THE MINERAL VEIN

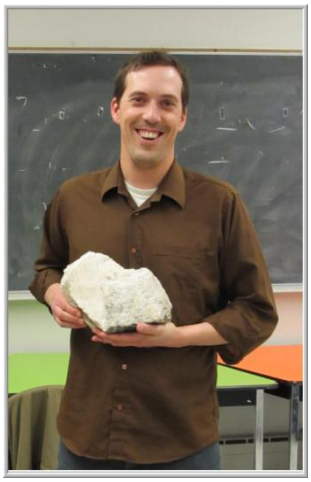
Official Newsletter of

THE MINERAL SOCIETY OF MANITOBA

MARCH 2013

The Bernic Lake Pegmatites

The world class TANCO pegmatite at Bernic Lake in SE Manitoba is well known to mineralogists and mineral collectors for its large array of rare minerals, some of which occur in enormous crystals tens of metres long. The geology and formation of the Bernic Lake pegmatite cluster was the subject of our guest speaker at the February meeting of the MSM. Mr. Paul Kremer is a geologist with the Manitoba Geological Survey who studied these pegmatites as the subject of his Master's thesis at Waterloo University. Paul's research work included detailed mapping of the area east from Bernic Lake, logging a lot of drill core from pegmatites not exposed on surface, underground mapping at the Tanco Mine, and age determinations of several granitic plutons and pegmatites in the area.



Pegmatites are coarsely crystalline igneous rocks, commonly with a diversity of grain sizes; it is not uncommon to find fine- and medium-grained phases mixed with the coarse-grained parts. They are usually the final products of a crystallizing, cooling magma and the more interesting ones contain all the interesting "leftovers" known as the "incompatible elements". These are the elements that do not easily enter the crystal lattice of the common granitic minerals like feldspar, quartz and biotite. They include valuable elements such as tantalum, cesium, lithium, beryllium and Rare Earth Elements. Tanco is highly enriched in Lithium-Cesium-Tantalum (known as an "LCT" type) and in fact it contains 80% of the world's cesium supply in the form of the otherwise rare cesium-rich zeolite mineral pollucite, $(Cs, Na)_2(Al_2Si_4O_{12})\cdot 2H_2O$.

Many pegmatite swarms exhibit a systematic zoning in the amount of these incompatible elements that depends on the distance from the source pluton. Paul's work, along with that of other researchers indicates that the source granite pluton for the Bernic Lake pegmatites is probably west of Tanco beneath Bernic Lake.

Mapping the geology of the area revealed that most of the pegmatites are located near the faults between different rock types and in fact some were intruded along a major east-west fault zone known as the North Bernic Lake (NBL) shear zone during active deformation. Combined with his structural measurements and age determinations on the local granites, this revelation made it possible for Paul to determine the tectonic history of the area. He concluded that some pegmatites that are relatively intact and undeformed, including Tanco, were intruded in fractured zones caused by NNW-SSE directed compression. This same event generated more movement along the NBL Shear Zone and some of the pegmatitic magma/fluid intruded into it while movement was still taking place. This produced pegmatites that show some signs of deformation (see photo below).

A pegmatite dyke at Bernic Lake cutting the fabric of the host rocks but also deformed itself. Photo by P. Kremer.

Continued on Page 3

THE MINERAL SOCIETY OF MANITOBA
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The Mineral Vein is published monthly from September to June.

Meetings are held on the first Wednesday of each month from September to May inclusive at the Manitoba Museum in room P47 on the Planetarium level. They begin at 7:30 PM and feature announcements, an invited speaker and a raffle. Members are encouraged to bring along any new, interesting specimens, or specimens appropriate to the speaker's topic.

Field Trips take place from May to September to interesting sites in Manitoba plus neighbouring provinces and states.

Membership: A single membership is $15 while a family membership is $20. Memberships run from October to October

Table of Contents

UPCOMING EVENTS

March 6th: *Mineral Treasures of Afghanistan*. This will be a two part presentation beginning with a brief overview of Afghan geology and the setting of some of the major mineral occurrences by John Biczok. This will be followed by Tim O'Bryan who spent several years in Afghanistan with the US Air Force and accumulated numerous pieces for his collection while there. Tim will be bringing many of his pieces to show us as well as a slideshow on the area.

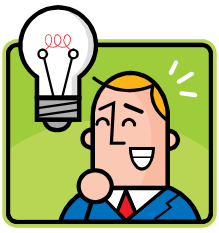
Afghanite crystal

April 22nd, 1:00 PM. Earth Day indoor field trip to the Manitoba Mines Branch Midlands facilities, starting at 1 PM. This will be a chance to see what facilities and equipment the Mines Branch has for cutting large specimens, making thin sections for microscopic study, etc. They will be providing the visitors with small gift bags and raffling off a book entitled "Beginners Guide to Rocks and Fossils". Best of all there will be cake! and coffee. More details to come.

MINING WEEK AT THE FORKS CANCELLED

The Manitoba Department of Innovation, Energy and Mines has decided to cancel the 2013 "Mining Week at the Forks" event. No reason has been given to us but one can probably assume it was due to budgetary restraints. The department will be working with its various partners (mining companies and non-profit groups like the Mineral Society) over the next year to see if alternative funding can be found to revive this event in 2014.

The cancellation of Mining Week at the Forks is certainly a major disappointment to the Mineral Society. This was one of our major outreach and fund-raising activities each year and it may be difficult to find a suitable replacement. That's why we are appealing to the membership for their ideas. Do you know of a spring-time event that draws a large crowd that would be receptive to the MSM putting up its mineral displays and selling our glue-card fossil and mineral kits? Perhaps one of the local science fairs or a tie-in with an event the Fort Whyte Center or the Manitoba Museum? Is there enough support in the membership to organize and host an annual mineral show again? If you have any ideas please bring them along to the March 6th meeting if you can, or e-mail them to Marion Foster at 2mandm@mymts.net



WE NEED YOUR LEFTOVERS!

Although *Mining Week at The Forks* has been cancelled for this year, the MSM will be carrying on with our exhibits and activities at Oak Hammock Marsh and the annual Manitoba Mines and Minerals convention in the Fall. We are running low on some items for the glue cards and are asking for your help. If you have any of the following items that you would be willing to donate please bring them to the next meeting(s) and pass them along to Yvonne Searle. The items we need are:

- Barite
- Brachiopods
- Crinoids
- Coral (*like the big colony or horn corals found in the local limestone quarries*)
- Dinosaur bone
- Feldspar

Of course these do not be particularly well formed since they will be broken up into ~1 cm pieces anyways for the glue cards.

FIELD TRIPS

Our new field trip committee chairperson this year is Russ Epp and Russ has come up with a list of prospective field trip locations that he is looking into, including:

- Cat Lake pegmatites *for garnet, epidote, etc*.
- The Red River Floodway *for* selenites
- Holland, Manitoba *for pyrite crystals*

Russ will also be contacting some of the mines in SE Manitoba to see if we can arrange an underground tour and will be undertaking scouting trips to several other locations in the spring that the club has not been to before. We expect to also arrange trips to some of the traditional spots like the Souris agate pits, local limestone quarries, etc. As always these trips will depend on the weather conditions and the in many conditions the water levels in the area.

If you have any ideas for a good field trip or would like to help organize one of the trips, please get in touch with Russ by phone or at one of the meetings.

BERNIC LAKE PEGMATITES (*continued from P.1*)

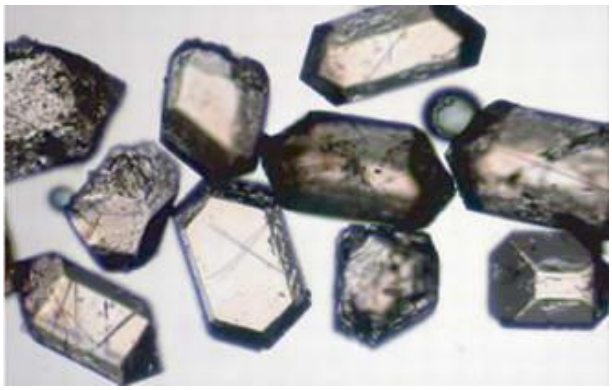
Not only was Paul's presentation a great summary of the origin and controls on the pegmatites of the Bernic Lake area, it was a glimpse for the audience into many of the techniques used by geologists to unravel the geological history of an area. These included the way measurements of the structural features of the rocks can be used to determine the tectonic history. He also touched on the analytical techniques geologists use to determine the ages of rocks and many of the members found it fascinating that one can now determine the age of rocks more than 2700 million years old (a.k.a. 2700 Ma) with a precision of plus or minus 1-2 million years. The age of the volcanic rocks in the Bernic Lake area has been calculated at 2724 million years whereas two of the younger granite plutons intruding the area were dated a 2640 to 2645 million years and the pegmatites themselves are 2647 million years old.

For more information on Paul's work in the Bernic Lake area check out the following online publication:
http://www.manitoba.ca/iem/mrd/geo/field/roa06pdfs/GS-18.pdf

Paul's talk was very well received and generated a lot of good questions from the members and we thank him for a job well done.

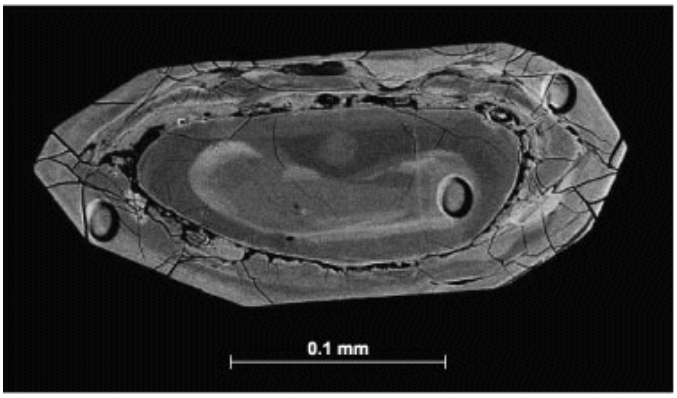
ZIRCONS

The age of the rocks in the Bernic Lake area was determined by using the uranium and lead isotopic compositions of "a geologists best friend", the mineral zircon. Zircons are typically small but well-formed grains, especially in fairly silica-rich igneous rocks such as granites. They contain minor amounts or primary uranium but no primary lead, therefore the amount of lead and uranium isotopes measured in a zircon can be used to calculate how long it took for decay of the uranium to produce that much lead, i.e. the age of the zircon and its host rock.



An example of well-formed zircon crystals separated from a rock prior to age determinations.

There are several ways that the isotope contents can be determined, depending on the size and type of grains. Some zircon grains have an original igneous core which is overgrown by a younger rim due to later metamorphism. In this case, the zircons are "drilled", either by a laser beam or an ion microprobe to vaporize it into small pits (see below). The resultant gas is drawn off into a mass spectrometer which precisely measures the various isotopes. The compositional ratios of these isotopes are then plotted on a type of graph with very well defined curves that indicated the age of the zircons.



A back scattered electron image of a zircon ~0.2 mm across showing an igneous core area dated at 2480-Ma-old core overgrown by younger rim at 1800 Ma. Photo courtesy of AccessScience.com

The age-dating of zircons is especially useful for the very old rocks found in the Canadian Shield and other ancient parts of the Earth (e.g. more than 2500 million years). A variety of techniques can be used for somewhat younger rocks including rubidium-strontium isotopes from amphiboles and potassium-argon isotopes from micas.