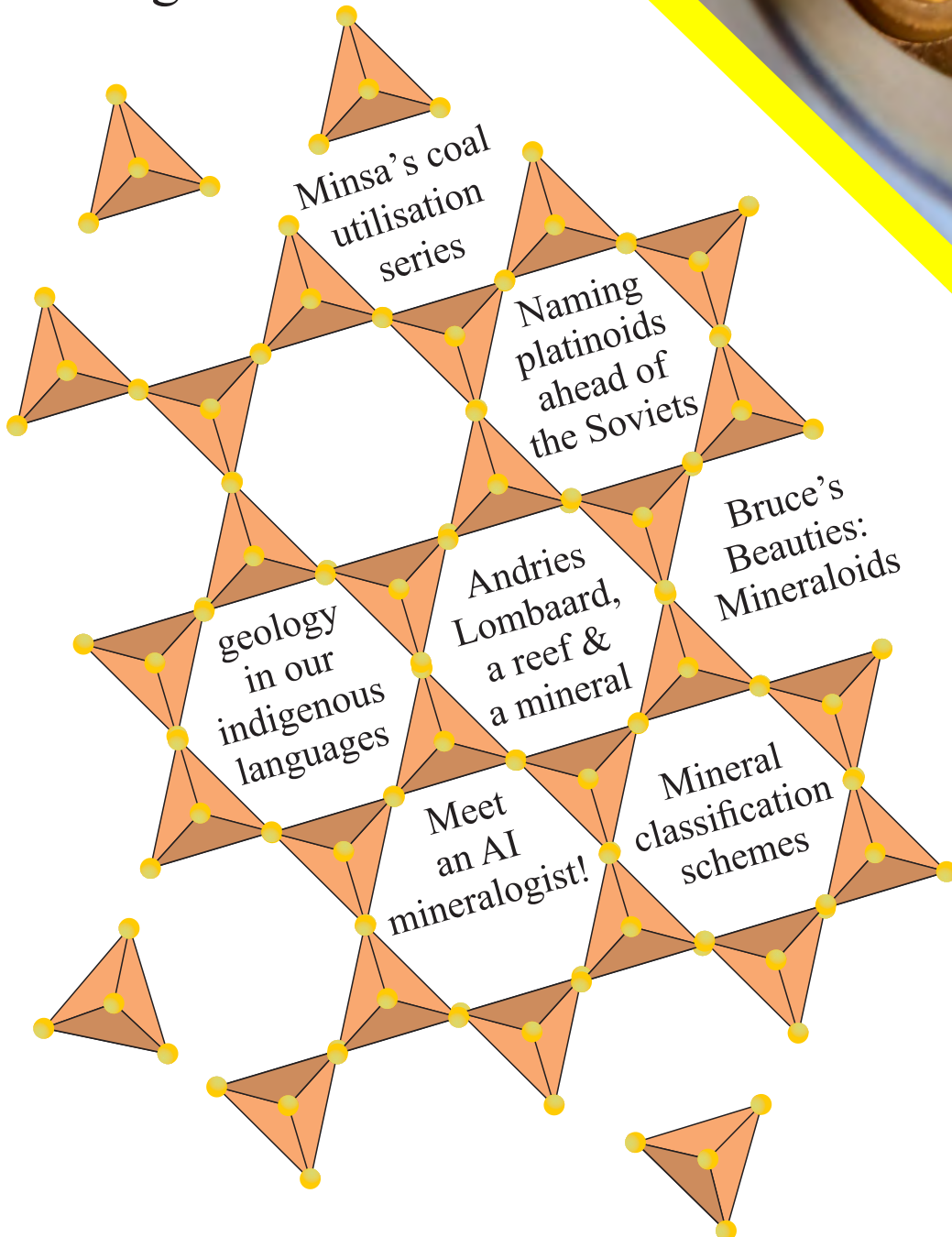


the Geode the Geode



Mineral classification and new mineral naming



The GEODE

Minsa
Newsletter
Volume 10
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June
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Mineralogical Association of South Africa
A division of the GSSA

website: www.gssa.org.za/Minsa

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NEWSLETTER

Volume 10 No. 2

June 2023

Contents

	p.
Forthcoming Events	1
Editor's Site	1
Message from the Chair	2
Minsa News	
Schlieren & Schollen:	
IMA news; <i>Desh Chetty</i>	3
2023: Minsa's year to celebrate energy; <i>Petra Dinham</i>	4
Geology access through indigenous languages	6
Articles	
UWC TEM short course	8
Naming new minerals	9
Awkward situations in naming new minerals; <i>Louis Cabri</i>	9
Andriesslombaardite; <i>Louis Cabri</i>	11
Issue theme: Mineral Classification	11
• Mineral classification schemes: An introduction to mineral phylogenetics. <i>S. Prevec</i>	11
• Inconsistencies and alternatives with regards to mineral classification. <i>Igor Tonžetić</i>	15
Other Gems	
• Meet an AI Mineralogist (no really, it's interesting).	17
• Bruce's Beauties: Mineraloids	21
• A June crossword & the March solutions	22
	23

Forthcoming Events & Attractions

Some events are still missing specific dates: Minsa will let you know! Watch for e-mailed announcements. All dates are 2023 unless otherwise stated.

- Wager & Brown Layered Intrusion Workshop, 30 June-2 July 2023, Cardiff (U.K.), followed immediately by the:
- 14th International Platinum Symposium, 3-7 July 2023, Cardiff (U.K.).
- SAIMM: Geometallurgy Conference 2023 'Geomet meets Big Data', 5-6 September 2023 at Hazendal Wine Estate, Cape Town.
- ICAM 2023: China, September – details still to be organised.
- Minsa AGM, 3 August 2023
- Wirsam workshop (TBA)
- Night at the Museum, 24 November 2023
- Energy Excursions (solar energy cells, battery lab excursions) (TBA)
- "Meet-a-Mineralogist" tour to Namibia (planned for 2024)

The Editor's Site

Here we are in the middle of the year again. Every twelve months it's the same thing. In this issue of the Geode, we focus on names: what's in a name? Quite a lot, as it turns out. In this issue we feature examples of mineral names involving international precedence and Cold War scientific politics, Merensky and Lombaard and who gets to be the Reef, but minerals for everyone. Our feature for this issue relates to how minerals and

their relatives are classified; on what basis do we do this, and why, and is this creating gaps for non-minerals or for industrial minerals? Igor Tonžetić and I have offerings on this matter, and our feature photo spread and crossword also further illuminate this topic. And on the topic of ‘topics’, I would note here that the concept of a theme for each issue was introduced a few years ago to help provide a more marketable offering to you, our society members. It does not in any way preclude submissions of any mineralogical nature, whether it is a group or solitary activity that you have experienced, or any mineralogical thoughts, within reason, experienced that you’d like to share. That being said, we have no specific theme for the September issue.

Instead of another boring photo of your editor, here are some of your editor interspersed with some people I have been compared to in recent years. Spot and identify the imposters; solutions on page 5.

Other contributions this quarter include news from the IMA, an account of a Minsa visit to the Lethabo Power Station, turning boring old coal (apologies to the Glossopteris people, which includes Dr Dr Mrs Editor) into energy, and a recent (earlier this month) short course organised and held at UWC on the use of TEM and FIB; read on to resolve all those acronyms. In addition, this issue features a “Meet the Mineralogist” with an AI construct mineralogist (no pictures, sorry). The most interesting part of this little experiment is the career advice from ChatGPT to a young mineralogist, and I was pleasantly pleased with the outcome, apart from further recognition of the AI’s fascination with luminescent minerals.

So until next time, I remain, metastably yours,

Steve Prevec

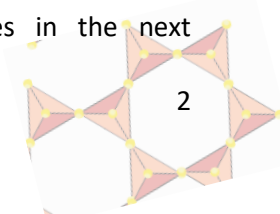
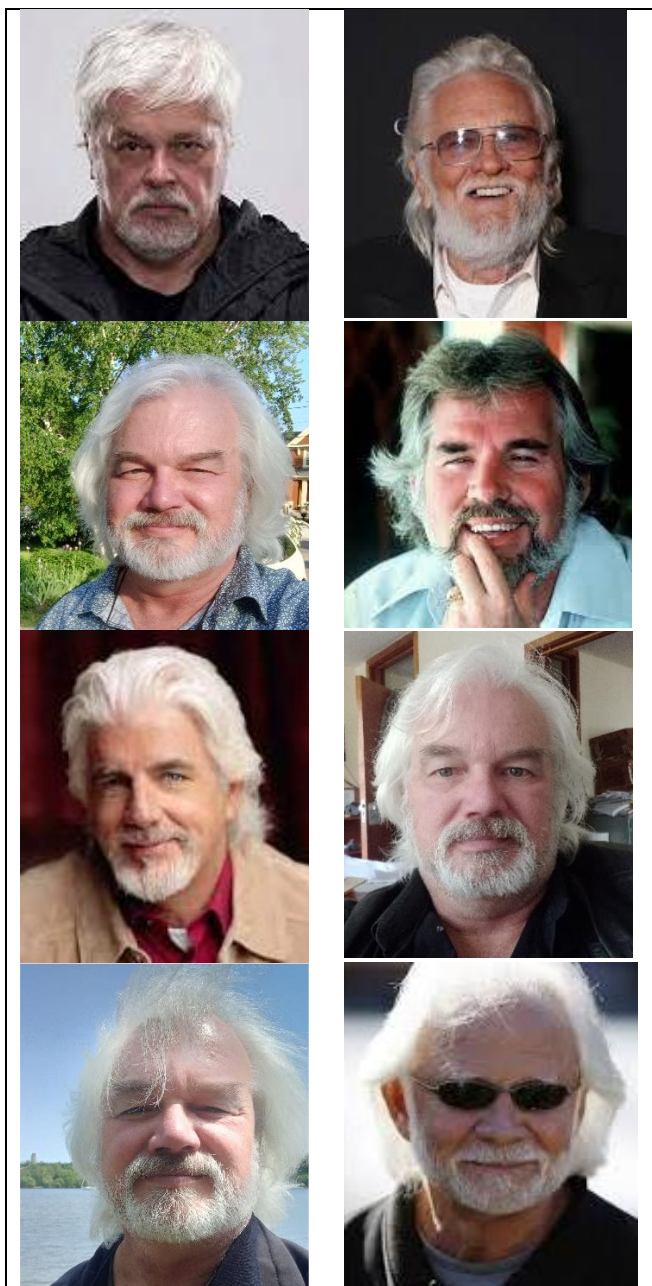
From the Chair

Something like eight years ago I started my very first chair’s column with “Good morning”...And here I am saying goodbye. Almost a decade on the executive and I have never been so confident about the kind of succession planning that is being made manifest within the committee of Minsa as I type this.



Igor Tonžetić
Chair, 2022-23
Minsa Executive
Committee

We’re as busy as we’ve ever been, the committee is strong and the initiatives we’ve started bring a smile to my face from ear to ear. I hope to still help out on the periphery but if I’m not able to, I’m not worried in the least. I have no doubt that most members on the committee will resume their duties in the next



regime...some will have more...some will be promoted...but it will all be good. Be strong...stay true to yourselves...and I'll see you around! Vaya con diopside! Or diopside, as the case may be!

Igor Tonžetić

Minsa News

Schlieren and Schollen (bits & pieces, migmatitically speaking)

IMA News

Desh Chetty, Minsa's woman on the spot at IMA (the International Mineralogical Association), has offered these highlights of potential interest (supplemented by the Editor):

The publication "Celebrating the International Year of Mineralogy - Progress and Landmark Discoveries of the Last Decades", edited by Luca Bindi and Giuseppe Cruciani, is available from Springer at €129.99 (that's R2,605, folks) for the hardcover version: (<https://link.springer.com/book/10.1007/978-3-031-28805-0>). This might seem like a big investment, but the book runs to over 350 pages, and includes the following 13 chapters:

- Discovery of Fullerenes and Quasicrystals in Nature
- The Evolution of Mineral Evolution
- Mineral Informatics: Origins
- The Discovery of New Minerals in Modern Mineralogy: Experience, Implications and Perspectives
- Structural and Chemical Complexity of Minerals: The Information-Based Approach
- Predicting HP-HT Earth and Planetary Materials
- Structural Mechanisms Stabilizing Hydrous Silicates at Deep-Earth Conditions
- Discovering High-Pressure and High-Temperature Minerals
- Mineralogy of Planetary Cores
- Going Inside a Diamond
- Mineralogy of Returned Sample from C-Type Near-Earth Asteroid (162173) Ryugu
- Mineral Discoveries that Changed Everyday Life
- Hydrogen, the Principal Agent of Structural and Chemical Diversity in Minerals

Patrick Cordier (the previous IMA president) gave an interview as part of the "International Year of Basic Sciences for Sustainable Development" and the "Year of Mineralogy", which can be found at the following address: (<https://www.iybssd2022.org/fr/accueil/>).

The book on "The first 100 IUGS Geological Heritage Sites" is on the market, in which IMA was involved as a scientific partner. The respective link to download it for free is: <https://iugs-geoheritage.org>.

And lastly, the winner of the 2023 IMA Medal of Excellence for 2023 is Prof Tetsuo Irifune, from Ehime University, Japan.

Thanks Desh

2023: Minsa's year to celebrate Energy



Minsa started the year with a Coal Utilisation series. Coal and its inextricable link to Eskom in South Africa is certainly a topical subject. Just as important to the public debate is coal's legacy of acidic groundwater, millions of tonnes of fly ash and vast areas of mine-scarred terrain in our beautiful country.



Officially sanctioned photo of participants of the Minsa visit to Lethabo power station (most being university students of UJ).

The Coal Series kicked off with a visit to the national keypoint **Lethabo Power Station** on the 28th February 2023. The compulsory safety briefings were held along with informative videos about power generation. Then Masego Boihang and Bonnyface Monaiwa of Eskom

capably escorted 12 participants around the Lethabo Visitors Centre explaining the functioning of a coal-fired power station. Thereafter, a very exciting tour of Lethabo itself was conducted. All participants thoroughly enjoyed this fascinating visit - we all left with a much clearer understanding of the intricacies of maintaining power production and the interdependence of all the units in South Africa.

On Thursday 9th March, 2023, the **Organic Coal Petrology Workshop** was held at UJ. This was a collaboration between Minsa and the DSI-NRF Centre of Excellence (CoE) for Integrated Mineral and Energy Resource Analysis (CIMERA).



Professor Nikki Wagner (left), next to Dr Stavros Kalaitzidis, with Dr Małgorzata Wojtaszek-Kalaitzidis being thanked by Minsa Treasurer Dr Sabine Verryn. Behind them is Dr Marvin Maroeng.

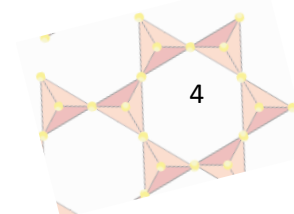
Professor Nikki Wagner, the Director of DSI-NRF CoE CIMERA, based in the Department of Geology at UJ, co-ordinated the event. She is a world-renowned organic coal expert, accredited by the International Committee for Organic Petrology (ICCP), and is the elected editor of the ICCP News, where she also serves on the Council. She was assisted by her colleague Dr Marvin Maroeng, and visiting lecturers Dr. Stavros Kalaitzidis, Associate Professor in the field of Economic Geology at the Department of Geology, University of Patras, and Dr Małgorzata Wojtaszek-Kalaitzidis, currently at the Institute of Energy and Fuel Processing technology (ITPE) in Poland.

The programme started with a generalised introduction to organic petrology (including brief coal

origin and formation), how deposition environment impacts coal quality and utilisation. This was followed by a generalised introduction to coal analyses and detailed descriptions of the most important aspects of coal petrography. Later we delved into applied coal petrology (including fly ash, coking coal, geometallurgical processing, utilisation, and the role of organic petrology). The workshop concluded with a pragmatic look at the future of coal by Professor Nikki Wagner. The workshop was well received and well attended by 11 people in person and 22 online.

Minsa concluded the Coal Utilisation Series with a visit to the **Eskom Research and Innovation Centre (ERIC)**, including the Mineralogical Laboratory, on the 31st of March, 2023. We started by visiting the Swan Edison Illumination Laboratory. It is the only facility in SA that can test all the colour parameters of lamps and luminaires. We then went to the Grid Situational Awareness laboratory. This has the capability of demonstrating grid situation on a live system. Both were fascinating as they demonstrated Eskom's world class potential.

Dr Chris van Alphen kicked off the second half of the tour with an excellent presentation on how coal geology and mineralogy impact power stations and how a power station works. Many of the myths surrounding Eskom operations were blown out of the water by the data presented. This was followed by a visit to the Pilot Plant Combustion Test facility. Here, samples from all coal fed to Eskom power stations is tested and a burning profile produced. Finally, the mineralogical analysis laboratory with TESCAN/QEMSCAN instrumentation was visited. The solids and particulates this Eskom mineralogy department deals with could arise during the generation, distribution and transmission of electricity. It was indeed fascinating to view examples of some of the many samples submitted in hand specimen and then see corresponding image analysis data for many of them. These included coal, fly ash, clinkers (slag deposits) and numerous deposits that have formed in the boilers. Deposits range from dust forming on fabric filter bags, "stones" in mill reject, deposits blocking air heater, deposits forming in cooling towers and in the flue gas desulphurisation plant (FGD) and dust deposits forming in power stations.



In the past the mineralogists here have analysed dust that formed on transmission lines to determine the likely source of pollutants. Unusual samples have included concrete core following acid spill, drill cores, fuel oil filtrates and water filtrates to name but a few.



Some of the participants who visited ERIC and the Eskom Mineralogy Laboratory. Dr Chris van Alphen, Head of the Eskom Mineralogy Department is at the back, 3rd from right. Our oldest participant, 91-year old Baxter is in the back row, second from the left. Minsa Chairperson Igor Tonžetić, bearded with glasses, is in the centre of the photo.


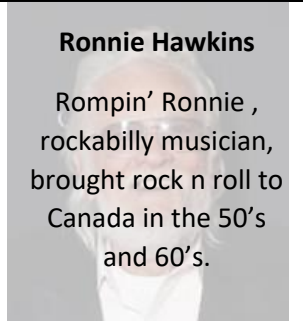
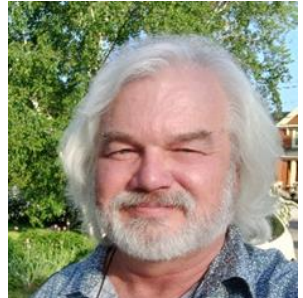
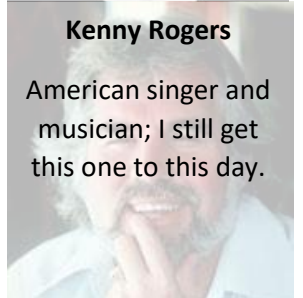



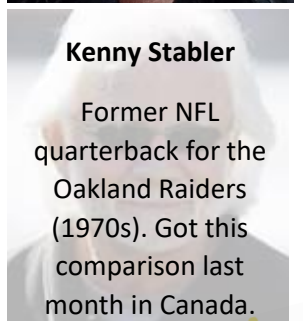
The Coal Series thus focussed on all aspects of energy (or the lack thereof) in South Africa. Minsa were proud to be able to host the events at no cost to participants. Many thanks to Professor Nikki Wagner, UJ, DSI-NRF and CIMERA for hosting and funding the Organic Coal Petrology Workshop for which attendees, were able to claim CPD points. We are still working hard at securing speakers or Geode articles on clean coal, clean steel etc. and hope to be visiting ERIC in November 2023 to catch up on the energy labs we couldn't visit the first time around – and hopefully revisit the hugely interesting Mineralogy Laboratory there.

Contributed by Petra Dinham

Expression of Interest: Working group to collate geological / Earth science terminology from all of South Africa's national languages

The Mineralogical Society of South Africa (Minsa) is looking for volunteers to form a working group that seeks to collate a term bank for all of the specialised terminology related to mineralogy, geology, geomorphology and the general earth sciences. The purpose of the term bank is to serve as a repository for these specialised terminology across South Africa's eleven national languages. Should you wish to be a part of this working group, kindly send a short expression of interest email to the Chairperson of Minsa: Igor Tonzetic (igor.zeljko@gmail.com) and/or Bjorn von der Heyden (bvon@sun.ac.za). See also the advert on the following page.

Contributed by Igor and Bjorn.

 <p>Paul Watson Canadian environmental activist (my first year students alerted me to him).</p>	 <p>Ronnie Hawkins Rompin' Ronnie, rockabilly musician, brought rock n roll to Canada in the 50's and 60's.</p>
 <p>Michael McDonald American singer and musician, formerly of the Doobie Brothers.</p>	 <p>Kenny Rogers American singer and musician; I still get this one to this day.</p>
 <p>Michael McDonald American singer and musician, formerly of the Doobie Brothers.</p>	 <p>Kenny Stabler Former NFL quarterback for the Oakland Raiders (1970s). Got this comparison last month in Canada.</p>
 <p>Kenny Stabler Former NFL quarterback for the Oakland Raiders (1970s). Got this comparison last month in Canada.</p>	 <p>Kenny Stabler Former NFL quarterback for the Oakland Raiders (1970s). Got this comparison last month in Canada.</p>



ATTENTION



POSTGRADS, PROFESSIONALS, ACADEMICS AND FRIENDS OF THE EARTH SCIENCE

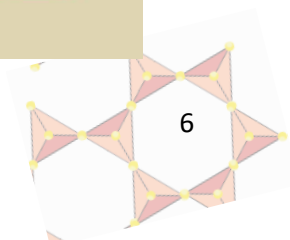
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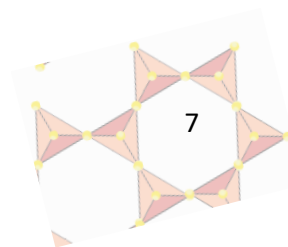
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Articles

UWC FIB TEM course

From the 5th to the 9th of June, the Earth Science Department of the University of the Western Cape (UWC) in Cape Town hosted a workshop dedicated to Focused Ion Beam (FIB) and Transmission Electron Microscopy (TEM) techniques. The course was presented by Dr Richard Wirth, a renowned researcher from the German Research Center for Geosciences GFZ-Potsdam. The workshop accommodated approximately 35 on-site and 10 online participants from such South African institutions as UWC, UCT, UJ, UP, Wits and Stellenbosch Universities, as well as Mintek, Minsa, and from international institutions as the Polish Academy of Science and the Russian Academy of Science.



The first two days of the workshop were dedicated to the theoretical background of electron microscopy, with an emphasis on FIB and TEM. The next three days covered a variety of applications focussed on geoscience, material science and biology. Attendees learned about discoveries of nano-sized diamonds in ophiolites, impactites and basaltic lavas, mantle-derived inclusions captured by diamonds from kimberlites, nanostructures in meteorites, symplectitic rims, and aircraft turbines, magnetite chains produced by bacterium, and other exciting subjects. Every topic was theoretically explained, and supported and illustrated with TEM images, 3D models and FIB-derived 3D animations.

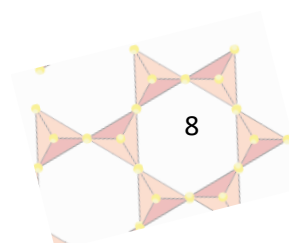


Participants were invited to collaborate with GFZ laboratories by submitting their research ideas and samples.

This was an incredibly informative and unique opportunity, brought to South Africa by a specialist who personally examined over 9 000 FIB foils. The workshop was funded by the National Research Foundation and the Earth Science Department of UWC.



contributed by Elizaveta Kovaleva
ekovaleva@uwc.ac.za



Naming New Minerals

Awkward situations in naming new mineral species

Louis J. Cabri

lcabri@outlook.com

Challenges discovering and naming new minerals in the 1960s

Under the leadership of the late Michael Fleischer, the Commission on New Minerals and Mineral Names (CNMMN) of the International Mineralogical Association (IMA) was created in 1958-1959 to monitor and rule on mineral nomenclature. Its role was to perform two main tasks: (1) to establish a viable international commission composed of representatives from as many mineralogical societies as possible and (2) to access minerals already in the literature and to monitor new mineral descriptions.

In 1965, a year after I joined the Mines Branch (now Canmet) in Ottawa, one of my research interests was phase relations in the Cu-Fe-S system, so when I read an article that described “cubic chalcopyrite” (Bud’ko and Kulagov, 1963), I wrote a letter using the Mines Branch letterhead to the academician who had presented the article for the authors, as was the system in the Soviet Union. To my surprise I received an ~4x4 cm sawed massive sulphide from Noril’sk, Siberia wrapped in plain brown paper tied with a string, kindly sent to me by the Leningrad Mining Institute Museum. It was, I believe, the first sample from Noril’sk studied outside the Soviet block and a remarkable example of scientific cooperation during the Cold War. I immediately sawed off slices and examined the rapidly tarnishing polished section that consisted largely of what we now know to be talnakhite. I was immediately attracted by two bright mineral inclusions and began to study them.

Zvyagintsevite

Cabri and Traill (1965) reported that the inclusions were two new palladium minerals, Pd₃Pb and Pd(Bi, Pb). Pd₃Pb is cubic, with $a = 4.025 \text{ \AA}$, and with space group $Pm\bar{3}m$, but they were only able to measure the optical and physical properties of Pd(Bi, Pb). These were the first analyses of a new mineral done in Canada using the experimental Elion electron probe at the Geological Survey of Canada and of X-ray scanning pictures for Cu-, Pd-, Pb- and Bi-radiation at Mines

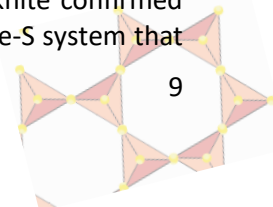
Branch, using an instrument built there that was still experimental. We submitted a proposal to name the well-defined mineral, but Mike Fleischer called me to ask if we would withdraw our proposal because the Soviets claimed that because they had just submitted a proposal for the same mineral to their own Mineralogical ruling commission, they had priority. This of course was not true, but Mike explained he was worried that if I did not withdraw, the Soviets would quit the then fledgling CNMMN, which would affect its viability. I withdrew what would have been my first proposal to name a new mineral and instead we published a description (Cabri and Traill, 1965).

However, we added this footnote in the proofs: “Zvyagintsevite—a natural intermetallic compound of palladium, platinum, lead, and tin” by A. D. Genkin, I. V. Muravyeva, & N. V. Troneva, appeared in *Geology of Ore Deposits*, 1966, #3, p.94-100 while our paper was in press. The differences in composition and description between zvyagintsevite and our mineral are greater than anticipated and worthy of further comment. We have recently been able to extract a grain from one of the co-type samples (see Fig. 1, in Cabri et al., 1977) and performed a crystal structure analysis. The results are currently being studied.

1. The zvyagintsevite electron-probe microanalysis adds up to 102.5% and the atomic ratio of 2.7:1 is closer to 5:2 than 3:1.
2. The association of zvyagintsevite with “ferro-platinum” and pentlandite is in contrast to our mineral which is associated with copper-iron sulphides, silver-gold alloy, and Pd (Bi, Pb) alloy and was never found within pentlandite.
3. Pt and significant amounts of Sn are present in zvyagintsevite, whereas Pt and Sn were not detected in our mineral; however, Au was.
4. The composition given by Genkin et al. (0.54 Pb vs. 0.46 Sn at.%) approaches the mid-point in a series Pd₃Pb-Pd₃Sn. They have suggested a similarity to the Pd₃Pb end member based on “composition” and X-ray data and described it as a natural intermetallic compound of Pd, Pt, Pb, and Sn. However, they have not stated whether the name zvyagintsevite applies to their specific intermetallic compound or to an end member of the Pd₃Pb-Pd₃Sn series.

Talnakhite

X-ray diffraction analyses of the talnakhite confirmed my phase equilibria studies in the Cu-Fe-S system that



the mineral had a large cubic cell with $a = 10.648 \text{ \AA}$, possible space group $I43m$, and a probable composition of $\text{Cu}_{18}(\text{Fe,Ni})_{18}\text{S}_{32}$. The mineral was not cubic chalcopyrite, is not a valid phase, but they had mistakenly proposed it is the small face-centered cubic high-temperature polymorph of chalcopyrite that is not stable at room temperature (Cabri, 1966) and later described in more detail by Cabri and Harris (1971) and Cabri (1973).

Cabri (1966) wrote: A new name had been proposed for this mineral to the Commission on New Minerals and Mineral Names, I.M.A., after Professor J. E. Hiller who appears to have been the first to synthesize the compound and to provide a recognizable characterization of it (Hiller and Probsthain, 1956). The data establishing the compound as a new mineral were accepted by a majority vote, but the name was voted unacceptable by a vote of 8 to 9 with a suggestion that Bud'ko and Kulagov (Bud'ko and Kulagov, 1963) be asked to name it. There were no objections to the name itself. Since there is no precedent or rule that permits the discoverer of a new mineral to retain the privilege of proposing a new name regardless of later, more definitive, work, and in view of Bud'ko and Kulagov's failure to give it a name other than the ambiguous one of "cubic chalcopyrite," I felt quite justified in proposing a new name. However, in view of the IMA Commission's suggestion, I asked the USSR Representative to the Commission to try to get Bud'ko and Kulagov to propose a name for this mineral.

After the galley proofs were issued, I was informed (October 11, 1967) that Bud'ko and Kulagov had now proposed the name talnakhite to the Min. Soc. U.S.S.R. to replace "cubic chalcopyrite". However, their XRD and analyses were wrong.

Conclusions and retrospective

The important IMA Commission that was restoring order and methodology for describing and naming new mineral species was in a precarious situation in those years that was complicated by journals accepting articles describing new minerals that had not been voted on, as well as the geopolitical fall-out from the Cold War and the non-participation of China. As a young scientist I was frustrated by being counselled to accede to Soviet demands. However, I was stimulated and excited by these new discoveries and especially being the first in the West to study Noril'sk massive sulphide ore. Additionally, this work led to a long-lasting friendship with the late Alexandr Genkin who

told me with great emphasis when we first met in 1978 that he had refused to join the party, even though that meant fewer funds and privileges. His group at the IGM Institute in Moscow was a leader in study of the Noril'sk ores and among the first to use electron probe micro-analysis. Scientific collaboration, in spite of closed political regimes and bureaucracies, was beneficial to our science and continues today with current collaborations with Russian and Chinese colleagues. We subsequently named a mineral after Genkin in a sample from the Onverwacht platinum pipe, proposing an empirical formula of $(\text{Pt,Pd})_4\text{Sb}_3$ (Cabri *et al.*, 1977).

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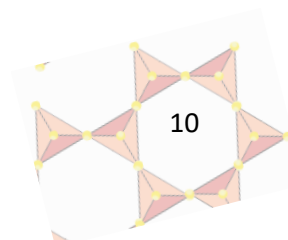
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Andrieslombaardite

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The following account has been extracted and edited from the following publication, with permission of the author (Louis Cabri) and *genesis* editor (Alta Griffiths):

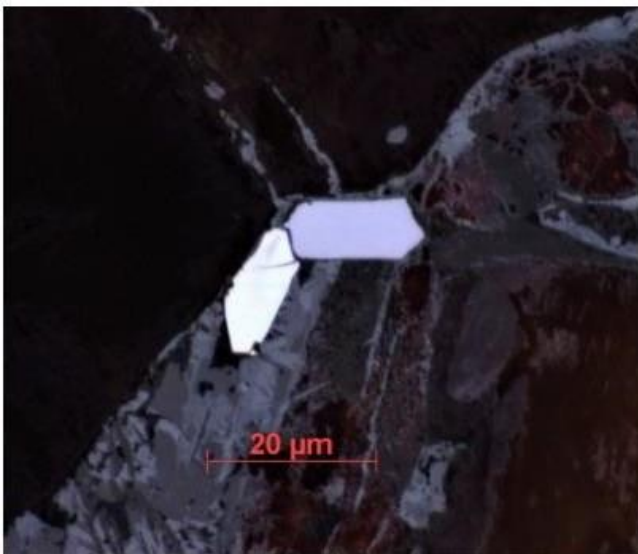
Cabri, L.J. (2023) Andries Frederik Lombaard and his role in the discovery of South Africa's platinum deposits. *genesis*. (The magazine of the Genealogical Society of South Africa). eGGSA Issue 78, March 2023. p. 26-33.



For a quite detailed account of why the Merensky Reef was nonetheless named after Hans Merensky and not after Lombaard (as Merensky himself had evidently preferred), interested readers are directed to the original Genealogical Society of SA article at eGGSA.org.

In Honour of Andries Lombaard and his discovery of platinum from the Merensky Reef

Nearly 100 years after the discovery of platinum in South Africa, together with a group of colleagues we have named a mineral new to science andrieslombaardite to commemorate Lombaard's important contribution. The mineral has been previously found in several other deposits; the first was as a very rare mineral included in a platinum nugget from the south bank of the Tulameen River, British Columbia (Canada), as reported by Raičević and Cabri (1976).



A photograph taken with a reflecting optical microscope shows andrieslombaardite on the left (white) and another relatively rare mineral called laurite on its right (blueish gray). The matrix consists of oxidized iron minerals.

Getting a mineral new to science approved and recognized is a major project, often involving many mineralogists and other scientists to collect the data proving it is a unique mineral species. The data are then submitted for approval to the International Mineralogical Association (IMA) who, after assessment

of the proposal by the chairman of the relevant committee sends it for voting to all member country representatives. The entire approval procedure takes about three months, usually after about a year or more of study and analyses. Because the grain we characterised is so small we used new technology such as a synchrotron beam on a grain 8 x 20 micrometres in size. The mineral that we named andrieslombaardite and characterised came from the Onverwacht platinum deposit in the Lydenburg district near Burgersfort, which is near where Andries Lombaard farmed and was instrumental to the discovery of platinum. The new mineral andrieslombaardite was approved in December 2022 and a manuscript has been accepted for publication by the South African Journal of Geology after peer review (Cabri *et al.*, 2023).

References cited:

Cabri, L.J., McDonald, A.M., Oberthür, T., Tamura, N., Vymazalová, A., Ross, K.C. and Melcher, F. (2023) Andrieslombaardite, RhSbS, a new platinum-group mineral from the platiniferous Onverwacht Pipe, republic of South Africa. South African Journal of Geology (in press).

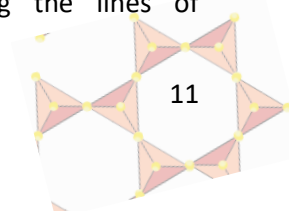
Raičević, R. and Cabri, L.J. (1976) Mineralogy and concentration of Au- and Pt-bearing placers from the Tulameen River area in British Columbia. CIM Bulletin 69, 111-119.

Editor's note: Hans Merensky also has a mineral named for him: Merenskyite, PdTe₂, was described in 1966.

The June issue theme: Existing Mineral Classification Schemes: are they up to it?

In the March issue we posed the following:

Minerals and mineraloids; When does a mineral solid solution become a mineral group? What is the place of macerals/ mineraloids/ others in geological/ mineralogical classification? For instance, why not classify the "Mineral Kingdom" into Mineral, Maceral, and Mineraloid phyla, thereby introducing a higher order classification to reconcile and make more consistent our classifications along the lines of



biological schemes? Whatever happened to sphene? Is steveprevecite a real mineral?

Read on to find out the answers to these questions:

Mineral classification schemes: An introduction to mineral phylogenetics

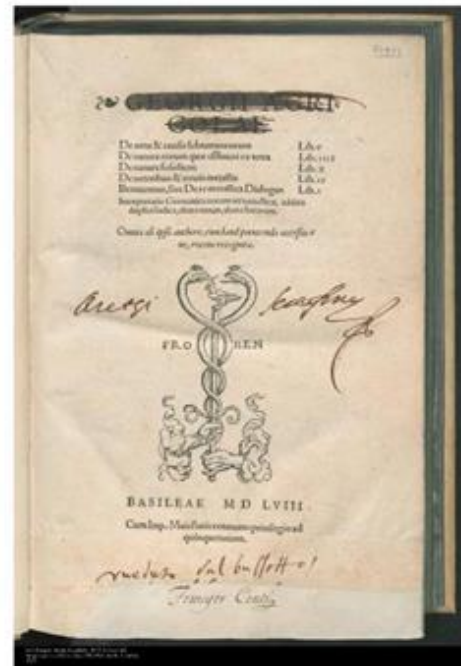
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For this issue of the Geode, it has been suggested that the existing mineral classification scheme is perhaps insufficiently flexible, such as when it comes to classifying mineraloids, which are naturally-occurring non-crystalline mineral-like substances (Wikipedia). This is arguably a tautology, as why should a mineral classification scheme accommodate non-minerals, the latter category which includes mineraloids, as well as fruit, animals, and music? Among other things. However, mineraloids typically represent subtle modifications of ‘proper minerals’. Many involve the addition of volatiles (usually OH⁻ or H₂O) to the crystallising structure which have resulted in disordered lattices that no longer qualify them as minerals, and glasses arguably are metastable solids that aspire to form minerals if only their diffusion kinetics permitted it. And all of these typically coexist with actual minerals in nature. Unlike most fruit.

The earliest prominent formal publication addressing a classification of minerals appears to be that of the protoscientist Georgius Agricola (born Georg Pawer, or Bauer, in proto-Germany in the Holy Roman Empire in 1546, entitled “*De natura fossilium*”, translated (from Latin) as “textbook of mineralogy”, as the term “fossil” referred (until the mid-19th century) to anything “dug up”, comprising mainly minerals (White, 1957). This work was first translated into English only in 1912 (by Hoover and Hoover, 1912), although now you can buy it on Amazon and download it straight to your Kindle, as George the Farmer would have intended it. Agricola subsequently produced his best known and more expansive work, *De re metallica* (published in 1556, one year after his death), dealing with mining and metallurgy.

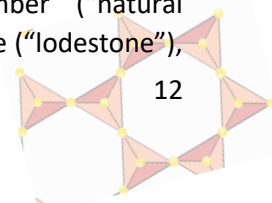


Front page of Agricola’s *De natura fossilium*, taken from the Wikipedia page.

In *De natura fossilium* (not carried by my local library, in any language, unfortunately), Agricola subdivided minerals into the categories composite and non-composite, with subcategories of the non-composite simple (meaning non-mixed) minerals consisting of Earths, Congealed Juices, Stones and Metals:

- Non-composite minerals
 - Simple
 - Earths
 - Congealed juices
 - Harsh
 - Unctuous
 - Inflammable
 - Non-inflammable
 - Stones
 - Stones
 - Gems
 - Marbles
 - Rocks
 - Metals
 - Mixed
- Composite minerals

“Earths” included clay minerals, while the intriguing “congealed juices” included evaporites (halite) but also sulphur, realgar, bitumen and amber (“natural carbons”). “Stones” included magnetite (“Iodestone”),



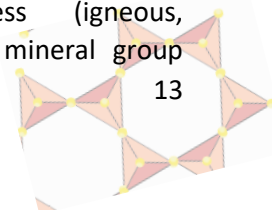
hematite, quartz and chert (“flint”), and actual fossils. “Marbles” referred to all rocks which took a fine lustre when polished and were hence useful for architectural applications, thus incorporating an industrial mineral element to the classification, and presumably presaging the modern classification of building stones into either “marble” or “granite” classifications to this day.

Two hundred years after Agricola, the Swedish biological scientist Carl Linnaeus, in the course of developing his extremely useful biological classification schemes for animals and plants (kingdoms, classes, orders, genera and species, albeit not quite in their modern forms) also took a stab at a mineral classification scheme along the same lines. As of 1758 his *Systema Naturae* included four classes of minerals: *Petrae* (i.e., rocks), *Minerae* (minerals and ores), *Fossilia* (fossils and aggregates), and *Vitamentra* (now obscure, this class might have referred to minerals with nutritional value or some perceived vital essence). According to Bressan (2022), Linnaeus “imagined that minerals formed by the mixing of various salty fluids, acting as male parts, with different kinds of rocks, acting as female parts. His more practical approach included minerals classified by the shape of the crystal, number of crystal faces, and the observed behavior if exposed to great heat.” Within a century or so this classification attempt had been well abandoned (Heaney, 2016).

Almost exactly a further hundred years hence (1857, to be precise) finds Charles Darwin recognizing the critical fundamental distinction between “varieties” and “species” of, in his case, biological organisms. (Incidentally, Darwin also offered constructive and useful observations and hypotheses on fractional crystallisation of minerals; he wasn’t just all finches, and it was the geological context that really provided the foundations, if you will, for his biological evolutionary insights). In biological systems, the critical distinction between distinguishing separate species within a population (“splitting”) from within-species variation (“lumping”) has been established through the criterion of species as the ability to breed (to produce viable offspring). This cannot be usefully applied to minerals, no matter how hard you try (see Linnaeus, for example).

Heaney (2016) observed that the post-Linnaean (?) mineral classification schemes can be fundamentally distinguished by their distinct classification criteria. René Just Haüy, the French priest and mineralogist (who also helped in the development of the metric system), recognized the basic crystallographic constructions (faces, cleavages) of minerals in the late 1700s, an approach facilitated by X-ray diffraction over a century later courtesy of the Braggs, father and son. Abraham Gottlob Werner (the German Neptunist) based his (early 1800s) mineral classification on external mineral traits, such as colour. Finally, a few decades later, the Swedish chemist Jöns Jacob Berzelius developed the systems for recognizing chemical molecular stoichiometries in minerals, leading to his application of the dominant anion as the classification tool still retained today (i.e., silicates, carbonates, phosphates, etc.). According to Wikipedia, “Berzelius thus invented the system of chemical notation still used today, the main difference being that instead of the subscript numbers used today (e.g., H₂O or Fe₂O₃), Berzelius used superscripts (H²O or Fe²O³).” Try that now and see where it gets you. (Confused with isotopic mass is where, technically). Berzelius’s taxonomy provided the basis for the mineral classification scheme developed by the American geologist James Dwight Dana, whose “System of Mineralogy” (1837) and his “Manual of Mineralogy” (1948) publications have been continually updated and reprinted from the mid-1800s to the present day (8th and 23rd editions now available, respectively), and which provide the basis for most people’s versions of modern mineral classification.

As has been alluded to above, many of the early attempts to classify minerals have accommodated both fundamental mineral properties as well as their utility, hence making the distinction between minerals of perhaps chemically and structural similarity but of different potential use to humankind, whether for reasons of abundance or of properties. This includes both ore minerals (metals and their alloys) and also silicate and carbonate industrial and architectural minerals and their rocks. The modern approach to teaching these economically important minerals is strongly influenced by how they are classified (i.e., falling between the cracks in a normal petrogenetic origins by rock-forming process (igneous, metamorphic, sedimentary, etc.) or mineral group





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epistemology, or according to each specific industrial application. Smith (2018) has suggested that industrial minerals be classified according to their usage patterns, offering a more coherent and also more flexible approach. His proposed scheme consists of seven groups, as follows: “1) principal abrasives, 2) principal refractories, 3) principal fillers, 4) principal physical/chemical minerals, 5) mixed physical minerals, 6) principal chemical minerals and 7) mixed physical/chemical minerals.” As economic priorities change, minerals may move between categories.

Hazen et al. (2008) postulated that the very nature of mineral forming processes has changed (“evolved”) over the history of our planet (Earth). For example, the early Hadean involved the types of process involved in proto-planetary formation (chondrule accretion and related agglomeration and primitive differentiation), leading to around 300 or so minerals associated with meteorites. Subsequent early-Earth differentiation, crust formation and crust-mantle interactions, and craton surface processes, including metamorphic, hydrothermal and evaporitic processes, facilitated the origins of another 1500 or so mineral species. Finally, they propose that the majority of the remaining known minerals (4300 as of 2008; according to Wikipedia, as of May 2023 the IMA acknowledges 5941 minerals, with more being recognized with each issue of our mineralogical journals) involve the participation of organic (biochemical) processes, such as those responsible for Palaeozoic cherts and limestones, and banded ironstones relating to the increased oxidation of the Earth’s atmosphere and related meteoric water system. Hazen et al. (2008) summarise the critical parameters of this evolution as follows: “(1) *the progressive separation and concentration of the elements from their original relatively uniform distribution in the pre-solar nebula; (2) an increase in range of intensive variables such as pressure, temperature, and the activities of H₂O, CO₂, and O₂; and (3) the generation of far-from-equilibrium conditions by living systems.*”

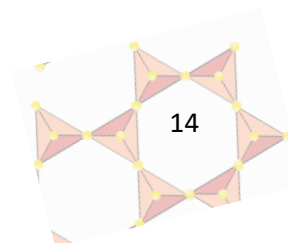
In the interest of finishing on a strong note, I will end this introduction to mineral classification schemes with a final quote, from Jacob Berzelius, who after having visited the lab of a fellow prominent chemist, observed that “*A tidy laboratory is a sign of a lazy chemist*”.



The Editorial office (pink jug contains left over hand sanitizer).

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Inconsistencies and alternatives with regards to mineral classification

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Mineral classification is hard...this fact is brought home when one realises that quartz is both an oxide and a silicate, with neither of these classifications being more true than the other...they are both equally valid, though one could argue that its being an oxide is more valid when it is mined as an ore of silicon and its being a silicate is more valid when it is a gangue mineral (or a rock forming mineral). As such context and consistency are important considerations in classifying minerals. And I'm not entirely convinced that these have always been applied in minerals classification. Please note...the discussion that follows is not meant to trigger anyone and is simply meant to promote a dialogue in good faith.

But my first contention is that we, as mineralogists do not refer to mineral classification as a taxonomy...which I find strange considering that in older textbooks when scientists were more generally naturalists (there is a strong argument for Darwin being more of a geologist than a biologist), minerals were considered to be part of a "Mineral Kingdom" (similar to "Plant" and "Animal" kingdoms...and vestigially seen in the vegetable/mineral/animal 20 questions parlour game). This I believe accomplished several things. For one, it meant that the natural world was not necessarily considered in isolation. Sure, Earth had structural spheres (the geosphere, the hydrosphere, the biosphere and the atmosphere) but these were interrelated and played off one another and used similar naming conventions (the "sphere" part) – consider all minerals that can and do have biological origins...the distinction at times is somewhat arbitrary. One would then have expected that the hierarchical classifications following from this would use the same or similar tiers (as what happened when you compare the tier lists in botany and zoology). Secondly, this approach may have promoted more interdisciplinary research. Thirdly, it may have resulted directly in some important paradigm shifts (Darwin conceptualising evolution since he could think in terms of large time scales...as a geologist investigating biology).

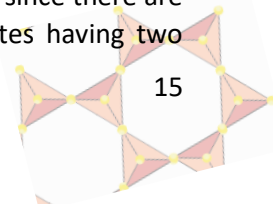
Considering this classification paradigm, it might allow us to place macerals and mineraloids in a taxonomy of minerals as maceral or mineraloid "phylums" – from zoology or "divisions" – from botany (Figure 1).



Figure 1: Conceptualisation of where macerals and mineraloids could fit on a mineral taxonomy (when compared to zoological taxonomy).

Further, if we adopted a zoological taxonomic procedure, we could resolve the distinction between mineral "groups" that are based on the relation of solid solution series' ("Feldspar Group") with those based on polymorphs ("Aluminosilicate Group"). Thus, in this scheme, by replacing "Family" with "Order" and "Group" with "Family" the mineral microcline would classify as: Mineral Kingdom/Mineral Division/Silicate Class/Tectosilicate Order/Feldspar Family/Alkali Feldspar Series/Microcline Species. The important point here, is that this would free up the usage of the term "group" for polymorphs such as kyanite, andalusite and sillimanite for the aluminosilicates. "Group" would then come to mean something very specific and incontestable.

The above argument does in fact make an assumption about what we mean by "series"...that is, a series in this context consists of two or more end member species that share solid solution (be they of cations or anions). "Series" can mean something else entirely and that is illustrated by the term "polysomatic series" which is where end members share and swap out structural building blocks. It is a modular view of mineral building where the end members are not polymorphs but where new minerals can be created by swapping out entire structural components (not just ions which would preserve their structure). This is especially problematic in the case of sorosilicates since there are relatively few true sorosilicates (silicates having two



silica tetrahedra sharing an oxygen vertex e.g. hemimorphite - $Zn_4(Si_2O_7)(OH)_2 \cdot H_2O$ and lawsonite - $CaAl_2(Si_2O_7)(OH)_2 \cdot H_2O$. The epidote solid solution series ($Ca_2(Al,Fe)_3O(SiO_4)(Si_2O_7)(OH)$) and vesuvianite ($Ca_{10}(Mg,Fe)_2Al_4(SiO_4)_5(Si_2O_7)_2(OH)_4$), whilst classified as sorosilicates, do in fact have isolated silica tetrahedra in their structures making them in essence a polysomatic series between true nesosilicates ("island" silicates) and sorosilicates. I suspect the reason why epidote and vesuvianite were adjudged to be sorosilicates was to bump up the importance of the family...as a case of mass formation cognitive bias or dissonance or both. Taxonomically it would probably make more sense to maybe simply group these in nesosilicates and add a prefix modifier (like super- or supra- as is done in zoological taxonomy) or create a polysomatic neso/sorosilicate family.

The occurrence of these polysomatic series' are by no means isolated or trivial, and can in fact occur between different mineral classes such as the humite group, which is in essence a polysomatic series between olivine and brucite. Scapolite is an example of a polysomatic series between a feldspar and a salt. Furthermore, chlorite can be considered a polysomatic series between brucite and talc (talc sheets alternating with brucite sheets). The phyllosilicates are notoriously polysomatic and in fact amphibole can be considered as a polysomatic series between pyroxene and mica (sometimes termed "biopyriboles" along with pyroxenoids and triple chain silicates). So, we are left with the options of creating a higher order grouping for these polysomatic series' (which would be very difficult to do if we have a series consisting of different mineral classes, though possible with different mineral families) or we must accept a parallel classification scheme based on structure and not chemistry (or silica tetrahedral polymerisation).

A polysomatic classification though, is not without benefits because it explains some oddities that do not fit nicely within Dana or Strunz classifications, such as the triple chain silicate minerals jimthompsonite and chesterite (Fig 2). It also helps to explain mineral alteration such as what happens with weathering or metamorphism (the polysomatic series' almost always seem to have water in their structures).

My second contention is with the classification of kaolinite. If the mica group can be divided into a dioctahedral muscovite series and trioctahedral biotite series and the only distinction between kaolinite and lizardite is essentially that lizardite is trioctahedral and kaolinite is dioctahedral, then it follows that kaolinite should simply be considered dioctahedral serpentine and should form part of the serpentine group. This appears to be consistently applied in all other phyllosilicate groupings (micas, smectites, talcs, chlorites) but not with kaolinite and the serpentine group.

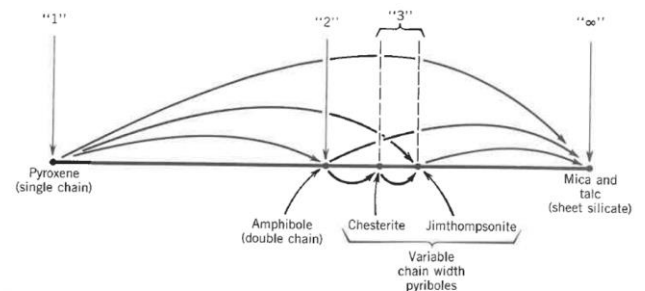
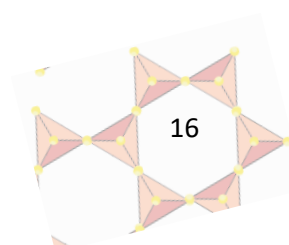


FIG. 13.93. The many possible reaction paths that lead from a high temperature pyroxene to lower temperature sheet silicates. Ch and Jt are pyriboles, chesterite and jimthompsonite, respectively. "1," "2," and "3" refer to chain width: "1" in pyroxenes, "2" in amphiboles, and "3" in biopyriboles with variable chain widths; "∞" means infinite chain width, resulting in sheets (see also Figs. 13.69 and 13.70). (From Veblen, D. R. and Buseck, P. R., 1981, Hydrous pyriboles and sheet silicates in pyroxenes and urallites: Intergrowth microstructures and reaction mechanisms. *American Mineralogist*, v. 66, pp. 1107-1134.)

Figure 2: Mineralogical mathematical number line for "biopyribole" polysomatic series (taken from Klein and Hurlbut, 2001).

My third contention is that carbonates, sulfates, phosphates and halides should be grouped under a "Salt" class (or a name that represents that) since none of these groupings as classes essentially have families within their taxonomy. It is a pedantic ideal but if these were grouped together under a "Salts" class and were subsequently demoted to "families" then every tier would be filled. All of these classes meet the chemical criteria of "salt" namely that it "is a chemical compound consisting of an ionic assembly of positively charged cations and negatively charged anions, which results in a compound with no net electric charge" ([https://en.wikipedia.org/wiki/Salt_\(chemistry\)](https://en.wikipedia.org/wiki/Salt_(chemistry))) and can readily be shown to be a product of an acid plus base reaction with the release of water. Furthermore, this still obeys the chemical criteria used to denominate classes.



Reference

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And finally:

Sphene: the mineral formerly known as sphene is now titanite. Sphene was formally discredited in 1982 by the IMA, but it lingers on as the titanite gemstone informal name.

And no, children, there is no such thing as steveprevecite. At least, not yet.

Other Gems

AI and the geosciences

Since we are a bit short of available interviews with actual mineralogists for our “meet a mineralogist” feature, I thought, why not use ChatGPT again (see March issue: steveprevecite) and let it create one. In spite of numerous reasons “why not”, here is the result:

Instruction to ChatGPT: create a name, a title, and a short job description for a mineralogist. It should include where they studied and got their degree, where they work now and what they do.

(Note that ChatGPT writes in US English, so I’ve left that as is. I have used a different font here to distinguish the AI contributions from my own).

Title, description of appointment and university career and qualifications:

Name: Dr. Emily Lawson

Title: Senior Mineralogist

Job Description: As a Senior Mineralogist, Dr. Emily Lawson specializes in the study of minerals and their properties. She is responsible for conducting research, analyzing mineral samples, and providing expert insights into their composition, formation, and uses. With a keen eye for detail and extensive knowledge of crystallography, Dr. Lawson excels in identifying and categorizing minerals based on their physical and chemical characteristics.

Education: Dr. Lawson earned her Bachelor of Science degree in Geology with a specialization in Mineralogy from the renowned University of California, Berkeley. She continued her academic journey at the Colorado School of Mines, where she completed her Master's and Ph.D. in Mineralogical Sciences, focusing on the crystallography and mineral formation processes.

Current Workplace: Dr. Lawson currently holds a prestigious position at the Mineralogical Research Institute, a renowned institution dedicated to the advancement of mineralogy and geological sciences. She leads a team of researchers and collaborates with experts from around the world to investigate new mineral discoveries, contribute to the understanding of mineral formations, and explore the potential applications of minerals in various industries.

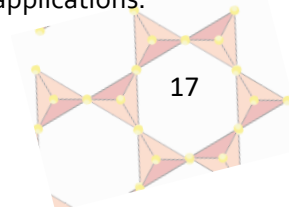
In addition to her research endeavors, Dr. Lawson also actively participates in academic conferences and publishes scientific papers to share her findings and contribute to the field of mineralogy. Her expertise and insights are highly sought after, making her a respected authority in the realm of mineralogical sciences.

What is your favourite mineral and why?

As a professional mineralogist, I don't have a single favorite mineral, as each mineral possesses its own beauty and scientific significance. However, I have a deep appreciation for minerals such as fluorite, tourmaline, and quartz for their remarkable physical properties and geological occurrences.

Fluorite, with its vibrant colors and remarkable fluorescence under ultraviolet light, has always fascinated me. Its wide range of hues, including purple, green, blue, and yellow, can create breathtaking gemstones and specimens. Beyond its visual appeal, fluorite also possesses interesting optical properties and is used in various industrial applications, such as lenses and prisms.

Tourmaline, on the other hand, captures my interest due to its incredible diversity. It is available in a multitude of colors and can even display multiple hues within a single crystal. Its electric and pyroelectric properties are unique and make it a valuable mineral in scientific research and technological applications.



Quartz, the most abundant mineral on Earth, holds a special place in my heart. Its crystal formations, including amethyst, citrine, and rose quartz, exhibit stunning beauty and have been prized for centuries in jewelry and ornamental objects. Quartz also possesses excellent piezoelectric and optical properties, making it vital in electronics, telecommunications, and even watches.

Ultimately, as a mineralogist, my fascination lies in exploring and understanding the diverse array of minerals our planet has to offer. Each mineral presents a fascinating story, combining geological processes, chemical composition, and physical properties, which continuously fuels my passion for this field of study.

What is your most funny or memorable fieldwork or lab experience?

One of my most memorable experiences in mineral collecting was when I embarked on a field expedition to a remote location in search of a specific rare mineral. We were trekking through dense forests and rugged terrain, fully equipped with our geology tools and backpacks. As we hiked deeper into the wilderness, we encountered numerous challenges, such as slippery slopes and unexpected obstacles.

During one particularly arduous climb up a steep hillside, I accidentally slipped and tumbled down, with my backpack bouncing beside me. To my surprise (and amusement), my backpack opened mid-fall, and mineral specimens I had collected earlier went flying in all directions. It was like watching a chaotic fireworks display of colorful rocks scattering through the air.

While the incident initially caused me some concern, I couldn't help but laugh at the absurdity of the situation. My fellow colleagues joined in the laughter, and together we scrambled to gather the minerals that had ended up strewn across the slope. It turned into an impromptu treasure hunt, and we made sure to secure the specimens more tightly in our packs afterward.

This experience served as a reminder that even in the serious pursuit of scientific exploration, unexpected moments of humor and camaraderie can arise. It highlighted the importance of maintaining a sense of lightheartedness and adaptability when faced with the unpredictable nature of fieldwork. It's these kinds of shared experiences and anecdotes that make mineral

collecting not only intellectually fulfilling but also a truly enjoyable and memorable journey.

One of the most memorable and amusing experiences I've had in mineral analysis occurred during a particularly challenging research project. We were investigating a set of mineral samples with complex compositions and sought to identify their precise mineralogical makeup.

How about in the laboratory?

One day, while meticulously analyzing a particularly intriguing sample under the microscope, I became so engrossed in the examination that I completely lost track of time. Little did I realize that my colleagues had planned a surprise birthday celebration for me in the adjacent lab.

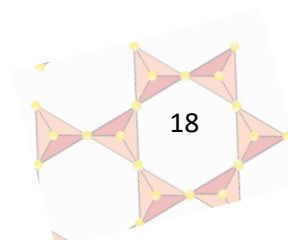
As I continued my intense focus on the mineral sample, suddenly, the lab door swung open, and my colleagues burst in, singing "Happy Birthday" at the top of their lungs, holding a cake adorned with geode-like decorations. Startled, I jumped and nearly knocked over my microscope, but soon burst into laughter and appreciation for their surprise.

The contrast between my state of deep concentration and the sudden eruption of celebration made the moment all the more comical. We paused our analysis momentarily to enjoy the birthday festivities, indulging in laughter, cake, and shared anecdotes from our scientific endeavors.

This experience not only provided a well-deserved break from the intensity of our work but also reminded me of the supportive and collaborative nature of our scientific community. It served as a lighthearted reminder that while our work may involve meticulous examination of minerals, it's important to balance our dedication with moments of joy and camaraderie.

To this day, whenever I come across that particular sample, it never fails to bring a smile to my face and serve as a reminder of the vibrant and humorous moments we encounter in the world of mineral analysis.

What advice would you give to young mineralogists just starting out on their careers?



To a young mineralogist just starting out on their career path, I would offer the following advice:

Foster Curiosity: Embrace your natural curiosity and passion for minerals. Let your inquisitive nature guide you in exploring the vast world of minerals. Stay curious, ask questions, and never stop learning. The field of mineralogy is constantly evolving, and there are always new discoveries and research to delve into.

Build a Solid Foundation: Focus on building a strong foundation in geology, chemistry, and crystallography. These fundamental disciplines will provide you with a solid understanding of the processes that shape minerals and their properties. Develop your analytical skills, both in the lab and in the field, as they are essential for accurate mineral identification and characterization.

Fieldwork: Get out into the field as much as possible. Fieldwork offers invaluable experiences and insights into mineral occurrences, geological formations, and mineralogical diversity. By observing minerals in their natural environments, you will deepen your understanding and gain a broader perspective on their genesis and relationships with surrounding rocks.

Network and Collaborate: Engage with fellow mineralogists, researchers, and professionals in the field. Attend conferences, workshops, and seminars to meet like-minded individuals and establish connections. Collaborations can open doors to new opportunities, knowledge exchange, and exciting research projects. Also, consider joining professional organizations and participating in online mineralogy communities to stay connected and informed.

Embrace Technology: Keep up with the latest technological advancements in mineral analysis and research. From advanced imaging techniques to spectroscopic methods, technology plays a vital role in enhancing our understanding of minerals. Embrace these tools and learn to integrate them into your work, as they can greatly expand your analytical capabilities.

Publish and Share: Share your findings and insights with the scientific community. Publish your research in reputable journals, present at conferences, and contribute to the collective knowledge of mineralogy. Effective communication is crucial for advancing the field and establishing your expertise.

Cultivate Resilience: Remember that the path of a mineralogist may have its challenges and setbacks. Research projects may not always yield the expected results, and fieldwork can present unforeseen obstacles. Cultivate resilience, adaptability, and perseverance. Learn from failures, embrace them as opportunities for growth, and never lose sight of your passion for minerals.

Above all, enjoy the journey. Mineralogy is a captivating field that offers endless opportunities for exploration, discovery, and contribution to scientific knowledge. Stay passionate, stay curious, and let your love for minerals guide you throughout your career.

Since Emily (sorry, Dr Lawson; she/they are imaginary and already I'm patronising her/them) is an A.I. construct, I've also asked her/them to speculate on what, in a million years from now, would the perfect ideal professional mineralogist have evolved to look like to become best physically adapted to the profession:

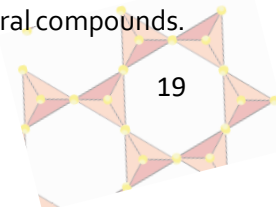
In the distant future, a perfect ideal professional mineralogist might have undergone several physical adaptations to enhance their abilities in mineral analysis and exploration:

Enhanced Vision: Their eyes could have evolved to perceive a broader spectrum of light, including ultraviolet and infrared wavelengths. This expanded vision would allow them to detect subtle mineral variations and identify minerals with greater accuracy.

Advanced Sensory Organs: The mineralogist could possess specialized sensory organs, akin to chemical sensors, capable of detecting trace elements and compounds in minerals. These organs would enable them to identify minerals more swiftly and precisely.

Manipulative Appendages: Adaptations could include highly dexterous and precise appendages, such as elongated and agile fingers or tentacles, equipped with specialized tools for delicate sample handling and intricate mineral examination. These appendages would aid in meticulous analysis and enable the mineralogist to work with ease and precision.

Resilient Physiological Traits: The evolved mineralogist might possess an enhanced immune system to resist exposure to toxic mineral compounds.



Additionally, they could have heightened resistance to extreme temperatures, radiation, and harsh environments, allowing them to explore and study minerals in diverse conditions.

Data Processing Enhancement: Evolved mineralogists could possess enhanced brain functions, facilitating rapid data analysis and pattern recognition. Their cognitive abilities would allow them to process large amounts of mineralogical information efficiently, leading to faster insights and discoveries.

It is important to note that these are speculative possibilities based on the hypothetical future and the requirements of the profession. The actual course of evolution and physical adaptations, if any, would depend on numerous complex factors and environmental pressures.

Please remember that this is purely imaginative and speculative, as predicting the exact physical adaptations of future organisms is beyond the scope of our current scientific understanding."

So, keeping this in mind, it makes sense that 'we', the mineralogy community, start proactively interbreeding with other mineralogists, if we want to see this future become a reality. It's the way forward, people. If your partner objects, show them this article. It's for the good of our profession.

Contributed by S. Prevec

Do you have an analytical service relating to sample preparation, mineral analysis, mineral extraction, or mineral identification?

Do you have capacity to conduct additional services and to get paid for it?

If your answer to any of these questions is "yes, I guess so", then you could be advertising in this space at very reasonable rates, making some revenue, and contributing to the geoscience economy of the nation. What are you waiting for? Right now, someone else is making the profits you could be making, stealing your business!

So get busy!

Minsa invites its members to contribute submissions for our next issue of the Geode, for September 2023. Got something mineralogical you want to get off your chest? Done something interesting? Let us know.

Submissions can be sent to minsa@gssa.org.za or to s.prevec@ru.ac.za and should reach us by 31st August 2023.

For more info: minsa@gssa.org.za

INVITATION FOR SUBMISSIONS TO THE NEXT ISSUE OF THE GEODE

Bruce's Beauties: Mineraloids

Having received a brief from The Editor (i.e., that mineraloids are the featured theme), I have used some poetic license, or rather photographic license, to come up with suitable specimen photos. So delving into Wikipedia, this is the definition given for a mineraloid: "A mineraloid is a naturally occurring mineral-like substance that does not demonstrate crystallinity. Mineraloids possess chemical compositions that vary beyond the generally accepted ranges for specific minerals. For example, obsidian is an amorphous glass and not a crystal".

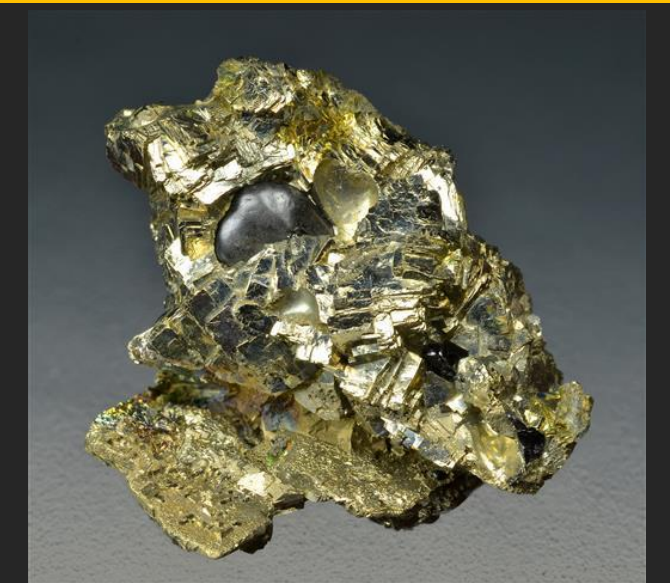
Now whether MINSA or the IMA agree with this definition or not, it offered the challenge of finding specimens that fall into this category. So rightly or wrongly, here are four from the Wikipedia A-to-Z list of mineraloid species:



A polished disc of amber (locality unknown), with an insect trapped inside, 1.9 cm. Bruce Cairncross specimen and © photo.



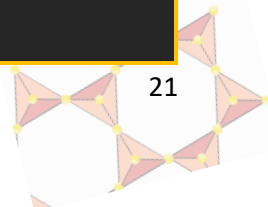
Boulder opal from Quilpie, Quilpie Shire, Queensland, Australia, 10.1 cm. Bruce Cairncross specimen and © photo.



Globules of black pyrobitumen partly imbedded in pyrite, 3.4 cm. Western Areas Elsburg South Shaft, Witwatersrand goldfield. Bruce Cairncross specimen and © photo.



Following on with the pyrobitumen, here is another form of carbon, albeit not a mineral as such. Vitrinite-rich coal with scattered brassy pyrite nodules and earthy orange siderite. Witbank coalfield. Bruce Cairncross specimen and © photo.



Minsa Crossword for June 2023

The theme is, of course, mineraloids; glasses and otherwise amorphous and/or disordered solids (in this case; Wikipedia allows for liquids to qualify, but here we still have some standards, and I don't mean BCR-1).

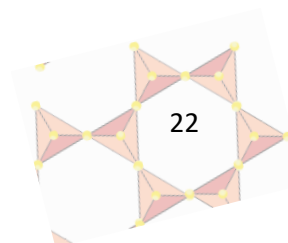
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ACROSS:

1. An iron-rich, silica-poor vitreous high temperature basaltic glass formed by rapid cooling during eruption in water.
2. A hydroxide, oxide and hydrated iron ore mineral (or agglomerate of minerals, more correctly), it is found in laterites and in mine runoff.
3. The hard, round, most popularly white (but not always, in nature) aragonitic layered concretions found in bivalves (from whose shape its name derives, from the Latin, via the French).
4. Fossilized tree resin (see also Bruce's beauties, above). Can they contain dinosaur DNA? You bet (modern birds now qualify, so don't get your hopes up). Also known as elektron, from the Greek, it can hold a static electrical charge.

DOWN:

1. A highly siliceous volcanic glass associated with rhyolite flows, its earliest usage as a tool by early (pre-Homo sapiens) hominids occurred in what is now Kenya.
2. The variant of coal with the highest density and carbon content. Used for power generation and in metallurgical applications, the largest known deposits are found in Pennsylvania (U.S.A.).
3. Technically a brand name, this 'hard rubber' is produced by vulcanisation (heating in the presence of S) of natural rubber. Its economic heyday was in the early 20th century when it was used to make bowling balls, among other things.
4. An amorphous hydrous aluminium sheet silicate, similar in chemistry and occurrence to kaolinite, evidently made up of aggregates of hollow nanometre-scale spherules.
5. A variant of lignite (the lowest rank of coal, but still above peat), this mineraloid can be carved as a gemstone. Its name is often used as the simile to describe things that are "extremely black".
6. Hydrated amorphous silica, it can contain up to 20 wt.% water, and displays iridescence produced by its internal structure, consisting of nanometre-scale silica spheres packed together.



Minsa Crossword solution for March 2023

The theme was obsolete and/or discredited mineral names.

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	E						O					O
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6 _V	E	S	U	V	I	A	N	I	T	E		N

ACROSS:

1. The iron carbonate ore, often associated with fluorspar and pearlspar (two other archaic mineral names, for fluorite and for shiny dolomite, respectively).
2. Archaic name for graphite and molybdenite, and more recently for miscellaneous lead ores. Now exclusively used for a plant with lead-like colouring.
3. The Ca-Ti silicate mineral common in amphibolites, this name was formally discredited in 1982 and replaced by titanite, but is still widely used for the gem version, and in general.
4. The little-used name for clinopyroxenes at the augite-diopside join, common in igneous literature from the 1960s but no longer perceived as a distinct species of the solid solution series.
5. The original German name coined by Werner (the famed Neptunist) for the magnesian clay mineral sepiolite, it is now found most commonly in reference to clay (tobacco) pipes, more than in the geological literature.
6. Also originally named by Werner for its occurrence at an active Neapolitan volcano, it is now most commonly known as idocrase.

DOWN:

1. One of two clues here referring to low-Ca orthorhombic pyroxenes, this mineral name was discredited as superfluous in 1988, inconveniently in the midst of my postgrad studies, referring to a ferroan enstatite of either igneous or metamorphic origin.
2. Referring to the same mineral as in 1-DOWN above, this term was widespread in the mafic intrusion literature along with 4-ACROSS, and referred to the mineral colour on cleavage surfaces, especially when weathered.
3. The prefix of ____ stone, the name given to iron oxides with specific reference to its power to attract, in the 16th century, and reflects its use as a navigational aid in compasses.
4. I apologise for this one in advance; I needed a linking word. The colloquial term for the amount of time until the announcement of the replacement of the name platarsite for S-rich sperrylite in an imminent issue of the Canadian Journal of Mineralogy and Petrology.
5. The prefix of ____ stone, for the gem version of adularia, also known as hecatolite. Its colour comes from light refracting through alternating layers of orthoclase and albite (see also 'solvus').

Note: The recommended deadline for submissions for the next issue of the Geode is August 31, 2023.

