News from the SSEF laboratory:

Research findings, exceptional treasures and gemmological 'oddities'

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Jadeite from Kazachstan

A petrological and petrographical analysis

Bachelor thesis of Kristina Ernst
University Basel

Jadeite grain with brownish omphacite ongrowth (Ca metasomatism) in jadeite-jade from Kazachstan. Photo with crossed polarizers. © K. Ernst, University Basel
Black chromite grain with fibrous kosmochlor (green) and surrounded by fine granular colourless jadeite and greenish larger richterite (amphibole) formed during retrograde Ca-supply. Photo © L. Franz, University Basel.
Gemtrade Nomenclature

CIBJO: The World Jewellery Confederation

Jade
is a general term describing two different minerals (jadeite and nephrite) in their massive form, as polycrystalline, quasi-monomineralic rocks. The term jade is usually used as a suffix after the mineral name.

HOKLAS
The Hong Kong Laboratory Accreditation Scheme (ISO 17025; 2006)

Fei Cui
翡翠
is a granular to fibrous polycrystalline aggregate. It is composed of jadeite as major mineral. It may consist of other minor minerals such as omphacite, kosmochlor, amphibole and feldspar.

New addition 2013 to include omphacite- and kosmochlor-jade into the Fei Cui definition (GAHK)

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The Hutton-Mdivani Jadeite necklace

Sotheby’s Hong Kong April 2014
Sold for world record 27.4 mio US$.
SSEF Test Report 73188 + Appendix
High translucency and excellent lustre (A-Jadeite Jade)

Treated Jadeite-Jade (B + C –type)
Dyed opal from Ethiopia

Dyed opal from Wollo, Ethiopia

© Swiss Gemmological Institute SSEF
Treated brown star sapphire (Thailand)

Fractures with air bubbles and Pb-glass filling showing air bubbles and „flash“ effects

Smoked Topaz 😊

Jewellery in the barbecue ??
A stone from a very distant star...

Reversible colour change when exposed to sunlight

...or rather from a “starlet” ...

Photochromatic artificial glass
Exceptional colour change garnet

Member of the pyrope – spessartine series with chromium and vanadium traces

140 ct

Exceptional colour change garnet

Colour change and Usambara effect !!
The classical source:
Spessartine from Kunene, Namibia

21.13 ct

Spessartine from Nigeria

Total weight of collection 328 ct

45.62 ct 43.22 ct 46.38 ct
Spessartine from Mogok

Spinel from Mahenge

Each Spinel > 40 ct
Epangko spinel mines (near Mahenge)

Spinel from Tajikistan (historic Kuh-i-Lal mine)

Christie’s Geneva Sale, May 2014
Lot 177

From 61.50 ct to 202.67 ct
With freshwater cultured pearls

With engravings of ten Mughal Emperors of the 17th and beginning 18th Century
Spinel from Vietnam (Luc Yen)

- Characteristic inclusions in Vietnamese spinels
- Blue Co-spinel from Vietnam: A spectroscopic study
- Bachelor thesis of Carina Hanser
  University Freiburg i. Br. (Germany)

- Greenish reaction under UV light
Verneuil synth. spinel

Sample from SSEF collection
Produced by Djeva SA (Switzerland)

light blue Ni-bearing synthetic spinel (Verneuil)

Blue Co-spine from Vietnam:
A spectroscopic study
Bachelor thesis of Carina Hanser
University Freiburg i. Br. (Germany)

dark blue Co-bearing synthetic spinel (Verneuil)

Unheated Cu-bearing tourmaline from Mozambique

ED-XRF spectrum

UV-Vis-NIR spectra

40.96 ct
Paraiba-tourmaline intergrown with lepidolite mica

PT = Paraiba tourmaline
L = Lepidolite

Anyolite, fancy trade name for zoisite-amphibole-ruby intergrowth.

Raman spectra

- PT = Paraiba tourmaline
- L = Lepidolite

Counts

Raman shift (cm⁻¹)
Melo pearls
Air)
bubbles
and
slight
negative
profile
of
filled
cavities
at
Melo
surface

Amber?

© Swiss Gemmological Institute SSEF

Man-made product of small natural resin pieces in plastic matrix
Problem solved at SSEF...

Anyolite, fancy trade name for zoisite

PT = Paraiba tourmaline

L = Lepidolite

Diamond testing
Imagine how to sort out imitations, synthetic diamonds, and HPHT treated diamonds from these melee diamonds?

Diamond testing at SSEF

Diamond grader and gemmologist Luc Phan @ SSEF

Automated Spectral Diamond Inspection ASDI

Check http://www.ssef.ch/asdi
Ruby necklace of the Tsar...
...and Queen Marguerita’s brooch

Emerald brooch of Queen Marguerita of Savoy (1851-1926), and was given to her by her mother the Duchess of Genoa at the occasion of her marriage to Crown Prince Umberto I in 1868.

This brooch is actually the centre-piece of her emerald necklace.

What a nice antique emerald parure

containing Zambian emeralds.
Unfortunately fake ...

containing Zambian emeralds

Quiz: 109 Emeralds, 6 grossularite garnets and one fluorite.
Renaissance Necklace

And what’s up with the Royals...
The Württemberg Parure
a historic pink topaz jewellery set

Pearl and emerald tiara
Pearl and emerald tiara

© Swiss Gemmological Institute SSEF

Beware of hair-styling!

Pearl

£80,000 - £120,000

Hammer Price £680,000

Lot: 1903

Woolley & Wallis sale 1st May 2014

Saltwater natural pearl
33.15 ct (132.60 grains)
half-drilled
16.5 – 17.4 mm diameter

SSEF Test Report 72642

(Estimate: £80,000 - £120,000
Hammer Price £680,000
Lot: 1903
Woolley & Wallis sale 1st May 2014
Abalone pearl

168.78 ct

159.75 ct

306.461 ct (1225.84 grains)
Length approx. 83 mm

Pinctada maculata:
Pipi pearl oyster
New pearl treatment:

There was only a slight increase in yellow seen when comparing the treated samples with the untreated ones submitted to SSEF.

However, as we have not seen the original colour of the treated samples, we do not know how strongly this treatment has affected their colour.
Unpolished Melo pearl

Melo pearl with cavity filled with artificial resin

Air bubbles and slight negative profile of filled cavities at the Melo surface

White LWUV reaction of filled cavities

© Swiss Gemmological Institute SSEF
Pearl “chanterelle”

Distinguishing natural from cultured pearls:

All saltwater natural pearls except the pearl in the centre which is a beadless saltwater cultured pearl of *Pinctada maxima*. 
Internal structure of a natural pearl

tiny aragonite platelets (nacre)

prismatic calcite

Pinctada radiata

X-ray Microtomography of a beadless CP

Irregular cavity

Beadless freshwater cultured pearl from China (Unio)
Sample mxt-1
Beaded cultured pearl from *Pinctada maxima*
Sample MXT 14b (5 microns resolution)

Cultured pearl with a bead

Bead carved from Mississippi-freshwater shell

Organic matter (Conchioline)
Calcium-oxalate and –phosphate aggregates in human or animal body

Kidney stones as a result of injured / regenerating epithelium cells in the kidneys.

Tokki Cultured pearls

Photo © H.A. Hami, SSEF
Formation model for Tokki cultured pearls

Two tissues become one

grafting formation of independent additional CP
calcium carbonate CaCO₃
conchioline-rich layers

Two tissues become one

grafting formation of independent additional CP
additional CP remains loose

© M.S. Krzemnicki, 2011

Loose additional cultured pearl (Tokki)

Sample mxt 37.20
Identification of shell species from the DNA of pearls

Collaboration between SSEF an the Institute for integrative Biology (ETHZurich) under supervision of Prof. Bruce McDonald

- Pinctada radiata,
- Pinctada maxima
- Pinctada margaritifera

(mixed in the picture)
Findings of the DNA-Study:

- Identification of shell species is generally possible (enough organic material)
- DNA can be analysed even when pearl is dried out after years of wearing.
- Tiny sample from drill hole is usually sufficient.

<table>
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<tr>
<th>P. maxima</th>
<th>P. radiata</th>
<th>P. margaritifera</th>
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Outlook:

- Geographic distribution of shell populations
- “Geographic origin” of pearls from DNA analyses

Population structure and patterns of genetic variation in a pearl oyster (*Pinctada radiata*) native to the Arabian Gulf

Amal Al-Saadi, 2013 (University of Queensland, Brisbane, Australia)
**14C Age dating of Pearls**

Figure 4. Calibrated ages of two historic pearls ETH-46322 and ETH-46323 that were formed before the bomb peak. Both pearls originate from the Arabian Gulf, and were calibrated using marine calibration curve INTCAL09 (Reimer et al. 2009) and ΔR=190:180 188.

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**14C Age dating of Pearls:**
as an additional test to support distinction between natural and cultured pearls

1900

Only natural pearls in the trade

1968 Chinese freshwater cultured pearls, *Unio*

2001 "Keshi" beadless saltwater cultured pearls enter trade in large quantities, *Pinctada maxima*

2009 saltwater cultured pearls with natural pearl beads *Pinctada maxima*

1916 Mikimoto beaded saltwater cultured pearls, *Pinctada margaritifera* Northern Australia

1960 beaded saltwater cultured pearls, *Pinctada maxima* Southern Japan

Pre 1900 first attempt for pearl cultivation (mostly Mabe) in Japan, Australia, Europe

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To confirm a documented historical provenance of a pearl.
14C age dating of Pearls:

Shell of *Pinctada maxima* from the Philippines, collected in 1990 (pers. comm. H.A. Hägni)

*Visit at Paspaley in North Australia*
Jade, since thousands of years, a mythical stone appreciated in the Far East and in the high cultures of native Americans, is currently again rising high and is sought after at auctions in Hong Kong and elsewhere.

Harvesting a natural pearl from Pinctada maxima...
Visit to Mogok: January 2014

Jade market in Mandalay
Baw mar sapphire mine

„Kanase” looking for spinels, rubies and sapphires, washed from gravels in carstic marbles at Inn Chauk
Thank you for your attention