Mineralogical Society of Western Australia Inc
September 2009 Newsletter

Editorial
Thanks to those members who have provided articles or information for this issue. Photographs in this newsletter have been reduced in size and are not suitable for enlargement. Members are reminded that short adverts are provided free of charge to members.

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October Meeting - Wednesday 7th October 2009
Starting at 7:30 pm at the WA Lapidary Club rooms 31Gladstone Road Rivervale.
Speaker: Murray Thompson
Topic: "South Australian Minerals"
The Olympic Dam Mine on Roxby Downs Station in South Australia's mid north is the largest deposit of its type in the world however; it is not the first time that this has happened in this state's mining history.

What was the 'Monster Mine' and where was it to be found?

In this presentation we will look at the copper producing phenomenon that was the Burra Burra Mine from 1845 to 1877; in particular its size, the impact it had on a young state, both technologically and socially and just some of the mineral treasures that have survived to this time.

2009 Future Meetings
Starting at 7:30 pm at the WA Lapidary Club rooms 31Gladstone Street Rivervale.

Wednesday 11th November 2009 (to be confirmed) Mineral Auction
Wednesday 2nd December 2009 Christmas Meeting
Speaker Margot Willing Topic "Emeralds & Other Beryls"

2010 Meeting Dates

Wednesday 3rd February 2010 – Speaker Susan Stocklmayer Topic: "Jade"
Wednesday 7th April 2010 – Speaker to be advised

Last meeting 4 speakers gave a short Presentation.
They were:- Murray Thompson ("collecting quartz crystals from White Rock Quarry, SA in the 70s."), Allan Hart ("Hafnium (Hf) and its minerals"), Susan Stocklmayer ("Euclase"), and Sue Koepke(Topic "The seminar field trips that were held before and after the Joint Mineralogical Societies of Australasia 32nd Annual Seminar."). We have received reports from 3 of these speakers which are reproduced below.

Murray Thompson: Quartz collecting in the Adelaide Hills.

Growing up in the Adelaide Hills there were numerous places to collect quartz crystals. From the roots of trees in the front yard at Bridgewater, to an old quarry at Ashton just twenty minutes away, and finally to the best known of all in South Australia, White Rock quarry. In the ten minutes allotted Murray gave a brief personal journey of discovery via anecdotes and featured specimens from these localities, spaning roughly thirteen years of collecting these fabulous 'sculptures of light'.

Before attending high school Murray could glean small clear crystals from the roots of Stringy- bark, gum trees in the front yard. Just a hundred metres down the street faceting quality, smoky quartz crystals to three centimetres were prised from the clay with a screwdriver.

Once he got a driver's licence Ashton quarry was in easy reach (and producing arguably the brightest, sharpest quartz crystals in SA at that time). While they would occur to several centimetres in length they were rarely found in clusters, by the mid seventies.

A chance purchase of an included cluster of crystals from a city rock-shop led Murray to White Rock quarry; even so there was a four month wait until permission was granted by the owners to visit. But what an initiation, several hours after starting the two person party was allowed to leave with two plastic (10 litre) buckets full of crystals, averaging eight centimetres in length, with a good deal containing phantoms. This started a small tradition in the Thompson family of visiting White Rock quarry for several more years. These visits culminated in the discovery in1977, of a blood-red clay pocket near the top of the quarry, some two metres square and half a metre deep. Among several other clusters this pocket yielded the 30 centimetre long 'battleship' specimen many years later, featured on the cover of the Australian Journal of Mineralogy (Vol 8, No 1 June 2002), plus a trove of fantastic memories and stories.

Allan Hart: "Hafnium (Hf) and its minerals"

Hafnium is element number 72. It is in the third row of transition elements and immediately below zirconium and immediately after the rare earth elements. Elements in the third row of transition elements have similar chemical properties to the corresponding element in the second transition row. Hafnium is more similar to zirconium than any of the other pairs, due to zirconium and hafnium atoms having almost identical sizes (1.44 Å for hafnium and 1.45 Å for zirconium) as well as analogous electron configurations in all their oxidation states, and so the chemistry of their compounds is also very similar. The similarity of properties of zirconium and hafnium compounds makes it very difficult to separate them. However, hafnium is twice as heavy as zirconium (note in the photo below the 10 gram pellet of hafnium is smaller than the 10 gram pellet of zirconium). Hafnium does react in air to form a protective film that prevents any further reaction.

Hafnium crystallized bar

Note Hafnium is smaller because it has twice the density of Zirconium.

top row - coins of elements Titanium, zirconium and hafnium
bottom row - anodized coins of hafnium in varying colours.

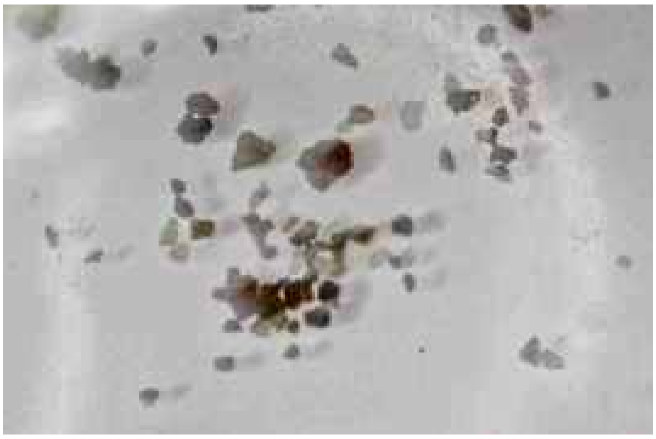
Discovery

In 1923, four predicted elements were still missing from the periodic table: 43 (technetium) and 61 (promethium) are radioactive elements and are only present in trace amounts in the environment, thus making elements 75 (rhenium) and 72 (hafnium) the last two unknown non-radioactive elements. Consequently Hafnium was discovered by Dirk Coster and Georg von Hevesy in 1923 in Copenhagen, Denmark in Norwegian and Greenland Ziricons and was named after the latin name for Copenhagen.

This made Hafnium the second to last element with stable isotopes to be discovered (the last was rhenium).

Minerals containing Hafnium

Mindat.org lists 2 minerals which contain hafnium. They are Hafnon and Zektzerite $LiNa(Zr,Ti,Hf)Si_6O_{15}$. These 2 minerals are illustrated below – the hafnon as hafnon sand in a capsule. Hafnon has been reported from Mt Holland in Western Australia. Hafnon may be more common than reported due to the difficulty in distinguishing it from zircon.



Hafnon sand in capsule

Enlarged Hafnon sand

The sample of Zektzerite shown below was analysed by Excalibur Mineral Company and was found to have 4.1% Na_2O, 4.26% HfO_2, 69.25% SiO_2, 21.58% ZrO_2, 0.04% TiO_2. The analysis technique used does not pick up Lithium – the Lithium would be included with the oxygen (it would be expected to have about 2.82% Li_2O (from webmineral.com)). The Zektzerite in the sample fluoresces blue under short wave ultra violet light.

Zektzerite left (daylight globe), right short wave UV with filter. Zektzerite fluoresces blue.

In addition to the above 2 minerals many other zirconium minerals will contain a small amount of hafnium with the raio of zirconium to hafnium being about 50 to 1. However, some altered zircons such as Alvite and cyrtolite may contain a higher percentage of hafnium. The sample of alvite shown below was analysed by Excalibur and found to have 4.89% HfO_2, 51.37% ZrO_2, 33.79% SiO_2. 4.48% Yb_2O_3, 4.26% Fe_2O_3, 0.72% Er_2O_3, 0.5% Y_2O_3.

Zircon var Alvite

ABUNDANCE IN EARTH'S CRUST

Hafnium is the approximately the 44th most abundant element (different sources may rank it slightly differently), above berylium, tin, uranium, molybenum, arsenic, antimony, silver, etc
But production is only 50 tons per year putting it at about the the 61st element in production only above some of the rare earths, gallium, thulium, caesium, rubidium and the platinum group metals.

Uses of Hafnium

As Hafnium has both a good absorption cross section for thermal neutrons (almost 600 times that of zirconium), and also excellent mechanical properties and is extremely corrosion-resistant, hafnium is used for reactor control rods. Such rods are used in nuclear submarines.
Zirconium is used in the nuclear industry for cladding fuel elements since it has a low absorption cross section for neutrons. Because of this difference in absorpsion in neutrons it is important that zirconium not be contaminated by hafnium and that hafnium not be contaminated by zirconium when they are used in the nuclear industry.
Hafnium is also in gas-filled and incadescent lamps, as a scavenger for oxygen and nitrogen in radio and television tubes, cathode in x-ray tubes and as a coating on tantalum for rocket engine parts. An alloy consisting of 89% niobium, 10% hafnium and 1% titanium is used for liquid rocket thruster nozzles (for example the main engine of the Apollo Lunar Modules 's C103). Small additions of hafnium increase the adherence of protective oxide scales on nickel based alloys. It improves thereby the corrosion resistance especially under cyclic temperature conditions that tend to break oxide scales by inducing thermal stresses between the bulk material and the oxide layer.
Hafnium is also used as the electrode in plasma cutting because of its ability to shed electrons into air.
Hafnium Oxide HfO_2 (hafnia) is used in optical coatings, and as a high-k dielectric in DRAM capacitors. Hafnium based oxides are currently leading candidates to replace silicon oxide as a gate insulator in field effect transistors. It apears that both IBM and Intel plan to use it to continue scaling down semiconductor features to continue Moore's Law, to continue to increase logic density in computer processors, increase clock speeds, or lower power consumption. Hafnia is also used as a refractory material in the insulation of such devices as thermocouples due to its very high melting point.

References

Analysis from Excalibur Mineral Company
Encyclopedia Britannica 2004 Ultimate Reference Suite
http://hafnium.totallyexplained.com
http://www.mindat.org/chemsearch.php
http://www.peridictable.com/properties
http://periodic.lanl.gov/elements/72
http://www.powdered-metals.com
http://www.speclab.com/elements/hafnium
http://www.webelements.com
http://webmineral.com

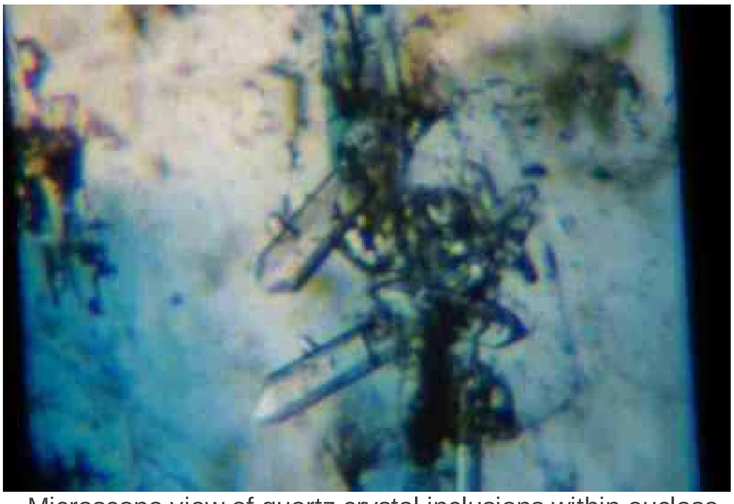
wikipedia Abundance of elements in Earth's crust
wikipedia Hafnium (IV) oxide
element samples and coins from Metallium inc (website http//www.elementsales.com)
All photos by Allan Hart from his collection.

Susan Stocklmayer: "Euclase"

Euclase, an uncommon pegmatite mineral, was discovered in Zimbabwe in the 1970's occurring as gem quality crystals. The specimens brought to show Members are from the "Last Hope" claims in the Urungwe District (a former district name) in NW Zimbabwe. The area is noted for its pegmatites and was an important producer of mica and beryl in the early to mid 20th century. The St Ann's pegmatite, also in the area, was one of the important sites for blue topaz crystals and is often featured in mineral books. A 500my metamorphic event resulted in the emplacement of widespread pegmatites to that area hosted within mica- and sillimanite schists. Paragenesis indicates that euclase is a secondary mineral partly replacing beryl; both are beryllium aluminium silicates and beryl often occurs with an encrustation of euclase. The crystals are monoclinic, often doubly terminated, transparent and many are an intense deep blue colour with hour-glass structured zoning. Quartz –as microscopic crystals occur within the euclase as inclusions. Crystal sizes are from a few mm to approx 25mm. Details on the euclase occurrence is the subject of two papers published in the Journal of Gemmology.
Further details- from Susan Stocklmayer


euclase crystals


Faceted gem of euclase showing blue colour


Microscope view of quartz crystal inclusions within euclase

Photos supplied by Susan Stocklmayer taken from slides.

Prehnite, Epidote and Garnet from Kayes, Mali

Report by Ben Nicolson



Prehnite on Epidote, Kayes, Mali.

In 2004 a significant new mineral producing locality was recognized in the Kayes (Pronounced Kai's) region of Mali. Local artesanal miners near the Sadiola Gold Mine began unearthing finely crystallized specimens of epidote and prehnite, often in attractive combinations. Well crystallized specimens of a dark brown variety of andradite garnet, known as melanite were also found in the area.

Prehnite occurs as attractive translucent pastel-green balls up to 3cm across. The prehnite occurs as individual balls but also as growths upon epidote crystals. Epidote occurs as coarse blocky euhedral crystals that typically range from 3-4cm in length and 1-1.5cm width, though much larger crystals are also found. Crystals occur singly and in complex groups.

Through colleagues working in the area I have been able to obtain a number of specimens from small miniature to cabinet size range. The specimens are variously single crystals of epidote, prehnite and garnet, and also combinations of epidote and prehnite. I will be bringing the specimens to the next Mineralogical Society of WA meeting, should any members be interested in acquiring any specimens for their collections. Specimens range in value from approximately $10 to $200 though most are very moderately priced. Examples are shown in the accompanying photographs.


Prehnite Ball and Andradite (var. Melanite) Garnet, Kayes, Mali

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Membership Renewals now over due

Annual subscription $20 + $5 joining fee (anyone who did not pay by 31st August has to pay the joining fee again).

These may be paid at the meeting, or alternatively posted to the treasurer (Sue Koepke).

FIELD TRIPS 2009

By arrangement members of the mineralogical society are able to go on field trips organized by the Western Australia Lapidary and Rockhunting Club inc.
Please register with MINSOC Field Trip organizers prior to attending any of the following events, but only if you are a current (financial) MINSOCWA member to confirm event details.

MINSOC Field Trip organizer Ben Nicolson

THE WESTERN AUSTRALIAN LAPIDARY AND ROCKHUNTING CLUB INC. 31-35 Gladstone Road, Rivervale, 6103. Rivervale W.A.
PROPOSED 2009 ACTIVITIES & EVENTS
Oct 25 (Sunday) – Toodyay area
Nov 15 (Sunday) Gravity Centre & Star Gazers Optical Observatory
Further 2009 activities and events will be published during the year

A lot of organization goes into making a successful field trip – please bring mineral specimens to club meetings for a show and tell.
OS&H – Yes, occupational, safety and health applies on field trips
Please make sure you have the normal safety gear – field boots and hard hat Plus carry extra drinking water. Take sun screen and fly repellant. Drive safely

Particularly important for group field trips:-
Please register your details with excursion organizer – name, car rego, mobile telephone
Please follow instructions by excursion organizer and if you need to leave a field trip early, advise organizer.

There are many opportunities to show case your mineral collection. Enquiries can be made with the various lapidary clubs throughout WA.

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The next Joint Mineralogical Societies of Australasia 33rd Annual Seminar
will be held in Adelaide 2010 over the June long weekend
Saturday 12 June, Sunday 13 June and Monday 14 June 2010
Make a note of the dates in your diary.

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