Issue 4 August 2019

Tim's Geonews

An informal collection of observations on minerals, microminerals and fossils of New Zealand by Tim Saunderson

Some time ago Peter Daymond-King kindly gave me some sand collected from the Ohinemuri River, near the Victoria Battery in the Karangahake Gorge. The battery was created in the 1890's to process ore from the nearby Martha mine which was at the time, one of the richest gold mines in the country. I won't go into the history of the gold mining in the area, fascinating though it is; there is plenty of info on the web. Such as this site:

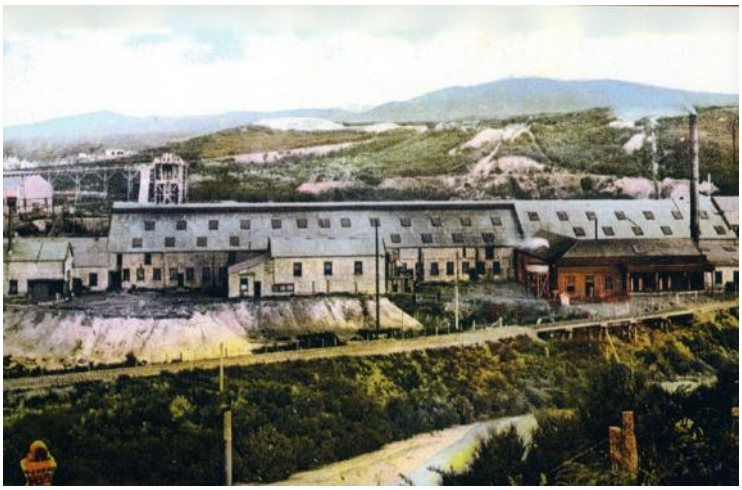
http://www.ohinemuri.org.nz/journals/41-journal-15-june-1971/751-the-waikino-battery

The river's source is north-east of the town of Waihi, close to the shore of the Bay of Plenty, but flows west rather than into the bay. It runs through the steep-sided Karangahake Gorge, forming a break between the Coromandel Range and the Kaimai Ranges.

The sand from the Ohinemuri river is derived mainly from rhyolitic ashfall and ignimbrite deposited east of the Taupo Volcanic Zone and also from weathering of the local andesites and rhyolites. Quartz is quite common in the sand, mostly as fragments and occasional whole crystals of alpha quartz after beta quartz but also as small quartz crystals (probably weathered out of the local andesite). The beta quartz crystals often have gas and/or fluid inclusions inside them, evident as slightly greyish bubbles. Usually beta quartz crystals consist of two terminations without prism faces in between them, however one of the crystals I found in the sand does in fact have prism faces which technically makes it "Cumberland habit"

For an explanation of Cumberland habit and various other quartz habits check out an excellent website called **The Quartz Page**

http://www.quartzpage.de/crs_habits.html



Victoria Battery, Waikino circa 1897

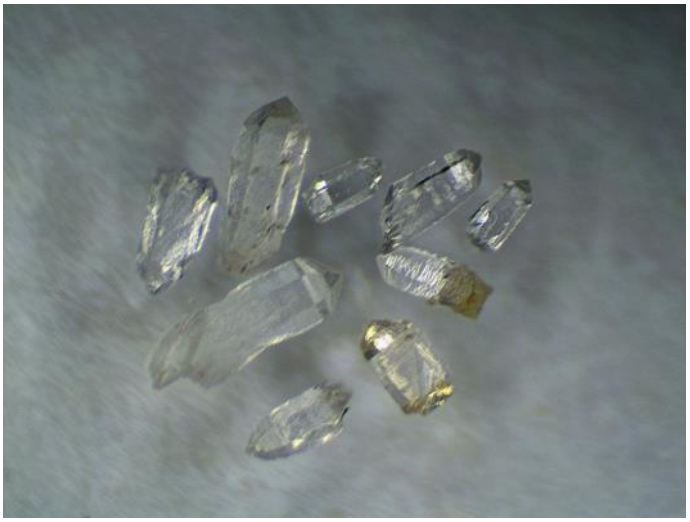
Small crystals of alpha quartz after beta quartz

Many of the crystals that make up the sand from this locality formed in lava inside a magma chamber. A fairly common phenomena is that of resorption; this is where crystals begin to dissolve back into the melt due to subtle changes in temperature and pressure. Resorbed crystals have very smooth, glossy rounded faces or sometimes no crystal faces at all. In contrast, crystals that are simply eroded or weathered tend to have a dull, frosted surface. Vermiculite crystals and fragments are found in the sand, often curved and slightly translucent. These would have originated in rhyolite.

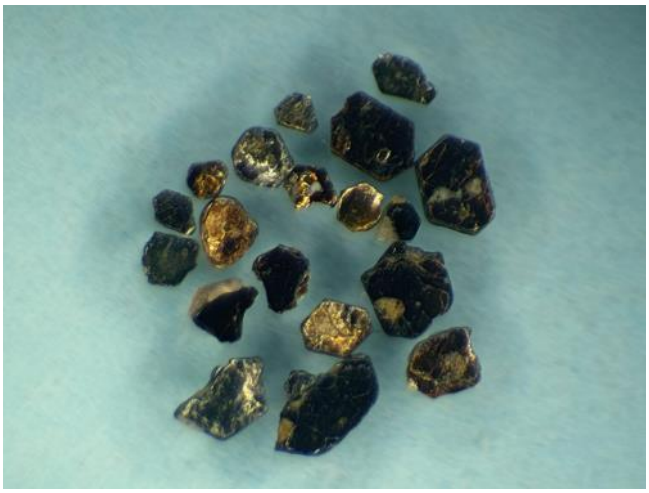
Ilmenite is relatively common as flattened black crystals that are not magnetic. Magnetite on the other hand seems to be quite rare—I only found three crystals.

Cumberland habit quartz crystal 0.58mm diameter. Note bubbles inside crystal.

The oval shaped crystal in the centre is a resorbed beta quartz crystal; the colourful blackish blob is iridescent biotite mica

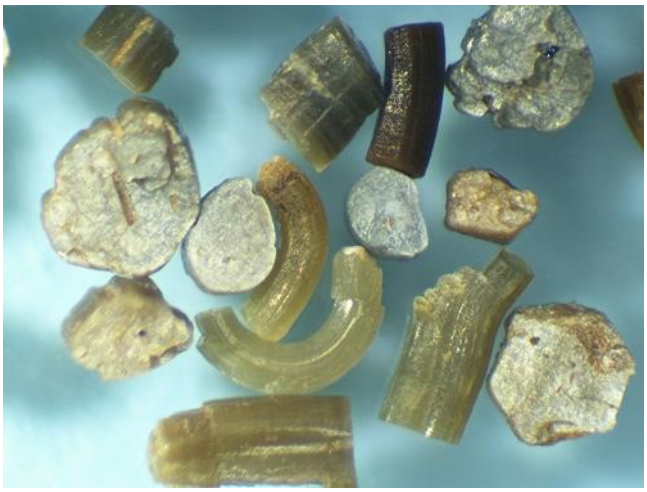


Normal quartz crystals to 1.3mm long.

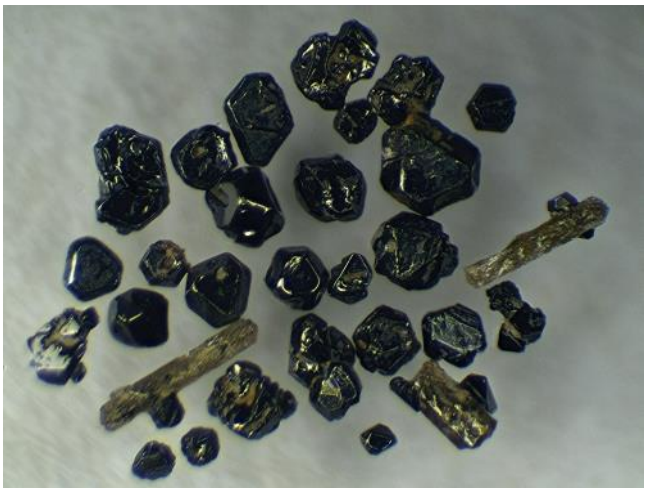


Biotite mica crystals (above and right). These often have a golden sheen at certain angles.

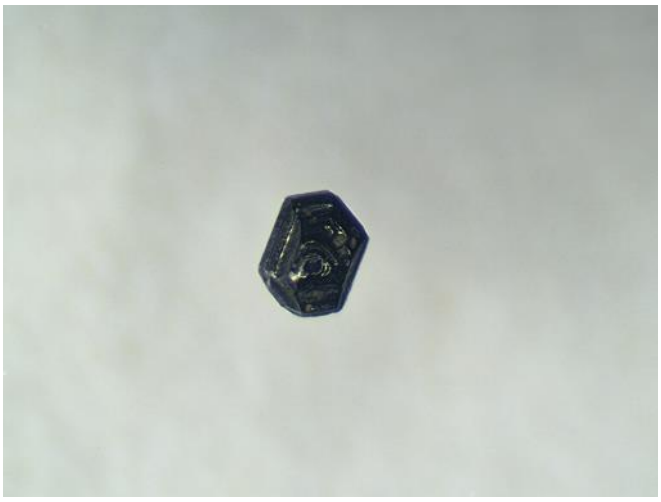
Biotite mica crystal 1.05mm across



Vermiculite crystals and fragments; these expand greatly when heated.

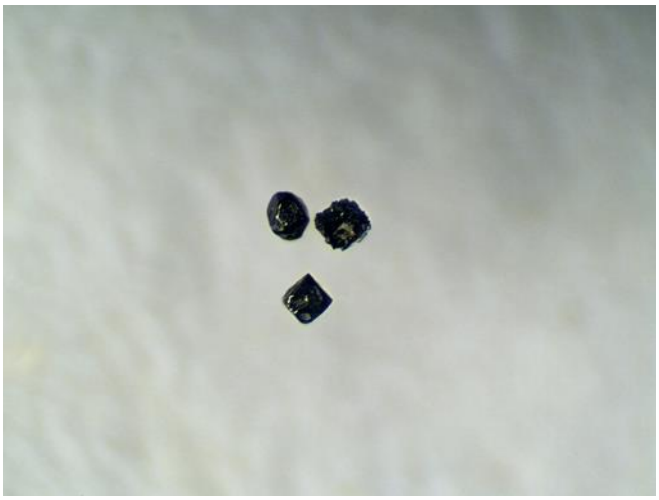


Ilmenite crystals, some embedded in enstatite crystals (dull greenish).



Tabular ilmenite crystal 0.58mm across.

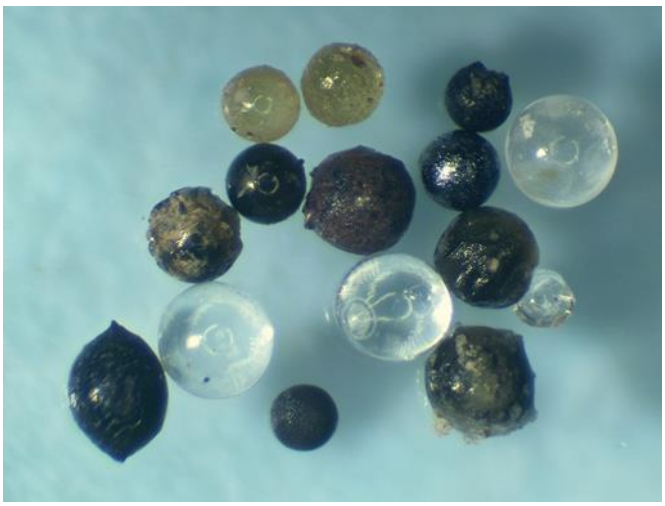
Ilmenite is non-magnetic.



Magnetite crystals (magnetic).

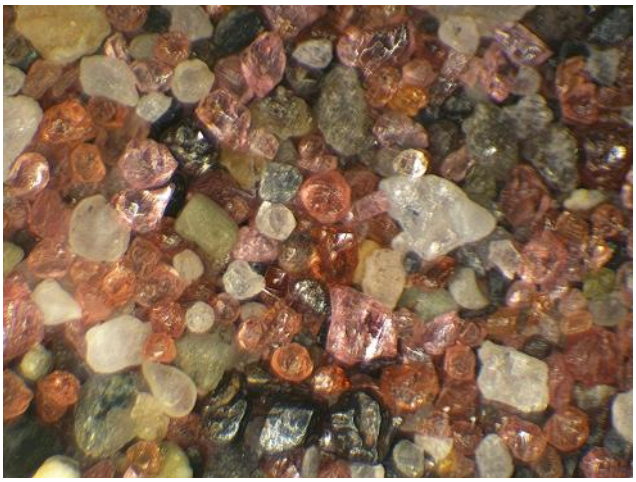
I have found a number of small spheres in the sand from Ohinemuri river, up to 0.54mm diameter, ranging from perfectly clear glass spheres to black, opaque semi-hollow spheres.

As far as I know, the Victoria Battery utilised a number of kilns for roasting the ore prior to crushing. It is possible that these spheres were created from rock dust being melted by hot gasses in the flue and being distributed all over the area via the smokestack. The clear glass spheres may be sandblasting beads but that doesn't explain the other ones. Micrometeorites look very similar to these but it is very unlikely that so many would be found in such a small sample of river sand. Another possibility I investigated is 'lightning induced volcanic spherules' (L.I.V.S.). These are created by lightning discharging through ash clouds during a volcanic eruption. The lightning

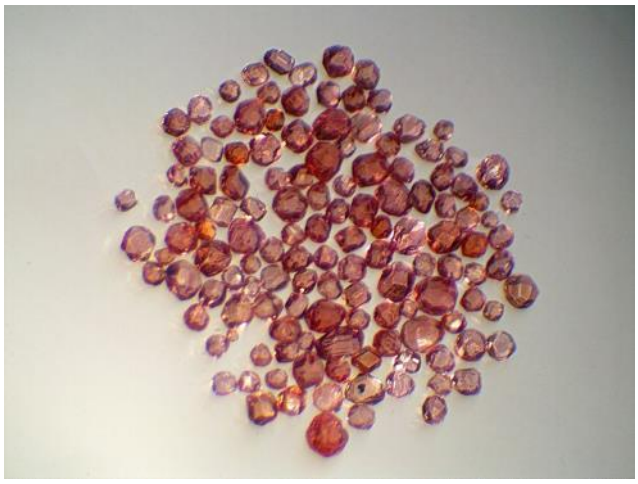


melts the ash, forming tiny spheres. I don't think this is a likely source for these spheres however due to their size; L.I.V.S's are usually about 5 times smaller than these.

Ian Ladds very kindly sent me some sand from Woodpecker Bay, between Punakaiki and Charleston on the west coast of the South Island. It is mostly made of minerals weathered out of the local orthogneiss (metamorphic alteration of granite), plus schists and other rocks further inland. There are many interesting and unusual crystals in the sand but I have been somewhat disappointed in my attempts to photograph some of them. Many of the garnets in the sand have beautiful, very fine growth striations on the crystal faces but although I can see them perfectly well through the microscope, my camera cannot capture the details at all. When I can afford to, I will see if I can get better equipment which will allow me to photograph small crystals with more clarity. The following are a few photos of just a small range of crystals from this sand (which is pinkish in colour due to the presence of garnets).

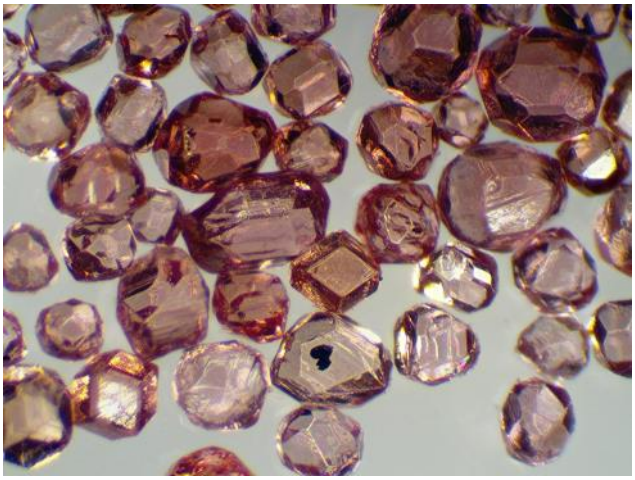


Woodpecker Bay sand, unsorted—straight off the beach. Note the high percentage of garnets, maybe 80%. FOV 6.4mm



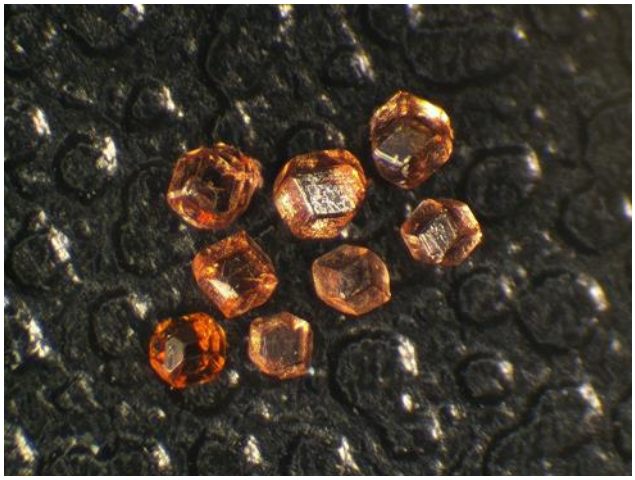
Garnet crystals sorted from the sand

FOV 8.5mm



Garnet crystals sorted from the sand

FOV 3.0mm



Dodecahedral (12-sided) garnet crystals

FOV 3.0mm

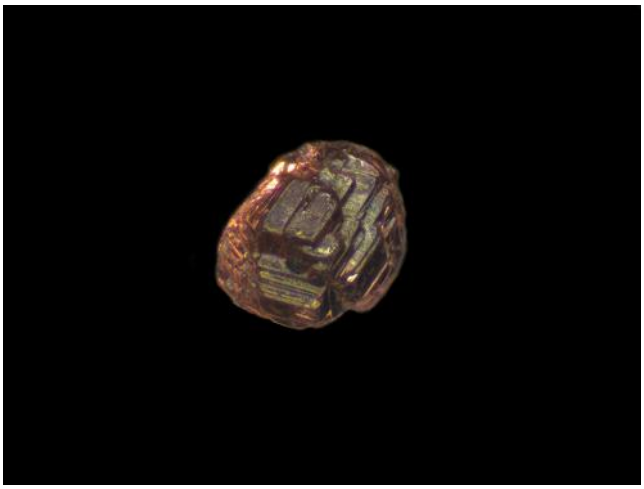
Icositetrahedral (24-sided) garnet crystals FOV 3.0mm

A very small percentage of the garnets from Woodpecker Bay have a rather unusual habit which for want of a better term I will call 'polyrectangular garnets'. These are flat crystals with a large number of rectangular or trapezoid faces. The finest examples of this type of growth come from the Navegadora claim in Brazil. See the following Mindat link for some incredible photos of these: https://www.mindat.org/gallery.php?loc=30796&min=3725

Although some of the descriptions on the Mindat site refer to these crystals as 'etched', I don't believe they are. Etched crystals tend to have a frosted surface and are more chaotic in appearance. In the case of the crystals from Woodpecker Bay I suspect they are possibly formed from flat fragments of shattered garnets that have subsequently re-crystallised. Most of the polyrectangular garnets I have found have rectangular faces on all sides including the edges. Unfortunately they are very small and I can't get very detailed photos of them. This is the first time I have encountered this form.

Polyrectangular garnet crystal 0.60mm

Polyrectangular garnet crystal 0.68mm



Polyrectangular garnet crystal 0.93mm

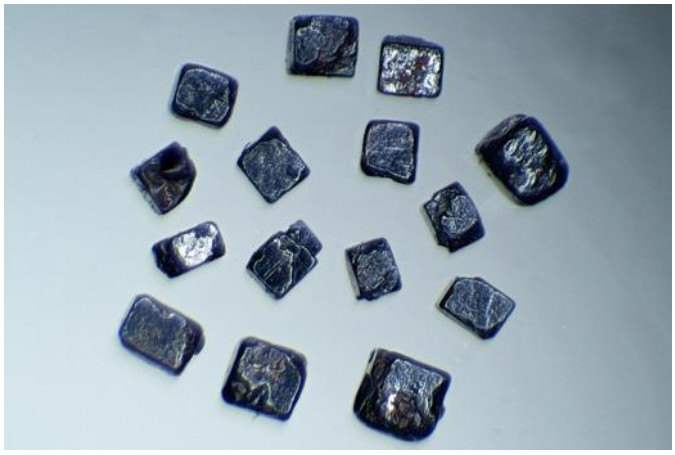
Polyrectangular garnet crystal 1.0mm

Greenish to dull blue anatase crystals, about 0.5mm

Scheelite crystal, 0.6mm

(The only one I found)

A fairly common component of the sand from Woodpecker Bay are goethite pseudomorphs after cubic pyrite crystals—black cubes up to 1.5mm across. An unusual component is micro-pebbles of nephrite jade ranging from opaque yellowish green to deep, transparent green. There is also gold present in the sand, although I only found two tiny flakes. At that rate I suspect you would be panning sand for a week and end up with maybe a dollar's worth of gold! Zircon crystals are very common, in a wide variety of sizes and shapes; all fluoresce pale orange under shortwave ultraviolet light. I also found about 20-30 flat, tabular pink crystals which might be morganite beryl. Beryl does occur in the area (though rarely) but I don't know if the morganite variety has ever been found there. Perhaps one day I will crush some of them up and run some tests to see if I can determine the presence of beryllium. They may of course just be flattened garnets.

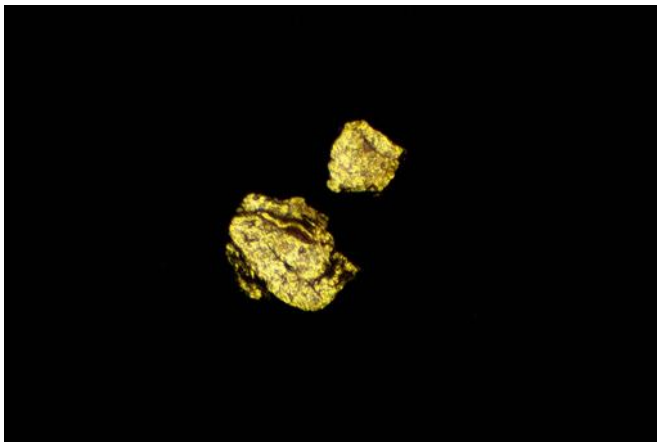


Goethite pseudomorphs after cubic pyrite

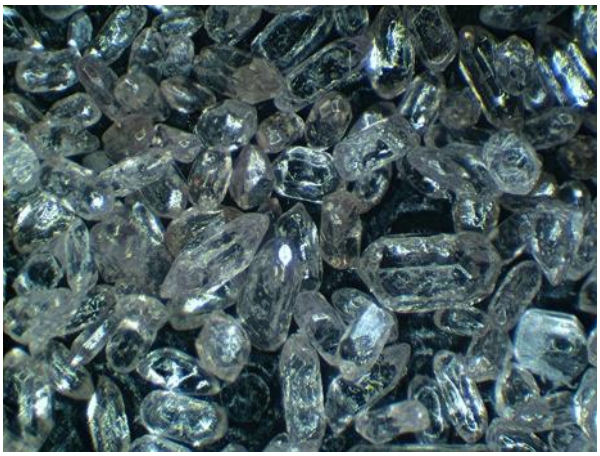
FOV 5.75mm

Nephrite jade micro-pebbles

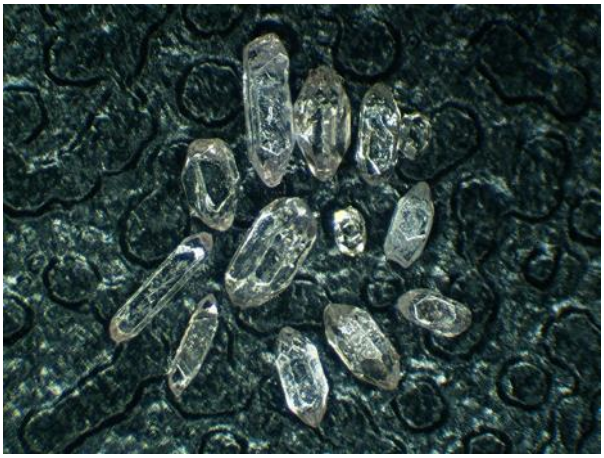
FOV 6.4mm



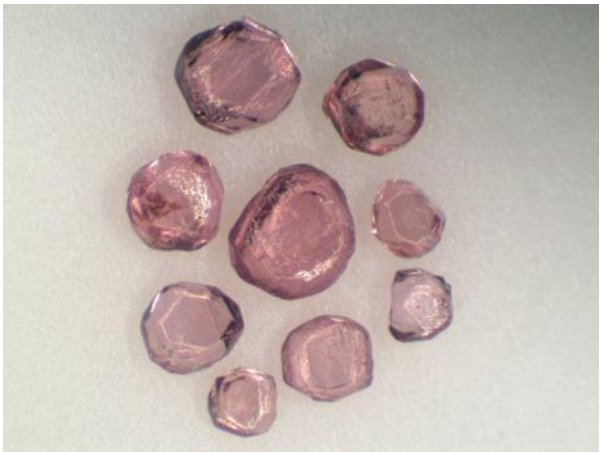
Gold flakes, 0.46mm and 0.25mm



Zircon crystals FOV 3.2mm

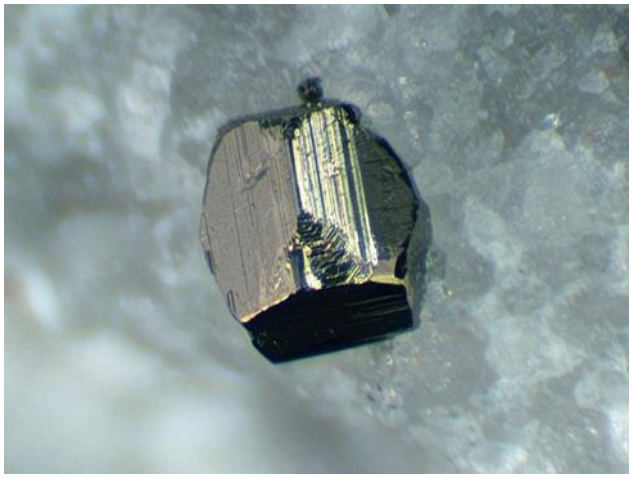


Zircon crystals FOV 3.5mm

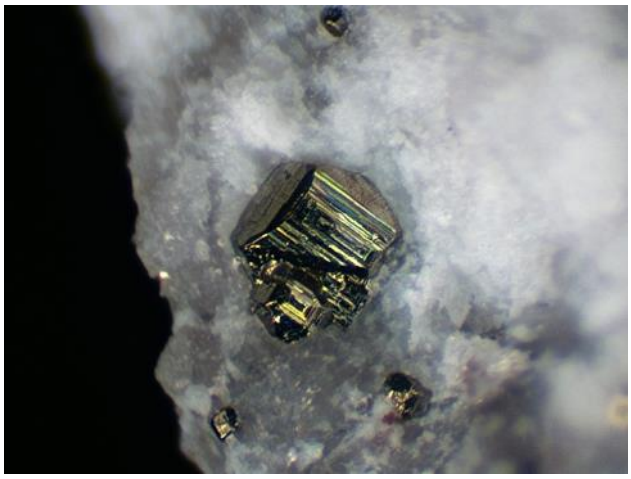


Morganite beryl crystals? FOV 3.2mm

Early this year a friend and I travelled to Coromandel for the annual Celtic fair. On the way back we stopped off briefly at Tararu stream just north of Thames. The area is known for a wide variety of minerals and the surrounding hillsides are dotted with shafts and adits of long abandoned gold mines. I only had about 10 minutes so I just grabbed a couple of random bits of quartz from the stream bed. I wasn't really expecting to find much in these two rocks but when I got them home and started examining them under the microscope they proved to be more interesting than I thought. The two pieces have probably come out of one of the gold mines and are a mixture of quartz, andesite and hydrothermal alteration minerals such as soft, white clay minerals—kaolinite, montmorillonite and what I think might be dickite. Dickite is rare in New Zealand although it has been found on the Coromandel Peninsula before. It would need to be analysed before I can claim that it is dickite because it is very similar to nacrite—another soft white mineral created by hydrothermal alteration, so bear that in mind when I refer to dickite in this article. The quartz containing this material has cavities filled or partly filled with 'dickite' which has a silky sheen and in partly filled cavities has a surface consisting of sparkly micro-crystals (very tiny hexagonal plates). Scattered through the dickite are crystals of pyrite, sphalerite, chalcopyrite, galena and very small crystals of rhodochrosite. Some of the pyrite crystals in this material are stunning in that they are well formed, often with a perfect mirror-like surface and are frequently complex modifications of cubic and dodecahedral crystals. Quite often the pyrite crystals have intricate growth patterns on the crystal faces. Dickite breaks away from the pyrite crystals leaving them perfectly intact. There are a few fissures in the quartz where quartz crystals have formed and in some cases they have been broken by movement in the rock and commenced growing again. I have occasionally found sheared-off quartz crystals completely embedded in dickite. Rhodochrosite occurs as very small cuboid crystals scattered thinly throughout the dickite, usually a dirty pinkish brown but occasionally small groups of euhedral transparent pink crystals can be found. All of the following photos are of minerals found n the two pieces of rock I collected at Tararu.



Pyrite crystal 0.63mm



Pyrite crystal with multiple, stepped faces 0.50mm

Pyrite crystal with raised rectangular steps on one face 0.63mm

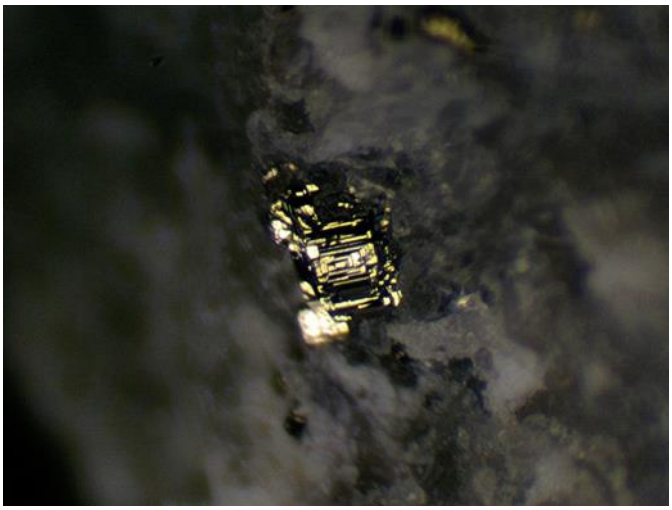
Pyrite crystal with intricate growth patterns 0.65mm

Pyrite crystal 0.65mm. The striations indicate that during growth the crystal alternated between cubic and dodecahedral forms.

Pyrite crystal with intricate growth patterns 0.37mm

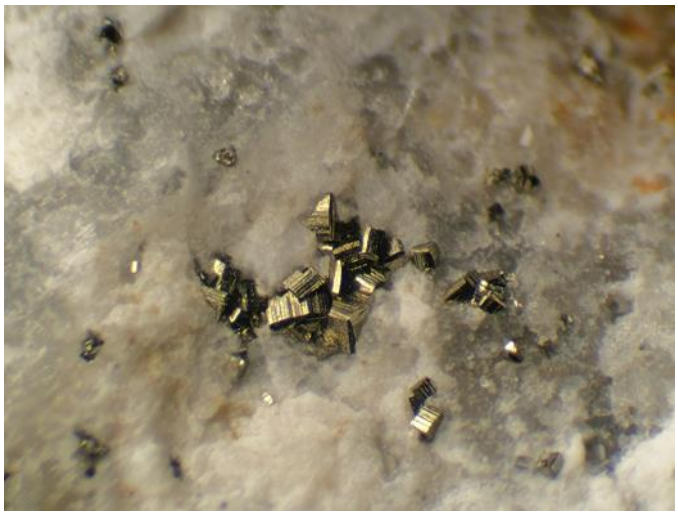
Cubo-dodecahedral pyrite crystals FOV 3.0mm

Pyrite crystals FOV 3.0mm

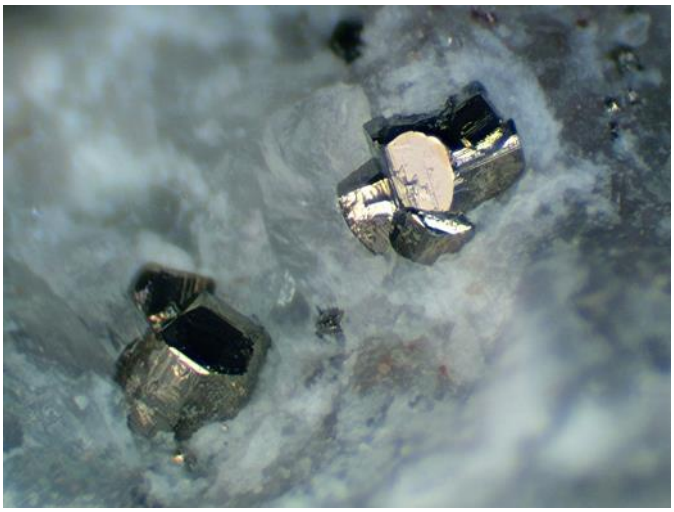


Pyrite crystal with stepped rectangular growth hillocks FOV 3.0mm

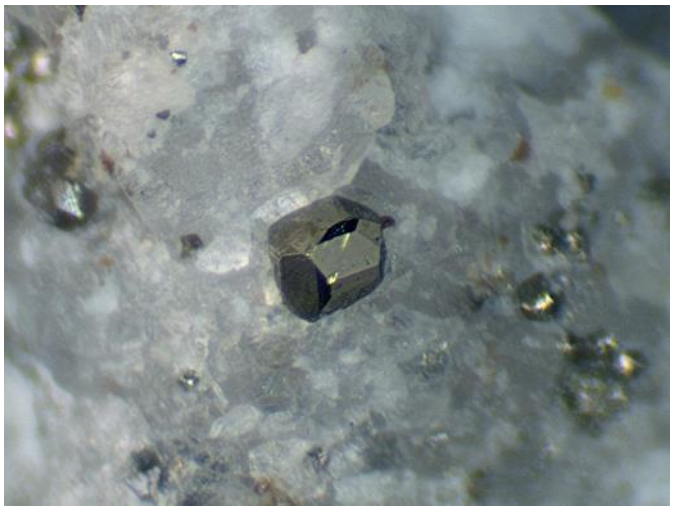
Cubic pyrite crystals FOV 3.0mm



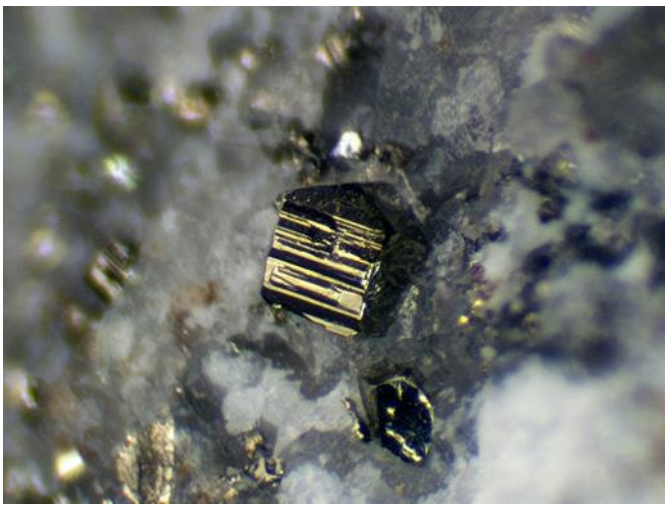
Cubic pyrite crystals FOV 3.0mm



Modified dodecahedral pyrite crystals 0.67mm

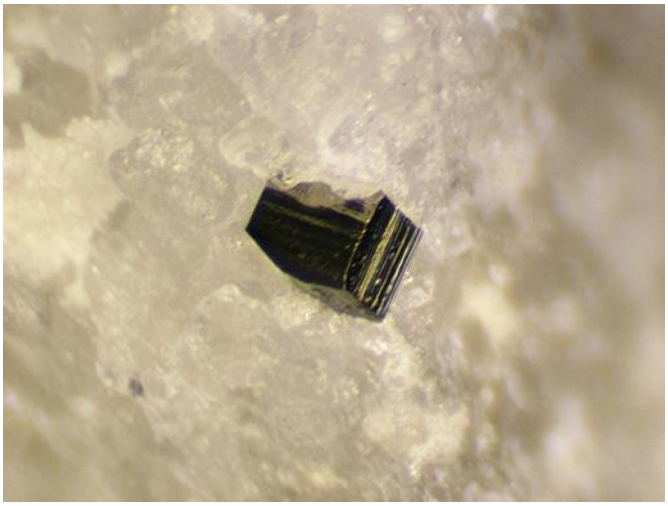


Modified dodecahedral pyrite crystal 0.32mm

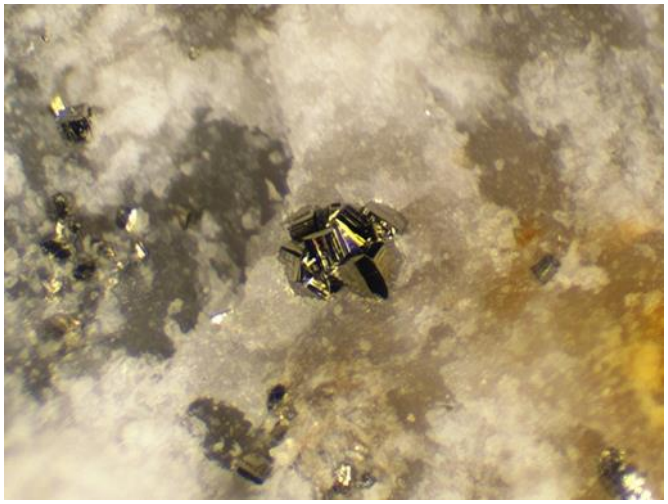


Dodecahedral pyrite crystal with rectangular growth hillocks 0.34mm

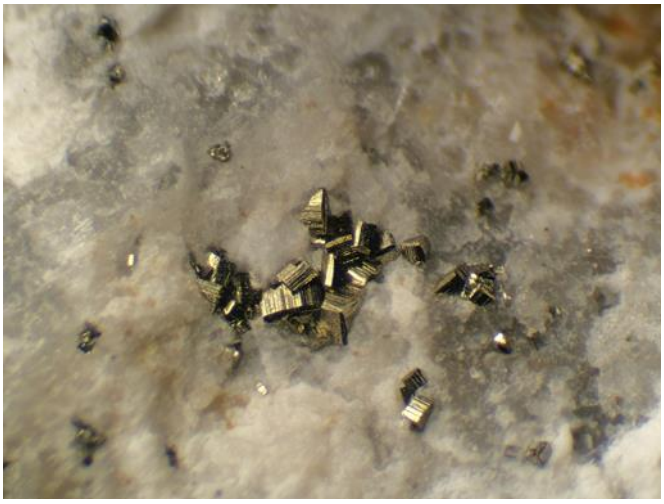
Twinned dodecahedral pyrite crystals (right) FOV 3.1mm



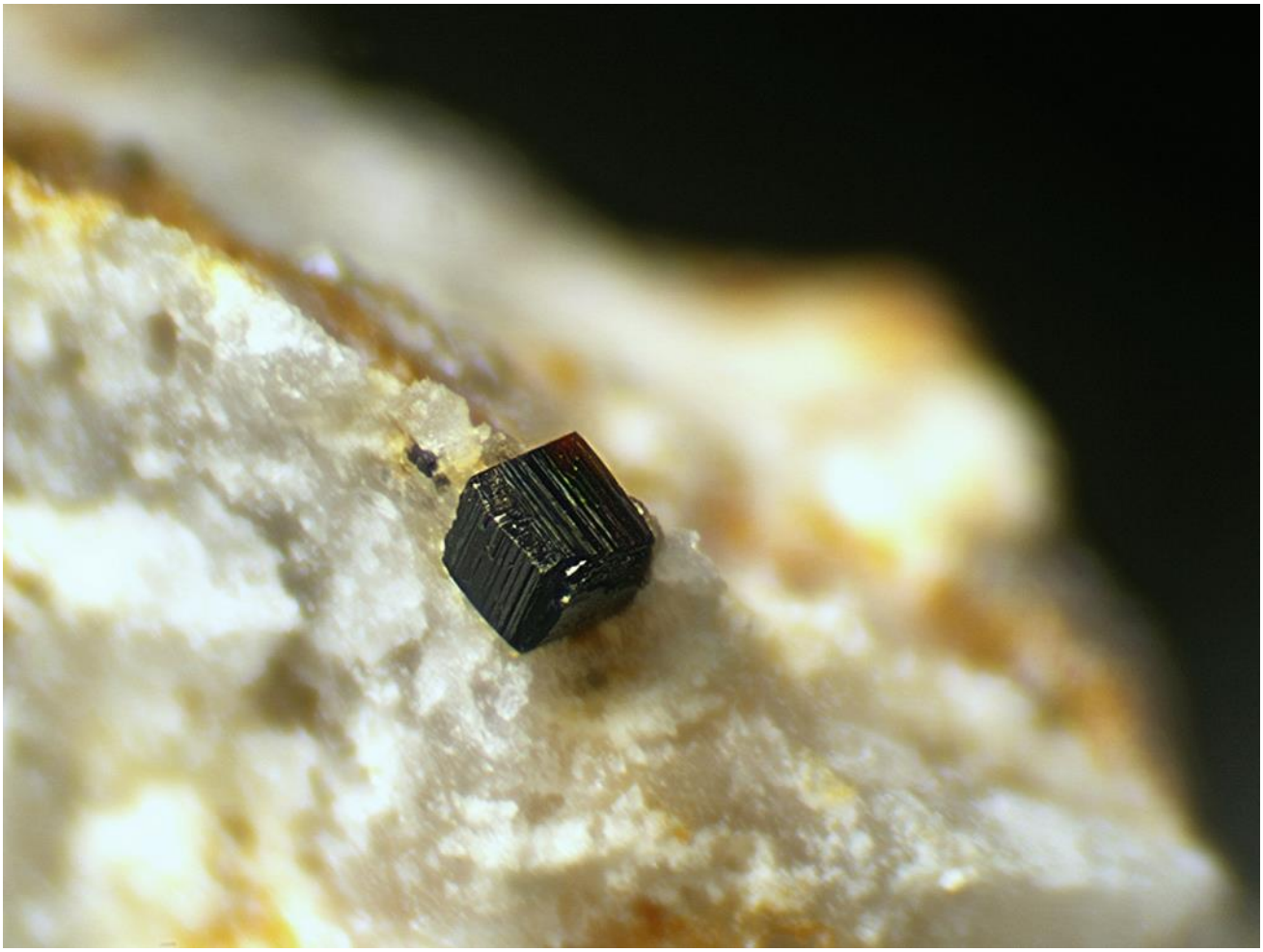
Modified cubic pyrite crystal 0.30mm



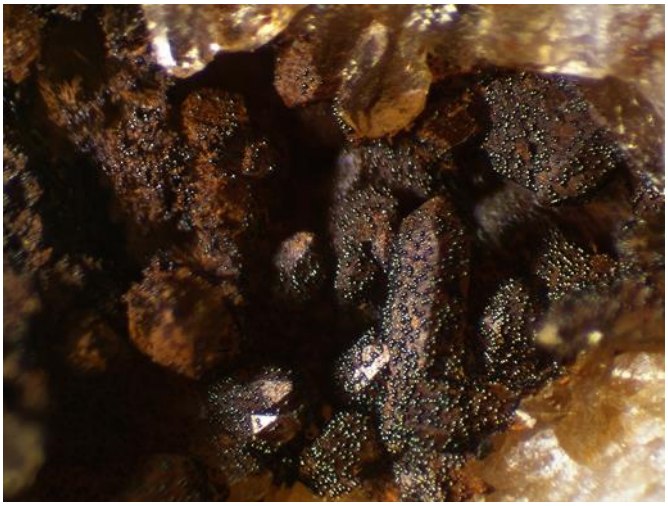
Modified cubic pyrite crystals FOV 2.0mm



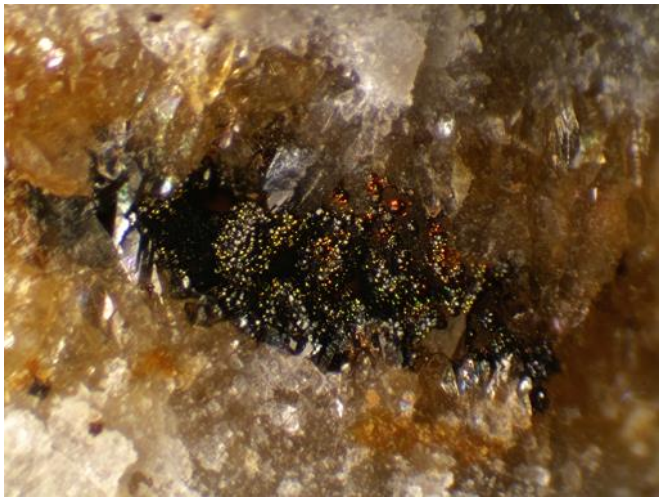
Striated cubic pyrite crystals FOV 3.0mm



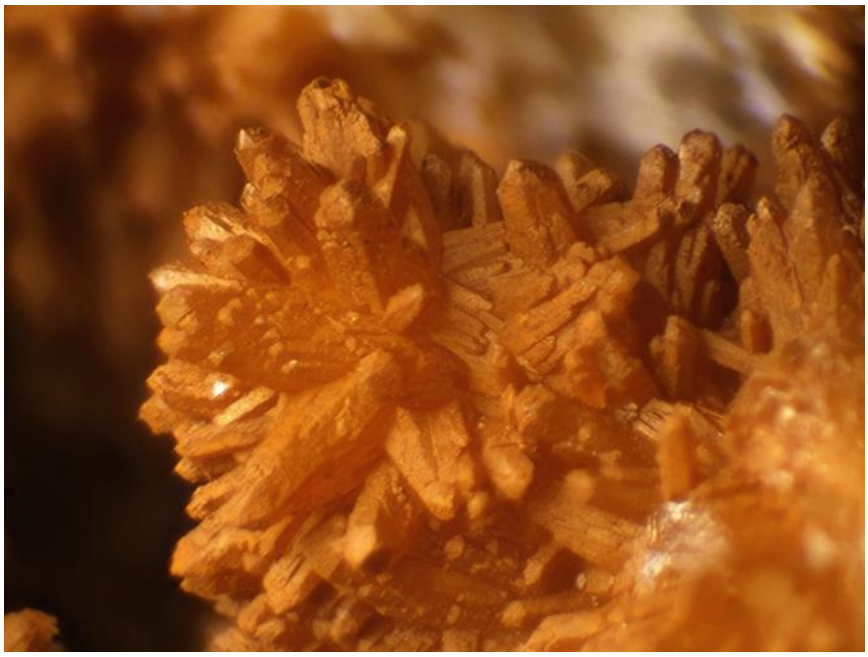
Pyrite crystals frequently decompose into various iron oxides/oxyhydroxides when exposed to weathering. Such crystals are usually composed of goethite, hematite or a mix of both; the crystal pictured above is an uncommon example of a lepidocrocite pseudomorph after cubic pyrite. If you look closely at the upper corner you can see that it is translucent brownish-red—a common colour for lepidocrocite. Hematite pseudomorphs tend to be dirty reddish-brown and completely opaque. Broken crystals from the same specimen show that these lepidocrocite pseudomorphs are often partly hollow with a porous core of goethite. In the same piece of quartz, some of the pyrite has decomposed into goethite with an iridescent surface coating. Also present are tiny spheres of translucent red siderogel scattered over quartz crystals. Siderogel is an amorphous iron oxyhydroxide that forms as a gel in the oxidation zone of iron bearing ore deposits and is considered a mineraloid rather than a valid mineral species.



Tiny iridescent spheres of siderogel on goethite coated quartz crystals. FOV 3.0mm

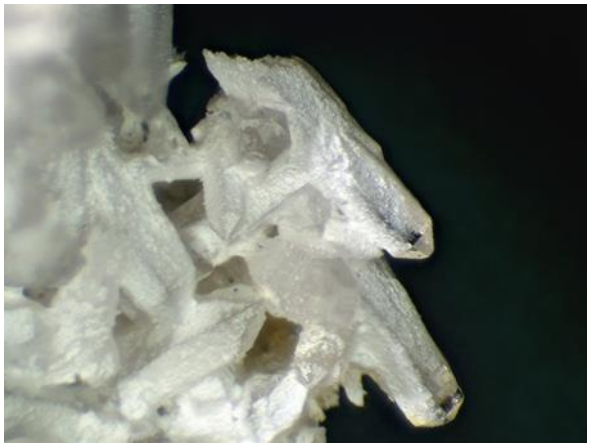


More siderogel on quartz. Note transparent red spheres (no goethite on them). FOV 3.0mm



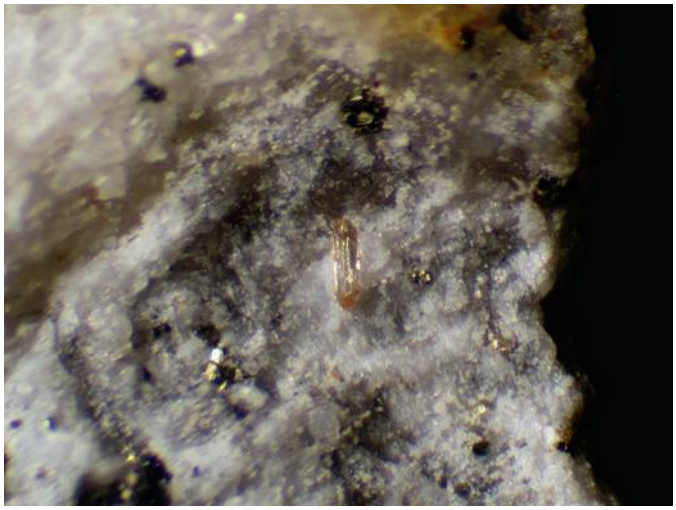
Quartz crystals assume some fairly bizarre forms at numerous localities on the Coromandel Peninsula such as these ones from Tararu which are covered in a light coating of limonite making them easier to study. These, I think, fall under the term "Artichoke quartz" which is simply a handy name for crystals surrounded by numerous 'daughter' crystals. Artichoke forms are caused by defects in the crystal lattice induced by both quick growth and impurities within the lattice. The limonite on the surface is simply a product of the weathering of pyrite.

There are also perfectly clear crystals of artichoke quartz present in the rock but they are very hard to study, let alone photograph.

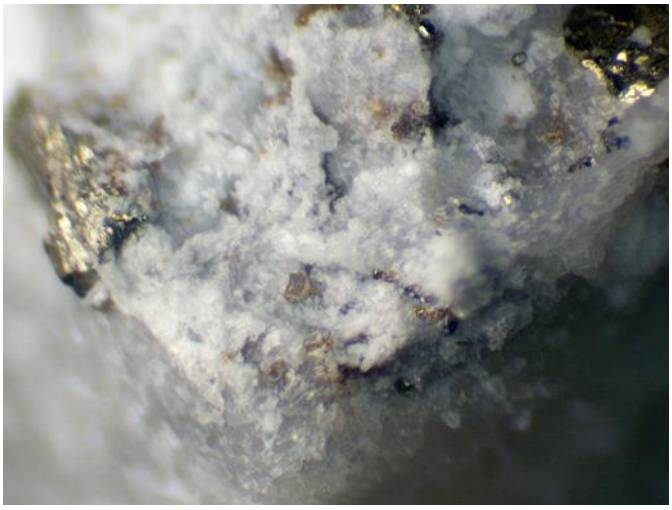


Broken quartz crystals coated with dickite FOV 3.0mm

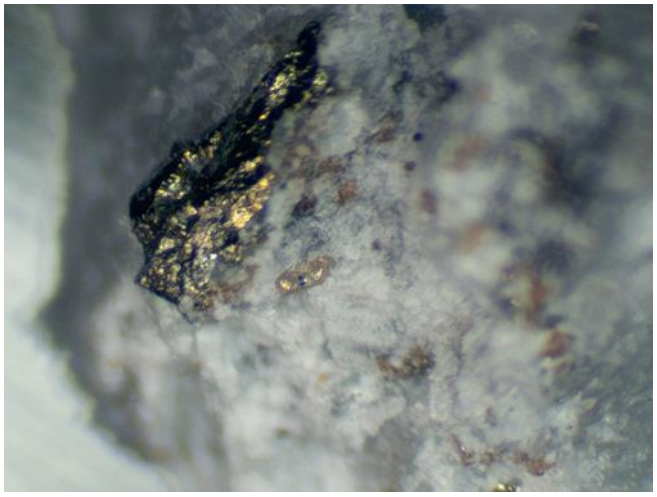
Broken quartz crystals coated with dickite and pyrite. FOV 4.15mm



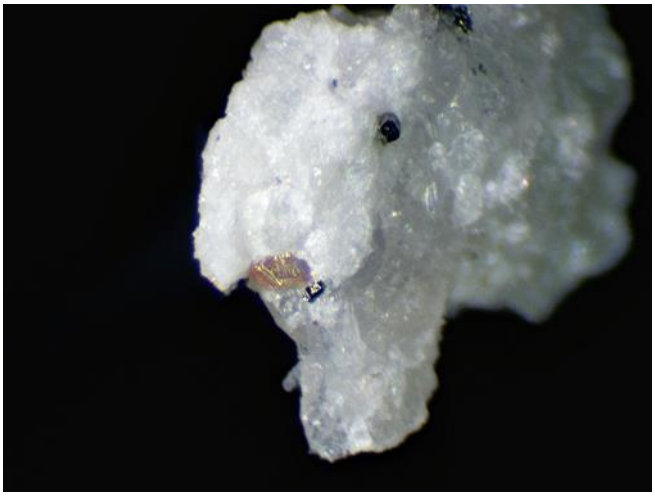
Pale orange zircon crystal 0.32mm long, on hydrothermally altered andesite.



Pale orange zircon crystal 0.10mm long, on hydrothermally altered andesite.

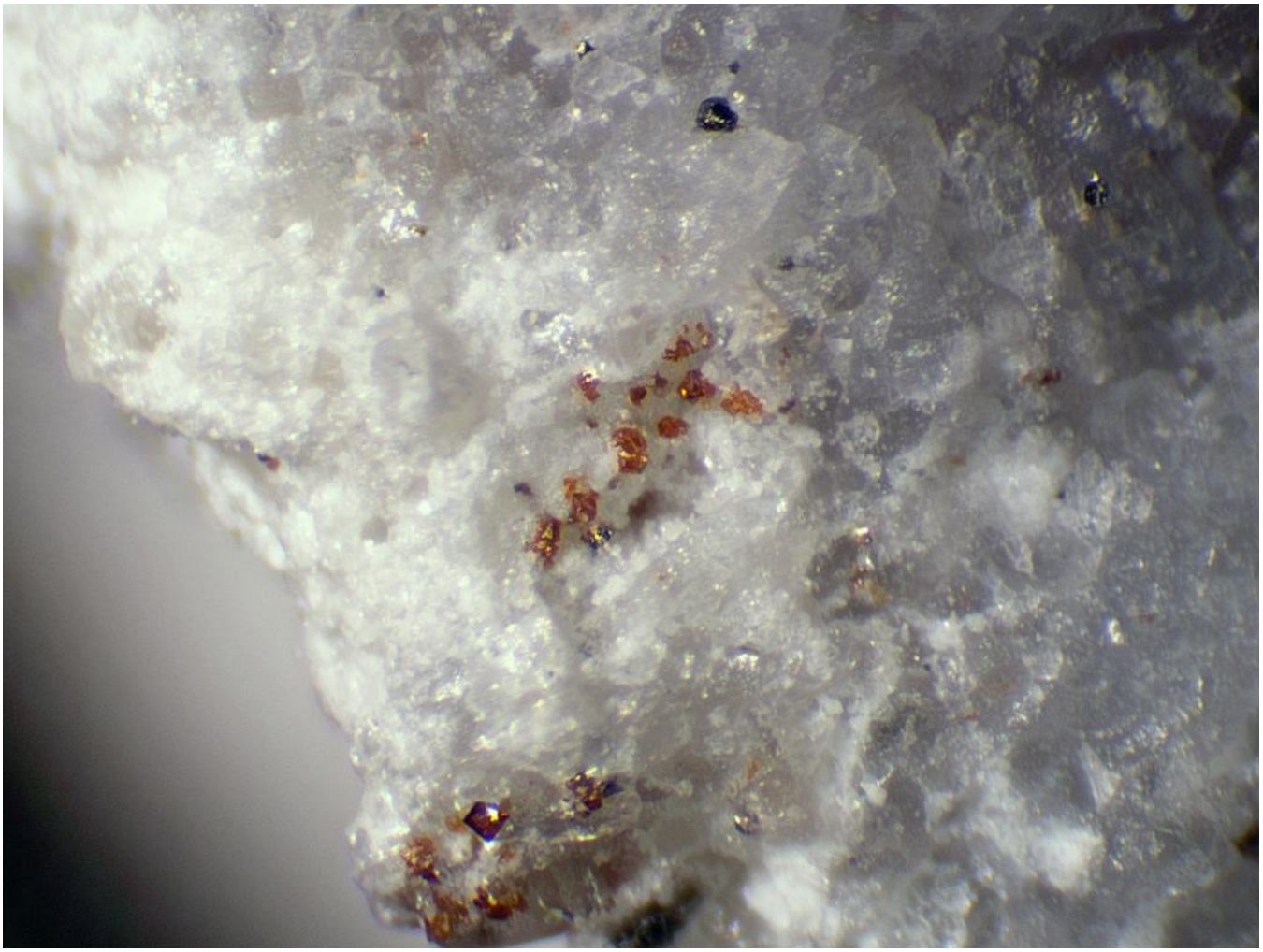


Pale orange zircon crystal with black inclusions (probably magnetite) 0.23mm long, on hydrothermally altered andesite.

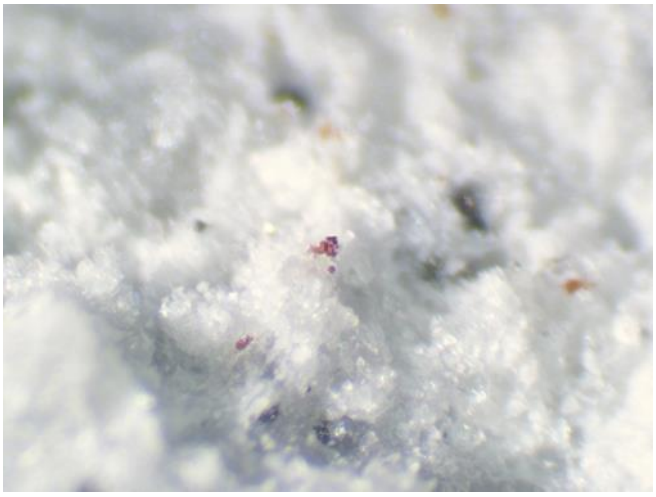


Pale orange zircon crystal 0.23mm long, on quartz with dickite

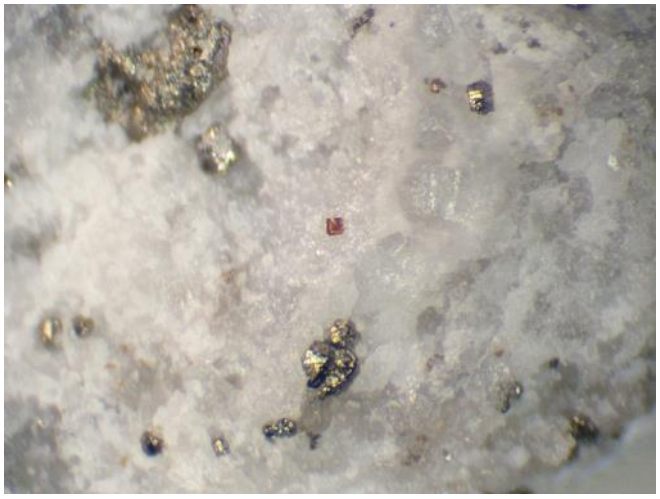
I was rather surprised to find zircons, they are very rare in this material. I have never found zircons on their native matrix before. That said, zircon crystals are very common in beach sands derived from granite where wave action concentrates them along with other heavy minerals. I tested these zircons and as usual, they all fluoresce orange under short wave ultraviolet light.



Rhodochrosite crystals to 0.07mm . It is hard to get the colour just right… they are actually slightly more pink than the photo shows.



0.02mm rhodochrosite crystals on dickite



0.04mm rhodochrosite crystal on dickite

Feel free to forward this newsletter to anyone who might be interested.

Comments and questions welcome.

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