Witwatersrand Gem and Mineral Club

Room 215 G
2nd floor
Department of Geology
Building opposite **Ditton rd** entrance
University of Johannesburg
Auckland Park

P O Box 3708
Cresta
2118
South Africa

Rocky Renditions
June 2013

Find us on Facebook :
http://www.facebook.com/#!/pages/Witwatersrand-Gem-and-Mineral-Club/346437298736246

Meetings

Visitors and new members are welcome at all club meetings.

Mineral Meetings	2nd Wednesday of every month
Presentations	Last Wednesday of every month

To those who haven't visited for a while, or who wish to join us for the first time, there is ample FREE parking available to the right of the gate, at the bottom of the hill.

Access to our club is wheelchair friendly, with ramps and lifts. So if you are a rockhound, collector or dealer, there's no excuse not to be where it's happening!!! *Rock n Roll time.*

Talks…Tales…Presentations

June's topic on Wednesday 26th is **OPALS**. Really Really! This time we really will be introduced to the magnificent world of opals. Renowned Gemmological Consultant, Arthur Thomas, has very kindly agreed to share a 40 minute adventure with us.

Arthur has been in the jewellery industry for over half a century. His hobby, passion and business has taken him to far flung locations which include the United Kingdom, Northern Rhodesia, Los Angeles and New York. In 1974, he was appointed Director of Education to The Jewellery Council of South Africa, and in 1982 chaired the working group that established the Gemmological Association of Southern Africa. Arthur has published books and provides on-going training for gemmologists. **Thank you Arthur**; it is guaranteed to be a jewel of an evening for all who attend!

Some interesting finds included in this edition:

- Are opals from Mars?
- Did you know that vast arid central Australia was once a great inland sea?
- Have you heard of "iron bacteria"? Natures little packman, thriving in acid conditions alongside opals.

Insight into how OPALS are formed ~ The Geology of OPALS

Crystal system	Amorphous	Streak	White
Hardness	4,5 – 6,5	Cleavage	None
Density	1.9 – 2.3	Composition	Hydrated silica SiO_2 nH_2 / SiO2-n-H2O ?

The word **opal** is adapted from the Roman term *opalus,* but the origin remains a matter of debate. Most modern references suggest it is adapted from the Sanskrit (ancient Indo-Aryan language) word *upala*. Another claim it is adapted from the Greek word, *opillos*, which has two meanings, one is related to "seeing" and forms the basis of the English word "opaque", and the "other" as in "alias" and "alter". It is claimed that *apalus* combines these uses, meaning to see change in colour. The argument for the Sanskrit origin is the strongest and the term first appeared in Roman references ±250 BC. Opal was then valued above all other gems and was supplied by traders from the Bosphorus, who claimed the gems were from India. *This concludes the history lesson for the day.*

A Simple Explanation

Unlike most minerals, **opal** is *amorphous* like glass. Most minerals are crystalline in nature, but opal is not, although precious opal does have a structure to it. Opal is formed from a solution of silicon dioxide and water. As water runs down through the earth, it picks up silica from sandstone, and carries this silica-rich solution into cracks and voids, caused by natural faults or decomposing fossils. As the water evaporates, it leaves behind a silica deposit. This cycle repeats over very long periods of time, and eventually opal is formed… now read on.

The long story of Australian Opals (referenced from Wikipedia and other sources)

Opal is an amorphous form of silica related to quartz, and therefore classified as a **mineraloid** and not a mineral. Between 3% and 21% of its total weight is made up of water, whereas quartz contains no water. A scientifically accepted standard defining a mineral, is that a mineral must have a crystal structure, which opal lacks. Despite this, almost all scientific references, including the Dana's System of Mineralogy, categorize opal with true minerals. It only forms crystal shapes when it forms as *pseudomorphs* after another mineral.

During the Cretaceous period, 135 to 65 million years ago, the central area of Australia was an inland sea. The **Great Artesian Basin.** Fine marine sands, rich in silica, were deposited around the shoreline. The basin formed when the sea receded ± 30 million years ago. Deep weathering caused changes to the sediments. As the water filtered down, it picked up silica from sandstone, and carried the silica rich solution into cracks and voids, caused by natural faults or decomposing fossils. As the water evaporated, it left a silica deposit. This cycle repeated over long periods, and eventually opal was formed. Opalised shells, woods and reptilian bones of the Cretaceous period are also found, their remains dissolved by the solution and replaced with opal, much like the fossil system. The solution is believed to have a rate of deposition of approximately one cm in five million years at a depth of approximately 40 metres.

Opals are one of the rarest gems of sedimentary origin and contain up to 20 % water, as a residue of the old sea, but also has many legends and folklore wrapped around it.

When conditions are ideal, **spheres** of silica, contained in silica-rich solutions in the earth, form and settle under gravity in a void to form layers of silica spheres. If the process allows spheres to reach uniform size, "precious opal" begins to form. For precious opal, the sphere size ranges from 150 - 400 nanometres, producing a play of colour by diffraction in the visible light range of 400 - 700 nanometres.

Each opal field or occurrence must have contained voids or porosity, to provide a site for opal deposition. In volcanic rocks and adjacent environments, the opal fills only vughs and cracks, whereas, in sedimentary rocks there are a variety of voids created by the weathering process. Leaching of carbonate from boulders, nodules, many different fossils, along with existing cracks, open centres of ironstone nodules and horizontal seams provide a myriad of moulds ready for the deposition of secondary minerals such as opal.

Much of the opal deposition isn't precious; viz "potch" or common opal, as it doesn't show a play of colour. Opaline silica not only fills the larger voids mentioned, but may also fill the pore space in silt and sand size sediments, cementing the grains together forming unique deposits, known as matrix, Opalised sandstone or "concrete" which is a more conglomeratic unit near the base of early Cretaceous sediments.

The many variations in opal types depends on a factors such as climate, which provides alternating wet and dry periods, creating a rising or more importantly a falling water table, which concentrates any silica in solution. The silica itself is formed either by volcanic origin or by deep weathering of Cretaceous clay sediments, producing both silica and white kaolin often seen associated with the Australian opal fields. Special conditions may slow down a falling water table in order to provide unique situations for the production of its own variety of opal.

The chemical conditions responsible for producing opal are still being researched; some maintain there must be acidic conditions at some stage during the process to form silica spheres, possibly created by microbes.

While volcanic-hosted and other types of precious opal are found in Australia, the majority of economic production is from sediment-hosted deposits, associated with the Great Australian Basin. Australia has 3 major varieties of natural sediment-hosted precious opal - black opals from Lightning Ridge in New South Wales, white opals from South Australia and Queensland boulder and matrix opal.

Boulder Opal forms in a different method, inside an ironstone concretion. The concretion was formed due to ionisation, from sedimentary deposition. By definition, they are ionised concretions of varying hardness with an approximate opal composition of SiO2at 28%, Fe2O3 + AL2O3 at 68% and H2O at 1% composition.

Source http://www.opalsdownunder.com.au/article… and www.ctminsoc.org.za

It is formed from trillions of submicroscopic spheres of silicone dioxide. That means you can only see them with an electron microscope. The spheres are in what is called a close packed cubic arrangement leaving spaces between the spheres that are often filled with water. The opal formula is SiO2-n-H2O, n stands for any number between 0 and 20 designating the percentage of water. The spaces between the spheres acts like a diffraction grating and breaks out the various wavelengths of visible light. *A stone that forms underground interacts with light in such a way as to break out the very spectrum that humans see*. The spheres in precious opal range in size from 1500 Angstroms to 3500 Angstroms (150 – 300nm). The smaller the sphere the smaller the wavelength of light is broken out. So small spheres cause a blue light to be broken out while larger spheres break out greens, yellows, oranges and reds. To put it in simple terms an opal works like a rainbow which is made up of millions of drops of water with spaces in between and depending on your angle of view, you see a complete spectrum of light which is broken out by the spheres and spaces.
Sounds like the theory of music ☺

Electrolytes save people from dehydration. Now see what else they're' good for!

The Formation of Precious Opal is caused by interaction of an electrolyte and kaolinite clay. Kaolinite is a two layer clay that has one layer of silicone dioxide and one layer of mixed silica and aluminium and trace elements. Kaolinite comes from the mechanical and chemical weathering of ***plagioclase*** feldspars, usually in the form of volcanic ash. In Australia, where most opals originate, large pure beds of this mineral were laid down millions of years ago. When the layers were being formed, Australia was dominated by a freshwater inland sea. As the feldspars were settling out the very finest gains of it settled out last, forming a thin layer of what was to become "**opal dirt**", a miners term used to describe the thin layer of clay where opal is found. This fine grained volcanic ash became kaolinite in a slow process of mechanical and chemical weathering. Then the ground went through some upheavals causing faults and cracks. By this time the **kaolinite was covered by sandstone** and the clay was protected and compressed. When fault lines appeared, there was an upwelling of the remnants of the fresh water sea in the form of a great underground aquifer that exists to this day; supposedly the largest underground aquifer in the world. When this water moves through the ground it picks up dissolvable minerals like iron and sulphur, creating an electrolyte which interacts with the kaolinite clay, dissolving the layer of aluminium and other trace metals like magnesium, leaving behind the insoluble silica which rolls up and forms a submicroscopic sphere. This happens in the finest layer of clay, where the particles are minute to start with, then the finest clay particles are transported to cracks and crevices. An ion exchange happens with the clay when the sulphide solutions hits it and an opal gel begins to form. Makes one ponder about pearls… Depending on the fineness and regularity of the clay particles of precious opal will form.

The main difference between my model of opal formation and the standard model, which would have us believe that silica saturated water deposits these apparently self-generating spheres into cracks and crevices. How the silica, which is insolvent in anything except fluoric acid, got there is left open and how the spheres form is also not addressed. The main difference is that mine is repeatable in a laboratory. Mr Len Cram of Lightning Ridge, New South Wales, Australia, also came up with this model and did the initial work 30 years ago.

Arizona Opals

While cutting opals for Lightning Ridge, I had access to clean usable opal dirt, which clung to the outside of knobbies I was working on. I was able to duplicate Len Crams work in my home lab, which led me to finding my own opal mine in **Arizona**. I discovered a deposit of precious opal on state land and was therefore almost inaccessible. Most of the rocks I found initially had a play of colour

Initially the opal was transparent and the colour of new dark blue jeans. When it had a play of colour, the colours swam through the stone like magic. Once it came out of the rock, it began to lose water and became opaque. The opal turned sky blue to black and the play of colour stood out even more. This kind of opal is called a reverse hydrophane. Hydrophane is a type of opal that seems dull and uninteresting until it's wet and the play of colour shows. Unlike most opal that loses water, this opal was stable.

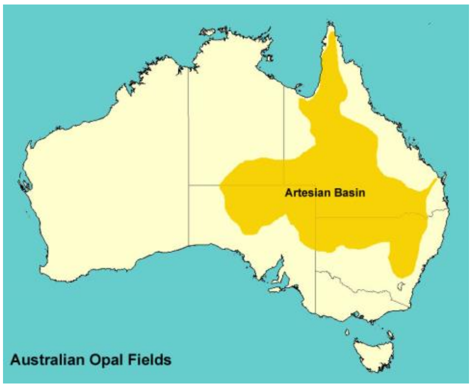
Adapted from an article by **Richard Carew**, AZopals.com

From Mars Dust to the Australian Outback

The red dirt at the centre of Australia might be a close mimic for the red surface of Mars, research suggests that sheds light on how opals formed in the land Down Under.

Precious opal is Australia's national gemstone. Both precious and common opals are made of amorphous spheres of silica 150 to 400 nanometres or billionths of a meter wide, but in precious opal, the spheres are arranged in highly orderly arrays, resulting in scintillating colours.

The red dirt of the **Great Artesian Basin** in central Australia, one of the largest continental basins on Earth. Precious opals have been mined there for over a century; they occur within 50 meters of the surface.



It was long a mystery why precious opal formed at relatively shallow depths in central Australia, and found abundantly there, yet almost nowhere else on Earth. Geologist Patrice Rey, University of Sydney, Australia found precious opal in the red centre of Australia, may have formed in conditions much like those on the surface of the red planet.

Given that the Great Artesian Basin is one of the largest intracontinental basins of Earth, and that precious opals can be found anywhere on this basin and almost nowhere else on Earth, what is unique in the geology and the geological evolution of the Basin?

The Basin was once filled with the Eromanga Sea, a shallow, cold, muddy, stagnant body of water that at its peak flooded 60% of the continent. The formation of Australian opal was due to an extraordinary instance of acidic oxidative weathering during the drying out of the central Australian landscape, following the retreat of the Eromanga Sea, starting ±100 million years ago. Such acidic oxidative weathering over a large region is unusual on our planet - the planet's surface is usually loaded with carbonates that neutralize acid.

Acidic oxidative weathering has also been seen on Mars. The red planet shares a number of features with the Basin; similar rocks, similar flooding then drying out history, similar mineralogy and the same colour.

It costs billions to send rovers and orbiters to Mars, Therefore, looking right here on Earth for ancient and modern analogues to Mars' environment is key to carry on research in greater detail and explore the role biology has in weathering processes. The weathering Earth's surface experiences are affected by biological processes — for instance, by so-called "iron bacteria," which can live off iron and thrive in acidic conditions.

These microbes are some of the most primitive micro-organisms. It's likely that these iron bacteria were present in central Australia, contributing to weathering processes. If this is correct, we could look in central Australia for biological proxies of ancient microbe colonies and better understand these ecosystems for comparison to Mars environments. In central Australia, these putative ecosystems went through wet and reduced to dry and oxidative environments. Evolution of these colonies could offer clues about what to expect and what to look for at the surface of Mars.

Australian Journal of Earth Sciences
http://www.astrobio.net/exclusive/5521/precious-opals-shine-a-light-on-mars

Talks... Tales... Presentations

I am delighted to announce that we have a sensational array of speakers and presentations linked up for the remainder of the year, so let's roll out the red carpet on the **last Wednesday** of every month at **7pm** . . .

Here's only a taste of what's to come :

July **Prof Nic Beukes**
Professor of Geology at UJ and co-author with our Prof Bruce Cairncross, have recently published the magnificent **The Kalahari Manganese Fields** book. Do take this opportunity to get your copy autographed by both authors. Nic specializes in sedimentology and stratigraphy, with emphasis on understanding the origin of iron.

August **Dr Sabine Verryn** **X-ray diffraction**
There's so much more to this topic than just light. Xray powder diffraction is used to identify and quantify phases (ie minerals). X-powder diffraction analysis, including data interpretation, as well as consulting services to Industry, Individuals and tertiary education institutions.

September **Peter Fels** **Mineral Collecting in Sweden - an Historical Review".**
Peter and Arne will be visiting our SA and Namibia and have kindly agreed to squeeze us into their exciting itinerary. Arne Georgzen will be bringing some rare Swedish calcites to show the club. He would also be interested in trading these for KMF or Messina specimens.

October **Kathleen Kuman** PhD - Associate Professor
Oldowan to Early Acheulean to Middle Stone Age,
Her work focuses on rock properties and shapes as well as their influences on tool types.
School of Geography Archaeology and Environmental Studies & Institute for Human Evolution.
University of the Witwatersrand / Origins Centre.

November **Celebration Time**
It is customary for Club Members to enjoy an informal, interactive social evening at the usual venue.

Raffle and Auction donations

Thank you to members who have donated worthy beautiful specimens to the club for auctions and raffles. Donations need **not** be limited to mineral specimens!!! As long as the subject matter is vaguely related to rocks, crystals and klippies. Raffles take place at month-end meetings ie the last Wednesday of every month. Tickets are on sale at meetings and you will be alerted to this. If you sell minerals at the club, please donate a nice rock to the raffle. Contact Keith Bailey in this regard at club meetings.

Membership

Yes yes, we'd love to have you on board, the more the merrier . . .
For those wishing to join the club, let **Bruce Cairncross** have the following:

- 2 passport sized photographs
- R25.00 in cash, and to.
- a certified copy of your ID Document or passport
  He will arrange a UJ access card for you.

The fees are payable to the Treasurer, **Jono Hotz**:

The **WGMC Banking Details** are as follows:

Standard Bank	Cheque account
Account number:	200551744
Branch code:	630522

Club Documents

By now we really hope you've popped your heads into our **Dropbox**. It's basically a virtual club library, rather like a website. Every month I add a new folder and pop all the newsletters and mineral related information in there for mineral minded folk to enjoy, without having to clog up one another's emails or waste unnecessary data downloading oodles of emails. If you are looking for a list of themes for our mineral meetings or any other info … https://www.dropbox.com/l/Ndv3wgfDrfoFHpmXe8GtP9 Open the *WGMC* folder.

Committee Members

The Club has several ***vacant*** committee positions and **would welcome new volunteers**.
Committee members for the year beginning 1st March 2013 are as follows:

Chairman	**Vacant**	
Vice Chairman	**Vacant** – volunteers NEEDED	
Mineral Section	**Vacant** – volunteers	
Treasurer	Jono Hotz	
	jonohotz@gmail.com	0824449628
Librarian	Massimo Leone	
	mass@thefacetingstudio.co.za	082 372 0328
Scribe / Newsletter Editor	Sharon Flax Waddington	
	Lifeisthepresent@gmail.com	082 9 234 794

If you're unable to reach my cell, please use **Rom Koppert's** Cell 083 227 5634

Other Club Contacts

Raffle Master	Keith Bailey
Access cards	Bruce Cairncross

If you have received this newsletter in error or wish to be added to or removed from the mailing list, please email me with UNSUBSCRIBE WGMC in the subject line.

Sharon Flax Waddington May 2013 **E&OE**