JUNE 2019

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Club Patron	Mike Johnston		mike.johnston@xtra.co.nz

GENERAL NEWS

Website. Dave Briggs runs the club website, check it out at www.nelsonrmc.org, it is being continually updated.

SUBS: If you have not yet paid your subs please contact Hub.

MEETINGS Please check your emails for up to date information.

Committee:

If any of you wish to become more active in the running of our club, please contact a member of the committee.

This edition contains a lot of photos. You can get a clearer view of them by zooming in. To do this just press Ctrl Shift +

To zoom back out it's Ctrl shift -

NELSON ROCK AND MINERAL CLUB -PRESIDENT'S REPORT 2018

The Nelson Rock and mineral Club have had a good year with a good mix of speakers and field trips.Three field trips had to be cancelled because of access difficulties or insufficient numbers and although some rearrangements were necessary with the speaker program, we ended up with a great lineup. There is a brief summary of Speakers talks and the Field trips on the back of this sheet. Our thanks must go to all the speakers and all the trip organizers as without their contributions the club would not flourish. However, I would ask that more Club members put themselves forward to lead field trips or to help the committee with trips and speakers. We did a trial of some short presentations by club members, rather than fill each meeting with one full length talk and we will continue with this occasionally next year, hoping to bring into the discussion, the thoughts and observations of some of our more retiring members. Also I would ask that members participate fully in the activities of the "Display Table" and the "Finds and photos of the month", so as to take a more active part in our meeting – and please feel free to talk about your finds and displays at the meetings, rather than leave the talking to speakers and the chairman. I would like to thank all those who have participated during this year and urge others to do likewise.

The Club's equipment and collection are only stored in a temporary manner and are not accessible for regular use or viewing. This is probably the most important long term item to be resolved, but as yet, the only alternative apparent is an offer by the steam Museum to house us, which appears expensive and somewhat distant from most members.

A special thanks to Marion Mathews for minding the Club Library, with a bit of help from Alan, also thanks to Greta Tapper who has cared for the sales table this year in the absence of Paul Henare. Thanks also to Dave Briggs for managing the website and offering some space to accommodate a small shed for our equipment and collection: to Tez Hardwick for compiling and distributing our Newsletter and for booking the library for our meetings and arranging the key and opening up. Our secretary Lis Martin has been somewhat hampered this year by work and leave commitments, but hopes to contribute more fully next year, thanks Lis. Last but not least our thanks go to Hubertus OpdenBuysch, our hardworking treasurer who keeps us on our toes and ensures that membership and bills are paid on time.

Your Committee are in the process of preparing a program of Speakers, events and field trips for next year and our plans are for more of the same sort of mix we had this year, but if anyone has any special ideas that they can contribute, please get hold of a committee member tonight to ensure that we have a program with something for everyone.

Finally I would like to thank Mike Johnston for being our Patron and for his advice and assistance to me over the year; and thank you all for attending this AGM.

Happy geologizing until our next meeting in January.

Thanks to Mike for the report, and for being a great President.

Mike Johnston, our clubs' Patron:

Nelson geologist Dr Mike Johnston, of Nelson is now an Officer of the New Zealand Order of Merit for services in geological science and history.

Growing up in the rich landscapes of Nelson has lead Dr Michael Robert Johnston to become an Officer of the New Zealand Order of Merit for services in geological science and history.

For as long as he can remember, Johnston has been interested in geology, seeing his role as someone getting to understand "why New Zealand, and particularly Nelson, is how it is" while sharing that information to the general public through groups, talks and books.

Johnston said when he was young, family outings around the region sparked his enthusiasm for earth science – being fascinated by fossils, rocks and the terrain.

"Pa would take us up to the Brook Dam ... and he used to point out this old railway line going up to copper mines."

He said his dad was also a keen fishermen so he would "trail along behind him in the rivers".

"I was more interested in looking at the different rocks.

"Back in those days ... in the Baton River, there was still old miners eking out an existence there. I used to stop and talk to them."

Since the days of Sunday afternoon drives packed in the car with his family, Johnston has become a leading authority on the geology of New Zealand, being in the profession for more than 50 years.

He has written numerous publications including books and papers on New Zealand geology, geologists, mining history, early European exploration of New Zealand, and Nelson history.

Johnston said one of his greatest achievements during his career was "getting to understand what makes Nelson", including Dun Mountain as a prominent attribute.

"That's a very unusual place, geologically, and it's got a lot of history from the copper and chromite mining that went on there in the 1860s."

Johnston has been a member of the Geological Society of New Zealand and its successor, Geosciences Society of New Zealand, since 1962.

Currently working on his seventh book, Johnston said it was geology that kept him alive and he would be involved in it till the day he dies.

"It keeps the brain ticking over."

One of the comments stated: "**Well done and well deserved Mike .** Your books have inspired me to get out there and find many of the mining sites around Nelson and Marlborough. Your research and detail is faultless. Looking forward to reading your latest book."

I am sure we all agree with that sentiment

After the Presidents report at the November AGM we were given a talk by Logan Coote. Logan was brought up on D'Urville Island and we thought he would be ideal to give a talk from his personal experiences. Logan currently manages the collections department at Blenheim Museum and has always been an avid collector himself.

His talk covered the history of the argillite and copper mining on the island and then cool rocks of the nelson mineral belt especially D'Urville island. Dun Mountain, the Cobb Valley and then onto his favourite mineral, jade (of which he had many samples to show us. He also knew about California which, he pointed out, bears many similarities to our local area.

A very entertaining and detailed talk which whetted our appetite for another field trip there:

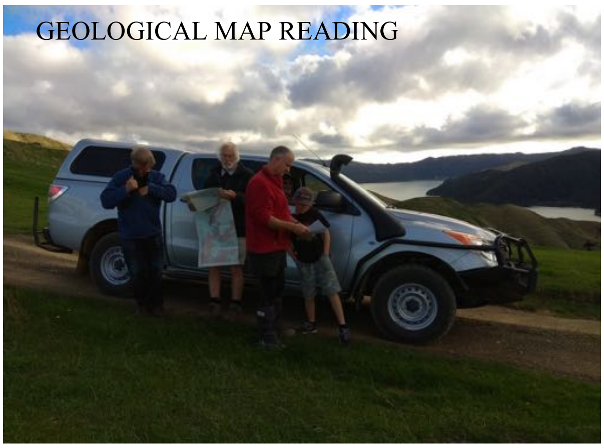
D'Urville Island Field Trip 25th – 28th April

This was the second Nelson Rock and Mineral Club trip to D'Urville Island, the previous being in 2014

The island is about 49 km long and 10 km wide and the northernmost third has been completely cleared of bush for farming. One of the main features which interests us there is the a band of Serpentinised rock, formed from upthrust moisture intruded basalt crust and debris which runs from North to South, formed some 270 million years ago when New Zealand was part of Gondwana. The other main block of rocks is the sedimentary Greville formation which contains fossils, especially ammonites and in the far west there are granites of the Brook Street formation, though the latter were not visited.

We took two 4WD vehicles across the French pass and we made for the Community Centre where we were to stay. We stopped on the way at a small stream issuing from a Serpentinised embankment, the first point of collecting.

We arrived at the Community Center just as a group of visitors from Driftwood Eco Tours were meeting with the D'Urville lighthouse keeper, plus a couple of Bee Keepers, and we had a short interesting chat with some of them. We offloaded our overnight gear and had a quick lunch then we set off to explore the top end of the island at a place which Chris had picked out from an interesting survey which showing a particularly tangled structure of different basalts and serpentine. The road to the north of the community center passes through many areas of low growing scrub, stunted because of the unfavourable mineral content of the serpentinitic ground on which it struggles to grow, but nonetheless there are patches of forest here and there. Driving north onto the treeless cleared portion of the island, at the end of the public road we found a domed outcrop where we fossicked about happily for an hour or more finding epidote in quartz, garnet and just the faintest traces of copper and other material yet to be identified.


GEOLOGICAL MAP READING

The next morning dawned fine, but the weather report was not good for the following day so we decided to do two excursions that day.

First trip was to Wharatea bay, a steep climb down from the ridge road to the coast, where we hoped to access Tunnel Point to investigate an exploratory copper addit. There was plenty of serpentinitic material

about the track as Dave, Chris, Tez, Victoria and Zac headed off, but the track was well worn and very steep through forest until close to the coast. The beach was littered with argillite chips and flakes from Maori tool making. Victoria's prize find was two complete Argonaut shell cases. The route to Tunnel Point was unclear, so the group turned back and were back at the community Center for lunch.

While the group were descending to Wharatea Beach, Mike explored exposures of serpentine and mélange along the ridge road, as well as finding time to examine and photograph some of the interesting flora associated with these areas.

After a quick lunch we headed off for Kupe Bay, but we had an extended stop at an interesting serpentine outcrop, where Mike predicted there would be antigorite. In spite of thorough searching, no antigorite was found, but there was plenty of rock breaking in the search for other minerals. Dave deftly reduced a block with diopside to collectable pieces. This site had been opened up considerably since the first trip. The embankment on the north of the road showed interesting demarcation between faulted blocks of material. Just for the record, on the first trip I did find antigorite, two very nice examples. Most of us collected material from this site, much of it for examination under the microscope.

Shortly after this stop we had magnificent views of Kupe Bay, far below us and we drove slowly down the narrow winding road to the beach.

Sue and Terry Savage met us there and Terry brought out his display box of mineral, shell and fossil finds in the area. Of particular interest were argillite stone implements and of course the ammonite fossils which I had first seen on the previous trip. I noticed that he had not found any new fossils in the previous four years, nevertheless we set off enthusiastically along the beach to search for finds. Once again we failed to find any ammonite fossils, but I was once again fascinated by the many sea smoothed boulders of layered Greville formation rocks scattered along the beach margins.

That night the ping pong table was disappearing under the load of samples, maps and papers scattered across it.

The third day, as predicted, was cold, wet and windy, so the morning was passed reading, examining samples or sitting in front of the fire. By lunch time the rain had stopped so we headed off into the blustery wind to check out some of the old Maori argillite quarries not far off the road. We located two of these, but the third appeared to be in paddock on private land, so we returned to the community Hall for our last night there.

COPPERMINE BAY

On the final morning we woke early, packed our gear in to the vehicles and tidied up the hall, before setting off to Kapowai to meet the ferry which would take us to Coppermine Bay. We were there early so we had time to fossick the shoreline. Of course I had told them we would find talc here. At first we found nothing and they began to doubt me, but finally a few pieces were spotted and then a large boulder of talc in the rock wall. The talc I had found so easily before had been covered over by an extension of the launching ramp. The ferry, run by Craig and Christine Aston whisked us off to Coppermine Bay where we divided into four groups,Vanessa and Irene on the beach reading and chatting, Tez and Zac on the jetty fishing, Dave, Chris and Victoria battling their way up the hill to the copper mine area and Stephen and myself fossicking around the shoreline – later joined by Tez and Zac. There was a very interesting mix of serpentenised rock around the shoreline, light coloured and dark and various shades of green, it appeared that some serpentenised pillow lava was amongst the mix. Such a variety that one was tempted to collect a bit of each, but we would have overloaded the ferry had we done that

COPPERMINE SPOIL HEAPS

The Coppermine gang returned with samples from the spoil piles which were distributed around so that everyone had a few pieces to take away. Interestingly all the samples showing copper mineralization were strongly magnetic. A few of the samples collected from the beach, not showing copper, were also slightly magnetic, whereas most of the material collected elsewhere was not magnetic at all.

The ferry boat returned to pick us up just before three, returned to Kapowai to load up the vehicles and dropped us and vehicles off at French Pass. We arrived home in Nelson just before dark.

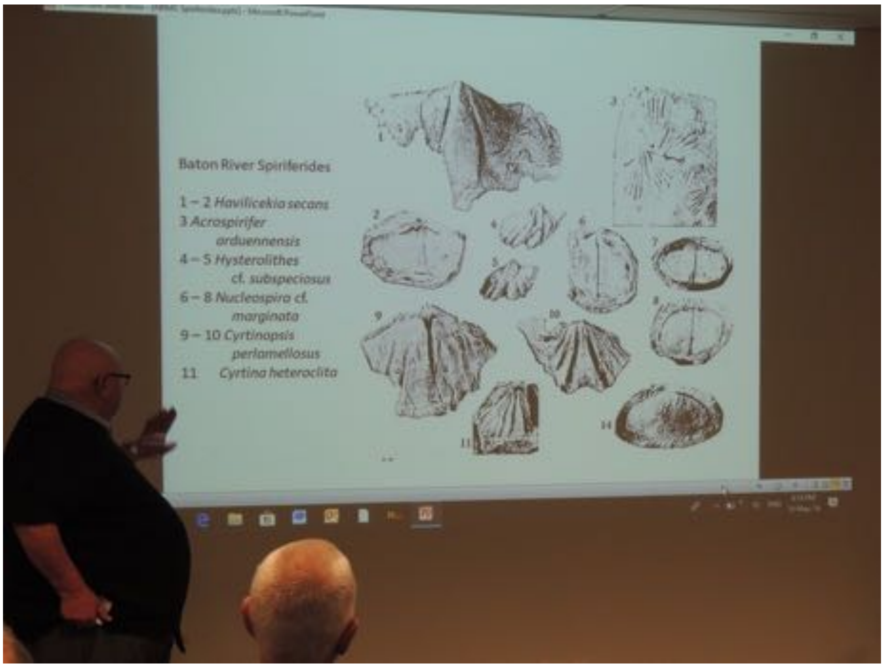
Nelson Rock and Mineral Club Talk by Don McFarlan May 16th 2019, report by Mary Davies

Spiriferinids - Was Their Last Stand at TeMaika Peninsula?

Talk accompanied by photos of fossils, charts/diagrams and maps

Don is a retired drilling geologist living in New Plymouth. He worked out of New Plymouth, from 2000 – 2016. He completed his master's degree under Jack Grant-Mackie (who was working on his own PhD at the time). He went on to complete a PhD at Otago University in 1985 and has published thirteen articles. During his career, favourite hobbies included the study of brachiopods, and retirement is giving him more time to spend on brachiopods. Don has completed a lot of his work in conjunction with Hamish Campbell and Jack Grant-Mackie, which included studying early Jurassic brachiopods in New Caledonia and publishing a book on Triassic and Jurassic rhynchonellides.

The spiriferids first appeared in the Ordovician and existed through the Silurian and Devonian, peaking in diversity in the Permian with 145 different species, after which a slow demise ensued; it took three cataclysmic extinction events in the Permian, Triassic and Jurassic for them to go extinct.



They are characterised by their butterfly shape along with two internal calcite spirals that supported the lophophore, moving water through the system. This feeding system died with the spiriferinids. There are two groups, the longer-lasting was the spiriferinids, which have fine holes in the shell allowing the mantle (the part of the body that covers the inside of the shell) to communicate with the outside. The spiriferids do not have these punctae. Both groups can also have fine spines on the exterior.

Other brachiopods existed alongside the spiriferinids, including the two main groups in mocern faunas, the rhynchonellides and terebratulides.

Current thinking shows that the spiriferinids held on in New Zealand longer than anywhere else on the planet, and as evidence Don showed us a photo of a the Dactyliocerasband in situ at TeMaika Peninsula that is Late Ururoan in age. No finds later than this have yet been found anywhere in the world.

A bit more information about spiriferids through the Time Periods:


Speriferides from Reefton 53mm wide

One NZ Silurian brachiopod was sent to Australia to be studied, but unfortunately has not been seen since.

An Early Devonian fauna can be found in and near the Baton River, not far from Nelson. Don showed us several photos of spiriferides found in the Baton River.

Devonian fauna is also found in/near Reefton, but is nothing like the Baton River fauna as it likely formed in shallower waters and shows a Malvinokaffric effect that is related to fauna found in a number of countries as well as NZ, including New Caledonia, South America and Africa, where the number of genera were greatly reduced but abundance of individual taxa increased.

Terranes. When they were alive, these brachiopods were living on the edge of the supercontinent Gondwanaland. Productus Creek in Southland butts up against the Takitimu Mountains and has been/is a great source of fossil brachiopods.

We have no brachiopods in New Zealand from the Triassic that made it through from the Permian Extinction. There is no evidence of spiriferides anywhere in the world in the early Triassic, but evidence in China shows them struggling back, and pockets such as these worked to spread around the oceans again. By the mid Triassic in NZ, the spiriferinids were present again. One example is Alipunctiferakaihikuana. Other brachiopods also appeared, and Triassic material surfaces in NZ in Southland, Nelson and Kawhia.


Alipunctifera from 88 Valley
75mm wide

The spiriferinid/ brachiopod data became much easier to fit together once plate tectonics theory was accepted as true and correct, and researchers were able to piece together how different land formations had changed and shifted and re-formed over time.

Don gave more examples of brachiopods. The Otapirian-spiriferinidRastelligera had a long hinge line series of teeth that locked the hinge together. It was endemic and fossils have been found in Spitsbergen, New Caledonia and Canada. It was present near both the north and south pole at the end of the Triassic. A related form is Canadospira, described by the great Russian palaeontologist A.S. Dagis. There is information here that needs to be resolved as J.D Campbell and Dagis were working separately on this group at about the same time and didn't read each other's work until it was published.

Don discussed a species of the spirferinidLaballa, an example of Ian Ladd's being found in Fault Gully near Nelson, a shell that first appeared in the Kaihikuan and lasted through the remainder of the Triassic Period.

After the cataclysmic Triassic event at the end of the Otapirian, a diverse fauna developed into the Jurassic, but it was smaller in size than the late Triassic species. Brachiopods were affected by the extinction, but spiriferinids worldwide were much reduced. No spiriferinids have been found in Aratauran beds in Taylor's Stream in the Hokonui Hills, but they are found in Aratauran beds on TeMaika Peninsula, and in other beds there ranging from the Otapirian to the Temaikan.

Brachiopods show Mentzeliakawhiana that appeared in the Late Triassic may be related to Early Jurassic species. Don showed us a distribution chart showing the spread of brachiopods in the Jurassic around the Tethys sea – Spain, Argentina, NZ and Australia were all included.

The Jurassic covered a longer time period (approx. 55 my) than either the Permian or the Triassic, and the Toarcian Oceanic Anoxic Event, possibly caused by increased volcanic activity, in the first half of this time period saw the end of the spiriferinids which were unable to adapt. They survived in areas closer to the north and south pole for longer than other parts, due to the cooler ocean waters; being close to the poles was a good refuge. NZ was close to the south pole at this time, which may be the reason for the spiriferinids last stand at TeMaika Peninsula.

There has been work done on the naming of brachiopods and bivalves resulting in changes, thus naming has become more streamlined, with some of the old names no longer pertinent.

Question time included:

By the mid-Triassic there was a whole new range of brachiopods, different to the spiriferinids, which weren't there at the beginning of the Triassic; does this imply that they came back in large numbers due to taking advantage of the 'space'? A lot more study is needed as there is still a lot to be found out.

There were not many spiriferinids in the Triassic, so what caused them to come back in the early Jurassic? There are no direct leads from anywhere else – some of the rock matrices that hold spiriferinids look the same as rock matrices in other places, but no evidence has been found of spiriferinids in these other places – remembering that only a small percentage of animals leave traces, so rocks are usually not fossiliferous anyway. The end Permian event was a really big extinction – spiriferinids survived in pockets, but changed a lot, as happens after extinctions. China has much earlier Triassic spiriferinids but not many went all through this period; and those that did, didn't survive long.

Names of Periods on the Geological Timescale come from place names in various countries – this is fairly selfexplanatory by reading through the names but includes England, America, Russia, Germany, France. New Zealand has its own names that correspond to the international timescale.

Pig Valley has Etalian fossils/brachiopods.

Not much in the way of fossil evidence has been found along the northern edge of the Hokonui Hills.

Huge thanks to Don for his highly informative talk – we appreciate very much his time and effort that keeps us thinking and learning about our incredible geological and animal world.

Write up by Mary Bourne

Is it Selenite or Calcite?

CALCITE

Selenite

A Facebook riend of mine sent me a picture of a rock that looked almost identical to a calcite sample I found at Riwaka, so I id'd it as calcite. Another friend chipped in and said it was selenite. Well they can look similar. Selenite is calcium sulphate and calcite is calcium carbonate.

Quick test, selenite will scratch with fingernail, calcite will not.
Back up test, Selenite does not react with HCl and Calcite does.

No more argument!

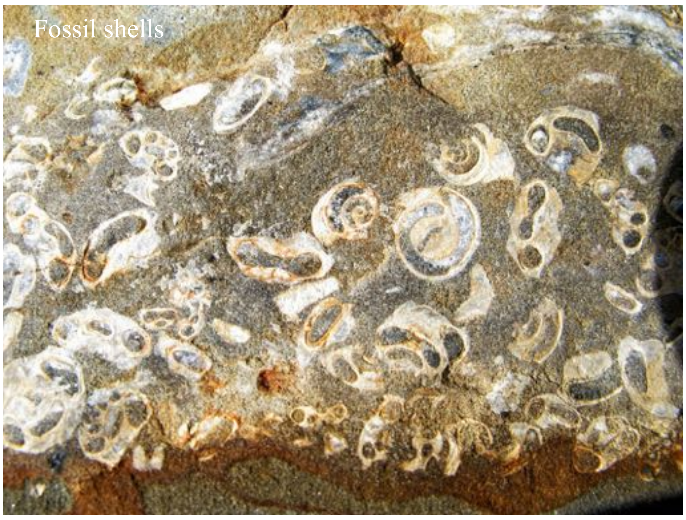
Field Trip to Kaikoura, February 2019

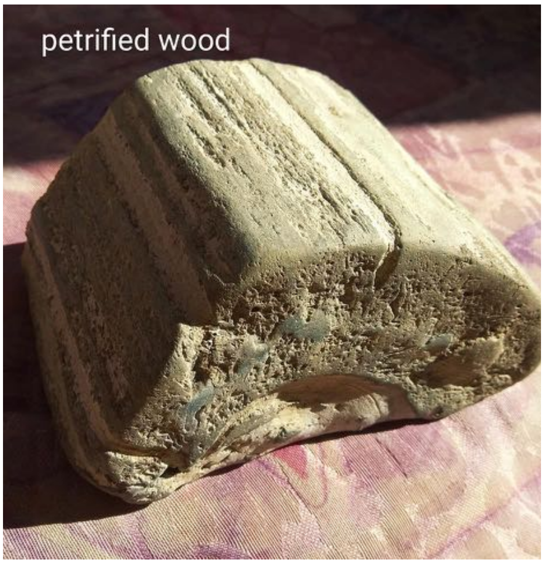
No specific write up for this trip, but I went there two weeks previously and visited similar sites.

This photo shows the effect of earth-quakes on the bed-rocks on the north kaikora bay.

Sample of Zebra stone from North Kaikora Bay. Formed by layers of silica and limestone. This sample tells a complicated geological history of the area.

Samples of cretaceous fossils from Oaro





Belemnites with tiny sharks teeth

Shark tooth

Library Open Day

As part of the entertainment for local school children during holiday time, the club was asked to help out with an interactive display.

Mike Blowers and Stephen Eagar aided by Paul and Greta, in conjunction with the Nelson Institute the Club agreed to assist with a "Show and Tell" session at the Nelson Library on Sunday 5th May .

We had our own mineral display for those without a background in our activities and this proved to be very popular.

Big thank you to the organisers and all who gave up their time to make this such a success.

Here is our feedback:

7th May 2019

Dear Mike
Please pass on to the Club members, who attended Sunday's Show and Tell at the Nelson Library, the gratitude of the Nelson Institute Committee. What a great afternoon. Such enthusiastic children (and adults).
Regards
Barbara Rhodes
President Nelson Institute

Field trip to 88 Valley May 2019

This trip was led by Ian Ladds as a continuation of the clubs study of the area. We were lucky with the weather (that's Nelson for you!) and all the attendees had an informative day out and came away with good samples. The area we were in was mainly showing Monotis fossils and our work consisted of finding out where the bedding started and finished.

I won the find of the month competition with this fine complete (unusual) specimen of Monotis Richmondia

Subduction, Magmas and Ophiolites – a talk by Mike Blowers (condensed version**)**

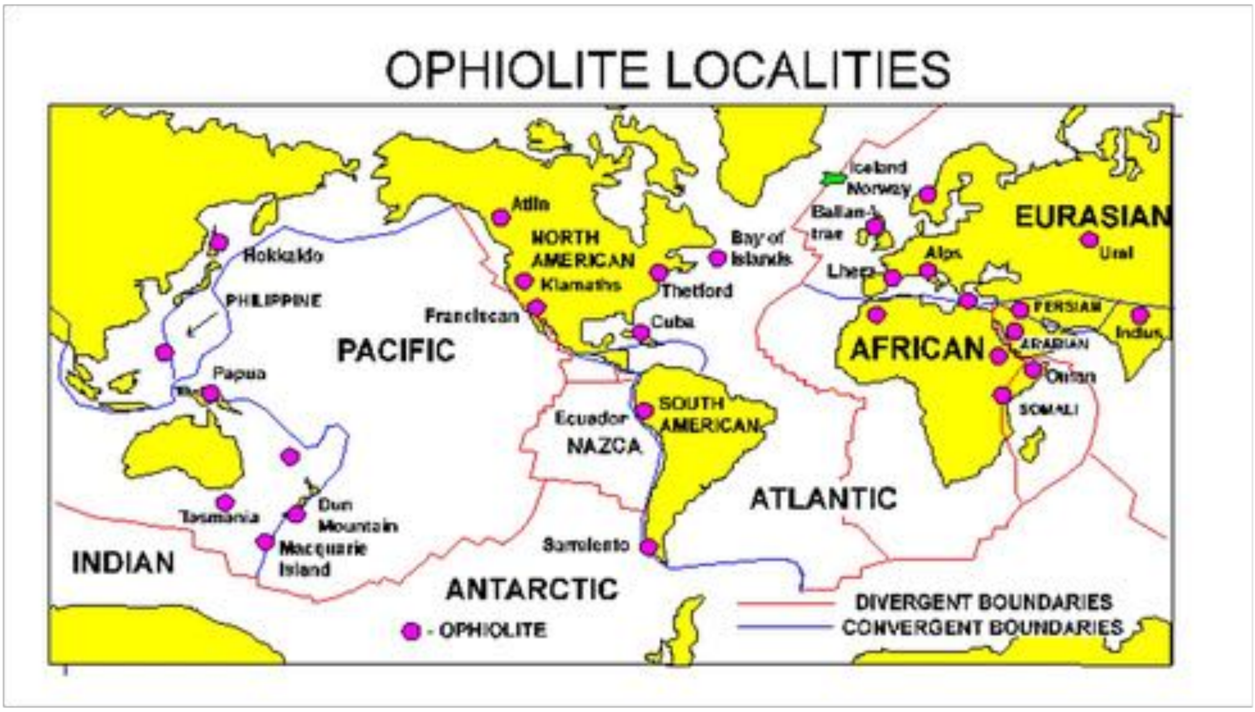
Mike commenced his talk with a brief look at three different ophiolites that he knew of. The first were the New Zealand ophiolites which we have all heard about, the second an ophiolite belt in Papua New Guinea that runs intermittently along an upthrust mountain chain and the third was a small belt of exposed ophiolites, some 14 Km in total length in the tiny Shetland Islands of Fetlar and Unst, adjacent to a thrust fault. In the light of this scanty knowledge he had made three conclusions

they were comparatively rare

they were thin or fragmentary

they were associated with subduction or faulting or collision or plate margins

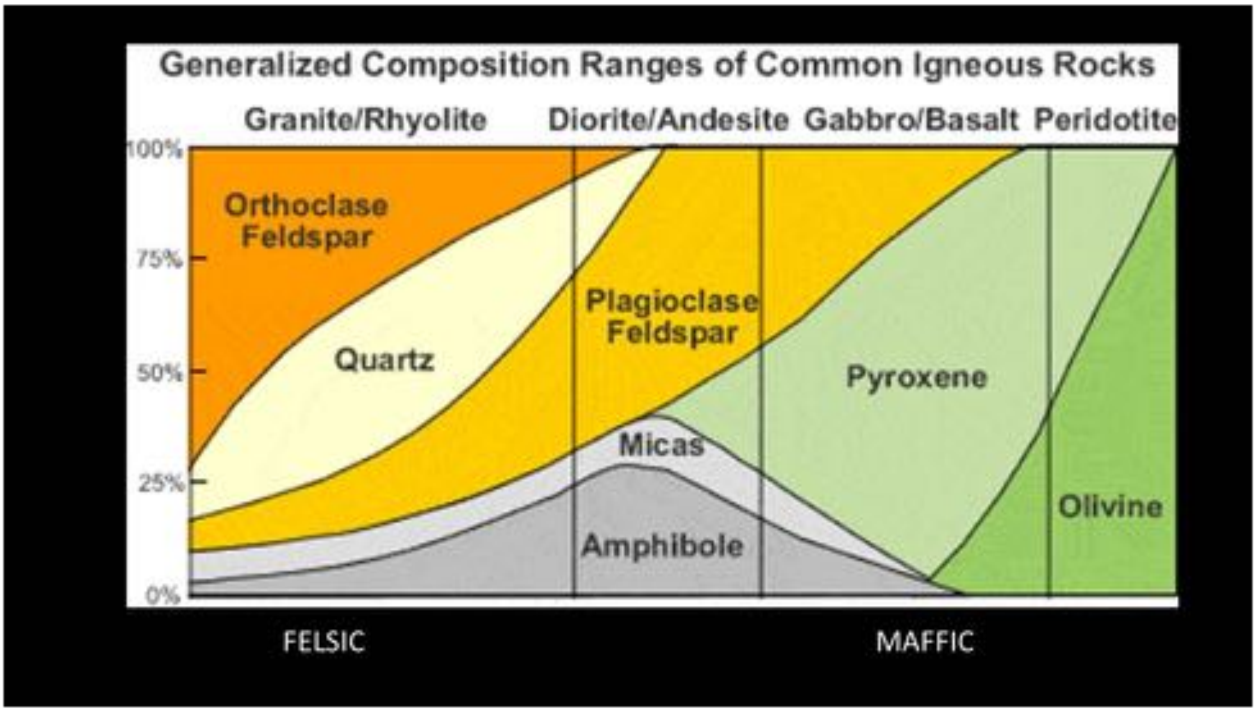
This is where he commenced thinking about putting together something about ophiolites and proceeded to search for more substantial information. The first thing he found was that at there were ophiolites all over the place as shown in this map of the world.



This map of localities seems to confirm at least one of his original ideas, but it soon became obvious that before going into details about ophiolites it would be necessary to know a little bit more about their formation, in fact it would be necessary to go into the full cycle of rock formation, plate tectonics, the formation of oceanic crust, it's subduction and the building of continents.

The first thing to look at is the very matter that the earth is made of, the molten magma underneath the land masses and the ocean crust. Upwelling of this magma in the likes of volcanoes and at the spreading margins of plates, contributes to the formation of new rock.

Consider the type of rock this might make. At spreading margins the mix of rising and cooling magma is basalt, while in volcanic areas it is a granitic mix. These mixes are very variable in composition, there is no one formulae for a granite or a basalt, like there is for the minerals that we are familiar with, like pyrite (FeS_2) or calcite ($CaCO_3$) or fluorite (CaF_2). So we show the variation of magma and igneous rock composition in a chart like this.

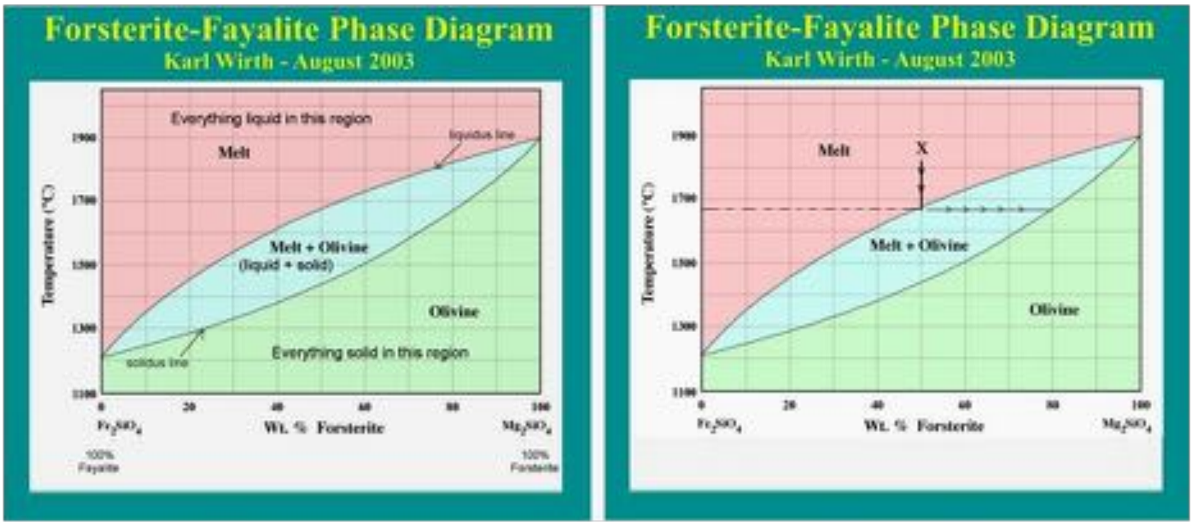


This chart does not show the chemical composition of the compounds such as feldspar, mica, pyroxene, amphibole and olivine, they are not fixed, only the quartz has a fixed composition SiO_2. Let us look at olivine for example. Olivine is composed of four different elements, Mg, Fe, Si, and Oxygen and there IS a fixed equation to show how they are related $(Mg,Fe)_2SiO_4$. At one end of the mixture is a pure compound Fayalite, Fe_2SiO_4 and at the other end a pure compound Peridotite or Fosterite, Mg_2SiO_4 and all mixtures of these are called Olivine. A bit complicated, and this same sort of complication applies to almost all types of rock.

Even more complicated is the way that a basalt cools down, the following diagram illustrates. The left diagram shows the temperatures that various mixtures of Olivine crystalise or melt – at the liquidus line, the other line, the solidus, indicates the composition of the crystals that form, look at the right diagram to see how this works.

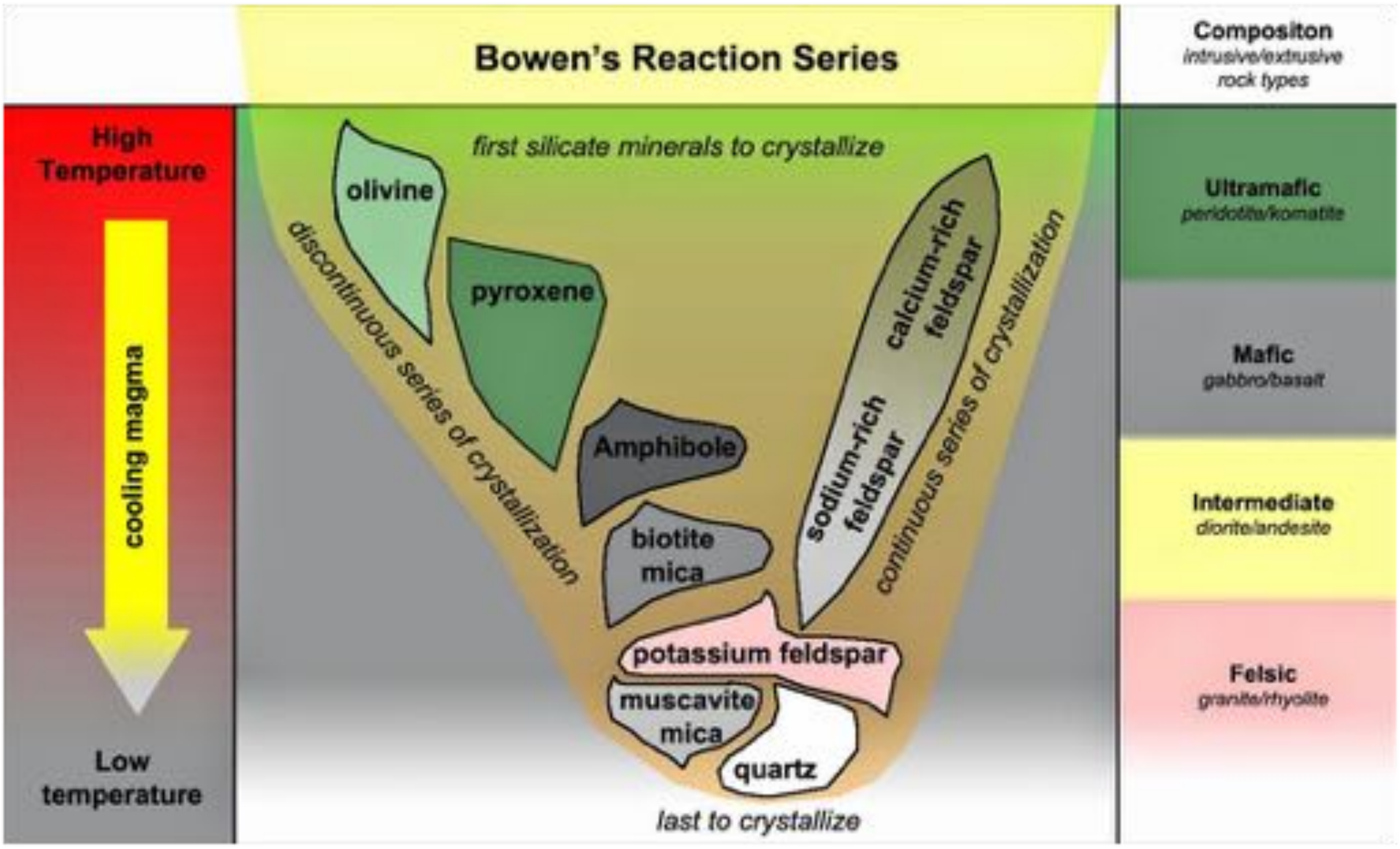
Say we start with a mixture of 50% Forsterite at a temperature of 1850^{o}, indicated by the X in the liquid region, it remains liquid until the temperature falls to 1680^{o}- where it meets the liquidus line, here it starts to crystalise, but to find the composition of the crystals, we have to draw a horizontal line across to the solidus line, and where it touches the solidus, is the indication of the composition of the solidifying crystals, in this case what crystalises out is 80% Forsterite.

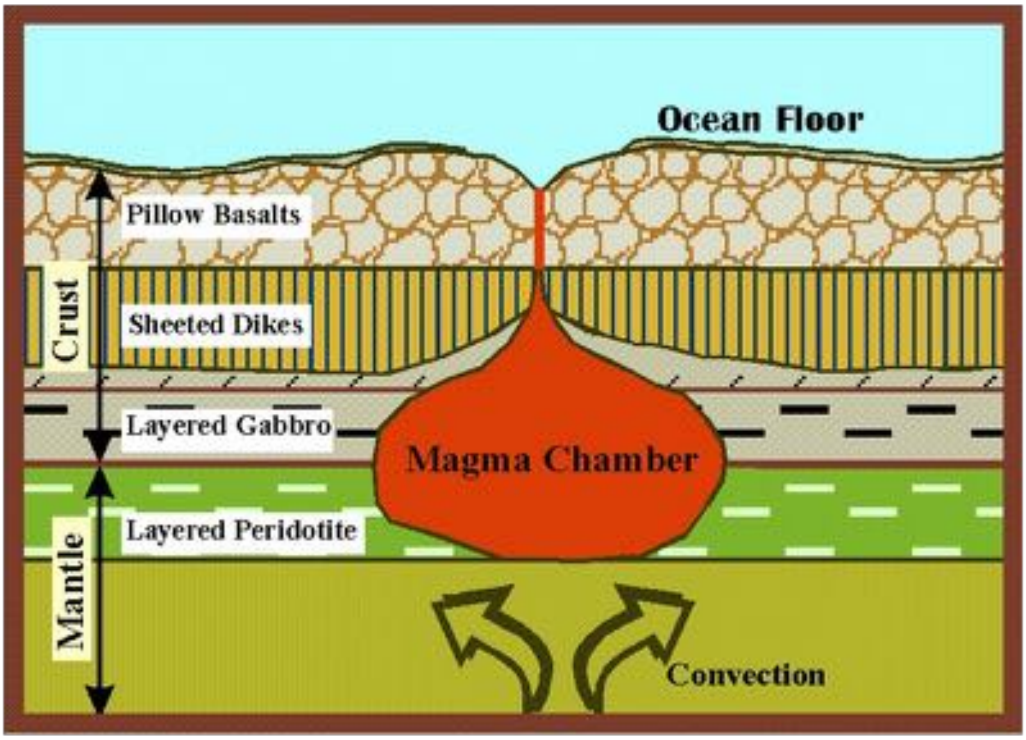
So the liquid and the resulting crystals are at different compositions. What happens Now? Well the crystals contain more Forsterite than the 50% starting liquid, so the remaining liquid is depleted of Forsterite, let's say it is now 40 or 45% Forsterite. We can continue to cool the remaining liquid and you will find more depletion of Forsterite (the same sort of construction to work out the composition) and so it goes on, the concentrations of crystals and of the remaining liquid changing and changing as the cooling process continues. So now you know why geologists use an imprecise word like "Olivine" to describe a mineral that could be anywhere between Fayalite and Forsterite. Of course it becomes even more complicated when you have more elements, for example magnesium, aluminium, calcium all jostling around in a magma, trying to crystalise with the silica, what a headache!



This is why there are so many different rock compounds and geology is full of imprecise definitions to account for these shifting compositions. You may come across many different types of chart to represent these fluctuating compositions for example showing the approximate composition of rocks or the variation of melting temperatures of different sorts of rock components.

To simplify what is going on with cooling and crystalizing magmas there is a Bowens reaction series chart which summerises how magmas cool and what component crystalises first second and third and at what temperatures this happens.



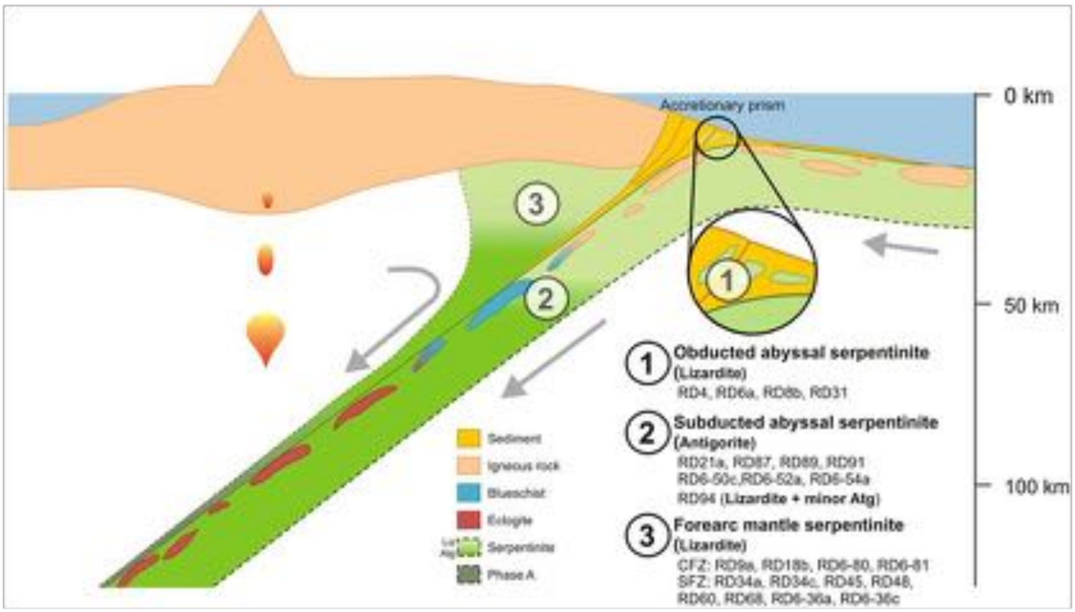


This chart represents basaltic magmas intruding and solidifying at an undersea spreading plate boundary.It shows the different layers that form, depending on the temperature of the various levels and the differing compositions as the cooling occurs. The molten basalt that breaks through and contacts the sea, chills immediately on the outside but the pressure of the liquid material within causes it to form balloons or pillows – hence pillow lavas. The slower cooling basalts form into sheeted dikes, something a little like columnar basalt and the gabbros and peridotites have their own position in the cooled crust that is formed.

Now once the molten basalts, which at high temperatures could not hold any water, have cooled down, they are able to react with water and slowly change into rocks containing bound water, a process known as serpentenization, metamorphosing into a new series of variable compounds the serpentines.

Over thousands to millions of years, this alteration becomes extensive. Generally when a crustal plate meets a continental boundary it will subduct and somewhere deep under the continent it will melt releasing the moisture and forming magma which often rises up to form volcanoes, as the next diagram illustrates. But sometimes the serpentinisedmaterial splits off the subducting crust, and pushes up into an accretionary wedge, which is how the surface deposits we call ophiolites are formed.

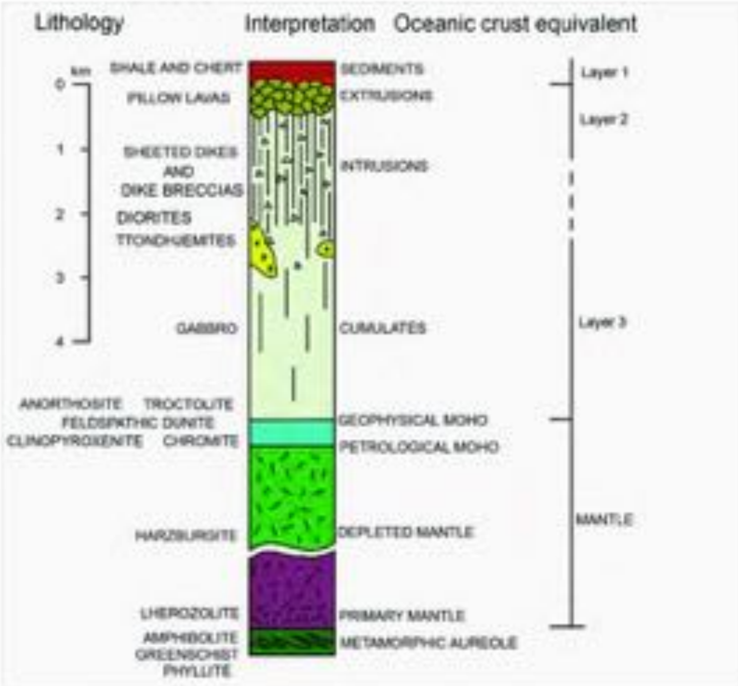
See the next diagram. You will see some new terms here like Lizardite and antigorite and eclogite which I won't describe, but these are other variable composition, metamorphic forms of serpentine which you can look up.

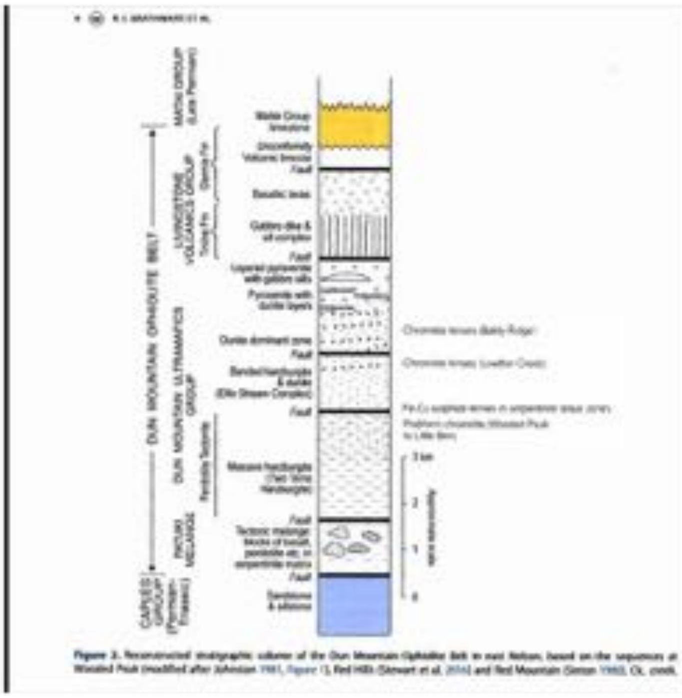


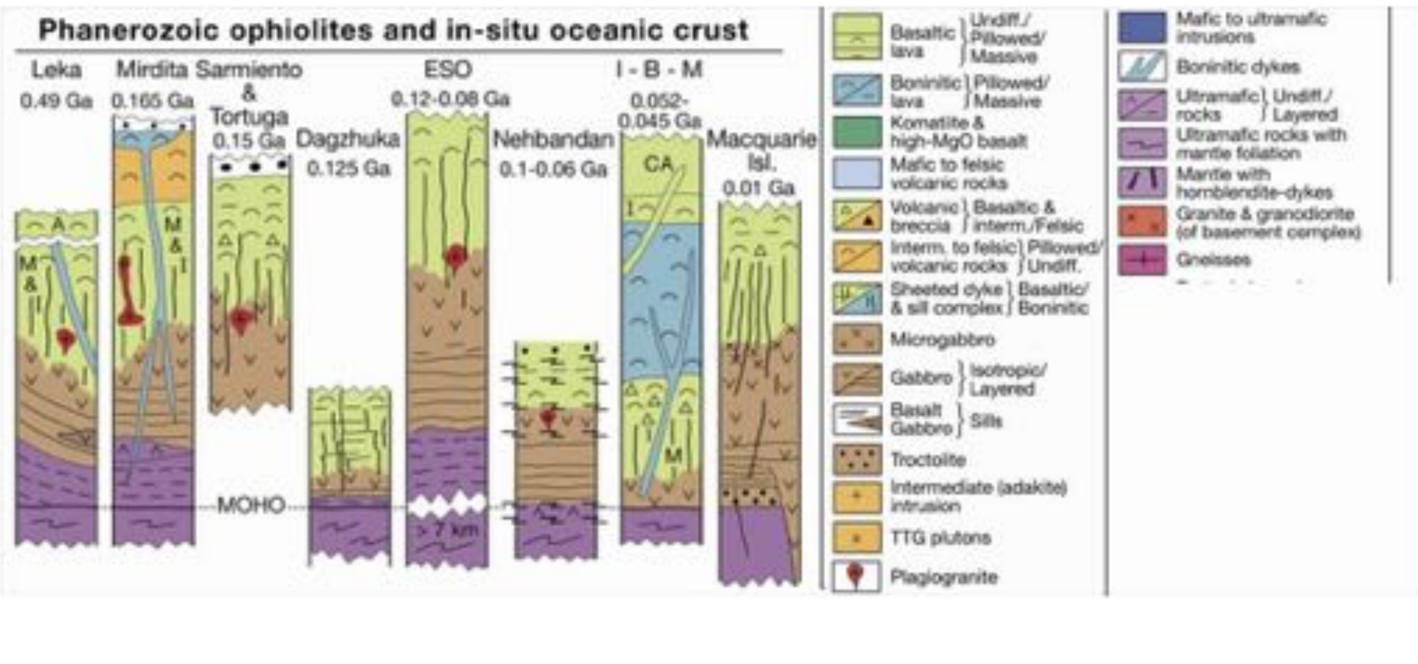
Sometimes these pushed up serpentines have the complete crustal structure, pillow lavas, sheeted Dikes, Gabbro and so on in visible layers, but often parts are missing, because they have remained with the subducting crust, or have been eroded away with time, or have been faulted away.

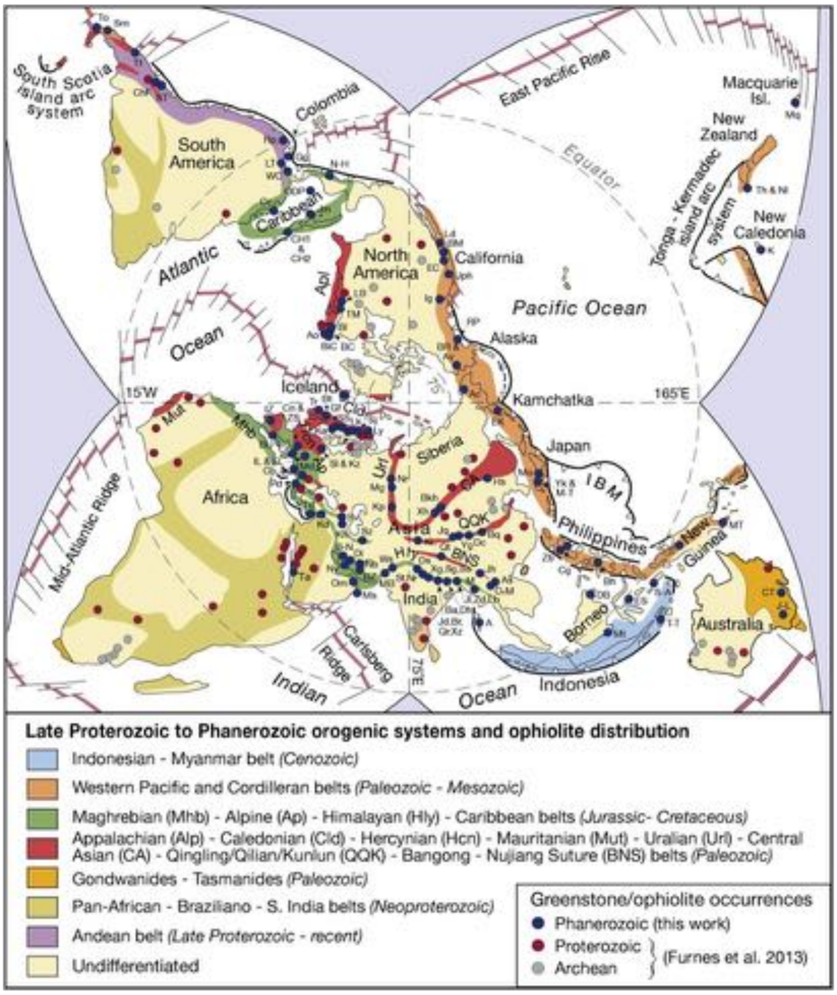
The serpentines, or ophiolites of New Zealand are generally fragmented and incomplete, for instance the pillow lavas are missing, though in places bits of them can be found, but not in the complete layered sequence as can be found in some other countries, most noticeably in the Oman. Our ophiolites are bounded by units of mixed material known as melanges which contain fragments of serpentines and other erosion products such as the argilites (another group of variable composition metamorphosed rock). It is within these melanges that one is most likely to find remnants of the pillow lavas – if one can only recognize them!

The next diagrams show the ideal full sequence and the fragmented sequence at Wooded Peak Hill and below that some of the fragmentary sequences from other countries.



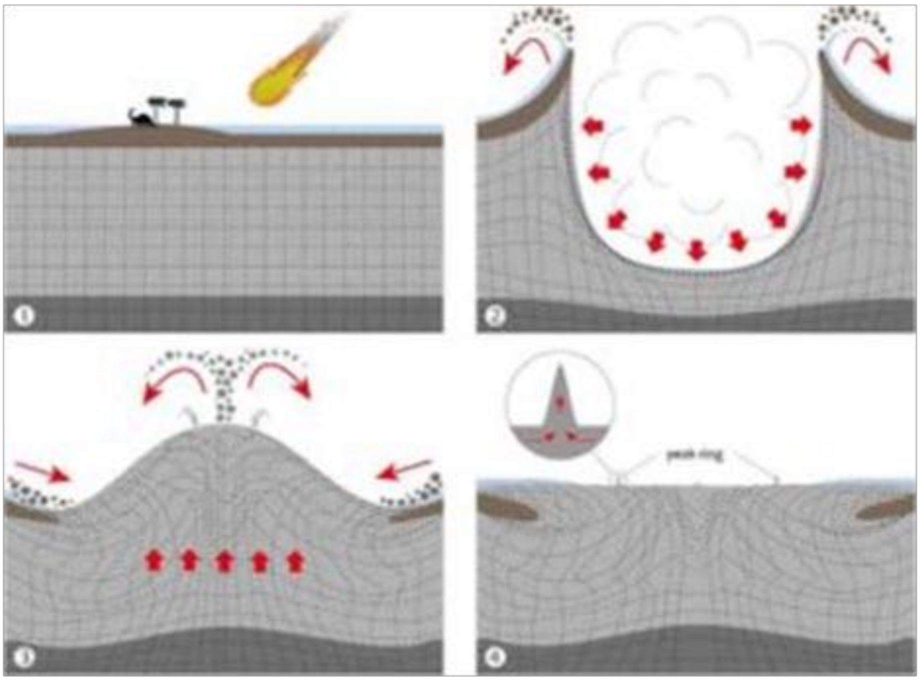






And to finish a diagram showing world wide ophiolite occurrences and the ages of these ocurrences which have been occurring since the time that continents and plates commenced their slow dance.

The formation of large meteorite craters is unraveled



66 million years ago a meteorite of a diameter 14 km wide struck the Earth with an enormous speed of 20.000 kilometers per hour drilling itself 20 km into the Earth's crust (1). Due to the impact temperatures of 10.000°C emerged temporarily, melting and evaporating the meteorite and parts of the Earth's crust. A shock wave arose molding a crater 30 km deep and 100 km wide (2). As the crater collapsed, the mass of rock behaved like a viscous mass, shooting up to form a 20 km high mountain (3). The liquid mass of the rocks of the collapsed mountain moved beyond the crater margins and solidified. This led both to the summit ring and to the flattening and widening of the crater (4). Credit: UHH/Min/Fuchs

About 66 million years ago, a meteorite hit the Earth of the Yucatan Peninsula in what is now Mexico. This event triggered a mass extinction that eradicated approximately 75 percent of all species and ended the era of dinosaurs. Like Prof. Dr. Ulrich Riller of the Institute of Geology of the University of Hamburg and co-workers report in "Nature", the hitherto mysterious formation of the crater and its mountaneous peak ring. The peak rises in the middle of the crater above the otherwise flat crater floor. In the future, these findings can help to decipher the formation of the largest craters in our solar system.

Much has been written and discussed about the gigantic crater with a diameter of about 200 kilometers, the center of which lies near the Mexican port city of Chicxulub. How the giant crater took its form has been a mystery until today. In particular, the formation of a circular series of hills could not be explained in detail. This so-called peak ring rises in the crater several hundreds of meters above the shallow ground and can therefore be found in other large craters in our solar system.

The structural geologist Prof. Dr. Ulrich Riller and an international team of scientists have now succeeded in describing for the first time the extreme mechanical behavior of rocks in the event of a large meteorite impact. The researchers found the evidence in the Chicxulub Crater as part of Expedition 364 of the International Ocean Discovery Program (IODP) and the International Continental Scientific Drilling Program (ICDP).

Computer simulations have shown that craters this size form within a few minutes. This means that solid rock behaves like a fluid for a short time and solidifies very quickly during cratering. As the science team reports in the current issue of the journal "Nature", their research supports the hypothesis of so-called acoustic fluidization, where rock behaves like a viscous mass through contemporary pressure changes (vibrations). The obtained drill cores display a variety of zones of broken rock, which the team considers to be evidence of transient fluidity of the rock. The team was able to transmit the results in numeric models, which simulate the exact formation of the crater and peak ring.

"The results of our research team have far-reaching consequences for understanding the formation of large impact craters in our solar system," explains Prof. Riller.

Reference:
Rock fluidisation during peak-ring formation of large impact structures, Nature 562, 511 (2018).
DOI: 10.1038/s41586-018-0607-z
Note: The above post is reprinted from materials provided by University of Hamburg.

UPCOMING EVENTS

Future program (possible, but definitely not finalised– Check your emails for updates)

More information

NELSON ROCK AND MINERAL CLUB = Program 2019

Date	Event	Speaker/Leader
July 17 Wednes-day	**MEETING Glaciation in the Top of the South**	**Dave Briggs**
21st	**Micro minerals workshop**	**Chris Frazer**
Aug 15	**MEETINGHawaianVolcanics and Eruptions**	**John Dow**
18th	**Riwaka Quarry**	**Peter Ingram**
Sept 19	**MEETING Club member short talks**	
22nd	**Canaan Downs**	
Oct 17	**MEETING Minerals, photography and identification techniques**	**Tim Saunderson**
26-28	**Trip – Labor Weekend – Golden Bay**	**Tez Hardwick +**
Nov 21	**MEETING AGM**	**Mike Johnston**
24th	Trip Faults Earlier in year if site is accessible	Paul Wopereis

The programme is flexible, updates will be issued by email, and you may check out our website.

Tim Saunderson as many members know, is a valued member of our club who has shifted to Auckland.

He is still very active with his interest, and if you would like to see what he is up to you may subscribe to his newsletter which he publishes on an ad-hoc basis.

This is free, all you need to do is email Tim and he will send you a copy whenever he publishes. His email is saphesia@gmail.com and the 3rd issue of his Geonews was produced on 24th February 2018. A well presented and informative read.

A large rock saw is available for rock cutting at a reasonable price, TheRockFella 10 King Edward street Motueka. Call 022 137 4574 for details