THE BRODIE CLUB

ROYAL ONTARIO MUSEUM OF ZOOLOGY

THE 1,036th MEETING OF THE BRODIE CLUB

The 1,036th meeting of the Brodie Club was held at 7:30 pm on February 16, 2010 in Room 432 of the Ramsay Wright Laboratories of the University of Toronto.

Chair: Ellen Larsen
Secretary: Ed Addison

The meeting was attended by 19 members and 3 guests.

Roll Call, Present: E. Addison, R. Addison, J. Bendell, Y. Bendell, Boswell, Crins, H. Curry, Eadie, A. Falls, B. Falls, Iron, A. Juhola, H. Juhola, Larsen, McAndrews, Pittaway, Reading, Seymour, Tasker.

Regrets: Abraham, Bertin, Bodsworth, Dunn, D. Hussell, J. Hussell, Machin.

Guests: Emily Addison, guest of E. Addison; Calvin Chan and Sharon Hick, guests of Jock McAndrews.

The minutes were moved for approval without change by Helen Juhola.

Ed Addison reported on our next meeting. David Evans, from the Ministry of Natural Resources, will speak at the March meeting about the limnology of Lake Simcoe.

SPEAKER:

The speaker was introduced by Jock McAndrews. "Nick Eyles holds a Ph.D and D.Sc. and is Professor of Geology at the University of Toronto. He has worked at the universities of Leicester, Newcastle upon Tyne and East Anglia in Great Britain, at Memorial University in Newfoundland and has been at Toronto since 1981 when he was awarded an NSERC University Research Fellowship. He has authored more than 150 publications in leading scientific journals on ice age geology and environmental geology in urban areas and has conducted geological fieldwork from the Arctic to the Antarctic, including work on Ocean Drilling Program onboard the drillship **Resolution.** Recent sabbaticals have been held in Brazil and Australia." (Information and photo from U of T website)

Nick has written several books: **Canada Rocks**, **Ontario Rocks** and **Toronto Rocks**. His latest, **Geological Wonders of Ontario: A Field Guide** is to be published by Fitzhenry and Whiteside, Toronto in July 2010.

A producer for CBC invited Nick to join a crew to develop four episodes for The Nature of Things. (http://www.cbc.ca/geologic/mts_eyles.html) They spent a year selecting areas in the world for their programs. They worked in each location for about a month.

Since many aerial shots were needed for the shows, a helicopter with a special camera mounted in a bubble on the outside was used to obtain high definition photo images.

The core of the earth is solid and is surrounded by magma, the molten liquid between the core and the crust. There is a dynamic between the crust and the layer beneath with hot magma working its way up to the surface and colder solid pieces from the surface working their way from the surface down into the magma.

The earth is 4.5 billion years old. Pangea was present as recently as 135 million years ago as a single 'super continent' surrounded by one ocean. Pangea broke up with differentiation into our current continents.

Nick indicates that the next super continent [Pangea II] will be located in southeast Asia.

The orientation of the Nature of Things programs is on changes in the oceans. The Pacific Ocean is closing at the present time but some oceans are still expanding.

The oldest crust of the Earth is from the Jurassic era. There are examples of it in the Atlantic off the east coast of the United States and in the Pacific, east of southeast Asia. Most of the ocean floors are only 150 million years old.

In Iceland, one can see on land what was once ocean floor. There are huge ridges with leakage of magma. These leakages are pushing the existing tectonic plates apart. The movement of this widening rift has been measured in Iceland with an estimate that the Atlantic has opened about 6000 km in 160 million years [since the Jurassic]. This rate of change is averaged to be about the width of a fingernail annually.

We see oceans being born today in east Africa. In the south, the Rift Valley is relatively narrow but moving northward through the eastern part of the continent, the geological feature continues to widen, being very wide in the Afar Triangle just south of the Red Sea in Ethiopia. In Kenya, the Rift Valley is very similar to the rift in Iceland.

In Africa, unlike Iceland, the magma rises up through silica formations. This makes a medium that is a tough paste differing from the soft red magma seen in Iceland. Near the Green Crater Lodge in southern Africa, large lakes display a good history of climate with evidence of water fluctuations reflected in layers in the walls of the lakes. The walls of some gorges provide similar evidence of climate and include layers of ash mixed with sedimentation from rising water levels.

Here the team found rocks, such as axe heads, that had been used as tools by homonids, hence the name *Homo habilis* [or 'handy man']. The brain size of homonids increased from 350 cc to 750 cc during this period of adapting to tools.

To the north, there have been "floods" of basalt on the sides of the Afar Triangle. This is the hottest place on earth. The team visited and photographed an unusual volcano near the north end of the Afar Triangle. The volcano was a 'shield volcano', shaped like a shield lying on the ground in contrast to the highly raised cones of lava volcanoes. Because the area was close to the Somalia-Eritrea border, they were accompanied in their work by personal armed body guards.

By breathing from sources of oxygen or air they avoided the sulphur gases produced by the volcano. They were able to walk down onto the lava lake that had a 3-4" crust. Returning from the volcano, they encountered a caravan of about 1000 camels hauling salt from inland to the coast. Nick would like to document this long standing traditional trade which as he feels it will soon be a thing of the past.

Nick noted that the banks of the Red Sea are moving apart. The Dead Sea is becoming 'more dead'. The water level in the Dead Sea is dropping one metre per year exposing strata that provide some of the best records in the world of changes in climate.

Nick and his colleagues also observed excellent evidence of earthquakes. In the Golan Heights, there are columns from past human constructs that are lying on the ground. The orientation of the fallen columns indicates where the earthquakes may have originated.

Nick mentioned hot spots of which there are about fifty in the world. Hotspots are locations on the Earth's surface that have experienced active volcanism for a long period of time. Hot spots are thought to be caused by a narrow stream of hot mantle convecting up from the mantle-core. There are hot spots in the Azores, Hawaii and a few in western North America, including Yellowstone and the Anahim hotspot in central British Columbia.

One question that the television programs under development wish to address is 'What happens when oceans close?' For this work, the crew went to the Pacific Rim of Fire with stops in Chile and Japan. The hard crust slabs from the Earth's mantle may extend down into the magma 600 km before becoming molten. Some magma makes it to the surface but some of that magma rises up through areas full of silica, slows down and stops forcing its way up. This builds up pressure under the crust until there is a "blow".

Mount Tambora in Indonesia was created above subduction plates. Subduction is the activity where a piece of the earth's crust moves beneath another piece of the Earth's crust. The eruption of Mount Tambora in 1815 is the largest eruption in recorded history. It created global climate anomalies. 1816 became known as the "Year Without a Summer" because of the effect on North American and European weather. Agricultural crops failed and livestock died in much of the Northern Hemisphere, resulting in the worst famine of the 19th century.

Mount Tambour NASA Photo

Along the Chilean coast, layers of fossils can be seen embedded near the tops of cliffs. This signifies prior ocean floors that have been uplifted during earthquakes. Charles Darwin saw these layers of fossils in his travels and concluded that the ocean floor had moved. The crew visited the Atacama Desert in Chile. The Atacama is comprised of salt basins and lava flows and is the driest place on Earth being fifty times drier than Death Valley in the United States. Nitrates for dynamite used during World War II came from this area. Within the salt flats are abundant living stromatolites.

The Andes are higher than would be predicted when taking into account only the formation of mountain ranges. They are considered to have uplifted several kilometres during the past 100 million years. Nick suggested that the higher than expected uplifting may be due to the subduction of the tectonic plate to the west and that led to added buoyancy of the Andes.

Chaiten Volcano and town of Chaiten
NASA image

The Chaitén Volcano was the second of two Chilean volcanoes visited. Chaitén is a volcanic caldera which is somewhat unique. Some might consider the hole in the middle to be a crater from a blasting out of material. However, in a caldera, the magma seeps out around the edges and the hole in the middle is created by a collapse of the central portion down into the crust. Chaitén has been very active in the past couple of years. The major 'out-gassing' has stopped but there is a ryolite lava dome plug pushing up through the middle. It will choke the volcano and subsequently lead to an explosion. The nearby town has been almost completely abandoned in the past couple of years because ash came down the mountainside in the form of a mud slide and it filled the town to a depth of 1-3 metres. There are still a few people living there despite the risk.

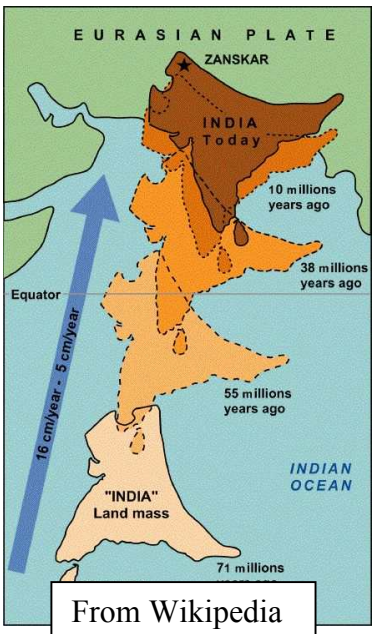
Mount Merapi in Indonesia is situated at a subduction zone, where the Indo-Australian Plate is sliding beneath the Eurasian Plate. It is a very active and dangerous volcano with unpredictable pyroplastic flows and smoke emerging from it at least 300 days annually. Despite deaths from previous eruptions, thousands of people continue to live in villages on the flanks of the volcano, attracted by the highly fertile volcanic soil. Nick and other members of the team walked on a slowly moving area that will blow into a pyroplastic flow within the next 12 months.

At Mount Fiji the crew documented the 'Fire Festival' at Yoshida, a local city. The volcano is incorporated into the local culture.

Nick spent some time on a ship with the technology to drill down into the ocean floor. The ship was able to drill into the subduction zone only because it had a system to control release of gas so that it does not blow up during drilling.

Nick also showed us a fault line that developed in Japan during the 1930s that now has one side of the fault 6m below the other side..

The Neotethys Ocean used to be situated north of India which was attached to the side of Africa. India detached from Africa and pushed north through the Neotethys and closed it off as India buried itself into south Asia. This process resulted in the disappearance of an ocean and led to the formation of the Himalaya Mountains. There were no volcanoes during this process because the two land masses collided without any subduction of the Earth's crust.



From Wikipedia

As fast as the Himalayas were pushed up they are being broken down by erosion. The crew visited spots where alpine lakes of melting water are dammed up behind ice dams that will break and flood the valleys below. The Neotethys Ocean floor shows up on the side of mountains where it has been pushed up. Concretions with ammonites have been pushed up 15,000 feet from the ocean floor. In Nepal, they are running out of snow to provide seasonal irrigation for growing summer crops. Nick had an interesting observation that the Nepalese and Chilean people had many similarities not only in their relationship to the land but also in appearance.

QUESTIONS:

What plate is involved in the earthquake in Haiti?
Haiti is on the northern side of the Caribbean plate that is being driven east into the North American plate. We can expect a major earthquake there every 200 years.

When will there be an earthquake in the San Juan- Vancouver area?
It can occur at any time. Most of Vancouver is built on delta sediments which, when they get jiggled in an earthquake, will be liquefied.

Uranium within our planet has helped to keep it warm. The Earth would have cooled much more quickly if not for the uranium contributing to the heat.

Are the hot spots related to the subduction zones?
No, they are small individual penetrations or upwellings of magma from the core. LIPS [large igneous provinces] in the oceans were thought to have arisen from blowing hot spots. The LIPS and hot spots are independent from plate tectonics. Mt. Erebus in Antarctica is a hot spot.

At Yellowstone, the crust has been subducted and also includes a spreading centre as with the rift developing in Iceland.

The planet Venus has had volcanic activity but there is no evidence of plate tectonics. It is possible that the crust of Venus is comprised of one big plate.

Why is the movement of the magnetic pole speeding up?
Don't know.

How does the pressure in Yellowstone compare to some other areas?
The 'plumbing system' is of a type that when it blows it will blow big.

The formation and uplifting of the Himalayas are affecting climate. Sediments from erosion of the mountains are moving down the Ganges. Increased sedimentation may change the ratio of gases in the air and may also amplify some movements of the earth.

The road cut as you approach Marmora from the west is limestone. Within the limestone is a dark layer which was an ash deposit from volcanic activity a long time ago.

The speaker was thanked by Bill Crins.

NOTES & OBSERVATIONS

Jean Iron informed club members that Ron Pittaway was recently elected to the bird listing committee of the American Birding Association. Ron is one of only four Canadians to be named to the committee since 1975. Congratulations from the club!

Jim Bendell reported that he and Yvonne had seen five Red-tailed Hawks, one Rough-legged Hawk and a Bald Eagle which was being mobbed by crows on their trip from their home (north of Perth) to Toronto today.

Jean Iron reported the sighting of an adult Ivory gull on the Toronto waterfront on Feb. 15. This is a rare occurence for Toronto. Ivory Gulls normally stay in the Arctic but there have been about four in the local area this winter.

Jock McAndrews reported that Fred Bodsworth is in good spirits but has a sore back and is still tired from his December accident.

A note of thanks to Ellen Larsen and Ed Addison for the speedy recovery from the blown projector bulb – up and running in under four minutes!

Bill Crins moved for adjournment at 9.15 pm.

NEXT MEETING

The next meeting will be held on Tuesday, March 16, 2010 at 7:30 pm in Room 432 as usual.

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CORRESPONDENCE

On Tue, Feb 16, 2010 at 9:21 PM, Joan Edwards <yjedw@shaw.ca> sent the following observations from Yorke.

The Birds at Home by the Sea

Red-winged Blackbirds: We twice found a nest in our garden that is beside our ocean shore.

Sandhill Crane: Early in one spring I saw one sleeping on the edge of a small island.

Glaucous-winged Gull - Daily dozens fly by our house. Once on an island I saw 51 nests.

Glaucous Gull: One Sept. morning I saw one going by from its northern Arctic shores.

Common Murre: Once I saw a few go by our shore going southward as they went by.

Meadowlark: We have seen just a few. Once I found a nest on a tiny grassy island.

Black Oystercatchers: In August, one day I saw young ones with their cries while swimming by.

California Quails: Twice we had a nest in our garden. Once in May we saw 6 baby ones.

Killdeer: We found one nesting on a small island not far beyond our shore.

Tufted Puffin: Some years we see young ones on the sea, going by with their adults.

Sooty Shearwaters; Crowds of them fly by in late summer, going to be near Australia.

Song Sparrow: Its songs are heard most of the year, but we seldom find their nests.

White-throated Sparrow: Through many summers they sing loud and clear near our house.

Bald Eagle: Daily on a post by the sea, but in fall it goes up rivers to eat dead fish.

Thayer's Gulls: Dozens from the Arctic go onto our small islands for winter by the sea

Dunlin: In winter there is often a line of them along the edge of a distant island.

Canada Geese: On many days we see them eating grass on a golf course by the sea..

Glaucous-winged Gull: About daily we see them sleeping and eating grass on the golf course.

Mew Gull: In the fall they come down for a while, then on to Mexico in winter.

Northwest Crow: Beside food stores at noon crows and kids eat lunch together.

Double-crested Cormorant: We see them on the small and rocky islands that are near our shore.

Starling: Years ago some were sent to New York. Now they are everywhere.