The Mineralogical Society of Western Australia Inc.

TRAPS IN MINERALOGY

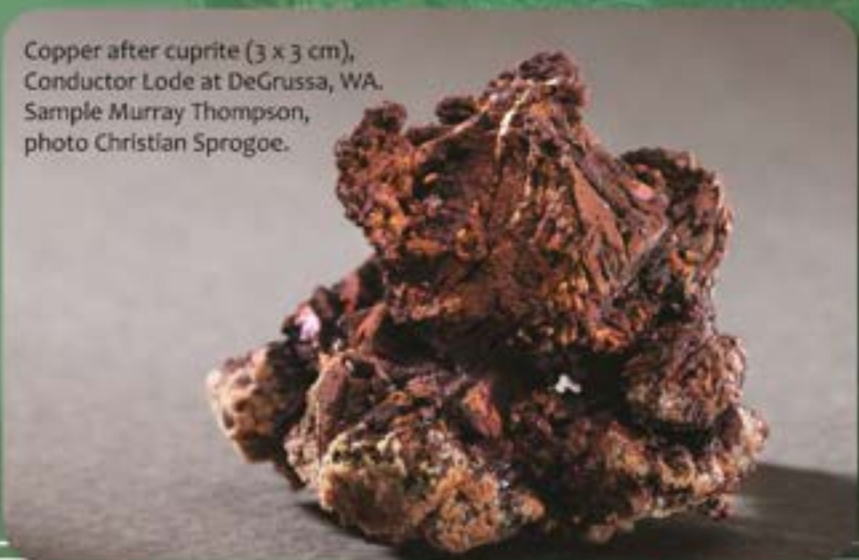
PSEUDOMORPHS, LOOK-ALIKES, FAKES AND SYNTHETICS

42nd Joint Mineralogical Societies of Australasia Seminar

31 August – 1 September 2019 • Perth, Western Australia

Other activities and field trips will take place before and after the seminar

Malachite pseudomorphs after azurite with fine crystalline wulfenite (7.5 x 5 cm), Whim Creek, WA. Sample David Vaughan, photo Christian Sprogoe.



Copper after cuprite (3 x 3 cm), Conductor Lode at DeGrussa, WA. Sample Murray Thompson, photo Christian Sprogoe.

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Welcome to Perth

I'd like to begin by acknowledging the Traditional Owners of the land on which we meet today, the Noongar people, and pay my respects to Elders past and present.

On behalf of the Mineralogical Society of Western Australia, it is my pleasure to welcome you all to this, the 42nd Annual Seminar of the Joint Mineralogical Societies of Australasia. Many of you have travelled long distances to attend this seminar, the 3rd held in Perth, and we hope that you enjoy this year's topic.

We decided on *Traps in mineralogy – pseudomorphs, look-alikes, fakes and synthetics* as the theme for the seminar. It is a topical subject on many levels. Nature itself goes to great lengths to confuse us by means of various processes that may disguise the true identity of minerals. Technological advances ensure that man competes with nature in creating gems and minerals. We felt the subject was big enough and worthy of being the sole focus of a seminar.

We hope that the program contains something for everyone, from the collector to the professional, and that the speakers will keep you thoroughly engaged over the next two days.

Social events include the Welcome to Perth function hosted by Crystal Universe on Friday night, the Seminar Dinner on Saturday night, and the closing party on Sunday night which is generously provided and hosted by our patron Mr Mark Creasy.

A micro-mineral workshop was held on Friday prior to the seminar, and following the two days of presentations, a mineral market will be held on Monday. This is to be followed on Tuesday by the seven day field trip to the Murchison region. Nowadays, gaining access to collecting sites is quite a difficult task — please be considerate when on these properties. We hope that the sites visited will yield a few good specimens for everyone taking part. The highlight of the field trip will be a visit to the DeGrussa gold–copper mine, and we extend a very special thank you to Sandfire Resources NL for their hospitality, generosity, and granting access.

On behalf of the Mineralogical Society of WA I would like to take this opportunity to thank all those who are sponsoring this seminar; our patron Mr. Mark Creasy, our other main event sponsors Swick Mining, Crystal Universe, the Perth Convention Bureau, our advertisers, and all those who supported the auction with their generous donations.

Our sincere thanks go to all the speakers who are so generously giving their time and sharing their knowledge with us, and to Sandfire Resources NL, whose General Manager Geology, Mr Shannan Bamforth, is officially opening our seminar.

Finally, but importantly, I thank the seminar committee and volunteers for their great work in putting the seminar program together. We lost count of all the hours, evenings and weekends they devoted to organizing this Seminar over the past two years.

To everyone who has supported this event, in every way, thank you.

Sue Koepke
President of the Mineralogical Society of Western Australia

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SE Qld 5 October 2019

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Gosford, Central NSW 12 - 13 October 2019

Toowoomba Gemfest
Toowoomba, SE Qld - 19 - 20 October 2019

Bundaberg Gem & Mineral Show
SE Qld 2 - 3 November 2019

Redcliffe Christmas Gem Show
Redcliffe, SE Qld 9 - 10 Nov 2019

Suncoast Gem Show
Mooloolaba, SE Qld 16 November 2019

Seminar Program

Day 1 – Saturday 31 August 2019		
0915-1000	**Registration and morning tea**	
1000-1015	**Welcome**	Sue Koepke - President, Mineralogical Society of Western Australia
1015-1030	**Official opening**	Mr Shannan Bamforth, General Manager Geology, Sandfire Resources NL

Session 1. Pseudomorph formation and experimental mineralogy

1030-1110	**Andrew Putnis**	Pseudomorphism in nature and experiment: from minerals to rocks and technological applications
1110-1140	**David Colchester**	Why rely on nature when you can make your own minerals?
1140-1210	**Des Lascelles**	Fibrous minerals and the genesis of asbestos and tiger eye
1210-1220	Notices	
1220-1320	**Lunch break**	

Session 2. World-wide pseudomorph localities

1320-1400	**Pavel Plechov**	World-wide pseudomorph localities in the collections of the Fersman Mineralogical Museum (*pre-recorded*)
1400-1430	**Rod Martin**	New Zealand pseudomorphs (volcanic)
1430-1450	**Steve Turner**	The amazing sulfide pseudomorphs of Peru
1450-1510	**Ross Pogson**	Goethite pseudomorphs after marcasite, Farafra Oasis, White Desert, Egypt
1510-1540	**Tea break**	

Session 3. Historical collections and their traps

1540-1620	**Paul Carr**	James Dwight Dana's visit to Australia, frozen prawns and the cool mineral connection
1620-1650	**Peter Elliott**	A world of misidentified minerals
1650-1700	**Geert Buters**	AJM website presentation

1830-2300 **Conference dinner & auction**

Mercure Hotel

Day 2 – Sunday 1 September 2019

0835-1000	Gascoyne Room	**Australian journal of Mineralogy (AJM) AGM**	
0900-1000	**Coffee break**		

Session 4. Australian pseudomorph localities

1000-1030	**Ralph Bottrill**	Pseudomorphs in the Dundas mines, Tasmania
1030-1100	**Peter Downes**	Mineral pseudomorphs from the DeGrussa copper–gold mine, Western Australia
1100-1120	**Lena Hancock**	Greenbushes' mysterious mineralogy
1120-1135	**Susan Stocklmayer**	Staurolite — a textural investigation
1135-1150	Photo competition results	
1150-1300	**Lunch break**	

Session 5. Gemmology traps

1300-1330	**Gayle Sutherland**	An overview of the gem trade's underbelly
1330-1345	**Susan Stocklmayer**	Euclase from the Last Hope claims, Hurungwe Zimbabwe
1345-1415	**John Chapman**	Lab-grown diamonds — their creation and detection
1415-1450	**Tea break**	

Session 6. Gems, minerals and museums

1450-1520	**Lin Sutherland**	Traps for mineral museum collections and research
1520-1535	**Steven Petkovski**	The Latz Tsumeb collection
1535-1550	**John Mill & Angela Riganti**	Photo competition awards & Closing remarks
1550-1600	**43rd seminar announcement, MinSocNSW**	

1600-1630	**Meeting for field trip participants**

1830-2100 **Social event at the home of Mark Creasy**
8 King's Park Road, West Perth

Abstracts of the 42nd Joint Mineralogical Societies of Australasia Seminar

Pseudomorphism in nature and experiment: from minerals to rocks and technological applications

Dr Andrew Putnis

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Pseudomorphism is a relatively common phenomenon in virtually all mineral groups and is easily recognized when one mineral is replaced by another while retaining the external morphology of the parent structure. Understanding the mechanism by which one mineral is replaced by another is more than merely a mineralogical curiosity and is relevant to the broader petrological question of how one mineral assemblage is converted to another as the pressure, temperature and chemical conditions change.

In this talk I will discuss the mechanism of pseudomorphism determined from simple laboratory experiments. I will introduce the concept of *interface-coupled dissolution-precipitation* and demonstrate it by *in situ* observations of pseudomorphism.

Some practical applications of pseudomorphism to the geomimetic synthesis of novel materials will further demonstrate the importance of this phenomenon.

After a BSc in Physics at Newcastle University I left Australia and taught Physics in London while also studying for another BSc, this time in Geology, at Birkbeck College, University of London. After completing a PhD in Cambridge and a 3 year postdoctoral position, I was appointed to a lectureship in the Earth Sciences Department at Cambridge where I worked until 1995. From 1995 until 2015 I was Professor of Mineralogy at the University of Münster in Germany.

In February 2015 I returned to Australia to take up my present position as Director of The Institute for Geoscience Research (TIGeR) at Curtin University.

My research interests have since moved from more classical mineralogy and crystallography to geochemistry and metamorphic petrology.

Why rely on nature when you can make your own minerals?

David M Colchester

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Minerals are by definition naturally formed crystals, except for mercury. However, many naturally formed **crystals** can also be grown artificially and these crystals should be referred to as **artificial minerals** even though they are real crystals and have the same composition and structure as their natural counterparts. I will describe how you can make your own (artificial) minerals by growing crystals of them. Growing crystals is both an art and a science; — an art because the result of each experiment is always unique. Crystal growing involves time, and patience! I will concentrate on growing water soluble crystals for two reasons: they are easy to grow and they usually don't feature prominently in mineral collections.

Although growing large well-formed crystals takes time, the effort is worthwhile because you can create some spectacular specimens. Also, large crystals often have variable morphologies and display minor crystal faces not present in small crystals. One method of growing large water soluble crystals is by crystallizing them out of a super-saturated aqueous solution. Use two beakers; one to make a saturated solution and the other to grow the crystal(s). To ensure the solution in the first beaker is saturated always have some undissolved salt lying on the bottom. Let it stand during the day for the solution to attain saturation. In the evening pour a quantity of this saturated solution into the second beaker and seed it with one or two small crystals. As the solution cools overnight super-saturation will occur and the seed crystals should grow. Next morning remove the crystals, blot them dry and remove any parasitic crystals. Pour the solution back into the first beaker to regenerate. Repeat the next evening. A daytime/night time temperature difference of around 8-10 degrees seems to work well. Artificial minerals (crystals) such as chalcanthite, alum, and lopezite grow well this way.

Since having spent time and effort in growing well-formed crystals the next thing is to examine their morphology carefully, identify the crystal faces present and make a drawing of them, preferably using a crystal drawing program. Matching adjacent faces to templates cut out of thin cardboard can often help identify faces. There are several mineralogy texts which list these angles.

To grow large, well-formed crystals via chemical reaction they need to be grown slowly. One way to slow down the reaction is to grow the crystals in a gel such as agar or silica gel. A solution of one reactant is mixed with the gel forming solution and allowed to set. A solution of the second reactant is then poured on top of it. As this solution slowly diffuses through the gel it will mix with the first reactant forming crystals that will grow steadily over a few days. Crystals of crocoite grow well by this method.

As all micro mineral collectors know well, small crystals are beautiful and appreciated. And small crystals are very easy to grow! The techniques and methods used to grow small crystals are those of chemical microscopy. This is a branch of qualitative chemical analysis where assays are performed on microscope slides using tiny amounts of chemicals. The reactions and products are viewed with a microscope. I will describe three methods of growing small (micro) crystals. As for large crystals, micro-crystals can be grown from drops of solution by allowing the solvent to evaporate. In the second method solutions of two soluble salts are mixed and react to form an insoluble crystalline precipitate. In the third method metal dendrites are formed by a redox reaction where a more reactive metal (e.g. Zn, sometimes Cu) reacts with a solution of a salt of a less reactive metal to form crystalline dendrites. You can watch ‘trees’ and ‘feathers’ grow in real time over a period of half an hour. Examples of dendrites include Cu, Pb, Ag, Sn, Sb, Bi. Medieval alchemists had their own version of this experiment calling it *The Tree Of Diana*. It was considered to be a precursor to creating the Philosopher’s Stone.

Crystals can be grown from a solidifying melt. Examples are β sulphur, bismuth, and ice. In limestone regions where water is naturally ‘hard’ due to the presence of dissolved calcium bicarbonate aragonite crystals can be grown in a hot water urn. Carbon dioxide is boiled off from the breakdown of bicarbonate ions in solution allowing calcium carbonate to precipitate out as tiny aragonite crystals.

Finally, you can grow minerals in your own mouth. This is an example of biomineralization. Brushite and apatite can be grown in this way.

I qualified in both chemistry and geology and worked as a soil chemist, exploration geologist and X-ray analyst. After retiring I worked with Pete Williams and others on characterising some new minerals (e.g. elsmoreite, cloncurryite and gillardite). I currently work with Ross Pogson on limestone cave geology and mineralogy and Ian Graham on various topics.

Fibrous minerals and the genesis of asbestos and tiger eye

Dr Des Lascelles

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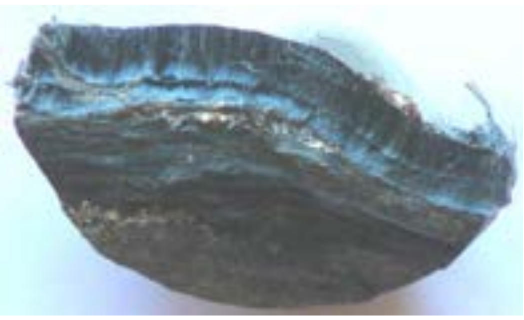
Fibrous minerals consist of elongated single crystals, most commonly amphiboles though many other minerals can also occur in a fibrous form. Fibrous habit is typically an indication of low temperature or activity of formation, i.e. low grade metamorphism, alteration or weathering. Crystallization of colloform botryoidal or spherulitic deposits typically results in radiating fibres, and pseudomorphs of minerals commonly consist of fibrous aggregates Fibrous minerals occur in four main forms:

- Massive — closely packed, randomly oriented, typical of many amphiboles in metamorphic rocks;
- Disseminated — single fibres typically randomly oriented as inclusions in other minerals or more rarely as individual fibres in vugs;
- Radiating — commonly spheroidal or botryoidal crystallized colloform aggregates;
- Parallel — closely bound parallel crystallites – asbestiform – slip fibres and cross fibres — asbestos consists of very fine flexible fibres.

Origin of blue asbestos

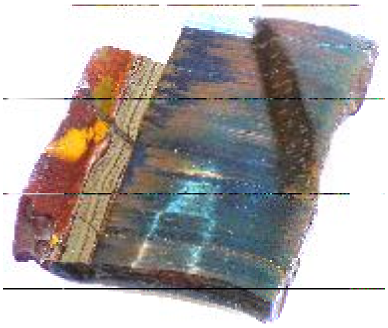
Riebeckite (sodium–iron amphibole) forms as disseminated fibres and acicular to prismatic crystals in chert bands in banded iron formation (BIF) and also as massive completely replaced mesobands. All pass laterally into chert without riebeckite.

Riebeckite is the result of Na-metasomatism, probably by the reaction of hot brine with the Al-poor Fe-silicate precursor of chert. The riebeckite bands are vertically stacked as the hot fluid percolated upwards through recently deposited BIF. Asbestiform riebeckite is called crocidolite or blue asbestos and when weathered and pseudomorphed by goethite is called



Crocidolite – blue asbestos

Silicified griqualandite



Blue Tiger eye

Red tiger eye

griqualandite. Evidence suggests that asbestiform fibres grow under conditions of tension or negative pressure and not during compression.

Tiger eye is formed by silicification of crocidolite and griqualandite and is a weathering product that only occurs in silicified saprolite. The various colours of tiger eye indicate the degree of oxidation and hydration of the blue asbestos prior to silicification. *Blue* tiger eye is unoxidized and typically contains some unsilicified riebeckite fibres; *red* tiger eye is oxidized to hematite prior to silicification and *green* tiger eye is a silicified mixture of partly hydrated riebeckite. *Yellow* tiger eye is silicified griqualandite.

Des graduated from London University in 1964 with BSc Honours in Geology and spent five years with the De Beers Group exploring for diamond, tin and nickel in West Africa and Australia. He researched weathering of ultramafic rocks (Fifield magnesite deposit) and completed an MSc in economic geology at Macquarie University.

Des worked in a variety of exploration and mining fields, including tin, nickel, copper, chromium, tungsten and lead/zinc, partly as a self employed consultant/contract geologist. He spent over 30 years in the iron ore industry, mainly in the Hamersley region where he contributed to the discovery and evaluation of the Hope Downs deposit and the Ferro Gully North Mine, and on Archean BIFs in the Yilgarn Craton (Koolyanobbing iron, Mount Gibson magnetite deposit).

On his retirement in 1998, Des enrolled at The University of Western Australia to carry out research on the origin of BIF and in situ enriched iron ore deposits, and has authored and co-authored several papers and one book on this topic. He was awarded his PhD in 2007 and continued to do research as an Adjunct Research Fellow at the Centre for Exploration Targeting, University of Western Australia until recently.

World-wide pseudomorph localities in the collections of the Fersman Mineralogical Museum

Dr Pavel Plechov

Fersman Mineralogical Museum of the Russian Academy of Science, Leninsky prospect, 18-2, Moscow, Russia
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The Fersman Mineralogical Museum was started by Peter the Great as the Mineralogical Cabinet of Kunstkamera in 1716. The Museum houses a special collection of mineral pseudomorphs currently numbering at 3051 specimens. Some of the most interesting pseudomorph localities in Russia and other countries will be discussed during the talk.

Well-known pseudomorphs in Russia and the former Soviet Union are glendonites from Kola and Taimyr peninsulas, akhtaragdite from Yakutia, rhodochrosite and vivianite in mollusk shells from Crimea, and pyrite in ammonites.

Glendonites (calcite pseudomorphs after ikaite) are widely distributed along the coast of the Arctic ocean. Most spectacular findings are “belomorskie rogulki” in the Kola Peninsula and glendonites from Taimyr. Akhtaragdite is hydrogrossular–chlorite–carbonate pseudomorph after minerals from the henritermierite or wadalite groups. It was first described in Viluyi river basin (Yakutia, Russia) and recently in Talhakh (Russia). Miocene fauna in the sedimentary iron Kerch ore deposit (Crimea) was replaced by rhodochrosite (with barite and other minerals) or vivianite (with other phosphates). Pyrite and calcite pseudomorphs in Jurassic and cretaceous ammonites are well-known in the Volga river valley and near Ryazan (Russia).

Recent findings of pyrite balls on cretaceous belemnites in clays of the Dzhegonas river valley demonstrate pyrite crystallization after organic matter due to redox conditions. Redox conditions also play an important role in the pseudomorph formation of copper, malachite, atacamite, and cuprite after other copper minerals. Localities in Russia will be discussed during the talk.

Pavel Plechov is the director of the Fersman Mineralogical Museum in Moscow (Russia), a professor at Moscow State University and the editor of *New Data on Minerals* (http://www.minbook.com/new_data_on_minerals.html).

His recent research has included studies of the mineralogy and petrology of erupted volcanic rocks of Kamchatka, the mineralogy of cristobalite, olivine, spinel and plumbogumite groups.

He is currently developing the mineralogical information system for the Fersman Museum collection.

New Zealand pseudomorphs (Volcanic)

Rod Martin

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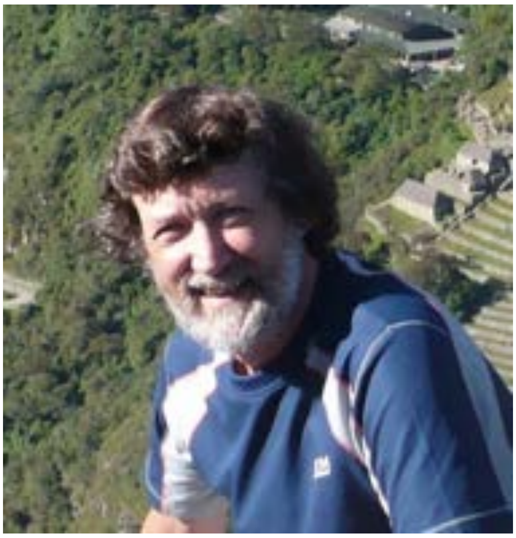
The sub-surface fluid circulation systems associated with New Zealand volcanic settings provide a number of suitable environments for the production of mineral pseudomorphs and epimorphs.

In New Zealand, one particular pseudomorph played a major role in the settlement and development of the country. Although documented earlier, it was the publication of *Mineral Deposit*s by Lindgren in 1933 that tied platy quartz pseudomorphs of carbonates (predominantly calcite) to the boiling zones of epithermal deposits. But, early gold prospectors in the Coromandel area in the 1860s to 1920 quickly saw the association between the bladed quartz and gold. The majority of the quartz pseudomorphs to be found today relate to barren reefs as the strong gold association meant that those from mineralized systems were sent for crushing.

As well as quartz after calcite pseudomorphs, some systems contain rarer quartz or kaolinite pseudomorphs of adularia.

Quartz after calcite, Karangahake Gorge, c. 250 mm.



Rod is an engineer and geologist who was employed in the glass industry for over 35 years. Now retired, he works independently to pursue his interests in the following fields:

- The identification of processes that form sulphates at the surface in low temperature environments such as those found in acid thermal areas
- Sulphate formation in other areas
- Zeolites of the Parnell Grit Formation, Auckland District
- New Zealand mineral occurrences
- Silica sinter research
- Minerals and crystals formed as by-products of industrial glassmaking

In 2012 Rod was elected to the International *Micromounters Hall of Fame* in Baltimore that honours those micromounters who have made significant contributions to the hobby.

The amazing sulfide pseudomorphs of Peru

Dr Stephen Turner

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The famous old mining districts of Peru such as Casapalca, Quiruvilca, Julcani and Huanzala, have produced an impressive array of collectable sulfide and sulfosalt specimens. Amongst these sulfide species are some attractive pseudomorphs and epimorphs. Hyrsl (2008) described all the known pseudomorphs of Peru; however it is worth examining the sulfide pseudomorphs because these represent changes in hypogene vein conditions rather than pseudomorphs which form during oxidation in a weathering environment.

Enargite and tetrahedrite from Casapalca.

The more common Peruvian sulfide pseudomorphs include tennantite after enargite, pyrite after pyrrhotite, pyrite after arsenopyrite, pyrite after chalcopyrite and less commonly tennantite after bournonite and pyrite after or encasing enargite.

Although the sulfide pseudomorphs are relatively uncommon compared to base metal mining districts elsewhere, they are reasonably prevalent in some of the Peruvian mines. Several factors may contribute this, including mineral districts with a marked zonation of ore minerals and metals from a higher temperature core transitioning outwards to lower temperature assemblages. This zonation also reflects changes from a central zone dominated by magmatic fluids to increased mixing with meteoric fluids and reaction with wall rocks progressively outwards. There is typically also a temporal zonation from early high-sulfidation state mineral assemblages, which include enargite and covellite to intermediate sulfidation assemblages with sphalerite, galena, chalcopyrite, tennantite / tetrahedrite, bournonite and pyrite and finally low-sulfidation assemblages with pyrrhotite, arsenopyrite and marcasite. These spatial and temporal changes can explain the enargite to tennantite or tetraehdrite or pyrite replacements but the reverse can also occur where pyrrhotite and arsenopyrite are replaced by pyrite or tetrahedrite by enargite.

REFERENCE

Hyrsl J, 2008. Pseudomorphs from Peru: *The Mineralogical Record Vol. 39 (2), p.103–109.*

Stephen Turner is currently Chief Geologist, Asia Pacific Region, for Newmont Goldcorp and based in Perth, Western Australia.

He graduated with a BSc (Honours) at The University of Western Australia (1979) and subsequently obtained an MSc (distinction) through the Geothermal Institute at the University of Auckland, New Zealand (1986). He gained his doctorate at the Colorado School of Mines (1997) with a field-based study on the giant Yanacocha high-sulfidation epithermal gold deposits in Peru.

Following his doctoral study on Yanacocha, Stephen stayed on in South America for several years as Chief Geologist with exploration programs throughout South and Central America. In 2001 Stephen was based in Newmont's Denver headquarters as global Chief Geologist. Stephen moved back to Perth in 2007. He maintains a keen interest in Peruvian mineral specimens which started him on the slippery slope to serious mineral collecting.

Goethite pseudomorphs after marcasite, Farafra Oasis, White Desert, Egypt

Ross E Pogson

Mineralogy & Petrology Section, Geosciences & Archaeology, Australian Museum Research Institute, Australian Museum, 1 William St., Sydney NSW 2010.
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The Farafra depression in Egypt's Western Desert has a triangular shape of 980 km^2 and lies at the Cretaceous – Early Tertiary limestone boundary**.** The White Desert (Sahara el Beyda) is an area of great natural beauty within the Depression, and is an Egyptian national park 45 km north of the town of Farafra, in the Governorate of Al-Wadi Al-Gadid. The White Desert has massive formations of fine-grained soft and friable limestone ('Khoman chalk') of white to cream colour forming its floor and has been eroded by wind-blown sand into strange shapes resembling animals and mushrooms. The deposits are marine in origin and have scattered shell fossils which have been dated to the Upper Cretaceous Period, about 80 million years ago. Higher up are vertical scarps of Eocene limestone above Paleocene shales. Erosion of the soft Cretaceous limestone has exposed resistant flint nodules, gypsum, fossils, 'ironstone' nodules and goethite pseudomorphs after marcasite.

The Farafra Oasis in the White Desert has yielded intriguing dark brown to grey-brown pseudomorphs of goethite after marcasite crystal clusters. These aesthetic, often 'spiky' pseudomorphs are all different — no two are the same — which adds to their fascination. These pseudomorphs are remarkable for their relatively sharp marcasite crystal shapes and show a variety of habits: stellate, spherical nodules, thin tabular fracture-fillings, and long, cylindrical tubes. Occasionally goethite pseudomorphs after pyrite cubes and cuboctahedra are found. Precipitation of the original sulfide crystal aggregates probably happened post-deposition of the Khoman Chalk unit, possibly as a result of diagenesis and dewatering during burial of the chalk, and probably occurred at low temperatures (< 100^oC). The sulfides have then been later replaced by goethite.

Ross Pogson graduated BAppSc (Hons I) in Applied Geology (1979), and MSc (2001) from University of Technology, Sydney. He has been with the Australian Museum since 1979, currently as a Scientific Officer and Collection Manager for Mineralogy & Petrology. He runs the Museum's X-ray Diffraction analytical facility.

Ross' principle duties involve the management of a rock, mineral, tektite and meteorite collection of over 80,000 items, and his work involves physical mineralogy, and computer applications. Research interests focus on zeolites (including laser Raman studies), cave minerals, and meteorites. He is an authority on the minerals of Jenolan Caves.

Other activities involve educational outreach programs of the Australian Museum – talks to amateur, professional and school groups, publications, and conference presentations.

Ross is a past Education Officer, Librarian, Secretary and Vice-President of the Mineralogical Society of NSW. He is a member of numerous scientific societies, and other interests include astronomy, Middle Eastern archaeology, photography and travel.

James Dwight Dana's visit to Australia, frozen prawns and the cool mineral connection

Dr Paul F Carr

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The Father of American Mineralogy, James Dwight Dana, published his first edition of *System of Mineralogy* in 1837 and shortly after visited Australia for two months as one of nine civilian scientists with the American Exploring Expedition of 1838–42. During his visit Dana travelled extensively with the Reverend William Branwhite Clarke, commonly referred to as The Father of Australian Geology, mapping and sampling the Sydney Basin sequence. Somewhat ironically, Dana apparently collected and described more fossils than minerals during his time in Australia.

While visiting the northern Sydney Basin Dana was presented with prismatic forms of calcium carbonate from Glendon in the Hunter Valley and later discovered and collected similar specimens from Astoria, Oregon. He described the prisms as being granular and consisting of a series of rhombohedrons. His description clearly indicates that he recognized the specimens as being pseudomorphs although he did not use the term and made no comment on the possible precursor.

Dana's eldest son (Edward Salisbury Dana, who also became a noted mineralogist) described similar pseudomorphs (termed thinolites) from Lake Lahontan, Nevada, and commented that the precursor may not have been recognized in nature at that time. These and similar specimens from worldwide occurrences were eventually referred to as glendonites and many potential precursors including glauberite and thenardite were proposed. The geological environment in which they occurred and other properties, however, made all of the proposed precursors unsuitable.

More than a century after Dana's description of glendonites from the Sydney Basin the new mineral ikaite ($CaCO_3 \cdot 6H_2O$) was discovered forming in the very cold waters of Ikka Fjord, southern Greenland. An additional two decades passed before the ikaite-glendonite connection was established, and ikaite became widely accepted as the precursor for glendonites.

Ikaite has been recognized from around the globe in a wide array of facies ranging from springs and lakes to estuaries, shallow-marine shelves and deep oceanic basins. All localities, however, are characterized by cold conditions and many have elevated alkali and phosphate concentrations which apparently suppress precipitation of calcite and aragonite. In addition to these natural occurrences, the white spots formed in the shells of frozen prawns have also been identified as ikaite.

Paul was fascinated by Chemistry as a teenager and commenced University with the intention of pursuing a career in that discipline but quickly became interested in geochemistry and mineralogy. This interest led to completion of a PhD in geochemistry and spending more than 40 years researching and teaching Geology in the university system before retiring at the end of 2015.

Over the last two decades he has been able to devote more time to mineral research and collecting and is now a regular attendee and exhibitor at major mineral shows. His recent research has included studies of glendonites and the chemistry of the adamite–olivenite series in the famous Tsumeb deposit.

A world of misidentified minerals

Dr Peter Elliott

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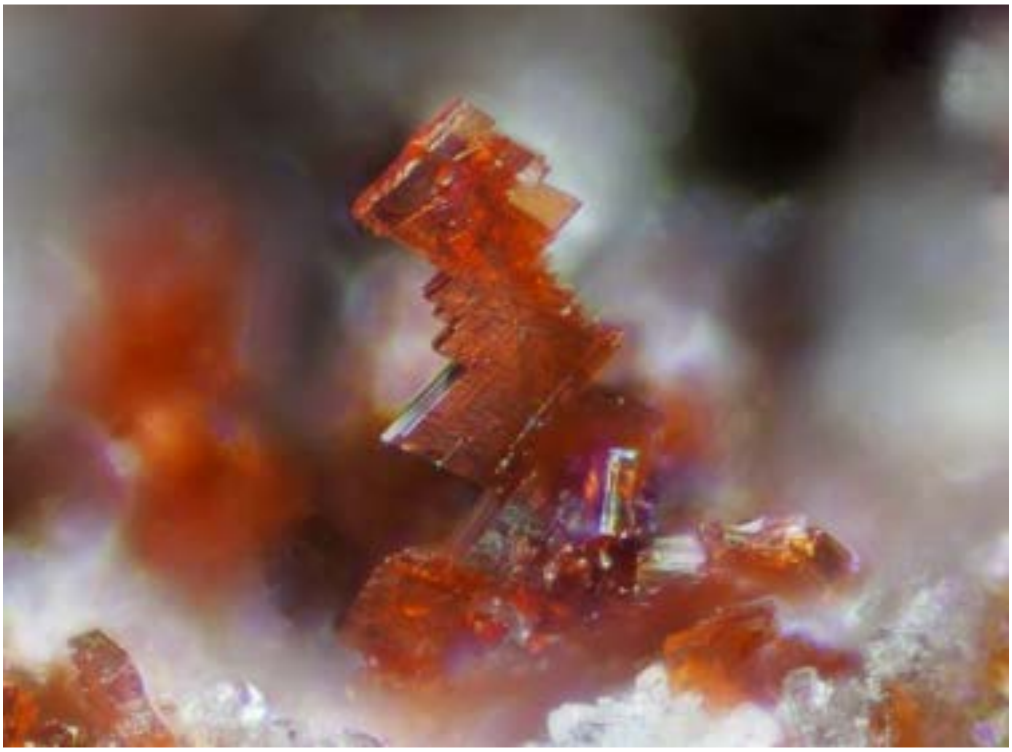
peter.elliott@adelaide.edu.au

Wrongly identified mineral specimens are common in Museum collections, in private collections and on dealers and tailgaters stands at mineral shows. They are also very prevalent on websites: collectors and dealers websites, auction sites and mineral databases and in publications: books, articles in mineral magazines and in the academic literature. Misidentified minerals most often turn out to be common species, but surprisingly often turn out to be very rare species and even new mineral species. Examples of new minerals that remained, incorrectly identified, in collections for several decades include domerockite, barlowite, baumoite and magnesiobermanite.



Magnesiobermanite crystal group, 0.3 mm in height, from the White Rock No.2 quarry, Bimbowrie Conservation Park, South Australia.

Most mineral collectors and many museums do not have access to instruments required for the identification of minerals, such as x-ray diffractometers or scanning electron microscopes, and so rely heavily on visual identification. Even when these instruments are used, incorrect answers are often obtained as the results obtained rely on interpretation.

One of the most notable examples of an incorrectly identified mineral is “chalcocite”, collected as large crystals from the Cattle Grid Pit (Mt Gunson mine, South Australia) in the early 1980s which were not correctly identified as wittichenite until 2008. Recently described new mineral species that have sat, wrongly identified or unidentified, in collections for many years include domerockite, barlowite, hylbrownite, middlebackite, reaphookhillite and baumoite.

Peter Elliott developed an interest in minerals at an early age and has been an active field collector ever since. He has authored and co-authored numerous articles on South Australian and Broken Hill mineral occurrences. He has been a member of the Mineralogical Society of South Australia since its inception and served on the committee for 30 years. An interest in mineralogical research led to the commencement of study at the University of Adelaide in 2001 and graduation in 2005 with a degree in Geology and Chemistry.

An Honours year and a PhD followed, devoted to researching of the crystal chemistry of Broken Hill oxysalt minerals and the characterization of seven new mineral species: birchite, plimerite, nyholmite, liversidgeite, edwardsite, yancowinnaite and aldridgeite. He has since described a further 18 new minerals. He is currently a Visiting Research Fellow at the University of Adelaide and an Honorary Research Associate at the South Australian Museum.

Pseudomorphs in the Dundas mines, Tasmania

Ralph Bottrill

Mineral Resources Tasmania
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The Dundas mines in western Tasmania are world famous for crocoite, but have a great deal of other very interesting mineral and geological curiosities, including some unusual pseudomorphs.

Most of the crocoite deposits are hosted by Cambrian ultramafic rocks, originally olivine–pyroxene–chromite rich rocks, but now largely replaced by serpentine, dolomite and other secondary minerals. The chromite crystals can be over a centimetre in diameter and most are largely pseudomorphed by magnetite, fuchsite or, most notably, stichtite. Some are well preserved but others are deformed by metamorphism.

The Pb–Zn–Ag mineralization hosted in these rocks is largely deeply weathered, forming gossans rich in cerussite, crocoite and other minerals. Crocoite can replace galena and cerussite and be replaced by gibbsite, dundasite, goethite, coronadite, hisingerite and other minerals. Gibbsite commonly replaces dundasite. Other good pseudomorphs include pyrolusite after manganite, philipsbornite after mimetite, limonite after siderite and plumbogummite after pyromorphite.

Dundasite replacing crocoite, with secondary crocoite. Adelaide mine, Dundas, ~15mm long. Steve Sorrell specimen.

REFERENCE

Bottrill RS, Williams P, Dohnt S, Sorrell S. and Kemp NR, 2006. Crocoite and associated minerals from Dundas and other locations in Tasmania: *Australian Journal of Mineralogy. 12, 59–90.*

Ralph is a geologist, mineralogist, petrologist and mineral collector, living near Hobart, Tasmania. He specialises in Tasmanian minerals, as well as minerals from Broken Hill, South Australia and a few other favourite areas. He works for Mineral Resources Tasmania (Mines Department) where he runs the geology/ mineralogy/ petrology/ geochemistry labs and rock collection; studies various Tasmanian mineral deposits, rocks and minerals, and helps with mineral tenement management and some geotourism projects.

He is an associate curator for minerals with both the Tasmanian Museum and the Queen Victoria Museum. This role includes assisting with the famous mineral collections in the Zeehan Museum. He is currently President of the Mineralogical Society of Tasmania, an associate editor for the Australian Journal of Mineralogy and a registered valuer of minerals and meteorites under the Australian Cultural Heritage Act. Since about 2008, he has helped managing the data for Australia and Tasmania in particular on Mindat (www.mindat.org).

Mineral pseudomorphs from the DeGrussa copper–gold mine, Western Australia

Dr Peter J Downes[1] and Murray Thompson[2]

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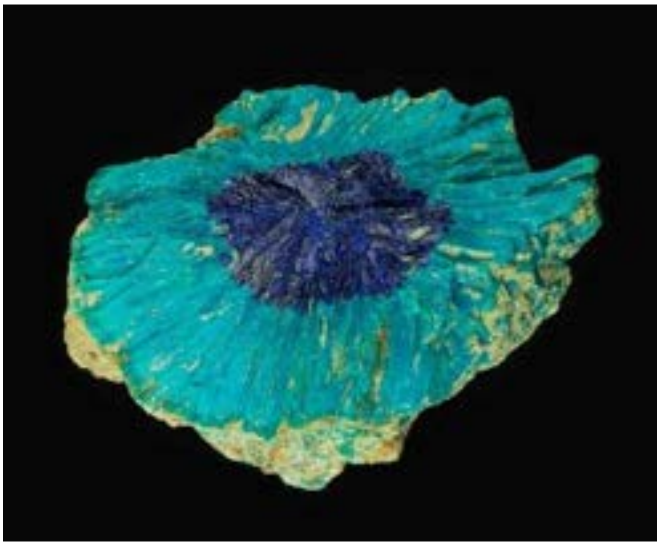
2 Desert Fire Designs, Unit 15, 14 Whyalla Court, Willeton, WA 6155; contact@desertfiredesigns.com

The DeGrussa volcanic-hosted massive sulfide copper–gold deposits are situated about 140 km north-northeast of Meekatharra in Western Australia. They occur within the Paleoproterozoic Bryah Basin in the central part of the Capricorn Orogen. At DeGrussa, the massive sulfide ores are hosted by the Karalundi Formation, a 2 km thick sequence of volcanogenic and sedimentary rocks, and comprise very large lenses of primary pyrite, chalcopyrite and pyrrhotite with minor magnetite, sphalerite, galena and arsenopyrite. The base of the massive sulfide is rich in chalcopyrite and magnetite, and passes upwards into iron sulfides with increasing zinc content and decreasing copper. Gold occurs as electrum with a high silver content in the basal chalcopyrite-rich zones.



A small nodule of chrysocolla (45 mm wide) replacing malachite after azurite surrounding an azurite core, DeGrussa copper–gold mine, Western Australia.

Prior to mining, oxide zone mineralization occurred in an approximately 80 m thick zoned profile above the DeGrussa and Conductor 1 sulfide ore bodies. A hardpan cap was underlain by a lateritic gold-rich oxide zone above an oxide–copper zone containing malachite, chrysocolla, native copper, minor cuprite, tenorite, azurite and rare mcguinessite overgrown by dolomite. Secondary supergene chalcocite formed a blanket beneath the oxide–copper zone and directly above primary sulfides in the DeGrussa lode. Complex, multi-stage mineralogical overprinting occurred in the oxide zone at DeGrussa resulting in various examples of mineral pseudomorphs. Perhaps the finest of these are native copper pseudomorphs after cubes and bipyramids of cuprite to 20 mm long. We will describe these pseudomorphs, along with nodules of chrysocolla after malachite that partially to fully replaced azurite (shown above), and consider their origins.

Dr Peter Downes is Curator of Minerals and Meteorites at the Western Australian Museum, and editor of the Australian Journal of Mineralogy. He investigates kimberlites, lamproites, carbonatites and associated alkaline rocks from the Earth's mantle, along with secondary minerals from the oxidized zone of Western Australian mineral deposits. He is also interested in the history of 19th Century mineral collections and the collectors who put them together.

Murray Thompson is a geologist, gemmologist and curator of mineral specimens. In 1987, he was awarded a Churchill Fellowship that afforded him the opportunity to travel the world and learn more about gem cutting and display (including visiting with gem cutters such as John Sinkankas, Glen & Martha Vargas and many others in several countries). He spent 16 years as a geologist in the resources industry working for Pacmin, Sons of Gwalia, WMC, BHP Billiton and Sandfire Resources. In 2017, Murray returned to his long-time interest in jewellery, gem-cutting and lapidary, with which he has been heavily involved since 1973, and founded Desert Fire Designs, focusing on the texture, pattern and colour of raw materials to design bespoke gems and collectables.

Greenbushes' mysterious mineralogy

Dr Elena A Hancock

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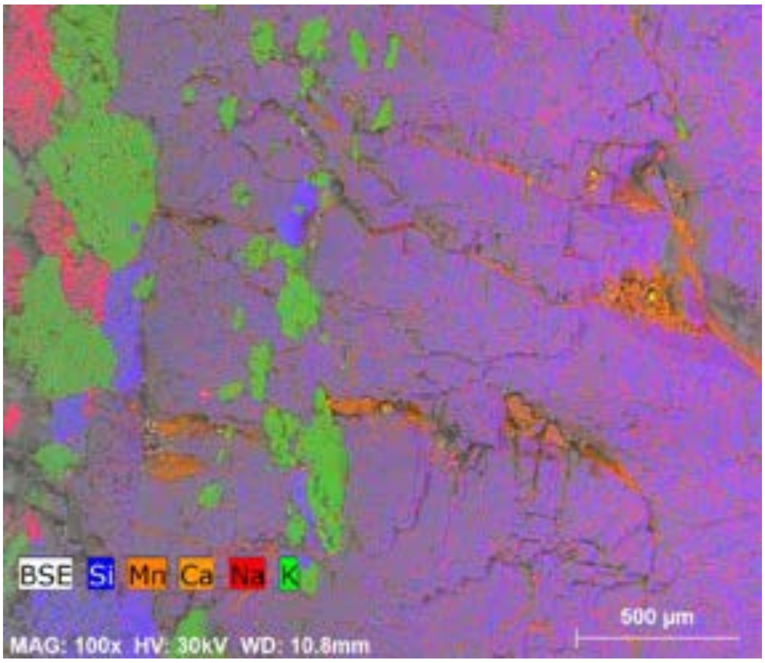
The Greenbushes pegmatite is a giant Archean Li–Sn–Ta granitic pegmatite deposit in Western Australia, which intruded at 2.53 Ga along the Donnybrook–Bridgetown shear zone into the Balingup Metamorphic Belt of the South West Terrane (Partington, 2017).

The pegmatite contains a variety of mineral zones that include a Li zone (spodumene and Li white mica), a Na zone (albite and tourmaline), and a K zone (microcline, muscovite, and apatite). In this study we used hypespectral data validated by pXRD and SEM-EDX to undestand the alteration mineralogy of Greenbushes drillcore and interpret processes controlling Li–Sn–Ta mineralization. Several unexpected outcomes were identified.

The first mineralogical mystery of the Greenbushes core is the abundance of never previously reported montmorillonite that pseudomorphs after spodumene crystals; together with Mn-rich phosphate phases and zeolites it represents a late hydrothermal alteration event affecting the pegmatite (see the orange phase in the SEM-EDX image). A second mystery is the atypical absence of petalite in the pegmatite — this Li-bearing feldspar could be expected to crystallize from the orthomagmatic fluid during later stages of cooling of rare element pegmatites. A third mystery is the presence and distribution of hydrothermal manganese in the Greenbushes pegmatite and its affiliation with lithium mineralization.



SEM-EDX map showing the distribution of Si, Mn, Ca, Na, and K on the surface of a cut core sample from drillhole C3DD024, at a depth of 12.5 m. Detected mineral phases: altered spodumene (purple), microcline (green), albite (red), and Mn-rich montmorillonite phases (orange).

REFERENCE

Partington GA 2017, Greenbushes tin, tantalum and lithium deposit, in Australian Ore Deposits, *edited by* GN Philips: The Australian Institute of Mining and Metallurgy, Monograph 32, p. 153–158.

Dr Elena Hancock obtained her PhD in 1994 at the Moscow University on mineralogy of lode and alluvial gold deposits of Russia. As a mineralogist, she has worked at Curtin University and the Western Australian Museum before joining the Geological Survey of Western Australia as a HyLogger Geologist. She is currently managing the HyLogger facility, which includes investigation of drillcore mineralogy, and is also undertaking a systematic study of gold in Western Australia.

Staurolite – a textural investigation

Susan Stocklmayer

baobab46@dodo.com.au

Staurolite ($Fe^{2+}_2 Al_9 Si_4O_{23} (OH)$; monoclinic) is a durable mineral with relatively high hardness (7.5 Mohs) and heft (SG 3.6-3.7). It is well known to mineral collectors as euhedral crystals that are usually stumpy and prismatic in habit. In the mid 18th century cruciform twinned staurolite crystals are recorded as religious objects and used as baptismal amulets. As a gemmological mineral staurolite crystal specimens are commonly brown coloured with dull, resinous surface lustres and are usually pock marked. As cut gemstones, staurolite is rarely fashioned due to its intense reddish brown - black body colour and low transparency.

Common twinned habits of staurolite crystals.

Geologically, these crystals and crystal groups are porphyroblasts that originate typically from a range of regional and contact metamorphic rocks.

During recent identification work, standard hydrostatic SG tests were performed on some matrix-free staurolite crystals from various localities in Australia. SG testing provides an identification parameter and is a simple test to perform. The unexpectedly low and spurious results required an explanation. Petrographic sections and mineral crushes demonstrated that many crystal euhedra have poikilitic textures, providing an explanation for the variation of SG results and the generally poor transparency. Textural examination of a range of crystals demonstrated a wide variation in the mineral's integrity.

Susan, a London University Honours graduate in geology, was initially employed as the Mineralogist at the Geological Survey in Rhodesia (Zimbabwe). In 1974 she qualified as an FGA by distance learning and practiced as a gemmologist in Harare before returning to England in 1985 where she worked as a Valuer in Worthing and with the jeweller, Philip Antrobus, in London. She moved to Western Australia in 1998 and continued working as a Valuer and as a lecturer with the Gemmological Association of Australia.

Prior to 1998 she published various papers in the Journal of Gemmology covering Zimbabwean minerals including emerald and euclase and, since moving to Western Australia, has authored and co-authored numerous papers on various aspects of gemmology culminating in the popular *Gemstones in Western Australia* bulletin. Susan has maintained close links with the Gemmological Association in London and is on the board of Examiners. She is currently Keeper of Gemstones for the Gemmological Association of Australia.

An Overview of the Gem Trade's Underbelly

Gayle B Sutherland

Mineralogical Society of New South Wales
gaylebws@gmail.com

The imitation of gemstones, practised for centuries, accelerated in the late nineteenth century to supply a newly-affluent middle class in Europe and the United States. The twentieth century saw the development of synthetic minerals and gemstones, as well as an increase in the sophistication of imitations, composite stones and gemstone treatments. Treatments and synthetics are becoming harder to detect and, while most can be identified by a qualified gemmologist, particularly with the use of a microscope, some will need analysis by a specialized laboratory to separate them from natural, untreated gemstones.

International markets, travel, the Internet, and large online shopping channels now provide an environment in which treated stones and synthetics flourish. Although synthetic origin is often disclosed at the source, such knowledge may not survive changes of ownership. Provenance, at every stage of production, is increasingly important for buyers who seek natural gemstones.

Synthetic ruby grown by flame fusion process cut into shape of a natural looking crystal and glued in a re-constituted matrix of rock powder mixed with resin.

Gayle Sutherland joined the Australian Museum of Natural History, Sydney, in 1985 and retired at the beginning of 2015. During that time she worked as a technical officer in Geoscience, assisting in curatorial and collection duties and specialising in Gemmology, for which she qualified with a Research Diploma of Gemmology from the Gemmological Association of Australia (New South Wales Division).

She has taken part in many mineral and gemstone activities at the Museum, attended conferences, given talks on gemstones, answered public enquiries and run a gemstone identification service from the Mineralogy laboratory. She has written numerous articles, assisted with scientific papers and co-authored a book, *Gemstones & Minerals of Australia*, re-issued in 2019.

Euclase from the Last Hope claims, Hurungwe, Zimbabwe

Susan Stocklmayer

Gemmologist
baobab46@dodo.com.au

Euclase, a rare beryllium aluminium silicate, was first recorded in Zimbabwe before the 1960s although it was in the 1970s and onwards that showy crystal euhedra, sought after as collectors' specimens and with gemmological potential, were first marketed. There have been declared productions from several mining claims within the general area centred at Miami, Hurungwe in the north-west central region of Zimbabwe. Of note are the euclase specimens from the Last Hope claims and this deposit has become a classic source. The presenter had the opportunity of examining specimens of euclase originating from these claims in the 1970s. The crystals are dominantly blue or parti-coloured blue with colourless sections. Mining claims purporting to have produced euclase specimens are all fairly closely grouped within a few kilometres of one another within small pegmatites associated with the circa 500 Ma Miami metamorphic event and hosted in sillimanite and staurolite schists and staurolite gneisses of the mid-Precambrian Piriwiri System.

Euclase euhedra from the Last Hope Claims, Zimbabwe.

Historically, pegmatites of the general area have been worked for significant tonnages of mica and commercial beryl, small productions of cassiterite and tantalite and some gemstones including tourmaline and chrysoberyl. The euclase found at the Last Hope claims originates from diggings excavated within weathered and decomposed pegmatite. Euclase is found in two forms – as transparent loose single crystals and small crystal groups, and in massive habit intergrown with beryl and quartz. Some crystals preserve the hexagonal form typical of beryl, indicative of replacement of the beryl by euclase. Pseudomorphs of up to14 cm diameter are recorded.

REFERENCE

Anderson SM, 1980. Euclase: Journal Of Gemmology, v.17(1), p.18–29.

See page 33 for Susan Stocklmayer biography.

Lab-grown diamonds – their creation and detection

Dr John Chapman

Director – Gemetrix Pty
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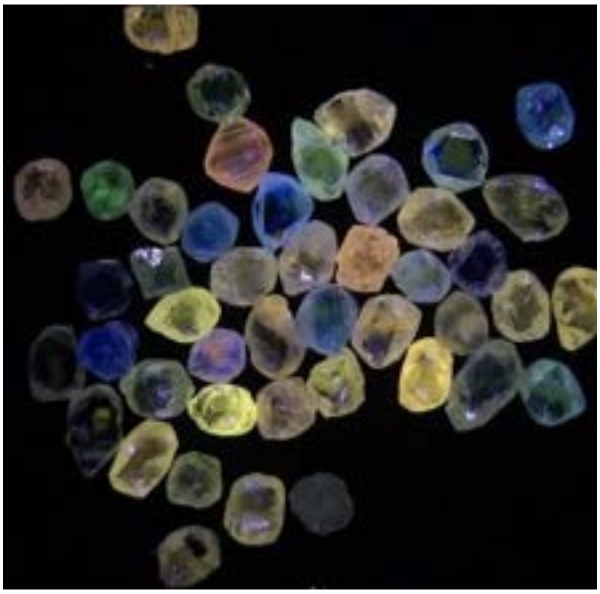
The first diamonds to be grown artificially were in the 1950s, but it was several decades later that the technology was sufficiently mature to enable mass production of synthetic diamonds for the industrial market, mostly grit-sized crystals of yellowish colour. This technology relied on high pressures and high temperatures (HPHT) to grow the crystals. More recently a technique using chemical vapour deposition (CVD) has become a viable alternative process. Both growing techniques are now capable of growing gem-quality diamonds and have been making a significant impact on the jewellery market, presenting a challenge to dealers and gem labs.



A collection of colourless rough natural diamonds showing a variety of fluorescent colours under LWUV, colours not commonly not found with synthetic diamonds.

Numerous detection instruments have been developed to identify synthetic diamonds that are often passed off for their more expensive natural counterparts. With near-colourless diamonds, many of these instruments determine if the stones transmit UV, the transmission being associated with a lack of nitrogen impurities that characterizes synthetic diamonds and a few percent of natural diamonds. More sophisticated methods employ spectrometers to detect an absorption or luminescent line at 415 nm found in almost all natural diamonds. Birefringence patterns between crossed polars can be effective in distinguishing naturals from synthetics when they are unmounted. Fluorescence at short (SW) and long (LW) wavelengths provides an effective low-cost method to detect synthetic diamonds, with the intensity of the SW being generally higher than that of the LW. Additionally phosphorescence is an added indicator – associated with HPHT-grown diamonds.

REFERENCE

Chapman JG and Deljanin B, 2018. An overview of synthetic diamond detection – methods and instruments: *Australian Gemmologist*, v.26 No 9 & 10, p. 209–216.

John Chapman is a physicist who has been active in the diamond industry for the past 35 years, mostly working for Rio Tinto Diamonds on technical matters from exploration, extraction, sorting, polishing and grading. His research interest was pink diamonds, especially their cause of colour and characteristics. Having left the company a few years ago John established Gemetrix Pty, a company that has developed and manufactures small fluorescence-based instruments for gemmologists.

Traps for mineral museum collections and research

Dr F Lin Sutherland

Senior Fellow Geoscience, The Australian Museum, Sydney
linsutherland1@gmail.com

Mineral museums are recognized collectors. They amass long-term collections, preserving minerals from various areas, geological settings and mines. Their operations interact with outside collectors and agencies, so that responsible mineralogical staff need to recognize the many traps the mineral world offers, such as pseudomorphs, look-alikes, fakes and synthetics, and implement accurate documentation of locality and context. The collections are built up through donations, museum collecting trips, exchanges, purchases from individuals, companies or dealers and specimens offered at mineral shows.

For mineral museums with public exhibits, collections open for inspection, educational activities and research on the collections, delivery of accurate information is needed. Activities will also involve updating mineral and locality names in line with changes in nomenclature and use. Against this background, some traps associated with gemstone acquisitions in the Australian Museum collections and research programs are presented to illustrate the topic. Insights into Museum personnel and their interactions can be gained from recorded accounts.

Three museum mineral curators/researchers and experts in mineral traps. From left to right: Dr Jeff Post (Smithsonian Natural History Museum), Dr Bill Birch, Dermott Henry (Museum Victoria).

IMA Meeting, Melbourne, August 2018.
Photo FL Sutherland.

REFERENCE

Chalmers O, 1992. Minerals in the Australian Museum – 1901 to 1945: *Records of the Australian Museum Supplement*, v.15, p.111–128.

Dr Lin Sutherland is a Senior Fellow in Geoscience at The Australian Museum, Sydney. A Life Member of the Mineralogical Society of New South Wales, he is also a member of the Queensland Mineralogical Society. He resides at Port Macquarie, NSW.

As a Curator and Research Scientist at the Australian Museum, he added many geological materials from Australia and other countries to the collections, to be used for display and research. This led to books *Gemstones of the Southern Continent*s, *The Volcanic Earth*, *Earthquakes and Volcanoes*, *Gemstones and Minerals of Australi*a (with Gayle Webb) and *Geology of the Barrington Tops Plateau: Rocks, Minerals and Gemstones* (with Ian Graham). His research interests focus on Australian minerals and gemstones, volcanism along Pacific continental margins, high pressure mineralogy and related tectonic settings. He has authored and co-authored over 160 reviewed scientific papers, including many on gem materials from Australia, New Zealand, Asia, Russia and South America.

The Latz Tsumeb Collection

Steven Petkovski

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Steven.Petkovski@ga.gov.au

In 1976, Clement Victor Latz from Adelaide, South Australia donated his collection of c. 1500 specimens to the Commonwealth Government to be managed by the Bureau of Mineral Resources (now Geoscience Australia). His collection was accumulated in a very short period of time and from many historic sites across Australia, but also includes 230 pieces from the famous Tsumeb mine in Namibia. It contains some of the finest large crystal groups of classical Tsumeb dioptase, smithsonite, cerussite, and calcite — a substantial feat for an amateur mineralogist who began his collecting career very late. The story of how he acquired his collection, significant specimens, key pseudomorphs, and two cases of mistaken identity will be discussed.

**Calcite from the Tsumeb Mine, Oshikoto Region, Namibia, 28 cm.
Latz Collection, R28045 Geoscience Australia.
Photo Jeff Scovil.**

After graduating with a Diploma in Geoscience from the Canberra Institute of Technology, in 2001 Steven joined Geoscience Australia (then Australian Geological Survey Organisation) as rock-store curator overseeing an accessioning project for half a million geological specimens. In 2008 he completed a Bachelor of Science (majoring in Geology and Marine Science) from the Australian National University.

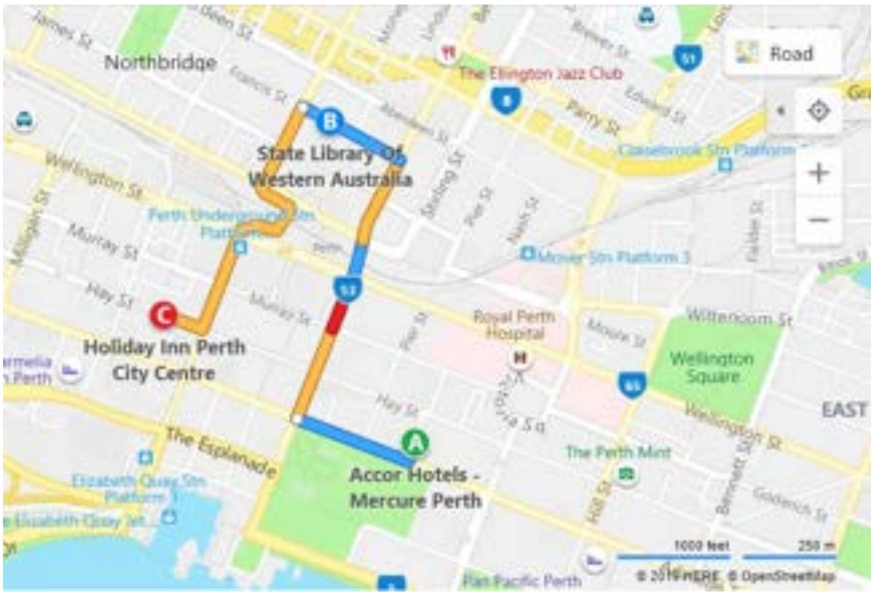
Since 2015, he has led the Collections and Visitor Services team at Geoscience Australia where he curates the National Mineral & Fossil Collection. In his role he ensures the development, preservation, accessibility and increased usage of the collection for research and education purposes. In addition to managing the organisation's Volunteer Program, Steven also chairs the Geological Time-walk Committee and is a member of the Society of Mineral Museum Professionals, Geological Curators Group, and the Geological Society of Australia.

NOTES

General Information

Seminar Venue and Parking

The State Library of Western Australia is located in the Alexander Library Building in the Perth Cultural Centre at *25 Francis Street, Northbridge 6003*. 24-hour undercover parking is available directly beneath the building in the number 11 Perth City Council Car Park. Entrance to the car park is from Francis Street. Information on alternative parking in the area is available on the city of Perth website at www.cityofperthparking.com.au. Bicycle racks are available at the front of the building.
There is wheelchair access to the Alexander Library Building from James or Francis Streets, lifts to all floors and a wheelchair accessible toilet on each floor.



Public Transport

The library is a short walk north of the Perth Railway Station and the Wellington Street Bus Station. The Blue Central Area Transit (CAT) buses travel close to the building with stops in Beaufort, Aberdeen and William Streets. Bus transport within the CBD and all CAT services in the city of Perth are free.

Registration for the Seminar

Registrants can collect their identity badges and documentation for the Seminar on Saturday 31 August from 9.15 for a 10.00 am start in the State Library Theatre Foyer.

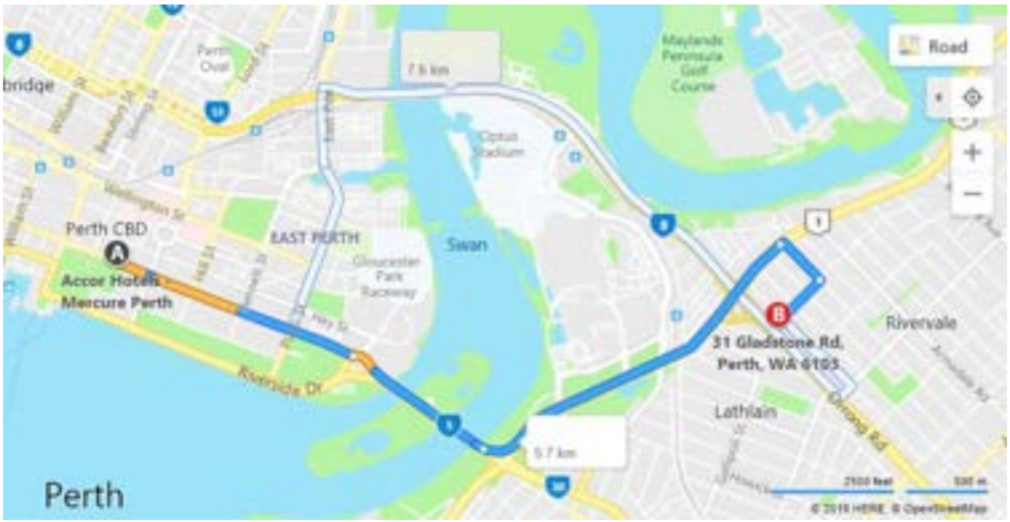
Seminar Catering

As per the Timetable for the Seminar, morning tea, afternoon tea and a light lunch will be provided in the State Library Theatre Foyer and environs.

Other events

Micro-mineral workshop

Ticket holders only — Friday 30 August, 31-35 Gladstone Road, Rivervale 6103. Arrival at 8.45 for a 9.00 am start, concludes at 3.00 pm (BYO lunch). Led by Alan Longbottom, and Clive Daw, this interactive session will include activities and demonstrations on the many techniques used for preparing/displaying small mineral specimens.

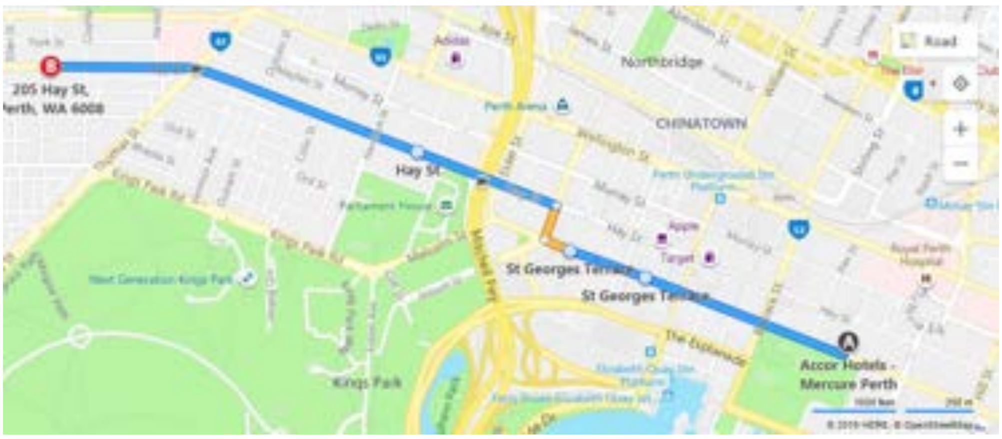


A morning at the Museum

Ticket holders only — Friday 30 August, 49 Kew Street, Welshpool 6106. Arrival at 10.15 for a 10.30 am start. Led by Dr Peter Downes, this tour will take you behind the scenes to inspect rarely displayed parts of the mineral collections of the Western Australian Museum. See map on page 47.

Welcome to Perth

Ticket holders only — Friday evening 30 August, at Crystal Universe 205 Hay St, Subiaco 6008. Open from 6.00 to 9.00 pm. Venue is accessible via the free Red CAT bus service and a short walk from West Perth.



Seminar Dinner and Auction

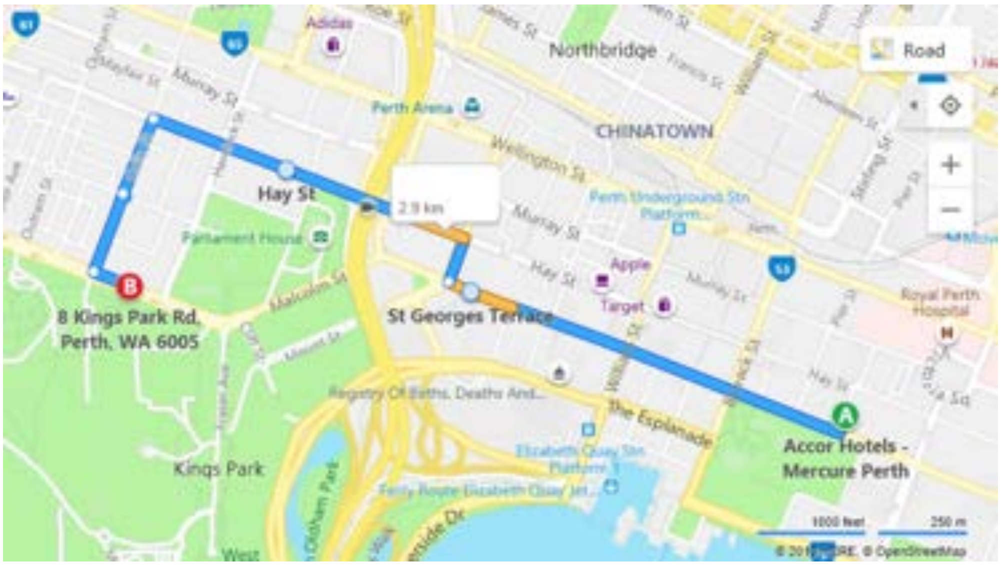
<u>Ticket holders only</u> — Saturday evening 31 August, at the Mercure Hotel (see map page 44). Arrivals from 6.30 for a 7.00 pm start. A Mineral Auction will be held during dinner. Credit card facilities will be available for the Auction.

State Delegates and Australian Journal of Mineralogy AGM

Sunday 1 September, 08.35 until 10.00 am. Held in the Gascoyne Room, State Library (off the Theatre foyer).

Social Event at the home of Mark Creasy

<u>Ticket holders only</u> — Sunday evening 1 September, 8 Kings Park Road, West Perth 6005. Starts at 6.30 pm and concludes at 9.00 pm. Join us and enjoy the famed hospitality of MinSocWA's patron.



Mineral Market

Monday 2 September, WA Lapidary Club, 31-35 Gladstone Road, Rivervale 6103 (see map on page 45). From 8.00 am for sellers to set up. Doors open to buyers from 9.00 am until 2.00 pm (a $2 door charge applies).

GSWA Perth Core Library and HyLogger tour

<u>Ticket holders only</u> — Monday 2 September, Perth Core Library, 37 Harris Street, Carlisle 6101 (see map on page 47). Arrive at 10.15 for a 10.30 am start. Tour lasts 30-40 minutes.

Led by Dr Elena Hancock, this tour will showcase cores from mineral exploration drillholes and how modern technologies assist in mineral identification and exploration.

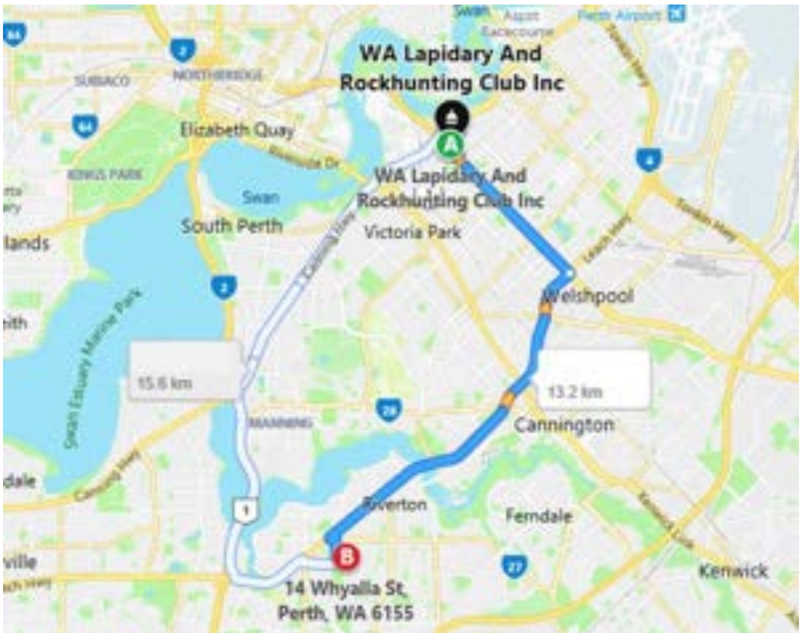
Behind the scenes at the Western Australian Museum

Ticket holders only — Monday 2 September, 49 Kew Street, Welshpool 6106, at 12.30 pm (see map above). Led by Dr Peter Downes, this tour will take you behind the scenes to inspect rarely displayed parts of the mineral collections of the Western Australian Museum.

Desert Fire Designs – workshop tour

Monday 2 September, Unit 15, 14 Whyalla Court, Willeton 6155 (southeastern suburb of Perth). Open from 2.30 to 5.30 pm. Led by Murray Thompson, this visit will showcase some of the finest specimens of Western Australian mineral and lapidary material.

Workshop also open after the field trip, on Tuesday 10 September, 2.30 to 5.30 pm.



DEHNE AND MAUREENS' MINERALS

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Upcoming shows

28th to 29th September 2019 Gemkhana

Hawkesbury District Agricultural Showground (Windsor/Sydney)

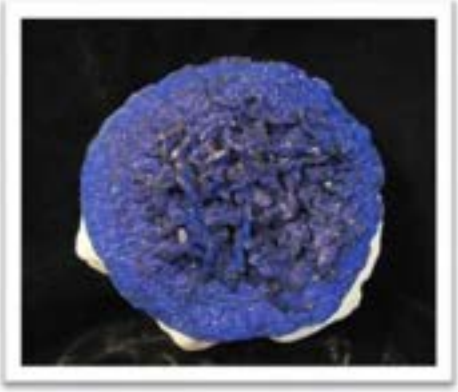
9th to 10th November 2019

Zeehan Gem and Mineral Show

Zeehan Primary School, Tasmania

1st – 14th February-.2020 Tucson USA,

Room151 Hotel Tucson City Centre (Inn Suites)



Contact us

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