December 2015

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GENERAL NEWS

PRESIDENT: Mike Blowers was voted in as president at the October AGM. What a great choice, and we wish him all the best for the coming year

Vice President: Dave Briggs was voted in as Vice President at the October AGM, Dave comes with great credentials and we are lucky to have someone at our club with his knowledge.

Digital file storage for Club business is being stored on Diane's OneDrive. The directory is viewable but not editable for those granted sharing rights. If you want access, email Diane and she will email you the link .

Dave Briggs is overseeing the construction of the club website, this will be up and running in 2016 and will be a continual work in progress. Details will be announced as soon as practical.

December 13th BBQ:Rabbit Island. 2pm, Straight across the T junction and to the right.

Talk by Professor Alan Cooper on the Haast Schists, 17/9/15, write-up by Mary Davies

Professor Alan Cooper, from Otago University, Dunedin, talked about the Haast Schists to the membership tonight.

Alan showed us a geological map that illustrated the complexity of the geology of NZ. There are two provinces of NZ – western and eastern – with the western province being originally part of the Gondwanaland supercontinent. These were once thought to have formed in place as part of a large New Zealand Geosyncline – but study and research have moved this old belief on to current and more accurate understandings involving plate tectonics. All eastern province terranes have been accreted to the Gondwana nucleus.

The Haast Schists were cooked up very deep in the Earth's crust. They incorporated all the schistose of the geosyncline formed of the Haast Schists – and these are well represented in the metamorphosed rock.

The 150 km boundary between the sediments of the Torlesse and CaplesGroups form the bulk of the Haast Schists, which are defined as the textural change between schistose and non-schistose greywacke. You can tell schist as it will split into parallel sided slabs when hit with a hammer.

There are four textural zones defining the schists which are differentiated by the white mica grain size and the foliation.

Textural zone 1 – detrital textures only with no orientation of metamorphic micas – rocks include sandstones, mudstones, greywacke, argillite

Textural zone 2 – weak orientation of metamorphic micas, contains psammite, will break along cleavage planes if hit. Rocks include foliated greywacke, semi-schist and slate

Textural zone 3 Detrital quartz and mica unrecognisable, maximum textural grade of psammite, banded with thin, discontinuous segregations. Rocks include quartzofeldspathicschist, grey schist

Textural zone 4 schist with coarse quartz and mica segregations, foliations of differing thicknesses and lengths. Rocks include quartzofeldspathicschist, grey schist, gneiss

TZ1 rockscan be found in Canterbury,TZ2further west,and TZ3 and TZ4 in Otago, Marlborough and the Southern Alps.

The Haast Schists have been deformed once, twice or three times. Alan showed us photos of different deformations – lovely structures with some folded just a little and others a lot. The schists formed when the terranes collided during accretion, causing folding on a grand scale. This process is known as Regional Metamorphism. Within this, nappes are the terminology for folds on a regional scale over 30km or so. The Haast Schists generally show multiple planes of foliation – thus multiple places where they will break.

When rock is heated, prisms of prehnite will form within quartz veins. If the rock is further heated you get pumpellyite which show as prisms of green, rich in iron. This manifests in low grade psammite. Add some more heat and the last two low temperature-forming minerals disappear, breaking down into chlorite, then with more heat into biotite. With more heating almandine-rich garnet forms, then albite plagioclase crystals rimmed by overgrowth of oligoclase. The temperature is now about 550degC. With more heating the rock forms kyanite and then melts into granitic

magma with high grade schist/gneiss and pegmatites. The pegmatites eventually differentiate into quartz veins.

We went through a series of photographs with explanations (this is reflected by the aggregate writing up of this paragraph): Metamorphosed greywacke is the dominant rock in Canterbury although there are others. Lake Hawea shows metamorphosed conglomerate. We saw the Greenschist of Burke River. The Taieri Reef showed pillow lava in the pumpellyite zone basalt. We saw photos of these pillows rounded and flattened, then almost obliterated. At its highest grade basalt becomes garnetised. Metabasalts are often associated with silica-rich rocks that originally includedradiolaria.On Mt Aspiring there is metachert in the greyschist sequence. In the garnet zone of the Haast Schists there is piemontite schist to be found. Marble can be foliated – we saw a photo of one stretch of limestone that had been cooked, flattened and folded. The final lithology in the Haast Schists is metaperidotite, now a serpentinite. This occurs in the Pounamu Ultramafic,first mapped by Morgan in 1908.Metaserpentinites are in tectonic contact with metagabbros, in turn intruded by basic dykes, and overlain by volcanic breccia. In places, if you smear the volcanic breccia out you will get greenschist. We saw a section of rock that showed a sequence of volcanic breccias overlain by marble/chert overlain by biotite rock, overlain byquartzofeldspathic schist**.** The entire sequence is remarkably like ocean crust – being referred to by geologists as an ophiolite. It was emplaced into the rest of the schist sequence during collision and accretion.

The age of the Haast Schists is less than 400 000 000 years.The rocks originated in the Carboniferous, Permian and Triassic. Then in the Jurassicthese rocks were brought underneath Gondwanaland due to sea floor spreading and the metamorphism occurred – this was 140 – 160 million years ago, during the Rangitata orogeny. The Torlesse Terrane material collided with the Aspiring and Caples Terrane material – greywacke with ophiolites. It caused major rock deformations and of course the growth of the different schist minerals during metamorphism. However, a recent study that Prof Alan has been involved in shows that some of the rocks associated with the Pounamu Ultramafics are much younger than the Rakaia terrane to the east. This has created a conundrum which will be investigated with further study and research into the future! Thisnew terrane (a block of ground that up until now has been included within the Rakaia Terrane) is newly named the Pounamu Terrane. The biotite rock of the Pounamu Terrane wasrecently U-Pb datedfor their zircons**.** The results showed that it had originally been a Cretaceous tuff as the zircons were in good condition, not rounded at their edges. The age of the zircons are108million years, but they have been subsequently metamorphosed at about 72 million years, indicating that the Alpine Schists is, in part, much younger than the Otago Schist.

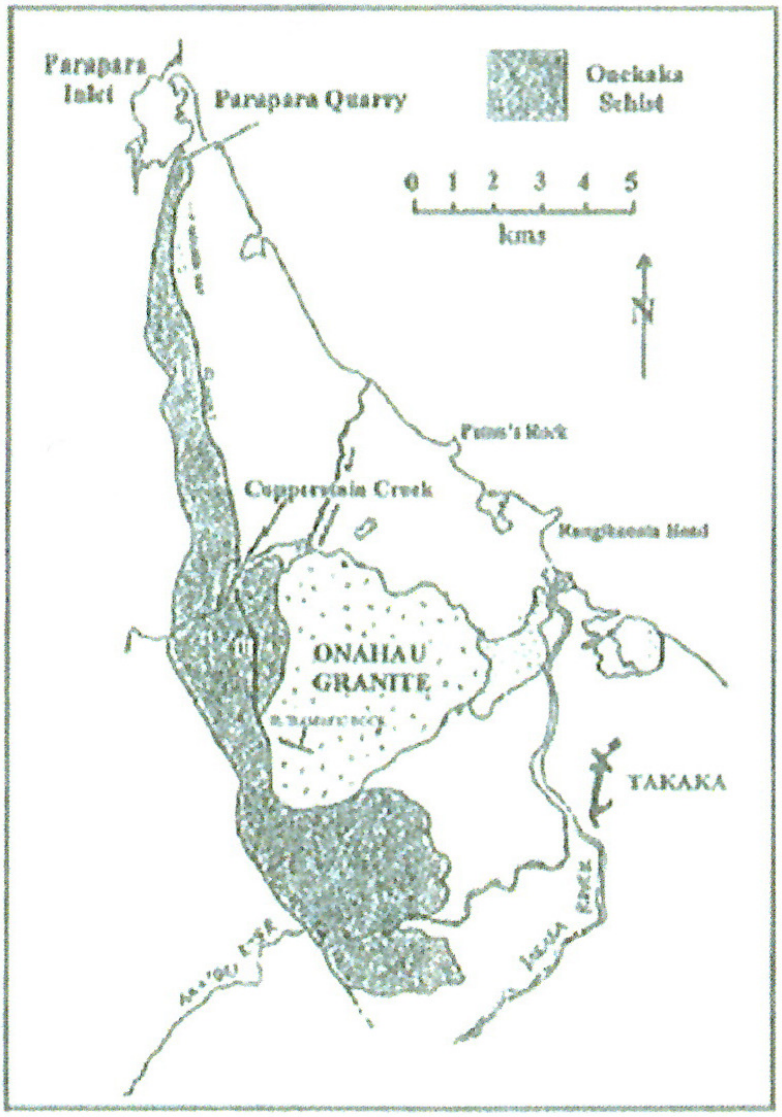
Where gold is found in the South Island, it means that it precipitated out of the fluid that was released during the climax of metamorphism.

We saw a photo of Gaunt Creek north of Franz Josef,where you can see the Alpine Fault. There is plenty of ongoing movement still happening due to the Alpine Fault and tectonic activity – there will be more schist being formed right now beneath New Zealand.

Mylonite and ultramyloniteare highly foliated with mica and feldspathic minerals being resistant to the effects of shearing. When they come close to Earth's surface they form cataclasite – these are simply mylonites that have been brought up and smashed.

Schists form at 40kms below the Earth's surface. The peridotites of Dun Mountain (dunite being

the main one) are like that too – they form deep down,and they rise up through oceanic crust from the Earth's mantle (more technically by the process of 'oblique collision').
Big thanks to Professor Alan for taking the time out to come and teach our club on this fascinating subject – this talk was followed by a field trip with Alan to Copperstain Creek in the rain!



FIELD TRIP TO COPPERSTAIN CREEK - 19 September

The Saturday morning was overcast with a light drizzle.. We were meeting at Motueka at 9am . Seven very keen members turned up. Our trip leader was Clyde and our guest speaker, Professor Alan Cooper accompanied us. By the weather forecast it was supposed to clear at midday, so we were hopeful of a nice day.

We arrived at the car park which is the start of the Parapara Peak Track. Ten metres from the cars is the first river crossing. Some were lucky to get across with dry feet. The track followed up the Pariwhakaoho River then climbed up into Copperstain Creek. The track is in poor condition, probably caused by slips after heavy rain several years ago. By the time we were in Copperstain Creek it had started to rain and we made our way upstream to a skarn in the creek bed.

At Copperstain Creek/Pariwhakaoho River the Regional and Contact metamorphism is exposed together with some skarn mineralistion. The Regional metamorphic rocks, comprising mainly of schists and marble are seen in the Pariwhakaoho R. where they dip eastward. These are metamorphosed Silurian and Ordovician rocks in age and yield a variety of minerals including pyrite, kyanite, epidote, micas etc. In Copperstain Ck., the Onekaka Schist is intruded by granodiorite from the Separation Point granite batholith emplaced in early Cretaceous time giving rise to skarn rocks and suphide mineralistaion. Here we found malachite, azurite, chrysocolla as well as layers of chalcopyrite. Further up the creek we saw skarn rocks including the minerals garnet, molybdenite and pyrite.

The garnet was plentiful and most had specimens to take home. Lunch in the rain and then started back down the creek back up onto the track. While some walked back to the cars, the rest of us decided to walk down Pariwhakaohe River for a bit, mainly looking for kyanite; unfortunately no nice kyanite specimens were found. We all met back at the car park, where a hot cup of coffee went down well, then headed back to Nelson.

Report written by Stephan Eagar and Dave Buchan

Dr Mike's Talk on October 14th 2015 on The Geology of a Small Part of China, reported by Mary Davies.

Dr Mike went to China as part of the history of geology group he belongs to. The conference was at the Geosciences University of China in Beijing where Dr Mike also stayed. Not many people spoke English – a good reminder to anyone wanting to travel there to do some brushing up before

going! Communicating with written Chinese worked fairly well. In university grounds were dozens of slabs of rock, including chrysanthemum rock.

We saw lots of photos of old China as Mike got out and about as part of the conference. There were pictures of street vendors, brick walls, and pointed curved roofs with granite terrain in the background. High rise living is much more common now in China. Some of the new high rise buildings are standing empty, not being worked on as due to the economic downturn. Temples pictured relate to Confucious. Trees are valued and there are lots of plants in the city – one photo was of a much revered serpent tree because of the markings in its bark.
The first geological stop (with members of the conference and university students taking part) was part of a day trip in the middle of the conference – this was to a quarry of Early Cretaceous Fangshan Granitic Complex. Granite is used extensively in buildings, walls, footpaths and the like and the waste is crushed for aggregate. Some of the features to be seen in the granite are drill holes from the splicing of the slabs, xenoliths, veining and pegmatitic dikes – some with tourmaline.

They visited Peking Man Site Museum at Zhoukoudian,which had a similar roof appearance to the way Maori worked with argillite, before going to the nearby Peking Man Archaeological Site.

Beijing is the home of Peking Man, or *homo erectus pekinensis*, one of our ancestors who lived about 750 000 years before present. The climate 750 000 years ago was alternating between glacial and warmer interglacial. Mike had a photo to show us of the popularist image of Peking Man. Photos showed a limestone formation with a village below it. Here were the actual excavations for Peking Man, which were found in caves in the limestone. There is secondary travertine coming in to the limestone, making it difficult material to work with as it tends to cement all the debris including artefacts and human remains. The deposits also reflect the freezing and warming that took place during the Pleistocene glaciations. There were descriptions carved in the limestone.

Peking Man Site Museum

Dr Mike went out towards the east from Beijing to the Zhaoyuan goldmining area bordering the Yellow Sea. This involved a 4 hour bus ride then 3 hours of a fast train gliding along at 303km/hr. The track is elevated to reduce danger from, for example, cattle moving into the way. Towers support the fast trains – there is a lot of engineering geology necessary before these tracks are installed.

We saw the geological map of the area. It showed Archean metamorphic rocks, Proterozoic metamorphic rocks and Mesozoic granites, to name a few.

Mike visited the Mount Taishan Global Geopark. He saw no Cambrian material though he would have liked to! But the hosts were focussed on showing the gold areas. They were on a gondola ride through granitic terrain – Mike showed appreciation of how difficult the local geologists might find it to map this terrain as it was very steep, rugged country. On some of the mountain tops there were temples in the granite with plenty of signs to give information about the geology.

Mike saw a lovely outcrop, which was Archean comprising migmatites – which is gneiss that has partially melted to form silica-rich granitoid igneous rocks (sediments rich in silica can become granite). Other metamorphics present were gneiss and schist. These rocks were a whopping 2.7 billion years old – Mike showed us photos of some of these rocks. These rocks are in marked contrast to the low-grade metamorphic rocks around Nelson, such the zeolite facies (readily distinguished by the red iron-rich zeolite heulandite) of the Richmond Group and the slightly more metamorphosed Maitai Group of the prehnite-pumpellyite facies (the Marybank Formation at Atawhai has been subjected to more pressure so that it belongs to the lawsonite facies).

They visited the gold mine – there were plenty of tipheads and popperheads. In China the mining is around more low grade material – creating a whole different economy. Everyone on the trip had a go at gold mining in another museum a bit like Shanty Town.

They visited another mine and we saw panorama photos with a popperhead, cyanide tanks and settling ponds. They visited the control room for the mine, and saw a map of the mine which showed the mine going to a depth of 630 – 700 metres. In the walls of the mine metamorphic layers often ended abruptly, displaying complex structural activity. Mike saw gold-bearing rock but couldn't see any gold within. In the processing plant were bore mills. Mike couldn't get information about the yield of this mine due to the double translating going on, not to mention that his hosts had never been to this mine themselves before. The finished products were largely turned into jewellery. China is the biggest gold producer in the world but does not export any of it. Instead it is all being retained in that country.

We saw a second photo of a Chinese geological map drawn by hand. This one illustrated pluton activity coming up from the Earth's mantle and affecting the surface of the land. It showed the history of the gold-bearing rock development during the Mesozoic. This gold formed in a craton – a very stable piece of land anda very different tectonic setting to our Median Batholith that formed on the edge of Gondwanaland.

Other brief points that came up were that lots of lovely rocks and minerals were on sale in the rock shops (at high prices); the translations from Chinese to English created wonderful funny moments, and we saw photos of the Great Wall of China which Mike visited.

Talk by Professor Ewan Fordyce on Thursday August 19th 2015, written up by Mary Davies

Early in his career, Prof Ewan was inspired by Frank Climo to complete his thesis on marine whales, after Frank dug up (or caused to be dug up) several tooth whales at Puponga Point. These tooth whales had jaws 1 ½ metres long and lacked teeth so couldn't be properly identified. There's scope to find more.

Prof Ewan's main stamping ground is the Waitaki Basin and fossils are his speciality. He has had a lot to do with setting up The Vanished World Trail, centred in Duntroon. This trail is all based on research and is a treasure for the public who want to find out more about New Zealand's geology, particularly that of the Waitaki Basin (this is geological terminology – in geographical terms this area is known better as McKenzie Country). You can follow the Trail near Oamaru for an 80km stretch – the signboards give lots of information about the fossils of the North Otago region. The Trail is self-guided and free. It's on both public and private land and is widely scattered, sign-posted, and have fossils, rocks, minerals and landforms on display and holds scope to collect on public land only. Each sign-posted site has a fingerboard or plaque explaining significant geology. Some of them require a short walk to reach the site. Examples of areas covered include the Anati-niEarthquakes and whale skeletons.

There are four parts to the Trail – the centre in Duntroon, the Trail itself, an Incorporated Society to promote the work, and the Friends of The Vanished World Trail which you can join by paying an annual subscription. The Trail is dependent on volunteers. It is strongly recommended that this treasure be cared for by future generations of New Zealander's – the current volunteers/guardians need to have more helpers to help carry this on – if you know anyone who might get into this tell them to visit the centre in Duntroon.

Prof Ewan mentioned two marine fossils found in the Nelson region – a young grill from D'Ur-ville Island about 200 000 years old and a fossil dolphin found on the North West Nelson coast.

Prof Ewan discussed the meaning of a fossil and surmised that it doesn't have to be contained in a rock or sediment – that it could be mummified or a bit of dna. All the fossils of The Vanished World Trail are taken from solid rock.

The Australian and Pacific Plates are doing a combination of pushing together or subducting one under the other, forming the largely submerged continent of Zealandia.In the Miocene mountains grew and then the sea retreated from the Otago region. In other words it was driven out when the plate boundary became active and forced uplift that drained the sea off the land. There was glacia-tion 12 000 years ago. The outwash from the uplift also formed the big Canterbury Plains.

The Waitaki Basin fossils range from the Cambrian to modern. Plant life includes Cretaceous leaves with beech-like leaves, and leaves from ancient explosion craters near Middlemarch. There is Cretaceous to Eocene (80m – 40mya) coal from swampy settings to be found, along with areas of amber. There are Microscopic remains of fossils that are mostly now extinct. These are also found in the Oligicene rock of Malta, Georgia , and the Soviet regions.

At Shag Point Prof Ewan found a Cretaceous Kaiwhekeaplesiosaur (sometimes called shagosau-rus) which is housed at Otago Museum. Fossils show the skull, neck, shoulders, ribs, belly, flipper and tail. This plesiosaur ate small soft-bodied prey. Mosasaur have also been found. This was eel-like, but big.

The Moeraki Boulders are septarian carbonateconcretians– they contain cracks within that radiate outwards.

In Taylor's Quarry, in Ototarastone (group of the Oamaru Formation) he has found brachiopods, scallops and bryozoans. These fossils originated from reef-like shoals around ancient volcanic Islands.

Oligicene vertebrates and invertebrates are found in Kokoamu greensand and in the overlying and harder Otekaikelimestone. Dr Brian Marples may have been the first to see the oligicene fossils in the greensand and limestones of the Waitaki Basin – he often spotted bones in the rocks as he searched for examples of spiders, his area of passion. Some of the finds in this rock include whales, dolphins and penguins. The age of some of the fossils found in this rock (and in other fossils, flora and fauna) and the fact that they have been living in New Zealand since the split from Gondwanaland suggests that New Zealand has never completely submerged, though Hamish Campbell might argue this one!

If you grind and heat Oamaru Limestone you will find organisms such as bryzoans, foraminifera, and ostracod. There is some bone but it's rare. This rock was formed in an environment with a constantly moving bottom current which broke and tumbled material causing it to become small and fragmentary fossils. The Takaka Marble metamorphosed the limestone altogether, obliterating fossils altogether. But the Greensand and Limestone fossils were formed further out in gentler, calmer water with not nearly as much breaking up which is why such wonderful fossils can now be extracted from it.

Prof Ewan described some of the fossil-extracting field work for us. The rock is not so hard that it can't be dug and scraped by a pocket knife. It was likely only ever buried one kilometre deep - shallower than the rocks of Mangahouanga in Hawke's Bay which have been far harder to extract dinosaur fossils from. We saw photos including of a dawn baleen whale being prospected and excavated with some help from a rock cutter. The prof is a big believer in treating fossil-bearing rock carefully so there's minimal or no damage to the fossil itself. Once extracted, the fossil is wrapped up in bandages for transportation. Other equipment used in extracting the fossils include pneumatic drills and cutters, chainsaws with tungsten carbide teeth, diamond saws and sinter cutters. Later in the lab scrapers, microscopes, and chemical processes (acetic acid, vinegar) are used, the latter repeatedly in a soaking, rinsing and drying process until no more crystals form. This work is often completed with the help of students and volunteers – often older folk.

The reconstructions, in addition to adding to research, relate stories of this ancient life to the public.

The shark Carcharodonangustidens is an extinct great white shark that was 9 metres long and weighed 6 tonnes; its fossilised teeth give perspective to its size. It was bigger than a modern great white shark which grow to 6 metres long and weigh 1 ½ tonnes.

Other fish found in the Oligicene sediments include the bony fish, moonfish and billfish.

Some of Prof Ewan's favourites are dolphins and the large fossil penguin platydyptes (25-22mya). Penguins have been hopping across beaches at the end of each day for 60 million years. When platydyptes was walking the beach, there would have been coconut palms as a backdrop. There are good fossil reconstructions of these that reflect well their size. Prof Ewan's favourite dolpin is wai-

patia. This is related to dolphins that live in fresh water rivers in southern Asia. They are endangered.

Most thrilling for Prof Ewan to work on are fragments of a fossil penguin discovered by him – another large species called Kairuku penguins. The fragments reveal a surprising amount of data about the penguin's relationships and life styles. This find brought the number of New Zealand species to four.
A new species of baleen whale, Mauicetus (23-30mya), was collectedby the Prof and his team. This whale had a toothless upper jaw, and was an ancestor of the modern baleen whale. It was likely to be a gulping filter feeder, taking tiny sealife to eat. It probably could suck in 70 cubic metres of seawater in one go.

The shark- toothed dolphins, squalodontidae, is now extinct and has no modern descendent. The reason for this is not known. Perhaps competition or climate change that it couldn't adapt to. The skull of this animal toured New Zealand with the Dead Precious exhibition a number of years ago.

The dolphin Otekaikeahuata (22-24mya) had a spear-like tusk. A fossil of this tusk is snapped off and about the length of a finger. The tusk may have been used to hunt, stab, stir up sand on sea floor, or for fighting. The fossil tusk is worn which means that it was still being used once it had snapped. This seems to suggest that it was using it to dig on the sea floor.

Huge thanks to Professor Ewan for a fantastic and informative talk – lots of scope for further learning from the matter covered here. We look forward to hearing about future finds from Prof Ewan and his team.

Field Trip to Oaro, October Labour Weekend by Tez Hardwick

We rendezvoused at Ward Beach at mid-day for lunch and fossicking. The sea has worn the pebbles smooth and flat, and if you search hard enough you can find lovely stratified samples. I took my Grandson Zac, who is 7, it was his first Rock Club trip and his problem was what to leave behind.

We walked along the beach hoping to find ammonites, but unfortunately ran out of time, it is quite a walk to the fossil location.

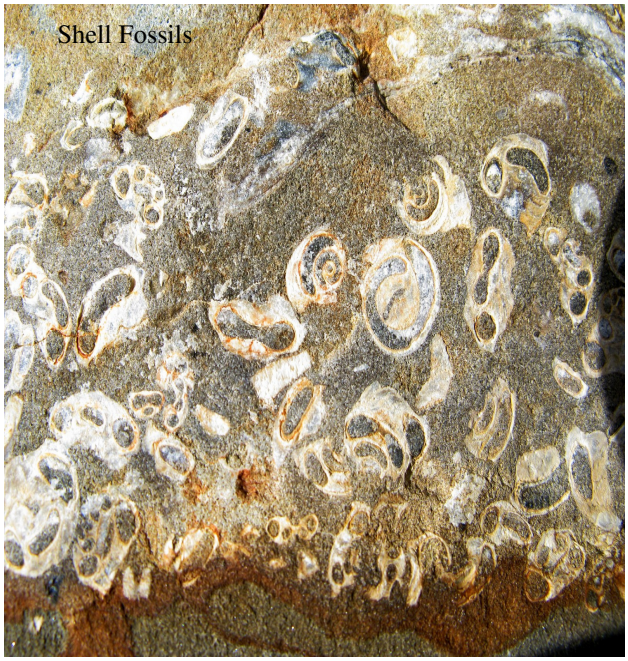
Dave Briggs vaulted over a rock, and soon discovered that he had also vaulted over a rather large sunbathing seal. Dave hopped nimbly away and we all took more care, there were many hidden seals.

After a couple of hours we hit the road again, our next main stop being a stream frequented by playful seal pups. Mike Blowers and Paul Henare got some great video and photos. The walk upstream took us to a picturesque waterfall (with more seal of course)

We met up with Clyde at the Goose Bay campsite, early to bed for a 5:30 start to catch the low tide.

It is about a 7km walk from the parking area to the beach alongside the railway track. The route can be easily travelled by bike. Where the tunnel starts there is a reasonable access to the beach, the last 10 metres or so being rather steep. And the we were straight into it. We get a couple of hours or so either side of low tide in which to collect.

NATURE'S CANNONBALLS
(CONCRETIONS)


Shell Fossils

We found bits of dinosaur bones, belemites, sharks teeth, pyritised wood, pyrites, belemnites, various shell fossils, selenite and more seals.

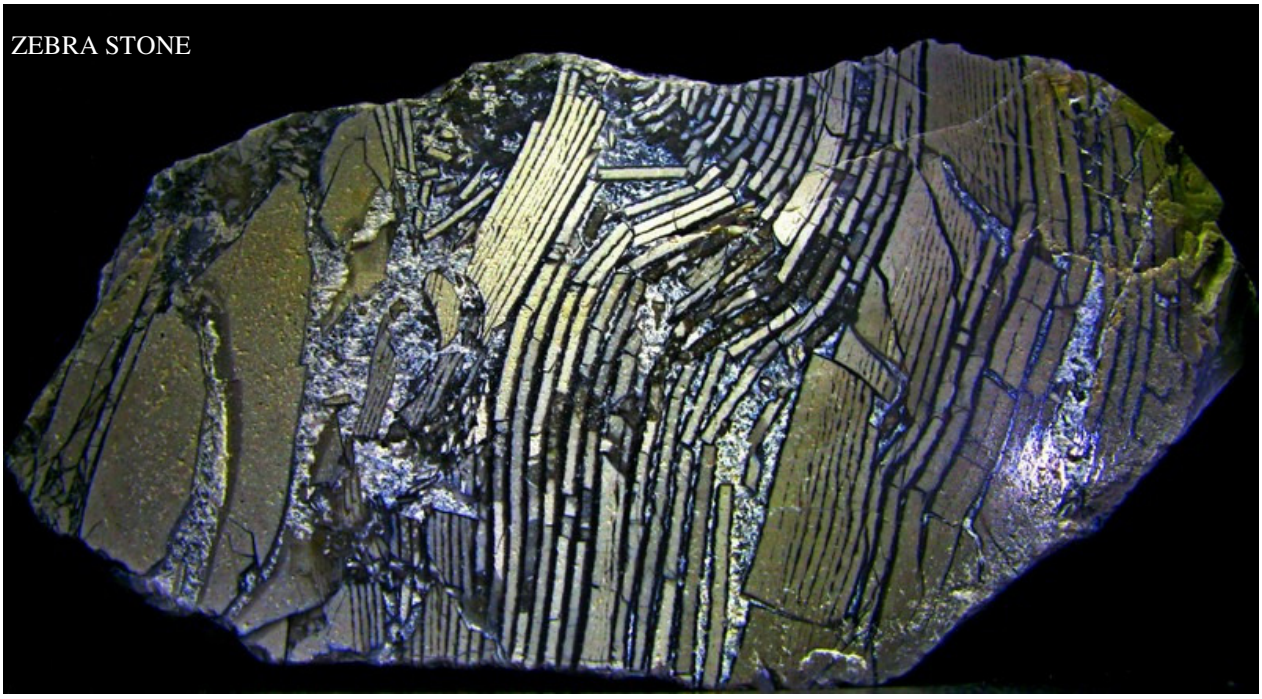
We walked back after some lunch, and found the stream where there is plenty of fossilised wood to be found.

We regrouped back at the camp site, Dave and Paul had to return to Nelson. The rest of us headed to Conway river for exploration.

Here we met a local farmer who had a keen interest in rocks, he took us to a location for fossils, something to follow up on a future trip maybe.

Next day we stopped of in Kaikoura by the wharfe in search of Zebra rock.

Early morning rockhounds, Oaro



This is a piece of Zebra Stone that I found then cut and polished it later. The faulting in it is quite remarkable. I would be interested if anyone knows how this piece might have been formed.

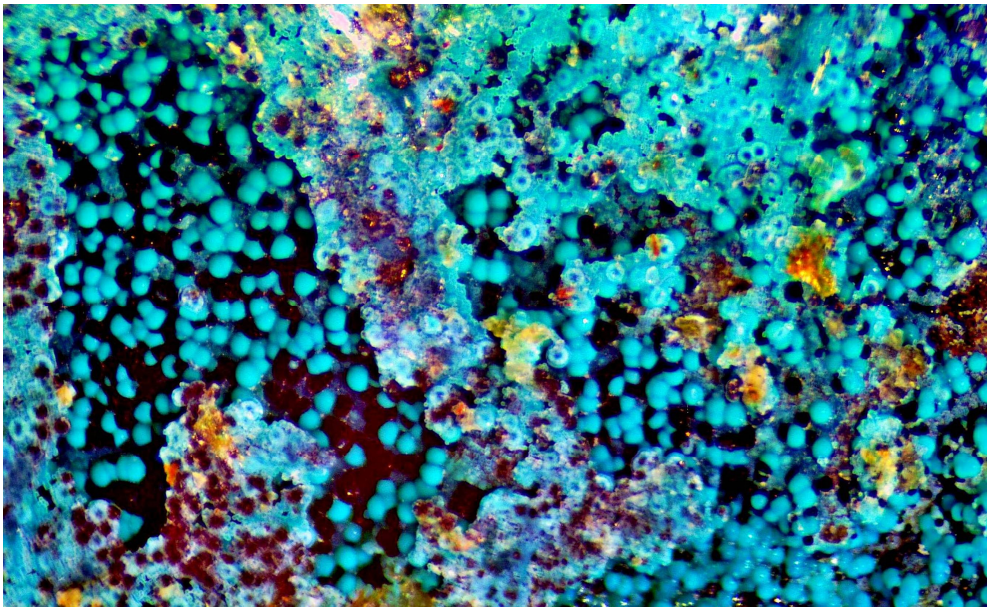
Then we drove to a sand dune site where Clyde showed us where to find ventifacts.

It was a great weekend and the weather had been perfect.

Jock Braithwaite Find of the Year Award

The entries had to have been personally found during the current year

The entrants were judged by Mike Johnston, Diane Toole and Hubertus op den Buysch. The winner was a micromount sample of MacGuinessite, found at the Champion Mine by Tez Hardwick



Mcguinnessite : $(Mg,Cu)_2(CO_3)(OH)_2$

Blue botryoidal crust of McGuinnessite with botryoidal black mineral (unknown)

Found at Champion Mine, NELSON

Named after Albert Leo McGuinness (in 1981).

Mcguinnessite is a rare mineral that occurs in serpentinized peridotite.

The width of view of this photo is approx 4mm

UPCOMING EVENTS

December 13th BAR-B -QUE: Rabbit Island. 2pm, Straight across the junction and to the right. There are permanent cooking facilities there, so bring something to throw on the barby, and a dessert to share. You can also bring along something to brag about.

BBQ Spot, rabbit Island 2013

January 9th: Club collection and database working bee at Davies-Bourne

February away trip, Waitangi Weekend: Reefton. Mike to make enquiries re a contact there.

Further details will be emailed to the members.

Malham Cove waterfall

Yorkshire

A sight not seen for centuries.

MERRY CHRISTMAS TO ALL NELSON ROCK AND MINERAL CLUB MEMBERS