued, with the general agreement on the following.

- We know that some Brodie members are not attending meetings because of health vulnerabilities either of their own or of people with whom they regularly interact.
- Face-to-face meetings are the heart of the Brodie Club, and we want to encourage as much attendance as possible.
- We endorse the wearing of masks because we think it will contribute materially to making our meetings as welcoming as possible to as many members as possible.
- We can store a few masks on site for use by attendees who need one, but just as mask wearing cannot be mandated, individual attendees should not face pressure to use them.
- How long this policy lasts will depend on assessment of its success and on continuing need.

SPEAKER: Tonight's speaker, Nick Eyles, was born in London, England, and emigrated to Canada at the age of 21 to complete graduate school at Memorial University in St John's, obtaining a PhD in 1978. He was appointed to the University of Toronto in 1981, from which he has just retired from teaching and is now Emeritus Professor. Nick worked as host with CBC on two five-part series on geology of Canada and the world for the Nature of Things and has written several popular books for the public on Canada's geology. He has been recognized by awards from the Geological Association of Canada, Royal Society of Canada, American Association of Petroleum Geologists, and most recently, with a Queen Elizabeth II Diamond Jubilee Award. Nick is currently working on establishing a UNESCO Global Geopark for Georgian Bay, and in retirement he's devoting more time to motorcycling and getting out of winters.

J. Tuzo Wilson: the unlikely revolutionary of plate tectonics

When attending an academic school in London, Nick Eyles took an extra evening course in geology. The instructor and course were sufficiently captivating that Nick and two others in a class of 11 became geologists! After graduating with a Geology degree, Eyles became a junior member of U of T Geology Department. Tuzo Wilson was part of the department at the time, but was quite senior and also very modest and Eyles did not get to know him well.



Years later, Nick was presenting seminars at Georgian Bay on the geology of the Georgian Bay islands. Susan Wilson, daughter of Tuzo, attended one of those seminars. She was a curator at the ROM and had used her curatorial instincts to preserve and organize her father's memoires and photos into a 160-page unpublished manuscript. Susan introduced herself to Nick and told him that she had not realized the enormity of her father's contributions to geology through his promotion of the concept of plate tectonics. That meeting led to a collaboration that ultimately led to the publication of the book Tuzo: The Unlikely Revolutionary of Plate Tectonics.

For centuries, there had been occasional publications of ideas and data that contributed to the ultimate acceptance of drifting continents and plate tectonics. Many of these were ignored in their time, however, especially by North American geologists where the established leaders in geology believed strongly that continents have always been fixed in their current locations.

In 1570, a Belgian cartographer Abraham Ortelius created what is considered the first modern map of the world. From his work people started to see the outlines and relative positions of the continents and started to wonder how they came to be; for example, suggesting that the oceans between continents resulted from biblical floods.

By the 1800s it had been noticed that some fossil plants and animals were found in many parts of the Southern Hemisphere that are now far apart from one another. In 1885, Eduard Suess, an Austrian geologist, proposed that there had been land bridges between South America, Antarctica, Africa and Australia that allowed organisms to spread across land masses, and that the land bridges had subsequently been flooded and eroded away. He called the connected land masses Gondwanaland, but envisioned that the pieces had not moved from their original locations.

Charles Schuchert was next to contribute to the expanding understanding of continents and their origins. Schuchert, who left school at twelve to work in his father's furniture factory, was an unlikely candidate to become a world leader in science, specifically in paleogeology. A fascination with fossils led to him to develop theories of expansion of continents over time, through the filling in of inland seas and building of new land at continental margins. Schuchert was recognized for his exceptional work as a professor at Yale and held senior positions within the largest American and global science and geological organizations. His stature helped ensure that his commitment to the idea of fixed continents was the view taught and accepted throughout North America.

In 1915 Alfred Wegener, a German scientist, made a big breakthrough when he realized that all of the continents could fit together rather neatly, like the pieces of a jigsaw puzzle, if the oceans could be removed. However, his theories were dismissed by leaders in science, in part due to the anti-German sentiment arising from the First World War and secondly because others in science considered the earth's mantle much too stiff to support such a preposterous idea.
John Tuzo Wilson was born in 1908, the son of John Armistead and Henrietta Tuzo. Armistead was an engineer who did much to develop civil aviation in Canada and who started the Royal Canadian Air Force. John's mother, Henrietta (nee Tuzo), was born into a wealthy upper-class family and was an accomplished mountain climber. It was from his mother that Tuzo developed his love of the earth.

Many others influenced Tuzo. As a teenager he worked in support of mountain climbers attempting to reach the top of Mount Everest in 1924. During this expedition he was influenced by mountaineer Noel Odell, who himself was a geologist. Later Tuzo worked as a geology field assistant in northern Ontario.

In 1930, he entered into a degree in physics at U of T and with his interest in geology quickly adapted that into the first joint degree in Geology and Geophysics. From 1930-1932, Tuzo was supervised by Sir Harold Jeffrey, a famous astronomer and geophysicist. Tuzo learned to fly in 1931, and in 1933 received a PhD from Princeton on basic mapping of the Beartooth Mountains of Montana. Throughout his education, none of Tuzo's mentors accepted the idea of continental drift, believing earth's crust to be too stiff, and because no plausible mechanism had been proposed for propelling movement.

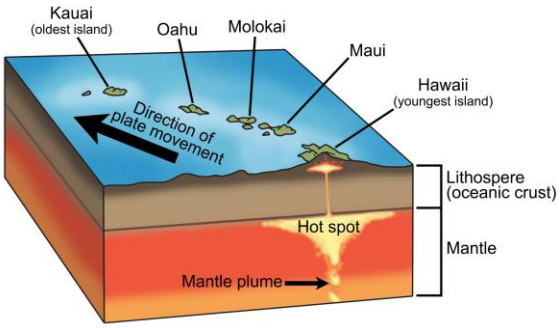
After his Ph.D. Wilson returned to Canada and joined the Geological Survey of Canada, using his flying skills to start mapping geological features from the air. Many colleagues dismissed this approach because they felt one had to have 'feet on the ground' to make significant progress, but the ability to map huge remote areas of the Canadian Shield with little logistic effort, and making it possible to literally see 'the big picture,' proved to be major boons both for military and commercial purposes in the years ahead.

In 1939, in the Canadian Army as a sapper with General McNaughton, Wilson used geology to predict locations of enemy batteries. He became indispensable due to his ability to analyze situations quickly and report his operational research promptly and succinctly to be implemented by the Allied forces. In 1946, the Russians replaced the Germans as the new enemy and Wilson's same analytical skills were applied to studies of the Canadian Shield that might be relevant in case of Russian incursion by land or by air.

After deciding to leave the army, Wilson was appointed professor of geophysics at U of T. Eventually he became the 57th president of the International Union of Geology and Geophysics, which gave him the excuse—and financing--to travel the world. Australian scientists were the first

to broadly accept the idea of continental drift, and although Wilson continued to believe in static continents, he was exposed to many landscapes and discussions with peers that may have started to erode his long-held views.

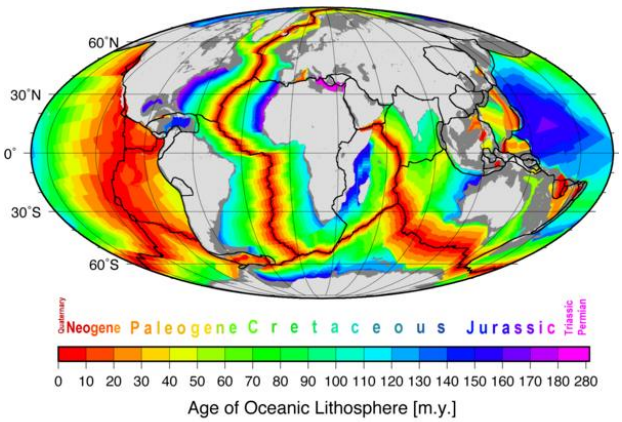
The Cold War of 1948-1960 led to the use of sonar and magnetic devices to detect Russian submarines. These same advances in science allowed for mapping of the ocean floors, which in turn started to be used by geologists to think again about continental stability. It was in 1952 that Marie Tharp discovered the mid-Atlantic Ridge while working with her colleague Bruce Heezen. Her discovery fully supported the theory of the American continents drifting away from Europe and Africa. Other key information came from magnetic records of sea floors that could be used to show the speed at which this was taking place.



In 1963, Wilson interpreted the formation of islands of Hawaii. The Big island has an active volcano, whereas smaller islands in a chain to the northwest are progressively older. Wilson proposed that the most distant island was once located where the Big Island is now, but died as it was moved away from the deep source of magma which then formed a new island. With enough time, the Big Island is expected also to go dormant as it moves northwest.

Soon after, Wilson analyzed where volcanoes occurred along fault lines around the world and how they were constructed, and was able to interpret rates of movement of land masses as they drifted. In 1968, ocean drilling confirmed his theories and allowed for development of a time line for when drifting occurred. For example, we now know that the Atlantic Ocean formed with Europe and North America drifting apart earlier than when South America and Africa drifted apart.

While Wilson's publications contributed directly to burgeoning growth in the new field of plate tectonics, it probably would have happened soon without him because so much new evidence was coming to light. Nonetheless Wilson's influence was huge, partly because he was a respected and prominent scientist who could conspicuously reverse his previous views on continental behaviour, but also because he was a fine communicator both within the scientific community and through popular lectures to the public.



Now geophysicists have been able to determine the rates and directions of continental drift. Another Pangea will form in future and there may well have been more than one in the past. Precise dating of zircon crystals has been used to indicate the number of past supercontinents. It was a big breakthrough to realize that creation of supercontinents would destroy oceans, and currently the continents are moving closer together at the expense of the Pacific Ocean. The eastern Australia plate is moving northward 5-6 cm annually! Western Australia, on the Indian plate, is moving more slowly due to resistance of the land mass of the Himalaya Mountains to the north. The North American plate is moving westward by 3.7 cm per year. As Nick describes it, where we are is moving daily the thickness of a sheet of paper!

QUESTIONS

Trudy Rising: Is movement measurable?

- Yes. From satellite photos and GPS, the beginning of the convergence into Pangea 2 is obvious.

Bob Kortright: Why did the scientists 'get it wrong' for so long?

- First, they accepted that the mantle was too thick to be able to move. Second, they used quantitative models that did not support the theory of continental drift.

Nancy Dangler: What is the driving force that is moving the plates?

- It is not the ridge pushing up more magma in the intercontinental ridges, because soft magma cannot push. Instead it is the oldest edges of the plates that are being subducted under our current continents. The lower edges of these subducted ridges have great mass and are hanging over the magma substrate. It is the hanging subducted edges of the plates that are pulling the plates apart.

Oliver Bertin: Seems obvious that earth movements could be mapped from airplanes, since the same techniques were used to map forces during WWII.

John Riley thanked the speaker and mentioned Nick's books, including the most recent one on J. Tuzo Wilson which formed the basis of tonight's talk. Nick noted that the best place to obtain his books is on Amazon.

OBSERVATIONS

Oliver Bertin commented on a review in the Globe and Mail of the efficiency of various environmental agencies in use of donated money. The Nature Conservancy of Canada was one of the highest rated agencies receiving a five star rating. Ontario Nature had a high efficiency of 78% of donations being directed to their stated 'raison d'etre'.

CORRESPONDENCE

Here are a couple of Tuzo Wilson items related to Brodie Club.

In January 1959, Dr. Wilson spoke to the Brodie Club about some of the new discoveries during the International Geophysical Year. At the time, Wilson was president of the Geodesic and Geophysical Society, which was one of the three co-sponsors of the IGY.

<u>From Oliver Bertin:</u>

Prof Eyles happened to remember a funny story about Tuzo Wilson (below), which I told him over coffee at the 2019 meeting. Eyles included the story in his biography of Tuzo to my great surprise.

Back in high school days, I was president of the Jarvis CI Science Club, a junior version of the Brodie Club that I joined 25 years later. Like the Brodie Club, we invited speakers to monthly meetings, listened intently to their speeches and then gave them coffee and cookies. All good fun,

and all very naive. Like the Brodie Club, we often had trouble finding good speakers. One of my fellow students offered to invite his neighbour to speak, not knowing who he was except that he was a scientist. A few days later, my friend, John, spied his neighbor on his knees in his front garden planting tulips, so went over and asked in a very polite manner: "Mr. Wilson, would you like to speak to our high school science club?" Tuzo looked up, saw his young neighbour looking down at him and immediately answered: "Certainly, John. I'd be honoured."

Trouble is, we had no idea who this Mr. Wilson was. We looked him up. "OMG! He's the most famous scientist in Canada. He's world famous. He invented Continental Drift. What's Continental Drift?" Mass panic at JCI!! So, we jumped into action, spruced up the chem lab, cleaned out the old test tubes and bottles and bunsen burners and made the room look surprisingly neat. We were ready to go! I was in charge of refreshments then as now. Some things never change. Another mass panic. We had no coffee cups. So, I rushed over to the corner store and picked up a stack of paper cups to serve the coffee. Phew. Just in time.

It was a great speech. Tuzo was wonderful. He took us all very seriously and told us all about Continental Drift. Whew! Thanks Tuzo! He treated us like real adults! But there was one problem. I had picked up wax paper cups instead of styrofoam. I didn't realize my mistake until I was drinking my coffee after the meeting, when I noticed puddles of wax floating on the surface of the coffee. Oh no! But I gulped the coffee down anyway. Tuzo? Yup. He noticed the floating wax too. He gave his coffee a very wary look. But he was very polite. He ate his cookies and drank his coffee without saying a word, thanked us all for inviting him to speak and headed off home. What a nice guy!!!!! Thanks Tuzo!

And, news of Patrick Moldowan:

Patrick Moldowan, Brodie Club member since 2017, recently defended his PhD in the Department of Ecology and Evolutionary Biology at the University of Toronto. His thesis focussed on the ecology and sensitivity to environmental change of a northern population of Spotted Salamander and was based at the Algonquin Wildlife Research Station in Algonquin Provincial Park.

Major findings from his thesis include:

- declines in breeding body condition of salamanders related to warming summer and autumn temperatures,
- the collaborative discovery of juvenile salamanders as prey for carnivorous plants, and
- population estimates and a wealth of descriptive natural history for a focal Spotted Salamander population in Algonquin Park.

Patrick has contributed several talks to the Brodie Club in recent years, including biodiversity and conservation on the island of Mauritius, odd and sods about his beloved salamanders, and, most recently, about corvids as human-subsidized predators of freshwater turtles and tortoises. He has taken a job with the Charles Darwin Foundation and will be overseeing a giant tortoise research program in the Galapagos for the next couple years.

Patrick wants to thank Brodie Club members for their warm welcome and insightful discussion at meetings. He will continue to follow activities of the Brodie Club from abroad as a corresponding member.

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