

# AUGUST 2021

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## JOURNEYS IN PEGMATITE PARADISE

by Duncan Miller

South Africa is famous for its gems and minerals, and visitors sometimes imagine they can pick diamonds off the soles of their shoes. Gold nuggets roll down streams and platinum can be picked out of some of the oldest rocks on Earth. This is all fantasy of course. The platinum, gold and diamond mines are so regulated that throughout their lives most South Africans never see native gold, or platinum, or an uncut diamond; and possessing them without a permit is a criminal offense. So, if you are interested in collecting minerals and gem material, and you don't just want to buy from the internet, where do you go? To Namaqualand of course! Namaqualand? Sounds like a province of some mythical place like Gondwana, domain of dinosaurs. It is. But it is also a place of stunning beauty and a swarm of accessible pegmatites, so it is a great place to visit.

Some people are just lucky. Some of us not only live in Cape Town, but also only a day's drive from the Namaqualand pegmatite field, one of the largest and mineralogically most varied in the world, so we have visited it often. Not nearly as often as we would like, and usually on the spur of the moment. Got to get out of the city. It's flower season, so let's go to Namaqualand.



Every few years, for two months the landscape is transformed. Red sand is replaced with unbroken swathes of orange and white daisies, and long grass grows in rocky valleys. In a good grass year, local people have been known to take leave from work to wonder at the grass. Nowhere else in the world would this make sense, but to see waving fields of waist-high grass where for years there is nothing but rock and ankle-high scrub, is magical. But like magic, the spell doesn't last long, and after a few weeks the dry grass has shed its seeds, the daisies have gone, and the desert settles down to a long roast in anticipation of good rains in another year.



Lack of daisies and grass doesn't deter rock hounds. In fact, I have heard a geologist threaten to burn the grass hiding the rock formations he wanted to show to colleagues. There is another reason why vegetation in the desert is bad news.... bees. But that comes later.

The drive north from Cape Town is along the scenic N7 national highway, the road to Namibia, home of even more fabulous mineral wealth than Namaqualand. But a Namibian trip takes several weeks to do the country justice, and usually we only have a long weekend to spare, so Namaqualand, just this side of the South African/Namibian border is our destination. The first half of the drive crosses the Cape Fold Belt, sandstone and shale mountains that are the eroded roots of a 500 million-year-old range, once toweringly majestic like the Alps, now rather more modest stumps. There is little of mineralogical interest in these sandy rocks, but the scenery is beautiful, especially the Olifants River Valley. Not an elephant in sight, but groves of orange trees. In early summer the scent of the orange blossom lies heavily in the valley, a last lingering reminder of agriculture on the fringe of the desert. Until 60 million years ago the Olifants River drained much of the interior of southern Africa and spewed diamonds into the sea, just as the Orange River (or Gariep River as it is now known after the wave of name changing that has swept the country) has done for the past 60 million. So around the mouth of the Olifants River there are the first of the alluvial diamond diggings that have disfigured the coastline with their huge excavations and spoil heaps from here north into Namibia.

On the northern side of the Olifants River the scenery changes quickly and dramatically, from the sandstone mountains to rolling hills in much older Namaqualand granite gneiss. This contorted gray rock has an exceedingly complex history which has kept geologists fascinated for the past century and will keep many future generations busy unravelling its story. What is known is that it represents the exposed and planed off core of a range of mountains similar to the Andes or Himalayas, which straddled southern Africa about 1000 million years ago. (This is still relatively young as far as South African rocks go, because around Barberton there are rocks 3 600 million years old.) The Namaqualand granite gneiss grabs the attention of geologists because it hosts some large base metal ore deposits, with operating copper, lead and zinc mines.



The pegmatites, essentially very coarse-grained granite bodies, lie mostly in a curved belt, running roughly east-west and following the Gariep River for a distance of about 200 km. The largest pegmatite bodies seem

to be near the margins of the Namaqualand granite gneiss, where it meets even older rocks recording earlier phases of mountain building and metamorphism. Our jumping off point into the pegmatite belt is the copper mining town of Springbok on the N7 highway.

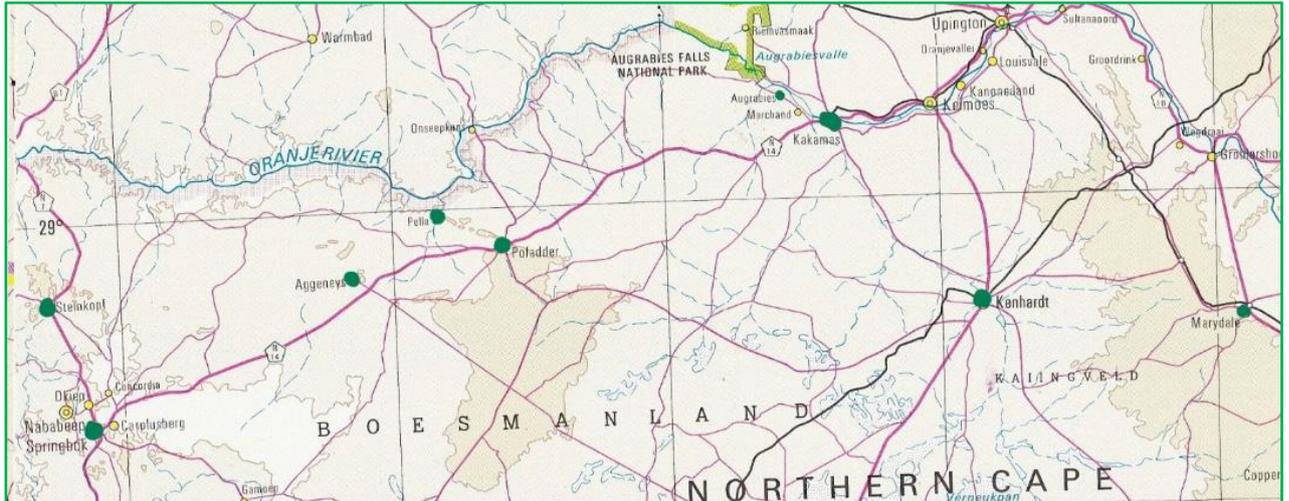
#### **What is a pegmatite?**

*“The American Geological Institute’s ‘Glossary of Geology’ (third edition) defines a pegmatite as ‘an exceptionally coarse-grained (most grains 1 cm or more in diameter) igneous rock, with interlocking crystals, usually found as irregular dykes, lenses and veins, especially at margins of batholiths’. Although pegmatites having gross compositions similar to other rock types are known, their composition is usually that of granite; the composition may be simple or complex and may include rare minerals rich in such elements as lithium, boron, fluorine, niobium, tantalum, uranium and rare earths. Pegmatites represent the last and most hydrous portion of a magma to crystallize and hence contain high concentrations of minerals present only in trace amounts in granitic rocks. Pegmatites are rich in volatiles such as water, carbon dioxide, fluorine and boron, which lower the viscosity. This makes the melt more fluid and lowers the solidus thereby prolonging the period of crystallization, which results in the formation of larger grains and crystals. Pegmatites, therefore, provide a unique mechanism of concentrating rare, more incompatible elements, that would otherwise be too sparsely disseminated in the host rocks to be of any economic significance.” (Boelema, R. & Hira, H. 1998. Pegmatite deposits. In Wilson, M.G.C. & Anhaeusser, C.R. eds *The Mineral Resources of South Africa* (6<sup>th</sup> edition):509. Pretoria: Council for Geoscience.*

Springbok has a rich and colourful mining history. The area attracted the attention of prospectors early in South Africa’s colonial history. In 1685 the governor of the Cape, Simon van der Stel, personally led an expedition on the 2000 km round trip, taking the better part of a year, to visit the copper-rich area. He was under the impression that he would find the fabled African kingdom of Monomatapa, and travelled through the rough country in style, in a carriage, with a vast retinue, even dragging two cannons to impress the locals. The locals were indigenous Nama stock herders, adorned with copper jewellery, which is what prompted the expedition in the first place. The Van der Stel party actually made it to the Concordia valley, dug a few holes into a malachite-stained hill, and returned to Cape Town bringing back some low-grade copper ore. The journal of this expedition (published in English translation by the Van Riebeeck Society) makes fascinating reading, with upsets caused by reluctant guides and a charging rhinoceros, desperate searches for water for the expedition’s livestock, and failed sorties to find suitable harbours on the coast for shipping ore. (Why has no-one made the period piece adventure movie yet?) As it transpired, at the time the copper ores were too remote and despite numerous subsequent expeditions and speculation, mining of the rich copper bodies around Springbok only started in the mid-19<sup>th</sup> century. Mining continued for 150 years, with the last mines closing down only a few years ago. These copper mines, with sulfide ore bodies in still poorly understood geological settings, have produced some spectacular mineral specimens. In 1966 a pocket of giant quartz crystals was discovered in the Jan Coetzee Mine. These crystals, up to 1 m long and encrusted with calcite and bright yellow barite crystals, grace many major mineral collections in the world.



Modern day Springbok is a town in transition between mining and tourism, that was presided over until recently by two uncrowned kings. The late George Swanson was a mineral dealer, and owner of numerous gemstone prospects including a famous blue lace agate mine, from which he exported material all over the world. The late Jopie Kotze was a tourism entrepreneur, owner of the Springbok Lodge guest cottages and restaurant, in which his extensive collection of local minerals and gemstones is still on public display. No visit to Springbok would be complete without sampling the Café’s giant beef steaks and viewing his collection.



Our goal, the pegmatite belt itself, actually starts a bit further north, near the village of Steinkopf. Here some Nama descendants still make domed huts with bent stick frameworks, formerly covered with reed mats and now with sack cloth. These used to be portable shelters for nomadic herders, although now most of the people are settled in the impoverished small towns in this north western corner of the country. Some of them make a precarious living by working the smaller pegmatites for quartz crystals, tantalite, scheelite, and wolframite for sale to mineral dealers and tourists. A few large pegmatites between Steinkopf and the Gariiep River are worked commercially, principally for albite feldspar for the ceramics industry but also sporadically for tantalite and mica. The largest working mine is Blesberg in the Noumas I pegmatite, about 40 km north of Steinkopf. It is one of a local trio of pegmatites currently being mined, Noumas I and II, and Swartkop. Noumas I is the largest known pegmatite in Namaqualand and boasts correspondingly large crystals. Enormous spodumene crystals form massive beams, but they are severely altered and cannot be removed intact. On the dumps we have collected fine specimens of fluorapatite, brick-sized blocks of the uncommon manganese mineral lithiophilite, beryl and phenakite, columbite-tantalite, and quartz.



Left and right, Apatite, quartz and hyalite opal. Centre. Phenakite, all from Blesberg. Photos DM



Far left. Native bismuth with malachite, associated with bismutite. Width of view 50 mm. (1986)

Right. Libethenite, again collected in the mid 1980s. Width of view 45 mm. Both ex Immelmann collection



From left. Apatite crystal. Height 15 mm (1979). Blue chalcedony with quartz. (1970s). Apatite with muscovite on albite. Width of view 40 mm. All ex Immelmann collection. Right. Self-collected lithiophilite 2009. Width of view 70 mm. JW



Above. Garnet and epidote. DM  
 Right. Tabular quartz. 110 mm high.  
 ex Harrison collection  
 Left. Columbite-tantalite, self-collected by the  
 late Ted Immelmann. DM  
 All Blesberg Mine



Norrabees mine

At a nearby dormant working, Norrabees (above), there are beautiful sprays of zoned pink and green tourmaline crystals on blocks of white pollucite, a rare cesium alumino-silicate mineral.



Tourmaline and quartz, both from Norrabees. DM photos



Left. A giant feldspar crystal at Witkop – (note the hat). Right. Rocks at Henkries of a white pegmatite in darker country rocks, showing the clear contrast.



*Once we were travelling in the pegmatite area and just assumed we could get overnight accommodation at Henkries. To our surprise, the building was fully occupied by a tribe of unidentified geologists due back there any minute. Hastily, we reversed up the road and took the track to an old mine to “cold camp” for the night. And what a night it was! Apart from the wonderfully clear, starlit skies above our heads, the ground around us was starlit too. The view (top left above) is of diggings for scheelite seen from our camp. In the mining process, small chips of scheelite were scattered all over the ground. Our UV light showed them all. JW*



**Scheelite in quartz from the mine above, under natural and short-wave UV light – width of view 45 mm  
Scheelite is a major ore of tungsten.**

In the low hills east of the Swartkop Mine there is even an emerald occurrence, with scarce green crystals embedded in slabs of black biotite schist, admittedly not a pegmatite, but part of the paradise. The pegmatites themselves form conspicuous light outcrops on the dark hillsides which project from the sandy scree as inselbergs. This is an ancient landscape, very little different from in the Cretaceous, 70 million years ago, when dinosaurs roamed across it. Rare fossil dinosaur bones have been found in the basal gravels in some of the river valleys and in sediments filling shallow depressions formed in the throats of small kimberlite volcanic plugs. Otherwise, there is a complete absence of fossils because it forms part of the largely levelled high plateau of the South African interior, which has been suffering erosion for many millions of years. As a result, the pegmatites too are very weathered, the giant feldspar and spodumene crystals often altered to clay minerals, releasing the more resistant minerals like quartz, garnet, beryl and tantalite.

East of Steinkopf the pegmatite belt continues towards the town of Pofadder, not named directly after the deadly puff adder snake, but after a historic local leader with presumably similar attributes. There is a good tarred road from Springbok to Pofadder, running past the major copper/lead/zinc mines of Black Mountain and Gamsberg near the mining town of Aggeneys. These mines are also in sulfide ore bodies, probably originating at hot fumaroles on an ancient mid-ocean ridge, and now part of a highly metamorphosed rock sequence. They are not a pegmatite but are included as we pass them on our way. They too produce collectable mineral specimens including large andradite garnets, and glossy magnetite crystals perched on a chalcopyrite and galena matrix. With permission of the mines, good specimens can be collected from the ore dumps.

#### **Minerals from Aggeneys**



**Calcite. Photo DM**



**Siderite-sphalerite epimorph after calcite. Photo DM**



Almandine garnet. Photo DM



Magnetite crystal. Photo DM



Just north of Pofadder is the quaint mission town of Pella, with a church built long ago by two priests with only a small illustration in an encyclopedia as a guide. **(Photo left from Wikipedia)** From a mineralogical point of view, the main attraction is the mineral market held for visitors on the local soccer “field”, a gravel stretch just outside the town. Mostly there are quartz crystals for sale, some the blood-red hematite included and encrusted Orange River quartz, which is now available on the internet and hence increasingly common in collections. The last time we visited Pella the whole district had been taken over temporarily by a film crew,

storming about in resurrected old military vehicles including a tank, making an adventure movie starring Nicholas Cage. As a result the quartz crystal prices had escalated ludicrously, and we left nearly empty handed. Often the mineral dealers get there first, and then there are only left-overs to pick through. It is all a matter of luck, but that is part of the fun of rock hounding!

Further east, the next accessible bunch of pegmatites is around Kakamas, with the added attraction of the Augrabies Falls. Here the Gariiep River plunges 65 m into a gorge carved from solid granite. It is a spectacular sight when the river is running strongly, and one of the great waterfall spectacles of the world. Kakamas is also the home of Jaco and Tania van Nieuwenhuizen, the Crystal Springs mineral dealers <<http://www.crystalspringminerals.net>>. They carry a large selection of Namibian specimens, Orange River quartz, minerals from the Aggeneys copper/lead/zinc mines, and seductive light green fluorites from Riemvasmaak near Augrabies. These have a thin druzy quartz coating which is difficult to remove, so don't bother; just enjoy the green fluorite peeking out of the quartz crust where it has broken off of its own accord.





Kakamas is riddled with pegmatites. On Middlepos farm, on the northern side of the Gariiep River, small pegmatite outcrops contain knots of mica around roughly crystalline, colourless chrysoberyl. Just 5 km east of the town there is a cluster of excavations in the defunct workings of the Baviaanskrans pegmatite, easily accessible off a secondary gravel road. Large blocks of amazonite litter the low hillocks and in a brief exploratory afternoon we found tantalite, black tourmaline, beryl, and small cubes of pink fluorite. On the farm Pypklipwes, half way between Kakamas and the neighbouring town of Kenhardt, there is a large vein-like deposit of fluorite, which was worked in the 1960s. The area around the excavation is covered with

heaps of colourless and green fluorite, some with attractive orange quartz crystal crusts. The landscape here, away from the Orange River hills is sandy and completely flat, and it is amazing that anyone found the fluorite-bearing pegmatite in the first place.

**A Kenhardt rose quartz deposit is shown above.**

Kenhardt is the centre of the eastern cluster of pegmatites in the Namaqualand belt. The Strausheim I pegmatite is famous for a huge mass of beryl found in the 1950s. The first weighed about 60 tons and was followed by other large masses, mined until 1972 as beryllium ore.



**Strausheim pegmatite wall, resident porcupine, and mineral specimen showing albite, muscovite and quartz.**

The most easterly pegmatites, before the belt disappears under recent sedimentary cover, are on the farm Angelienspan. These too are in completely flat countryside, and the mine dumps are the only positive features. There is not a tree in sight, but in spring the white daisy flowers cover the ground like snow. In some ways the Angelienspan pegmatites are the most intriguing of all. Not only are they the most remote, but one of them has produced perhaps the most aesthetic mineral specimens from any Namaqualand pegmatite. These are fist-sized, euhedral, orange spessartine garnets, embedded in a soft, greenish, muscovite. Many years ago, I obtained one of these crystals from the late Larry Introna, a dealer in Cape Town. It had long been my ambition to visit Angelienspan, to collect some of these garnets myself. One Spring my opportunity arrived, and a small group of us made the pilgrimage through the nearest town of Putsonderwater to this desolate, ancient, flat landscape covered in daisies like snow. They were our undoing, because the bees were out in force. In a landscape without trees bees often nest in the abandoned pegmatite excavations. Usually they leave one alone, but these bees were frantically busy and did not welcome our disturbing appearance. No sooner had we climbed from our vehicles than the attack began. These were no ordinary bees, but killer bees, the real thing - a noisy, angry, murderous stream of assault, and terrifyingly persistent. Running around waving your arms like a lunatic does no good. Nor does wrapping a towel around your head to ward off the stings. The only escape is to get into your vehicle, close the doors and windows, and start squashing. Hundreds of bee stings later, our enthusiasm for garnet hunting had evaporated. The Angelienspan garnets will have to wait for yet another trip. As I said, rock hounding is a matter of luck, the bad with the good! **DM**

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All photos © Jo Wicht unless otherwise noted.

## Tourmalines are found in pegmatites



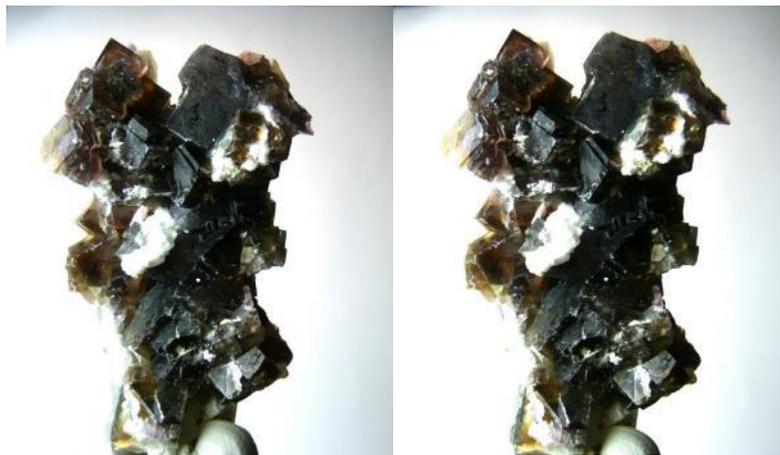
This tourmaline was faceted recently by Duncan Miller and probably came from a pegmatite in central Namibia. It is 15.36 ct opposed bar cut.

## PHOTOGRAPHING MINERALS IN STEREO

Duncan Miller

Inspired by an article by Pavel Martynov on mindat.org I have been experimenting with taking stereoscopic pair photographs of an otherwise rather uninteresting mineral specimen, so that it can be viewed in 3D. It is really simple. All you need do is rotate the specimen through five degrees, without otherwise changing its relationship to the camera, and taking two photographs of it. Then you swap the righthand photo for the left one, and view the pair by squinting. You can practise this by looking at the end of your nose. (If you look 'through' the page by diverging your eyes the image will be in reverse, with the crystals appearing hollow.) The full description of how to take such photos and view them, with some wonderful examples, is available here:

<https://www.mindat.org/article.php/1566/Minerals+in+3D%3A+learning+to+use+crossed-eye+method>



Stereo pair of fluorite from Okorusu, Namibia, 55 × 30 × 25 mm.