

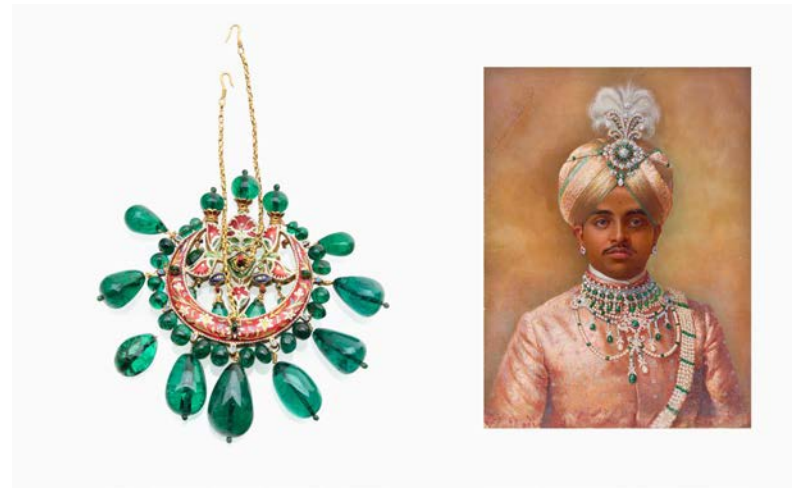


**SGG Zentralkurs | June 2024**

**| 'OLD' NEWS FROM SSEF **  
**with a focus on antique gems & jewellery**

Presentation by PD Dr. Michael S. Krzemnicki

# | Antique Gems



In historic Eastern cultures (e.g. Mughal Empire), gems were often drilled or half-drilled to fix them with metal wires as a pendant on jewellery.

Later, some of these gems have been recut and re-used in new designs and styles.

# Re-use of antique Gems



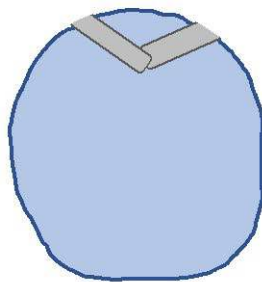
Historic multi-gem necklace recently investigated at SSEF.

All gems are suspended (double half-drill) and mostly faceted but with strong wear marks!

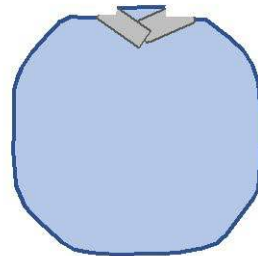
# Re-use of antique Gems



Some of the faceted gems show half-drilled holes very close (and fragile) near the surface. It is assumed that these stones were reshaped and faceted at a later (but historic) age than the original drilling.



Initial  
(assumed)



After historic  
re-cutting

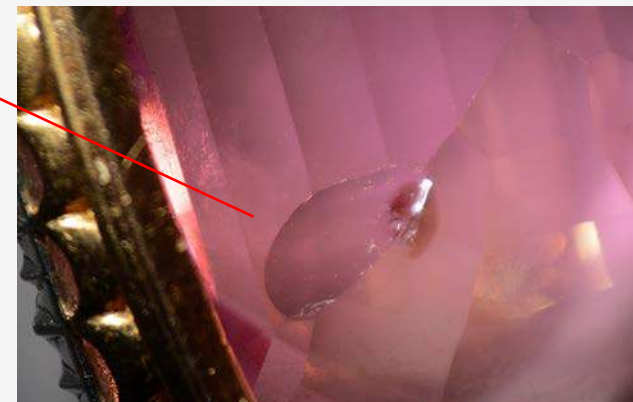
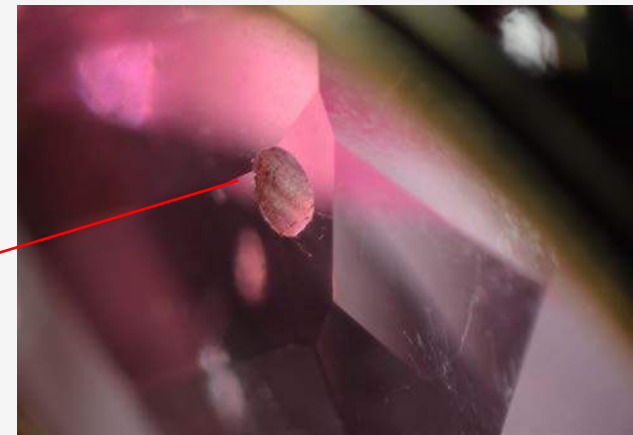


# | Re-use of Sri Lankan Sapphire



Relics of large drill-hole in a Sri Lankan sapphire. We assume that this stone was actually re-used and faceted from an even older jewellery (fixed through drill-holes) when set into this brooch in the 1860ies.

# | 'Classic' Sri Lankan Pink Sapphire



Relics (drill-holes) from former setting.

# | Emerald-coloured Glass

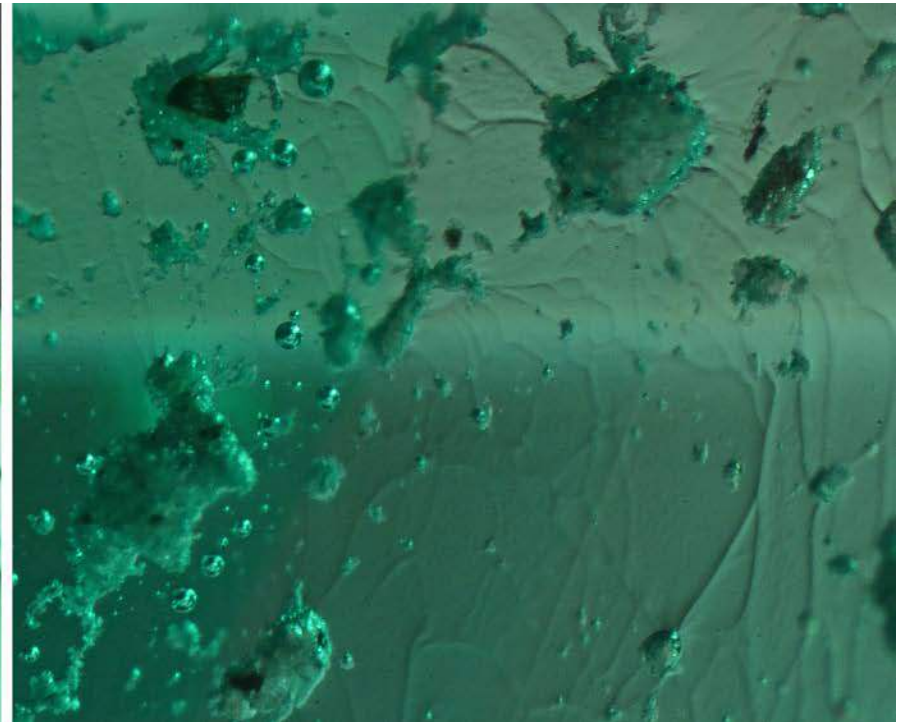


What looks like a classic 19th century brooch with old cut diamonds...

# | Emerald-coloured Glass

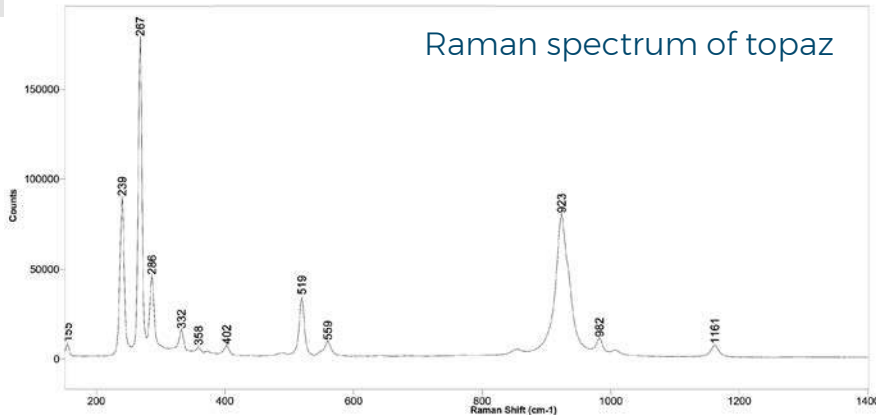
...turns out to be green flint glass. The green colour is from traces of chromium.

Intriguingly, the green glass contains many eye-visible “spiky” inclusions, thus well mimicking a Colombian emerald.

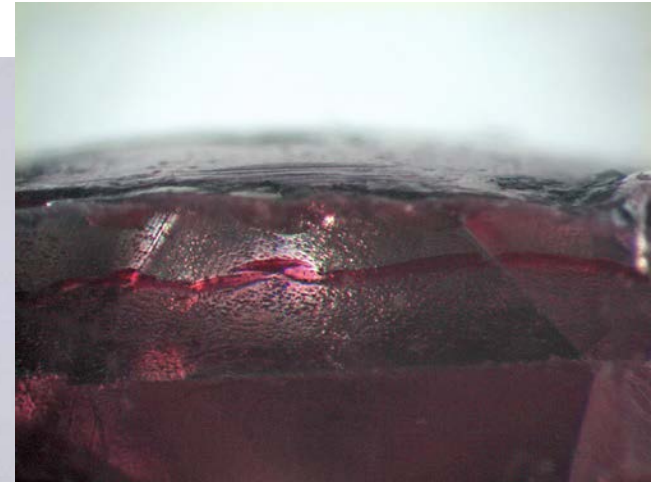




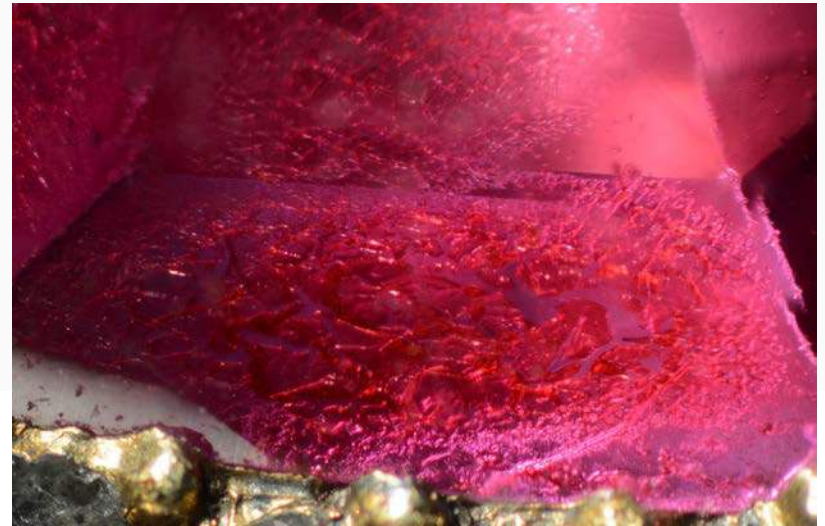
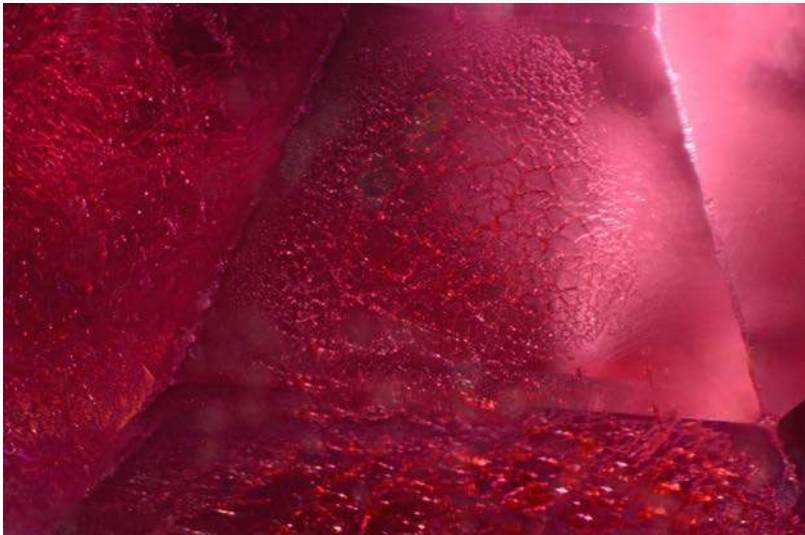
# Green painted Topaz to imitate Emerald



# | Pink painted Topaz



# | Pink Sapphires with orange painting at pavilion



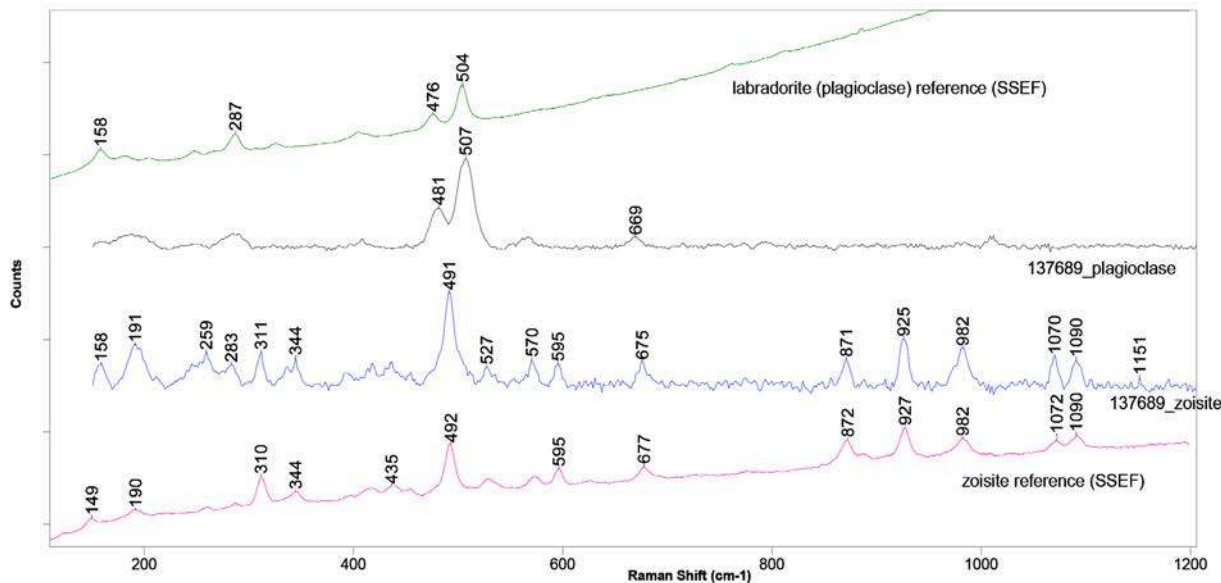
Bracelet with pink sapphires painted orange on backside and in closed-back setting. To intensify colour and slightly shift it to 'ruby'.

# | white Jade ???



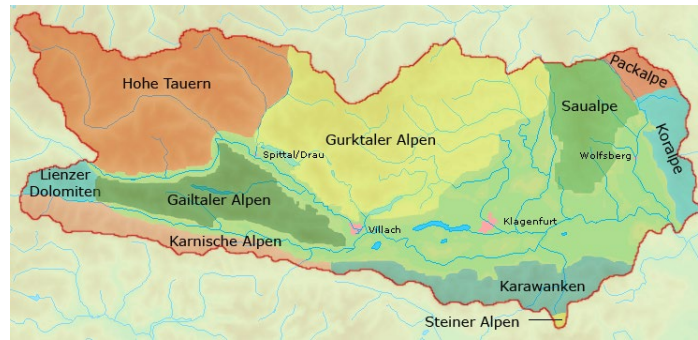
# | white Jade ???

...dense mottled intergrowth of zoisite (complex Ca-Al-silicate) and plagioclase. Thus not jade!



Symbol	Concentration	Error
Na <sub>2</sub> O	0.000%	0
MgO	0.000%	0
Al <sub>2</sub> O <sub>3</sub>	27.332%	0.047
SiO <sub>2</sub>	33.514%	0.083
SO <sub>2</sub>	0.019%	0.0043
Cl	0.267%	0.035
K <sub>2</sub> O	0.283%	0.01
CaO	37.192%	0.063
Sc <sub>2</sub> O <sub>3</sub>	0.209%	0.066
TiO <sub>2</sub>	0.002%	7.2E-05
V <sub>2</sub> O <sub>3</sub>	0.000%	0
Cr <sub>2</sub> O <sub>3</sub>	0.150%	0.0018
MnO	0.022%	0.0012
Fe <sub>2</sub> O <sub>3</sub>	0.495%	0.0039

# | white Jade ???

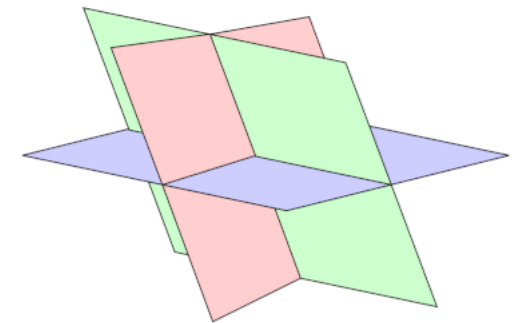


Zoisite, first discovered in 1794 at Saualpe in Austria, it was soon after named after **Sigmund Zois Freiherr von Edelstein** (sic!) (1747-1819), nobleman and natural scientist.

**Plagioclase**, solid-solution (Na to Ca-Al-silicates) within the feldspar group.

Its name comes from ancient Greek πλάγιος (*plágios*) 'oblique', and κλάσις (*klásis*) 'fracture', in reference to its two cleavage angles.

*(after Wikipedia)*



Three cleavage directions  
not at 90 degrees


# Exceptional Spinel: From rough to cut



371 ct




155 ct



**SSEF**  
SCHWEIZERISCHES GEMMLOGISCHES INSTITUT  
SWISS GEMMOLOGICAL INSTITUTE  
INSTITUT SUISSE DE GEMMOLOGIE


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SSEF GEMTRACK™ DOCUMENT 137464



**ROUGH SPINEL**  
Testing by SSEF

Date of Testing:	21 December 2023
Weight:	371.694 ct
Measurements (approx.):	39.00 x 35.00 x 31.60 mm



**CUT SPINEL**  
Testing by SSEF (Report No. 137464)

Date of Testing:	5 April 2024
Weight:	155.10 ct
Measurements:	31.01 x 27.80 x 22.70 mm

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TRACKING RECORD

**1** The rough spinel (371.694 ct) was submitted to SSEF and meticulously analysed and characterised on the 21st of December 2023.

**2** The rough spinel was then carefully cut and polished into a spinel of 155.10 ct.

**3** After cutting, the spinel (155.10 ct) was resubmitted to SSEF and extensively analysed on the 5th of April 2024.

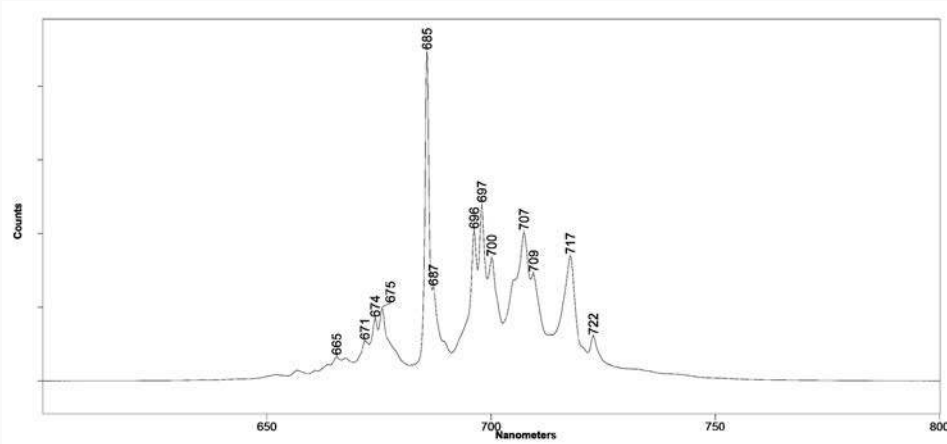
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Based on the consistency of the analysed properties and internal features of the described rough and cut spinel, it is the opinion of the SSEF that the spinel of 155.10 ct described in SSEF Gemstone Report No. 137464 was cut from the 371.694 ct rough spinel, tested by SSEF before cutting.

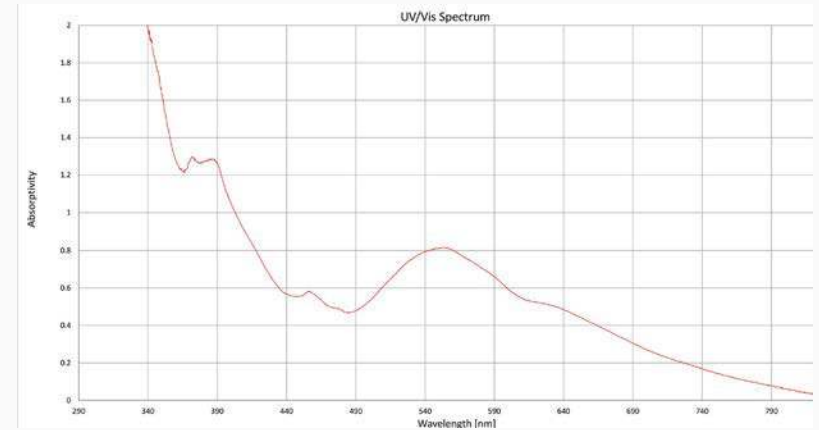
Disclaimer: SSEF makes no warranty for the provided documentation and issues this GemTrack™ document based on provided information and within the limits of gemmological characterization of gemstones. Measurements and photos are approximate.

Mandatory document verification: [www.mysssf.ch](http://www.mysssf.ch)  
If you can read this text, the present document is no longer valid. Please contact SSEF immediately. Email: [admin@ssef.ch](mailto:admin@ssef.ch)

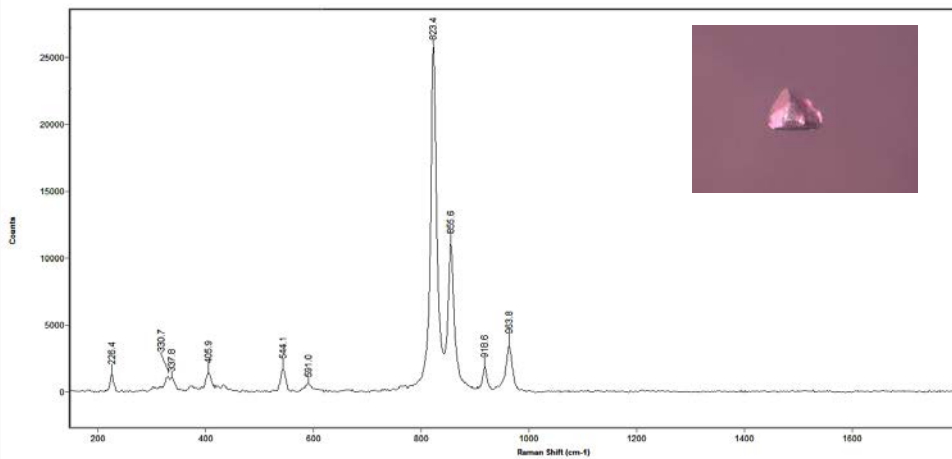
# Exceptional Spinel: From rough to cut



Cr-photoluminescence emission



Absorption spectrum, purple colour mainly due to Fe-absorption.



Forsterite ( $Mg_2SiO_4$ ) inclusion in spinel



# | The Making of...



Initial 371.694 ct



353.10 ct



313.44 ct



284.64 ct



256.26 ct



212.10 ct



212.10 ct  
table side



201.94 ct



190.37 ct



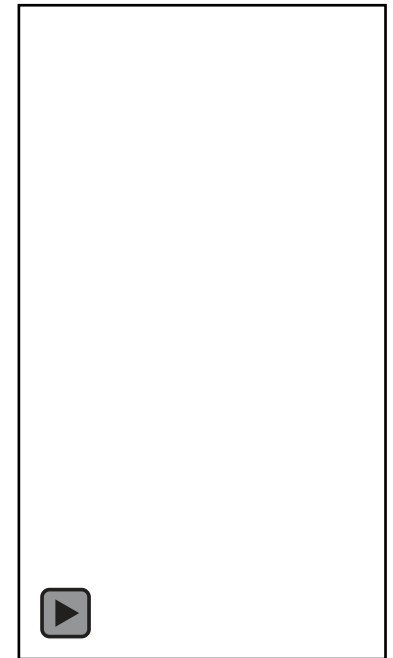
188.36 ct



172.98 ct



155.183 ct



Photos and clip © A. Henn, except initial and final stages (by SSEF)

# | Cobalt Spinel



Cobalt spinel of 1.0 ct with a deep but vivid cobalt blue colour as a result of very high cobalt concentration (about 2100 ppm Co).

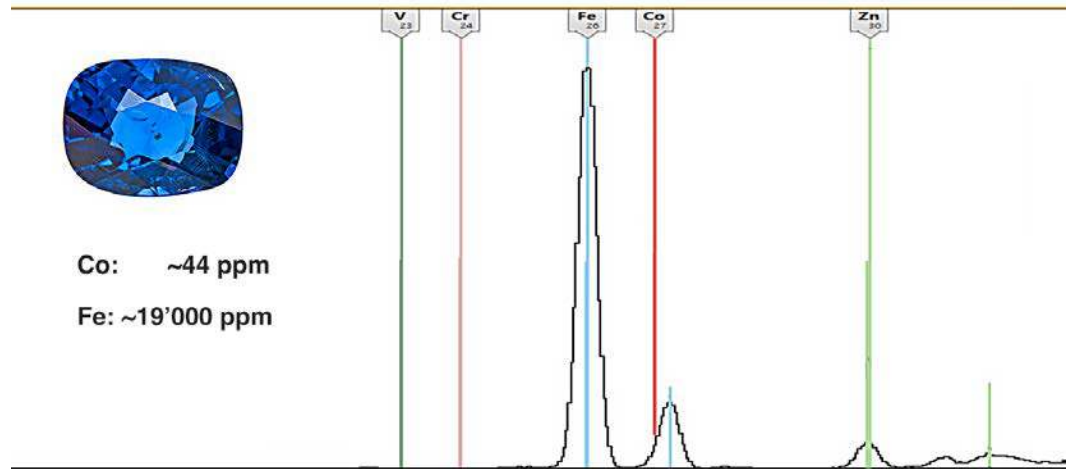
# | Cobalt Spinel

Cobalt spinel often contains about 40-200 ppm of cobalt. At this level, cobalt cannot be detected with chemical EDXRF analyses.



Co: ~44 ppm

Fe: ~19'000 ppm

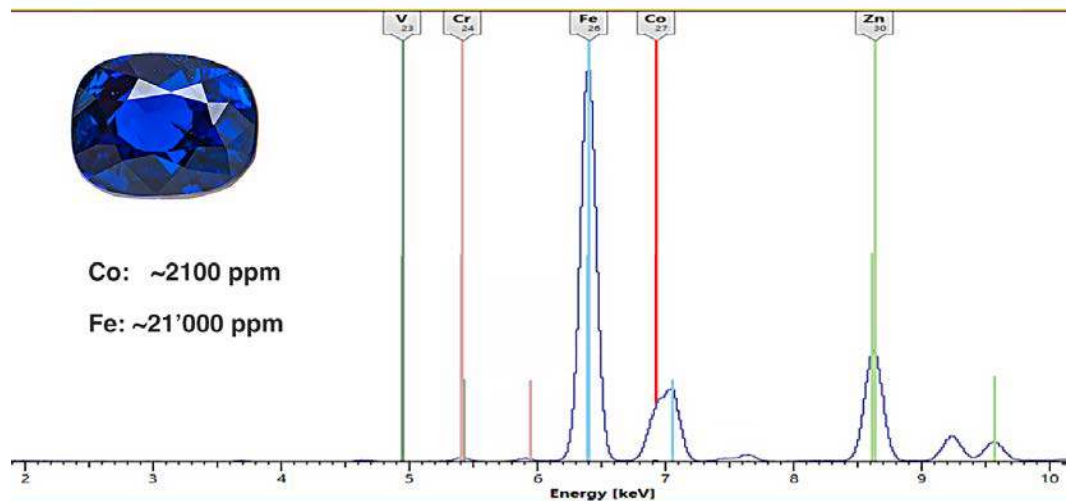


Recently we analysed a Co-spinel with very high cobalt concentration (about 2100 ppm).



Co: ~2100 ppm

Fe: ~21'000 ppm



# | Diamonds

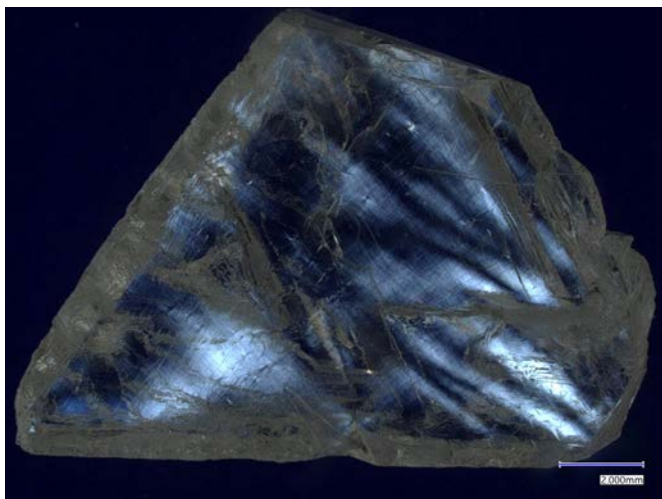


# | Diamond : from Rough to Cut



SSEF GemTrack™ for a diamond

# Diamond : from Rough to Cut



SSEF GEMTRACK™ DOCUMENT 137669



**ROUGH DIAMOND**  
 Testing by SSEF

Date of Testing:	6 February 2023
Weight:	4.929 ct
Measurements:	15.05 x 10.90 x 3.70 mm



**CUT DIAMOND**  
 Testing by SSEF

Date of Testing:	15 February 2024
Weight:	1.418 ct
Measurements:	10.34 x 6.24 x 3.49 mm



**POLISHED DIAMOND**  
 Testing by SSEF (Report No.137669)

Date of Testing:	30 April 2024
Declared Weight:	1.062 ct
Measurements:	9.22 x 5.93 x 3.19 mm

TRACKING RECORD

- 1 The rough diamond (4929 ct) was submitted to SSEF and meticulously analyzed and characterized on the 6th of February 2023.
- 2 The rough diamond was then carefully cut into a diamond of 1.418 ct. After cutting, the diamond was resubmitted to SSEF and extensively analysed on the 15th of February 2024.
- 3 After polishing, the diamond was then resubmitted to SSEF and extensively analysed again. A SSEF Diamond Grading Report was issued on the 30th of April 2024.

Based on the consistency of the analyzed properties and internal features of the described rough and polished diamond, it is the opinion of the SSEF that the diamond of 1.062 ct described in SSEF Diamond Grading Report No. 137669 was cut from the 4.929 ct rough diamond tested by SSEF before cutting and polishing.

Disclaimer: SSEF makes no warranty for the provided documentation and issues this GemTrack™ document based on provided information and within the limits of gemmological characterization of diamonds. Measurements and photos are approximate.

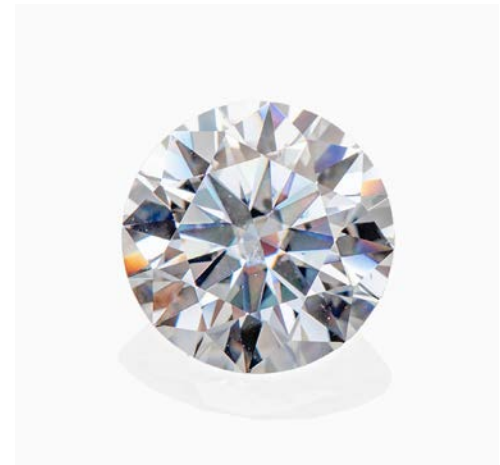
Mandatory document verification: [www.myssef.ch](http://www.myssef.ch)  
 If you can read this text, the present document is no longer safe. Please contact SSEF immediately. [info@swisssef.ch](mailto:info@swisssef.ch)

Based on microscopic observations and numerous spectroscopic criteria it was possible to confirm that the faceted pear-shaped diamond of 1.06 ct is the same as the rough diamond of 4.93 ct analysed by SSEF before cutting.

# | Diamond Imitation

Synthetic moissanite of 1.8 ct with engraved girdle.

Characteristic doubling effect makes identification easy!



# | Exceptional Pearls

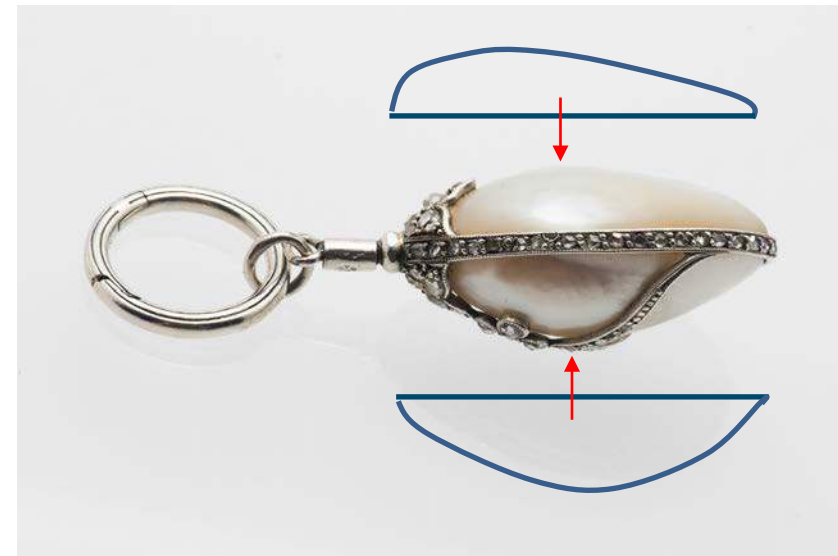


by Anna Hu



# | 'Pearl' Pendant made of two assembled Blisters

Interestingly, this 'pearl' pendant proved to be an assembled item made of two shell blisters.



# | Exceptional Non-Nacreous Pearls



Conch

Lion Paw  
Scallop

Horse Conch

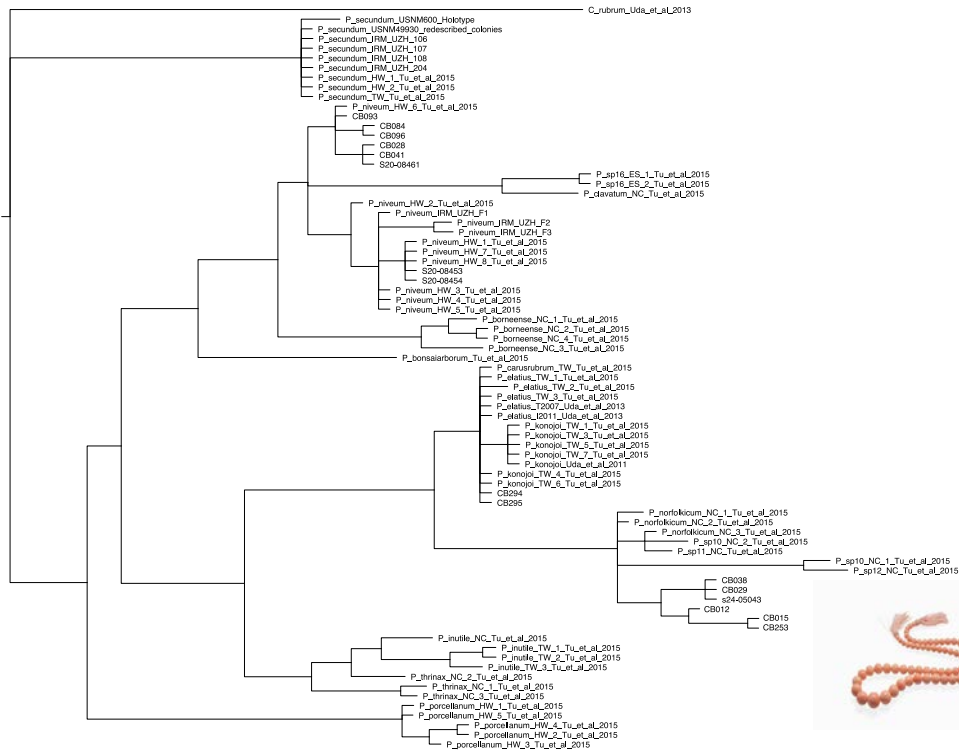
Melo

# | Corals



Exceptional coral strand with 67 coral beads (up to 26.75 mm) of perfectly matching colour and quality. Their subtle but attractive pink colour is poetically also referred to as *'angel skin colour'* (boke). Such corals are commonly attributed to *Pleurocorallium elatius*.

# Corals



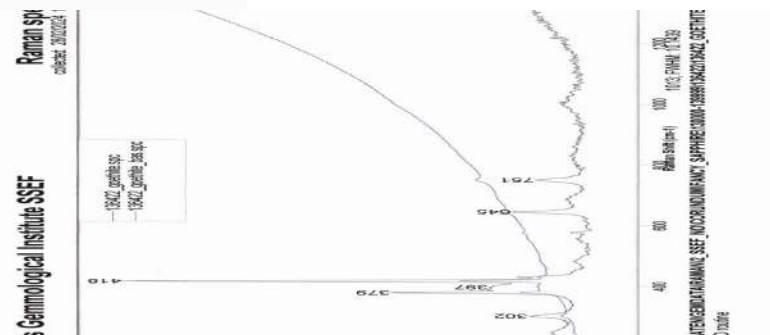
DNA testing on three randomly selected coral beads of this necklace revealed, that they belong to a scientifically so far **undescribed** *Pleurocorallium* species.

Sample code SSEF	Taxonomic group
136584_8	<i>Pleurocorallium</i> sp. (other than <i>P. elatius</i> , <i>P. konojo</i> and <i>P. secundum</i> )
136584_25	<i>Pleurocorallium</i> sp. (other than <i>P. elatius</i> , <i>P. konojo</i> and <i>P. secundum</i> )
136584_40	<i>Pleurocorallium</i> sp. (other than <i>P. elatius</i> , <i>P. konojo</i> and <i>P. secundum</i> )

# | Pink Sapphires from Mozambique



Recently, we have seen occasionally pink sapphires from Montepuez, Mozambique.

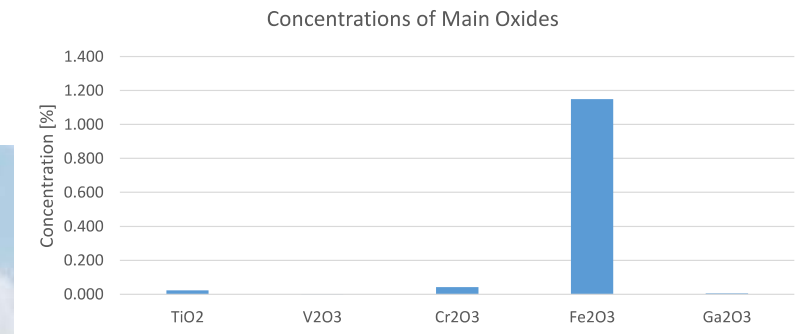


# | Fancy Sapphire from Umba valley, Tanzania

72 ct !



??

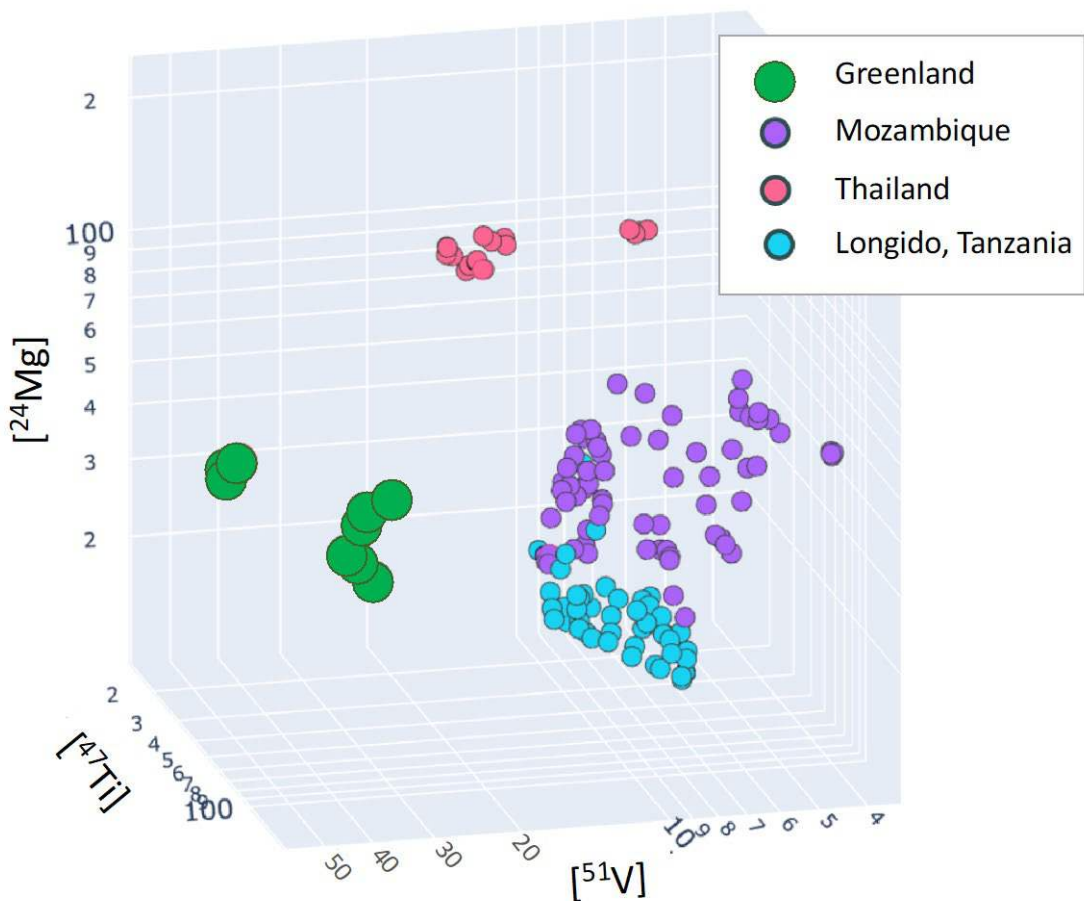


# | Dating of Greenland Rubies

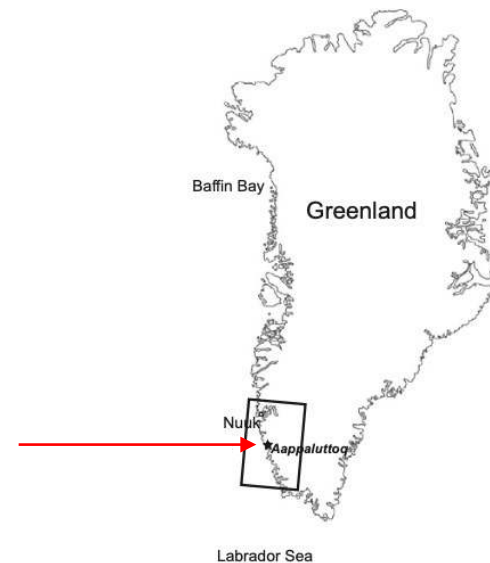


Three Greenland rubies of 2.39, 3.04 and 1.22 ct. Age dating was successful on a tiny zircon inclusion on the ruby of 1.22 ct (right).

# Dating of Greenland Rubies



Trace element signature of the investigated Greenland rubies is different to other rubies from ultramafic rocks.



Aappaluttoq ruby deposit in W-Greenland.

Map: Krebs et al. 2019;

Photo: Greenland Ruby A/S.

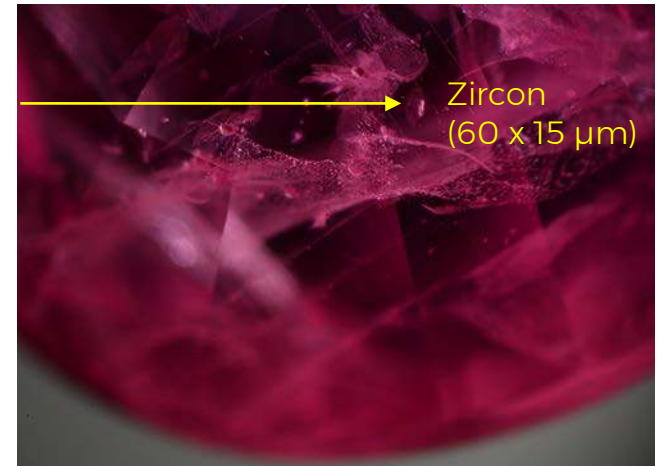
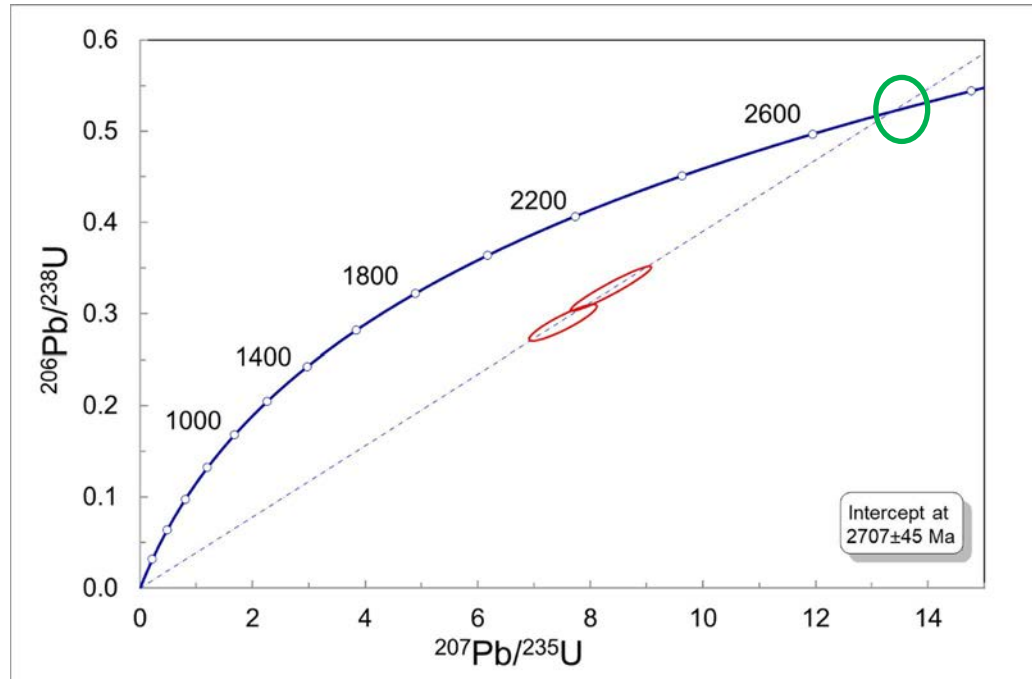


# | Dating of Greenland Rubies



All three Greenland rubies were heated at high temperature and with significant glassy residues in healed fissures and cavities!

# Dating of Greenland Rubies



We calculated an age of **2.7 billion years** for the zircon inclusion!

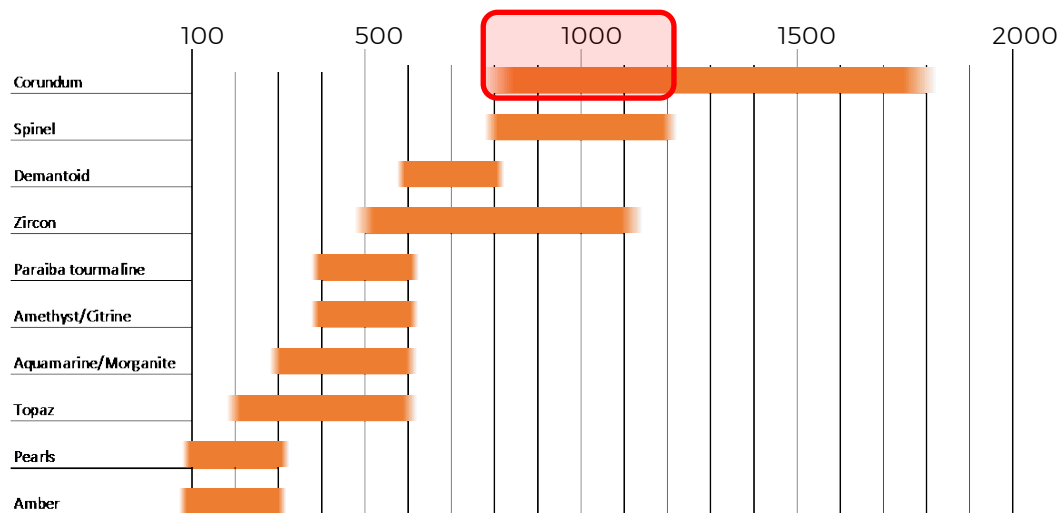
This is well in accordance with literature describing the rubies from Greenland as the oldest ones known on Earth (e.g. Krebs et al. 2019)



# Heat Treatment of Gemstones



Low-T heating of corundum  
about 700 – 1200 °C



*approx. temperature ranges as by gemmological literature*

*“The practice is therefore, to roast the reddish [stones] so that the mixed colours are made to disappear... A ruby stone having been roasted is re-examined, and, in case it does not gain clarity, it is re-heated. ....”*

Al-Biruni (AD 973-1048)

- In most cases, heat treatment results in a change/shift of colour.
- The lower the heating temperature the more challenging is its detection!

# | 'Low-Temperature' Heat Treatment of Corundum

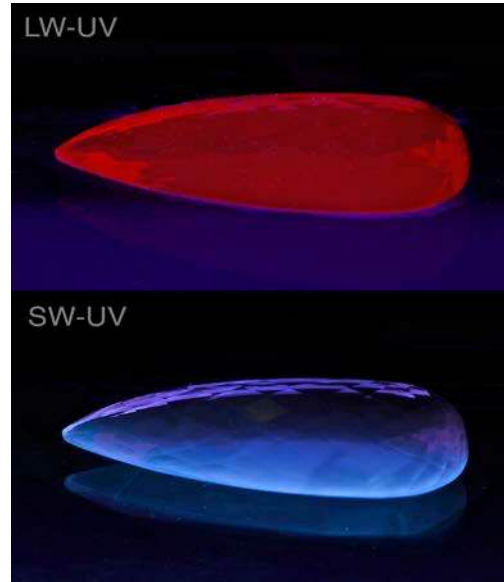


Unheated ruby from Mozambique.

Heat treatment at low temperatures (about 700 - 1200 °C) is mostly applied to remove bluish zones and slightly shift purplish sapphires to a pink colour.



# | 'Low-Temperature' Heat Treatment of Corundum



Detection of any heat treatment is commonly relied on a combination of 'classic' microscopy, UV reaction, and spectroscopic analyses (Infrared- and Raman spectroscopy).

# Detection of 'Low-Temperature' Heat Treatment

Very useful approach:

Phase transformations of hydroxides

Diaspore ( $\alpha$ -AlOOH) and Goethite ( $\alpha$ -FeOOH)



2 diaspore  
2 AlOOH



1 corundum + water  
Al<sub>2</sub>O<sub>3</sub> + H<sub>2</sub>O

2 goethite  
2 FeOOH



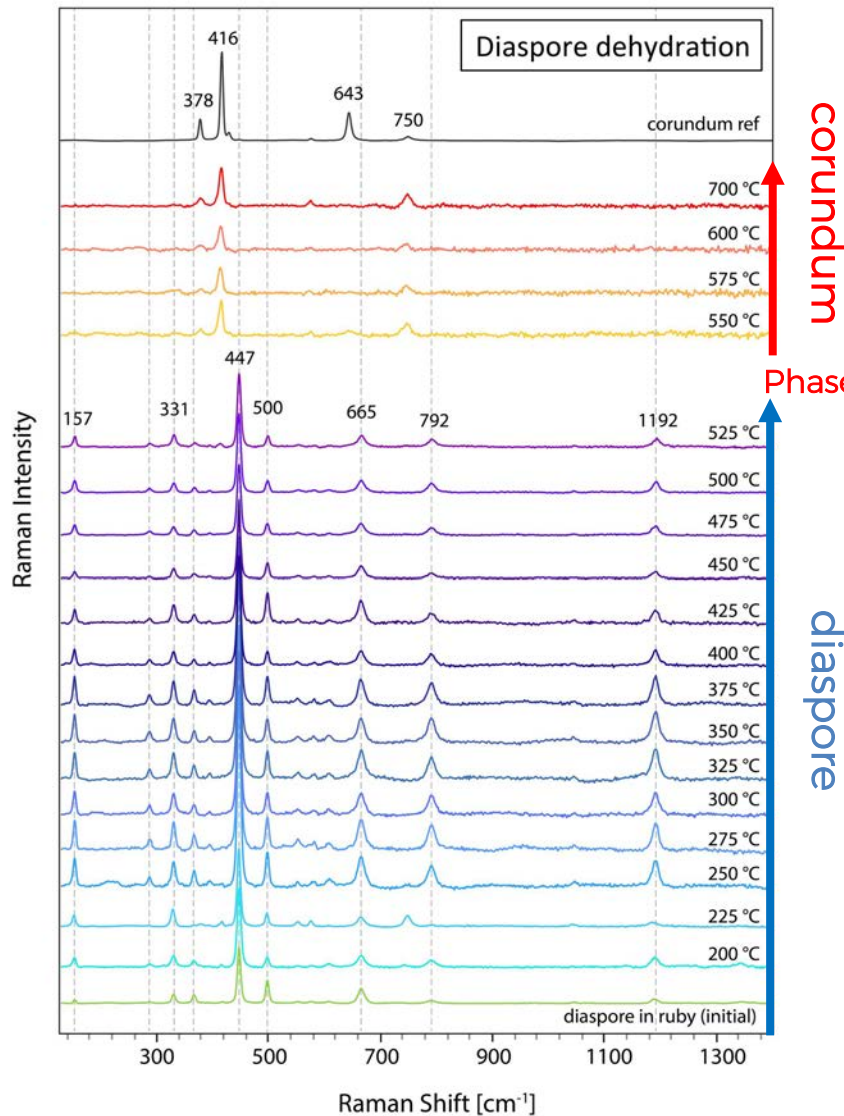
1 hematite + water  
Fe<sub>2</sub>O<sub>3</sub> + H<sub>2</sub>O

These are so-called **dehydration reactions** which occur when heating up these hydroxides (diaspore, goethite).

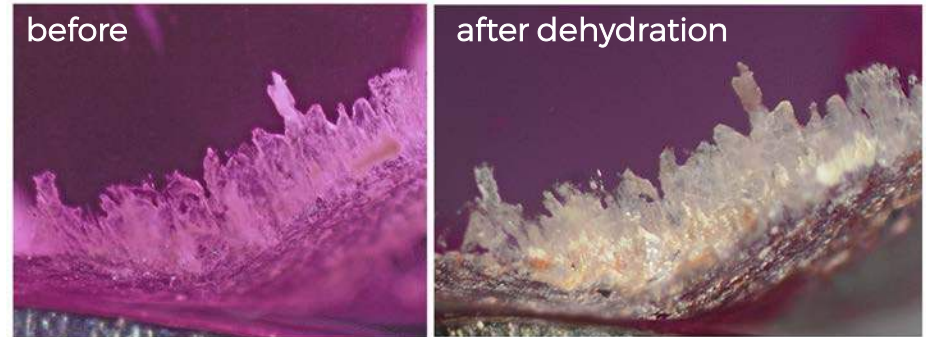
# Heating Experiment: Diaspore to Corundum



Sample 120993\_6  
Diaspore in Burmese ruby (Mogok)



dotted vertical lines: main diaspore peaks

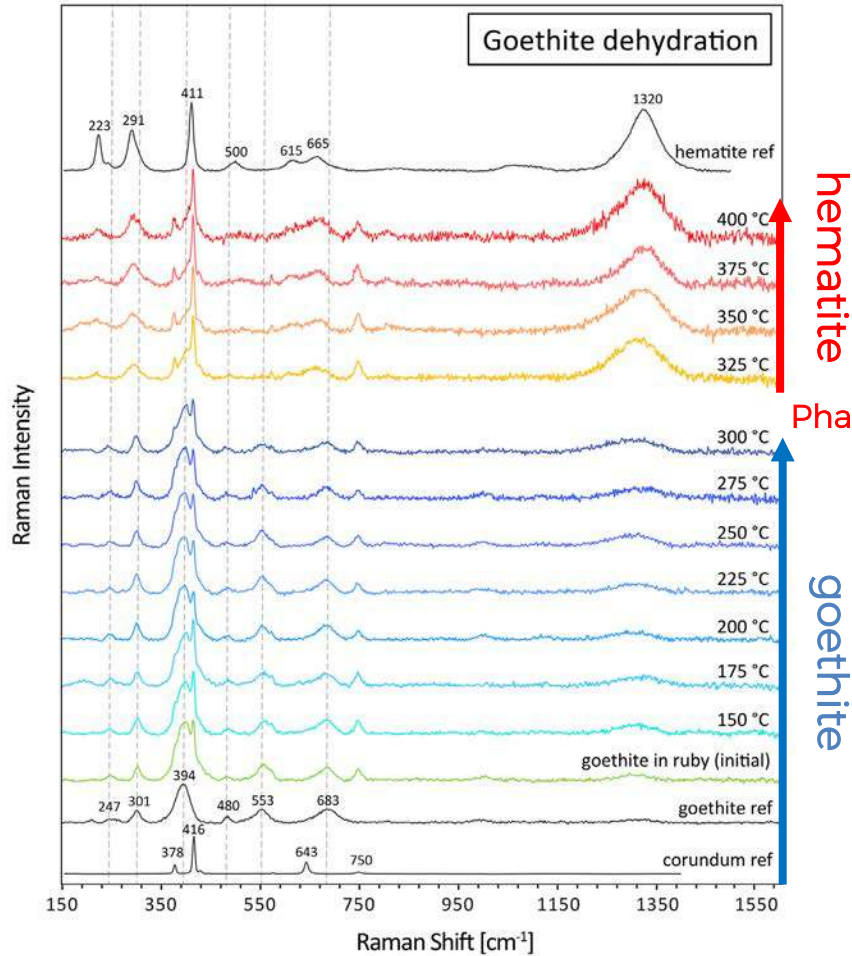


Diaspore in ruby (image width 2mm).

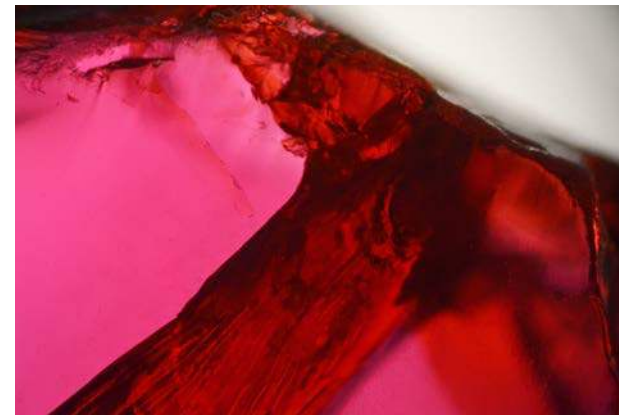
# Heating Experiment: Goethite to Hematite



Sample 85933\_C3  
Goethite in Mozambique ruby



dotted vertical lines: main goethite peaks



Goethite in fissure in ruby



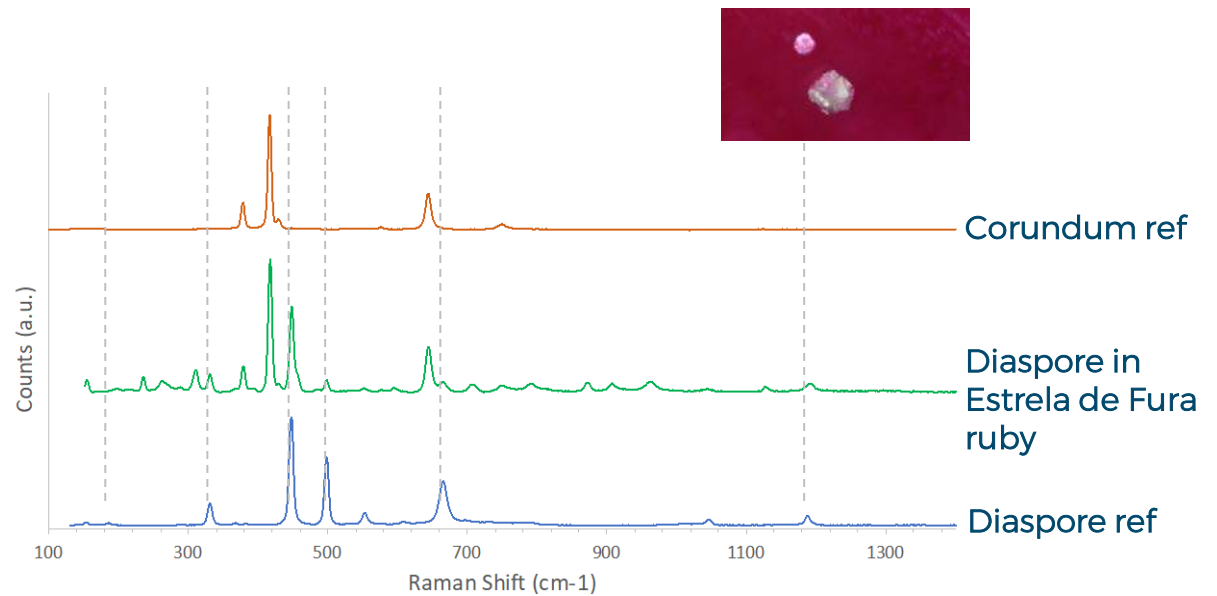
# | Real Cases



from Sotheby's International

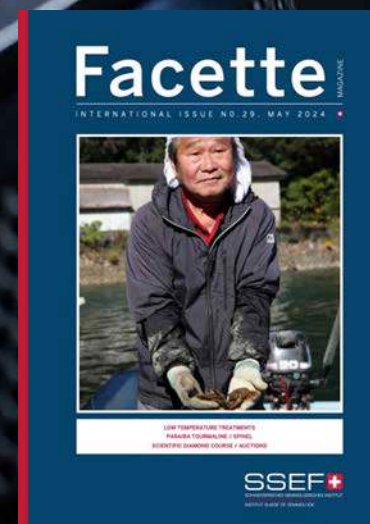
Estrela de Fura 55.22 ct

Sold at Sotheby's auction in June 2023  
for record \$34.8 million.



**Diaspore detected in fluid inclusion !**

# THANK YOU FOR YOUR ATTENTION



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