SSEF

SCHWEIZERISCHES GEMMOLOGISCHES INSTITUT
SWISS GEMMOLOGICAL INSTITUTE
INSTITUT SUISSE DE GEMMOLOGIE

THE PEARL FORUM
INHORGENTA Munich
15th February 2014

Outlook on pearl treatments and pearl testing

Dr. Michael S. Krzemnicki
Swiss Gemmological Institute SSEF
www.ssef.ch

Necklace with exceptional South Sea cultured pearls (SSEF 59459)
(diameter approx. 15 - 18 mm) from Pinctada maxima (silver-lipped pearl oyster)

World record at auction for necklace of exceptional saltwater natural pearls

With pearls measuring from 10.4 to 13.7 millimeters (SSEF 66235),
Sold for $8.5 million at Christie's Geneva in May 2013

Photo © Luc Phan, SSEF

The SSEF is testing and certifying pearls for the trade to maintain the confidence of the consumers in the product.

Main questions are:

- Is the pearl natural or cultured ?
- Is it from freshwater
  or saltwater molluscs ?
- Is the pearl treated, and how ?

- Eventually what is the species ?
- Eventually what is it's age ?

To solve these questions, SSEF is since many years strongly focussing it's research activities on pearls.

SSEF

Test Report No.SPECIMEN

on the authenticity of the following pearls, strung on a necklace

Shape:	round to roundish and button-shaped, drilled
Total weight:	approximately 35.2 grams (including thread and clasp)
Diameters:	approximately 5.45 - 6.80 - 10.20 - 6.70 - 5.55 mm
Total length:	approximately 48 cm
Colour:	slightly cream to light cream, partly with rosé and green overtones
Identification:	regularly graduated necklace of 64 NATURAL PEARLS
Comments:	The analysed properties confirm the authenticity of these saltwater natural pearls.

SWISS GEMMOLOGICAL INSTITUTE - SSEF

Basel, 19 October 2011 cy

P. LeNevre, MSc, DUG

Dr. M.S. Krzemnicki, FGA

Natural or Cultured ??

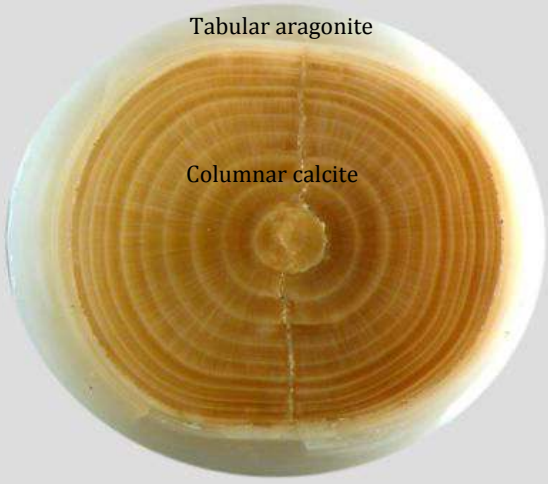
Natural pearls are forming accidentally and **without** any human intervention in a wild shell, living in its natural habitat.
Cultured pearls are produced in molluscs in a pearl farm, either with a shell bead in the centre or without bead.

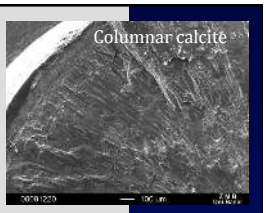
Photo: Mikimoto Pearl Museum

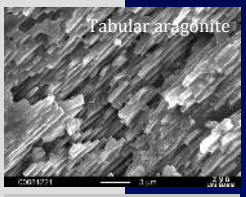
All saltwater natural pearls, except centre pearl which is a beadless cultured pearl („Keshi") from Pinctada maxima.

SSEF

Internal structure of a natural pearl



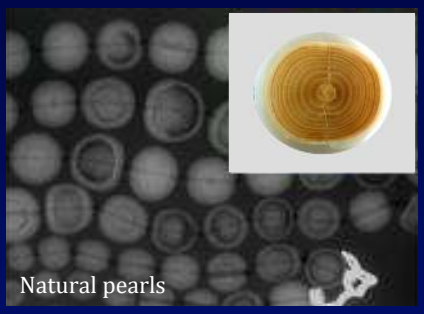




...is reflecting the structure of the shell in which it has grown

Photos © H.A. Hänni, SSEF & M. Düggelin, Centre for Microscopy, University Basel

X-ray shadow images : radiography



For many decades, radiography is the method commonly used for pearl identification

Photos: H. A. Hänni

X-ray micro-tomography (CT scan)

Scanco µCT 40 Scanner at SSEF

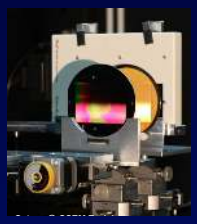
Photo © H.A. Hänni, SSEF

Natural pearl (P. radiata)

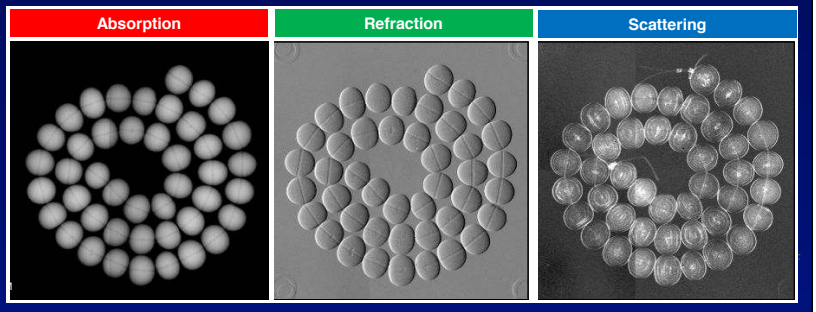
to visualize internal structures of pearls in 3 dimensions.

SSEF

New SSEF research project: Extended possibilities in pearl-radiography



Example:
Beadless cultured pearls (dyed) from China



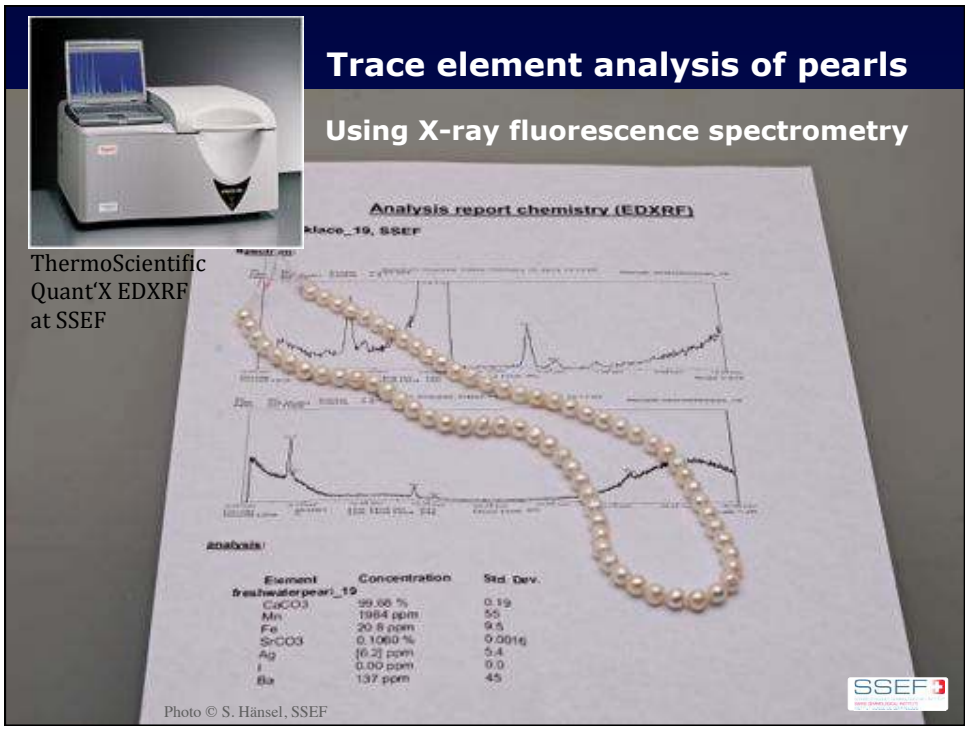
SSEF

Cultured Pearls with „new beads“ the next challenge...

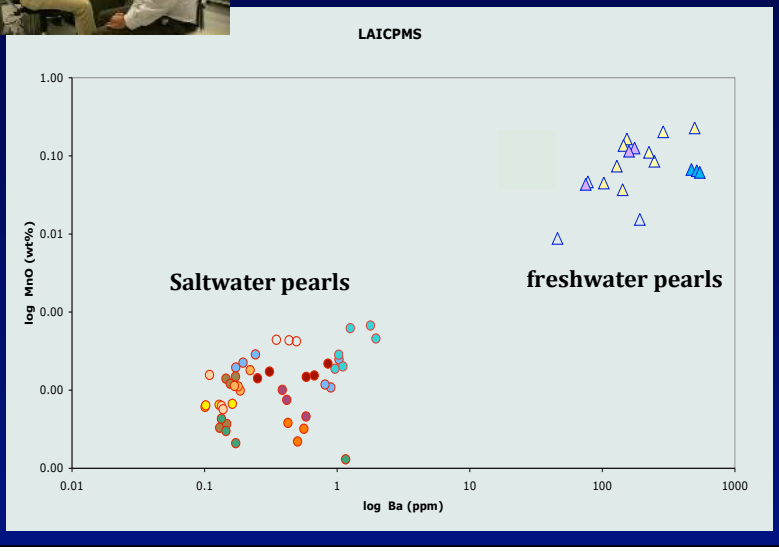
SSEF Trade alert in May 2010
http://www.ssef.ch/research-publications/press-releases/

Beaded cultured pearl from *P. maxima* with a natural pearl used as „bead“


necklaces in light
saltwater
freshwater
Photos © H.A. Hänni, SSEF
necklaces under x-rays
X-ray luminescence of pearls
analysed at SSEF
with the PearlView system
X-ray luminescence of natural and beaded cultured pearls
(bead = freshwater shell bead)
SSEF

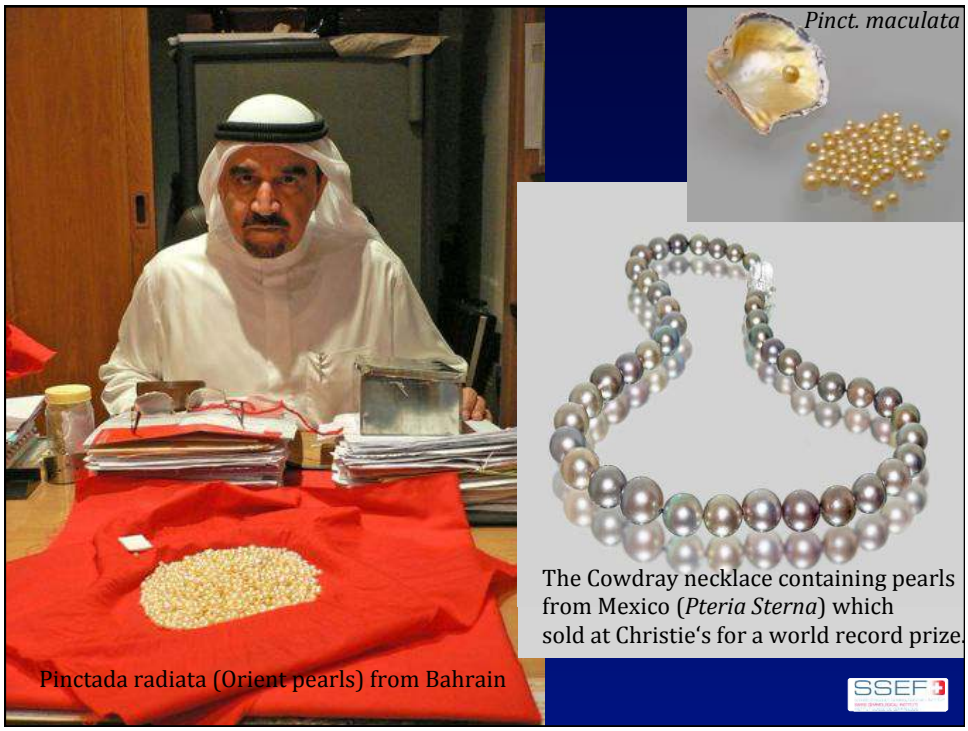

Trace element analysis of pearls
Using X-ray fluorescence spectrometry
ThermoScientific
Quant'X EDXRF
at SSEF
Analysis report chemistry (EDXRF)
Element
Concentration
Std. Dev.
CaCO3
Mn
Fe
SrCO3
Ag
I
Ba
Photo © S. Hänsel, SSEF
SSEF

Trace element analysis of pearls
using LA ICP mass spectrometry



Which species ?

Photo: Hubert Bari

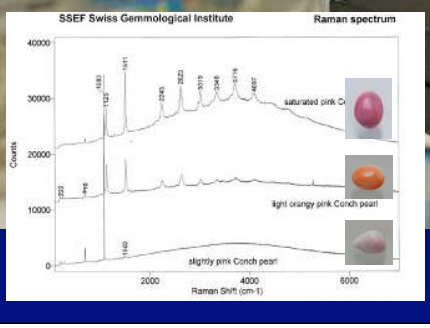

Pinct. maculata
Pinctada radiata (Orient pearls) from Bahrain
The Cowdray necklace containing pearls from Mexico (*Pteria Sterna*) which sold at Christie's for a world record prize.
SSEF


Harvesting a natural pearl from Pinctada maxima...
SSEF

Simple testing may do...

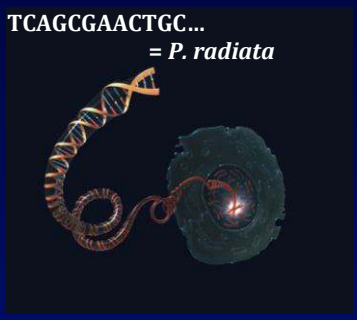
Pearls (and shell) of Pteria Sterna show a characteristic and distinct red fluorescence reaction under a longwave UV-lamp.

But often sophisticated methods are required



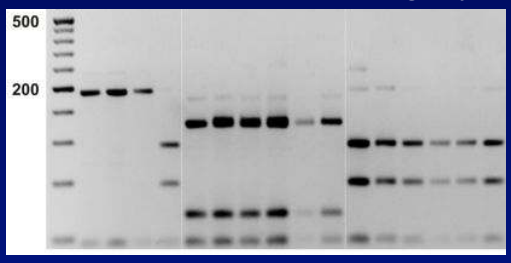
Raman spectra of Conch pearls *(Strombus gigas)* of different colour and saturation.

TCAGCGAACTGC…
= *P. radiata*



DNA fingerprinting of pearls

P. maxima *P. radiata* *P. margaritifera*



SSEF
SCHWEIZERISCHES GEMMOLOGISCHES INSTITUT
SWISS GEMMOLOGICAL INSTITUTE
INSTITUT SUISSE DE GEMMOLOGIE

Press Release For Immediate Release

SSEF - ETH Zurich collaboration achieves major breakthrough in pearl research: DNA fingerprinting and age dating of pearls

Basel, Switzerland –October 16, 2013: Researchers at the Swiss Gemmological Institute SSEF and the Swiss Federal Institute of Technology Zurich ETHZ have successfully extracted oyster DNA from pearls, allowing them to trace and fingerprint pearls from different origins. This is the first report of oyster DNA extraction from a pearl. The researchers' results have just been published in the international open-access journal PLoS ONE, and the technology is currently being patented.

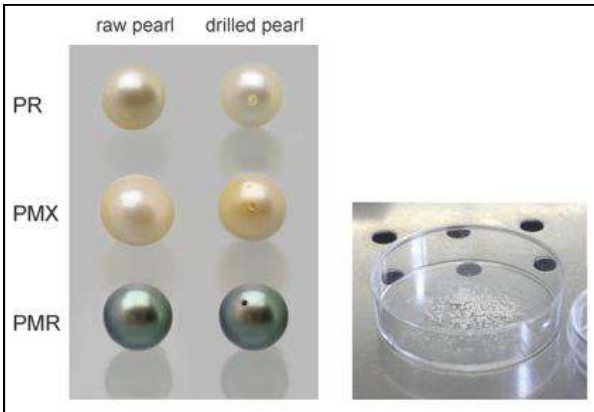
The team of Swiss researchers was able to recover minute amounts of DNA from a wide range of pearls. The amount of recovered DNA was sufficient to identify the mother oyster species of studied pearls. The sampled pearls came from *Pinctada maxima*, *Pinctada margaritifera* and *Akoya* oysters, which are the most important species in the trade of natural and cultured marine pearls. Samples also included *Pinctada radiata* pearls from the Arabian/Persian Gulf, *Pinctada maxima* from both Australia and Indonesia and *Pinctada margaritifera* from Fiji and French Polynesia.

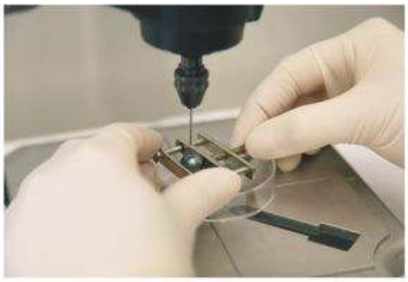
By collaborating with the Institute of Integrative Biology (IBZ) of ETH Zurich, the research team had access to extensive DNA extraction expertise and technology. The project was led by Dr. Joana Meyer of ETH Zurich and Laurent Cartier of SSEF. This two-year research project funded by the Swiss Gemmological Institute SSEF was carried out to advance knowledge about pearls and to investigate the possibility of using DNA to carry out geographic origin determination of pearls.

An important part of this project was the development of a practically non-destructive technique to extract DNA so as to preserve the commercial value of tested historic and modern pearls. In one sample, 10 mg of drilled sample powder (see figure below) was sufficient to successfully identify the pearl-oyster species based on extracted DNA material.

Dr. Michael S. Krzemnicki, director of SSEF, commented: "This is a breakthrough in pearl science and opens up new and interesting opportunities for future pearl research and testing. We are constantly exploring new scientific methods to test pearls and are excited about this new method we have developed in collaboration with scientists at ETH Zurich, one of the world's leading universities."

SSEF





Dr. Joana Meyer, head of project

Outlook:

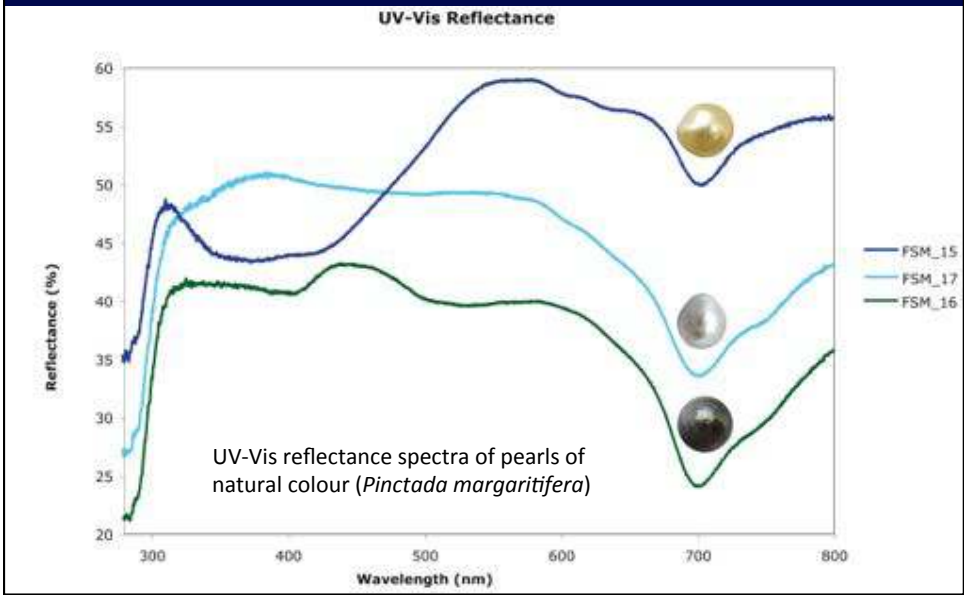
Determination of shell population by DNA analysis

= geographical „origin of formation“

SSEF

Treated / worked / fake pearls ?

Testing colour authenticity of pearls

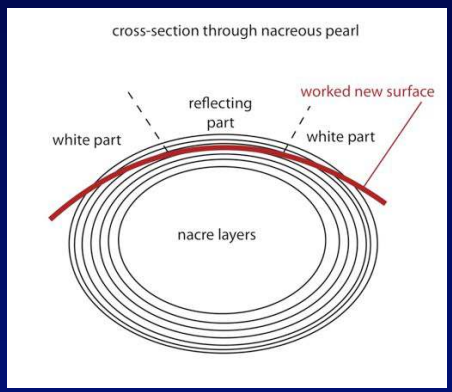


UV-Vis reflectance spectra of pearls of natural colour (*Pinctada margaritifera*)

Microscopic observations

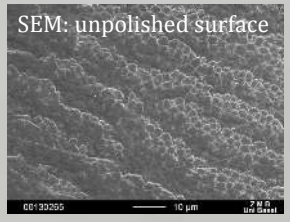
a visual examination with the loupe and the microscope can already reveal important information.

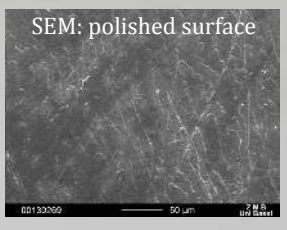
Worked surface of pearls



very common „treatment“ for natural pearls

Polished surface of pearls





Not considered a „treatment“ .
Nearly all pearls

Worked beads from shells (fake pearls)

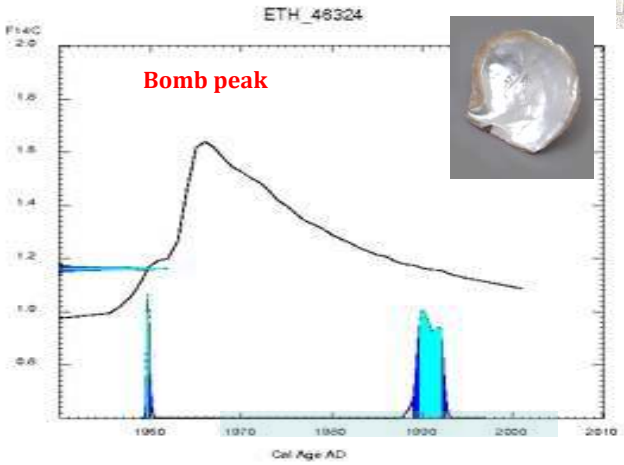
Age of pearl ?

...to support the documented historical provenance of a pearl

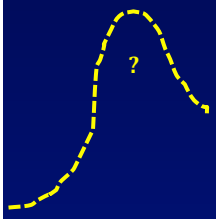
SSEF

Radiocarbon dating of pearls:

Shell from *Pinctada maxima (Silverlip pearl oyster)* from the Philippines, collected 1990 (pers. comm. H.A. Hänni)

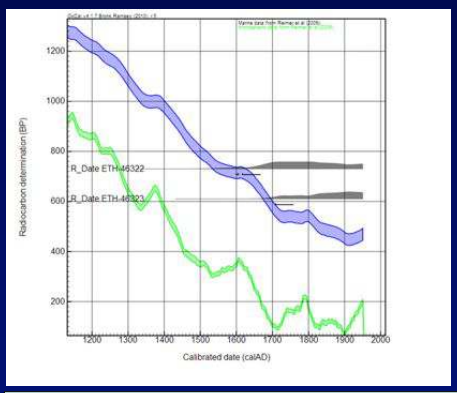


Kim Jong Boom ??



SSEF

Radiocarbon Dating of Pearls:



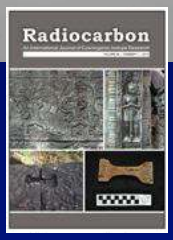


Figure 4. Calibrated of ages of two historic pearls ETH-46322 and ETH-46323 that were formed before the bomb peak. Both pearls originate from the Arabian Gulf, and were calibrated using marine calibration curve INTCAL09 (Reimer et al. 2009) and ΔR=190±180 yrs.

SSEF

La Peregrina Pearl
Sold at Christie's New York
for US$ 11 mio.

Tested and certified by **SSEF** !


Thank you for
your attention
Facette
Facette
Facette
Photos © Luc Phan, SSEF
Get more pearl news at www.ssef.ch
SSEF