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SWISS GEMMOLOGICAL INSTITUTE
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Christie's Expert Lecture
Sunday 27th May 2012

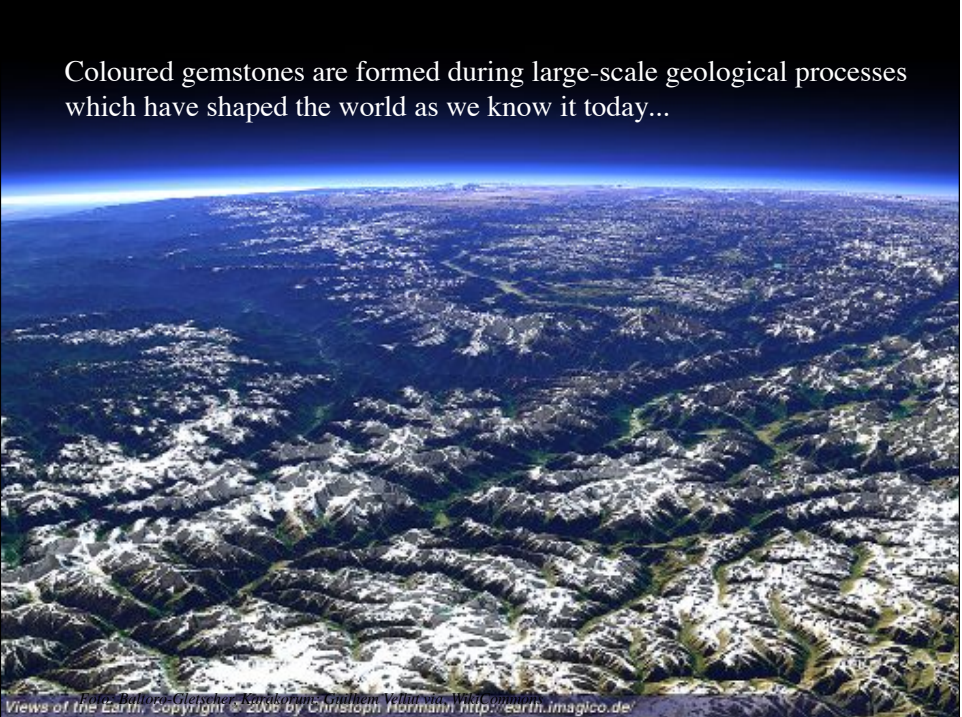
**Colourful Treasures of Nature:
Ruby, Sapphire, Emerald &
Pearls**

presented by
Dr. Michael S. Krzemnicki
Swiss Gemmological Institute SSEF

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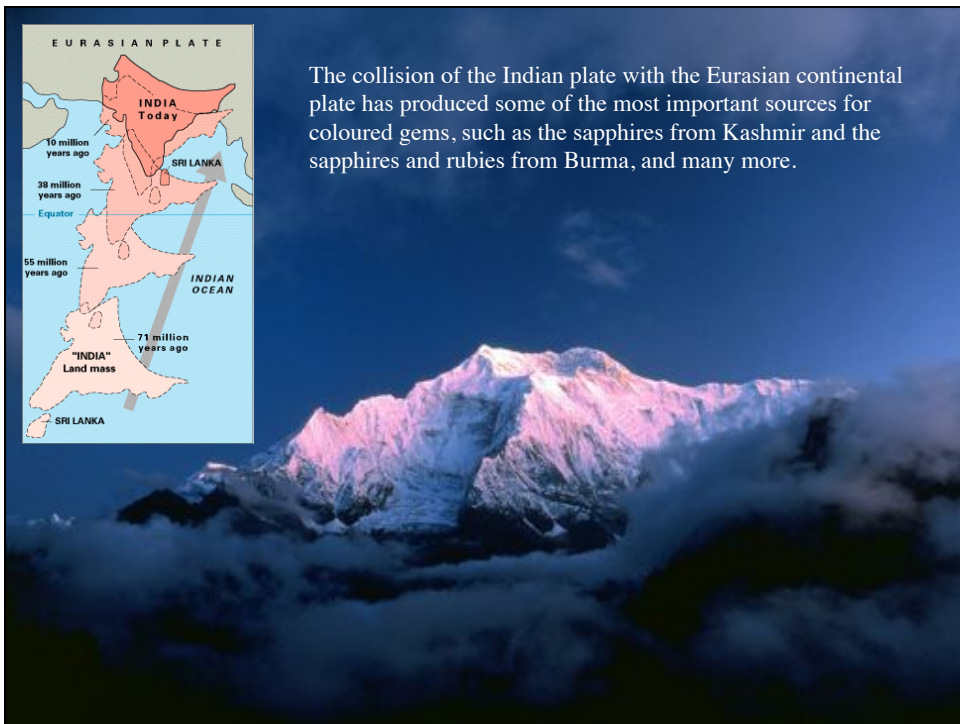
Coloured gemstones are formed during large-scale geological processes which have shaped the world as we know it today...



Views of the Earth, Copyright © 2007 by Christoph Reinmann <http://earth.imagico.de/>

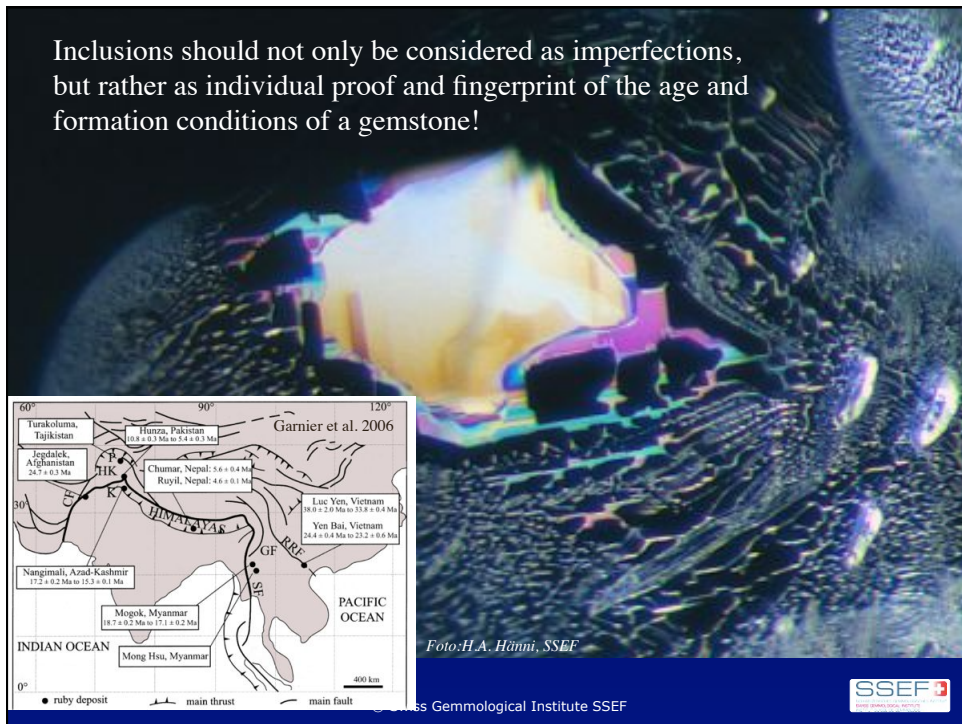


Foto: Baltoro-Gletscher, Karakorum; Guilhem Vellut via, WikiCommons



The collision of the Indian plate with the Eurasian continental plate has produced some of the most important sources for coloured gems, such as the sapphires from Kashmir and the sapphires and rubies from Burma, and many more.

Inclusions should not only be considered as imperfections, but rather as individual proof and fingerprint of the age and formation conditions of a gemstone!



Inclusions may also be very characteristic for a specific provenance of a gemstone, thus being a valuable proof for its origin.



Blue colour zone in a ruby from Mong Hsu (Burma)

© Swiss Gemmological Institute SSEF



These sources for coloured stones are often known since historic times and their gems have been treasured over centuries for their beauty and rarity.



Bagan, Burma © P. Boegli, Flickr.com

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Where do the stones come from...



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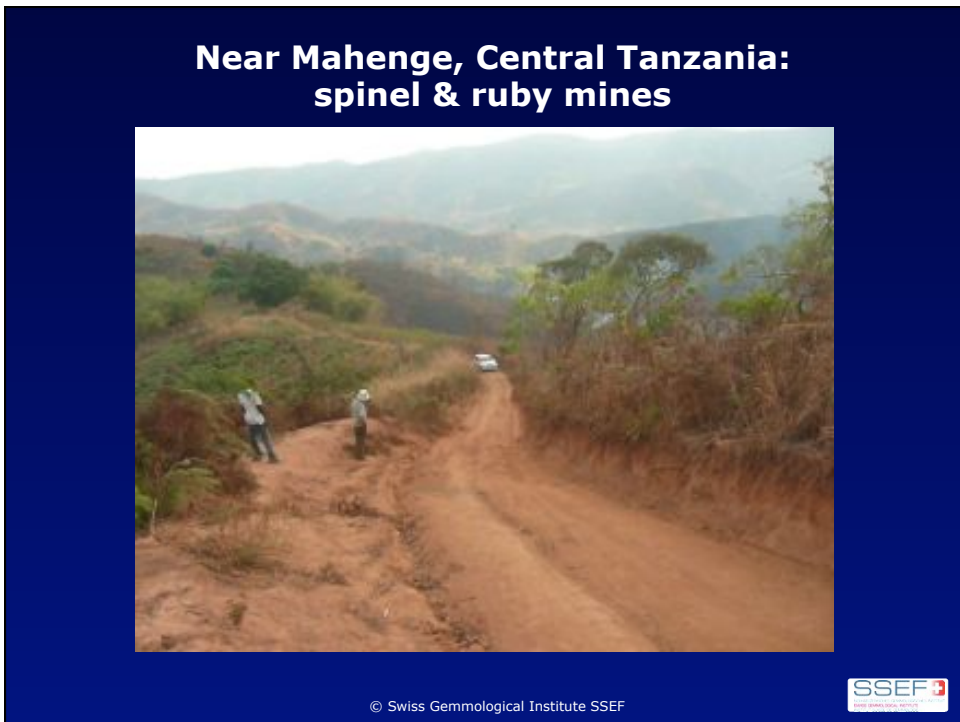
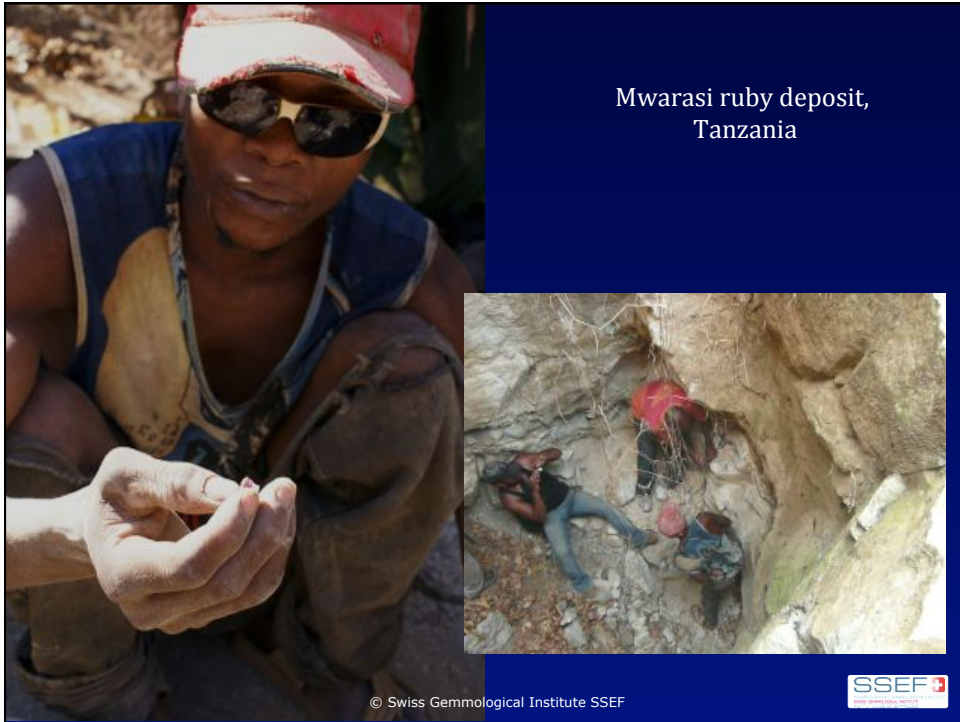




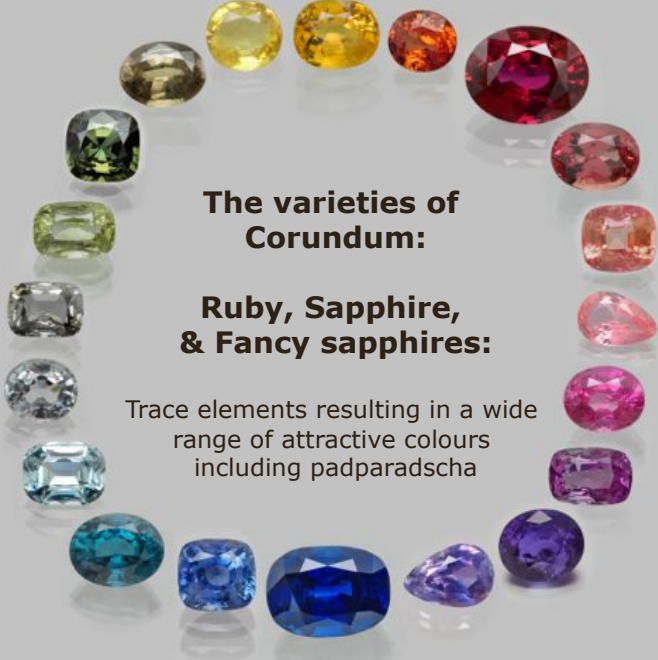
Foto: W. Balmer, 2009

The Umba valley, Northern Tanzania



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**The varieties of
Corundum:**

**Ruby, Sapphire,
& Fancy sapphires:**

Trace elements resulting in a wide
range of attractive colours
including padparadscha



Sapphire



Kashmir sapphire

The Kashmir sapphire mines

from Tom D. LaTouche (1890)
Records of the Geological Survey of India.

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The velvety blue of Kashmir sapphires



Photos © H.A. Hänni, SSEF

Sapphires from Kashmir contain sub-microscopic tiny inclusions which scatter the transmitted light. As a result, these stones often show a highly appreciated **velvety blue** colour.

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3799
A RARE SAPPHIRE AND DIAMOND RING, BY ETCETERA
11.01 ct

SSEF Gemstone Report No. 63039



© Swiss Gemmological Institute SSEF






Lot **3798**
 A pair of sapphire and diamond
 ear clips by Cartier
 4.70 and 4.60 ct
 SSEF report 62271

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Other sources for sapphire




- Burma (Myanmar)
- Ceylon (Sri Lanka)
- Madagascar
- Tanzania
- Pailin, Cambodia
- Australia
- And many more...

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Photos © H.A. Hänni, SSEF 2004

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Burmese sapphire





Lot 3719
 Burmese sapphire in a Cartier ring, 18.78 ct
 SSEF Gemstone report 62685

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Ceylonese sapphire







© SSEF Swiss Gemmological Institute

T. Waltham, 2011

100 ct unheated Sapphire from Ceylon at SSEF

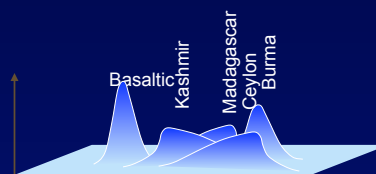
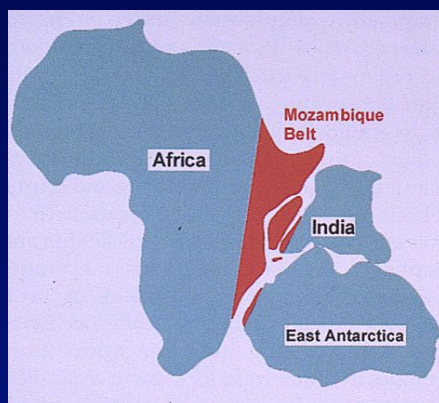
Ceylon (Sri Lanka) is a major source for sapphires and fancy sapphires since many centuries. Many old and historic jewellery contain stones from the so-called „Island of Gems“.



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Origin determination of sapphires



Sapphires in Ceylon, Tanzania, Madagascar were deposited in a large alluvial zone along the Mozambique belt 255 mio years ago.

© Swiss Gemmological Institute SSEF



The Kashmir - Madagascar challenge ?



Inclusion photos © H.A. Hanni, SSEF 2004

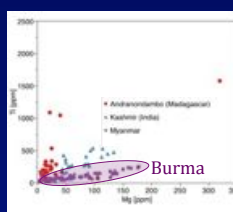
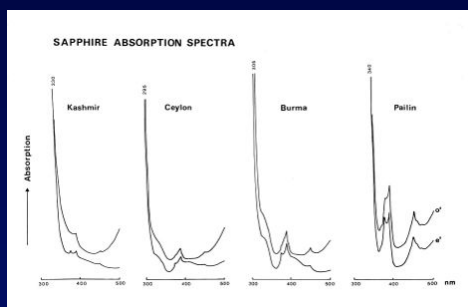
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Origin determination of sapphires

The origin determination of gemmological laboratories is always based on scientific analyses (trace element composition, absorption spectra), inclusion studies (e.g. Raman microspectrometry and FTIR spectrometry) and meticulous microscopic observations.

An origin of a gemstone mentioned on a gemstone report is always an expert opinion.




Lecture at the HK June Show on 23th June afternoon, organised by the Gemmological Association of Hong Kong, www.gahk.org



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Ruby



Burmese ruby



Courtesy of Albion Art collection

The ruby ring of Marie José, Queen of Italy © Swiss Gemmological Institute SSEF





Burmese ruby





Lot **3801**
A superb ruby and diamond ring,
by Etcetera

6.04 ct
SSEF report 59356
& Appendix.

Pigeon blood red



Colour of the ruby





Pigeon blood red

SSEF definition:
Poetical and historical colour term,
describing a saturated and vivid
crimson red colour of gemquality
untreated rubies from Burma
(Myanmar).

The SSEF does not apply this term
to rubies from other sources, nor to
heated stones.

At SSEF stones are compared to
colour charts and reference stones.



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Burmese ruby

...and from Switzerland ☺



Very similar formation

Lot **3707**
A ruby and diamond ring, 3.10 ct
SSEF Test report 62246

© Swiss Gemmological Institute SSEF








Formation of rubies in marbles of Southeast Asia

© Swiss Gemmological Institute SSEF

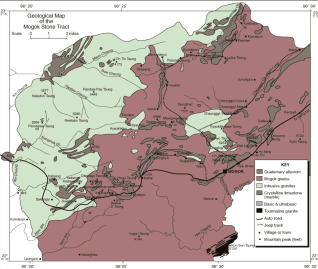


Possible model of formation:



Detrital supply (including Al and Cr) in a carbonaceous platform (lagoon). Metamorphic reactions result in the formation of ruby during the Himalayan tertiary orogenesis:

© JM Fotografie - Fotolia.com




Precambrian - - - Permo-Triassic

- coral reef, volcanic or tectonic barrier
- lagoon deep water
- evaporites (CaSO₄)
- sebkha (halite, sylvite)
- Carbonaceous platform
- detrital supply
- dolomitic carbonates
- carbonates
- silici-carbonaceous sediments
- silici-caliche sediments
- Continental platform, detrital supply

from Garnier et al. 2008

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New sources of excellent rubies in Africa



Excellent ruby of 8 ct from Montepuez in Northern Mozambique.



Excellent ruby of 11 ct from Winza in Central-Tanzania.



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New Ruby Deposit: Montepuez in Mozambique

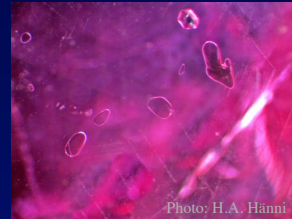


Photo: H.A. Hänni

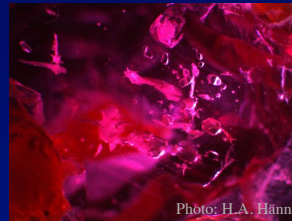


Photo: H.A. Hänni

Inclusions may resemble those of rubies from Mogok in Burma



emerald

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Indian treasures

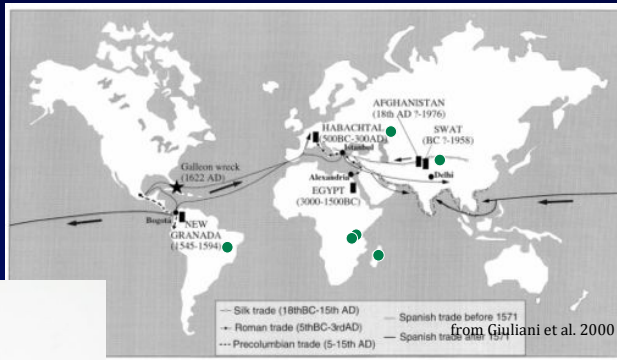


Emerald crystal 635 ct; Panjeer, Afghanistan

© Swiss Gemmological Institute SSEF



Emerald from Colombia




from Giuliani et al. 2000



Colombian emeralds from deposits located in the green foothills of the *Cordillera Oriental* in the Colombian Andes are the most important source for this gemstones since the 15th century up to nowadays.

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SCHWEIZERISCHES GEMMOLOGISCHES INSTITUT INSTITUT SUISSE DE GEMMOLOGIE SWISS GEMMOLOGICAL INSTITUTE		SSEF
Gemstone Report Rapports de pierre précieuse No. 58674 Emeralds-Emeralds		
Weight / Poids / Gewicht	23.792 ct	High / Haute / Alto Color / Couleur / Color Measurements / Mesures / Medidas Shape / Forme / Forma
	23.792 ct	
Identification / Identification / Identificación	E.M.E.R.A.L.D. Emerald The analytical properties confirm the authenticity of the Emeralds (emeralds). No indications of clarity modification. Origin: Colombia	
Number / Numéro / Número	58674	Weight / Poids / Gewicht
Measurement / Mesure / Medida	21.78 x 18.34 x 13.11 mm	Color / Couleur / Color
Clarity / Clarté / Claridad	gem of medium strong inclusion	Measurements / Mesures / Medidas
Comments / Commentaires / Comentarios	The national emerald described in the Gemstone Report No. 58674 by the Swiss Gemmological Institute (SSEF) possesses extraordinary characteristics and shows special features and applications. The national gemstone exhibits an impressive weight of 23.792 ct and a well-balanced good color, combined with an attractive shape and cutting style. The national gemstone resembles emeralds, with the exception that the laboratory of Colombia reported from the last century until now. Mexico, Chile, and China, all reported by the Swiss Gemmological Institute (SSEF) in the Gemstone Report. However, these gemstones do not have the characteristic of a well-balanced fine balance in all color, typical and characteristic for emeralds of Colombia. In addition to this quality, the size of the emerald shows no indications of clarity modification in a further cut. National emeralds from Colombia that are not listed represent a great variety and the national gemstone is thus very exceptional.	
Date / Date / Fecha	Basel, 8 March 2015, 10	
Prepared by / Préparé par / Preparado por	C. Pappe, MSc, GSA D. M. S. Koenig, MSc, FGA	

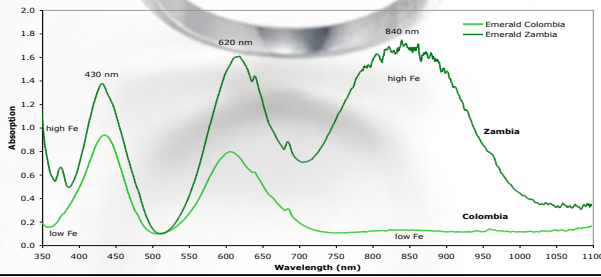
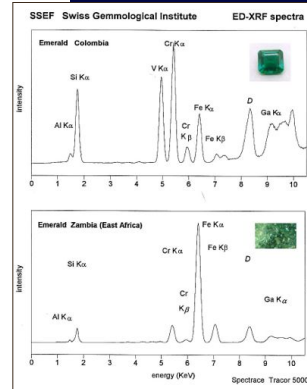
Lot **3796**
 Emerald and diamond ring
 23.792 ct
 SSEF Gemstone Report 58674 & Appendix

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The origin of an emerald is determined using a combination of sophisticated analytical methods and classical microscopic observations.

Lot **3708**
Ring with
Colombian
Emerald



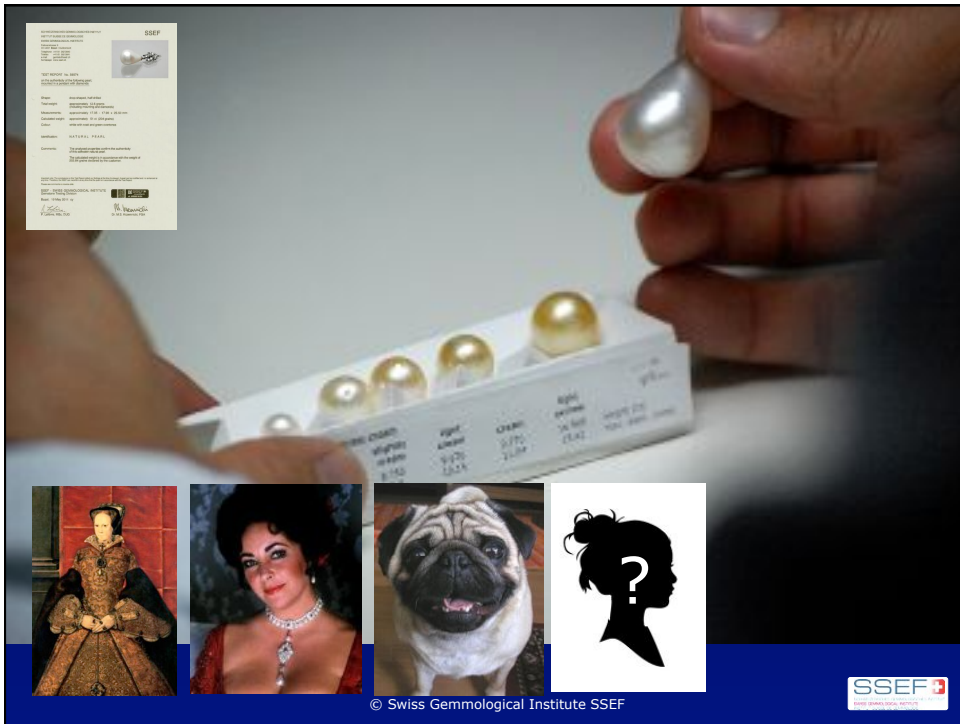
Pearls



La Peregrina Pearl

© Swiss Gemmological Institute SSEF





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Natural pearls versus cultured pearls

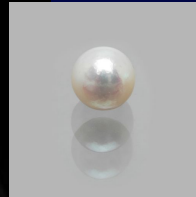
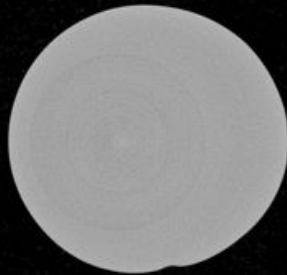


Natural pearls are forming accidentally and without any human intervention in a wild shell, living in its natural habitat.

© Swiss Gemmological Institute SSEF



Pearl identification



Natural pearls show internal structures which can be visualized by X-rays (radiography, X-ray diffraction, X-ray tomography).

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The relation between shell and pearl

We can distinguish between nacreous pearls (with mother-of-pearl) and non-nacreous pearls (with a „porcellaneous“ lustre)



Black-lipped Tahitian pearl oyster (*Pinctada margaritifera*)

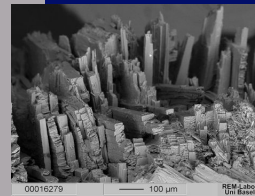


Melo pearls (Melo Melo)
a marine snail (gastropod)

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Flame structures



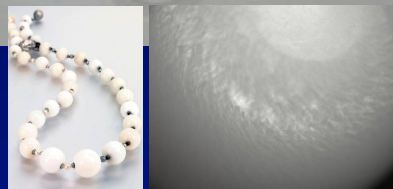
Flame structures due to densely interwoven tiny aragonite fibres in Conch pearls from the Queen Conch (*Strombus Gigas*) from the Caribbean Sea.

© Swiss Gemmological Institute SSEF



Lot **3655**
SSEF Test report 59541 & Appendix

Thirty-one natural pearls from a marine mollusk, mostly exhibiting a delicate flame-structure.



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Pearl "chanterelle"



© Swiss Gemmological Institute SSEF



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3791



3786

Natural pearls

Lot 3786 & lot 3791
SSEF Test reports 61501 & 60296

One necklace with fifty-five (lot 3786) and thirty-five (lot 3791) large saltwater natural pearls of matching shape and fine pearl lustre. Their colour subtly varies from white to slightly cream. Part of these pearls exhibit rosé and green overtones, poetically referred to as „the orient“ of the pearls.

© Swiss Gemmological Institute SSEF



Lot 3787

SSEF Test report 62136

Seventeen saltwater natural pearls of natural colour, combined with distinct purple, blue and green overtones.

Natural pearls



Lot 3790

SSEF Test report 50027

Natural pearl ear-pendants, designed by Wallace Chan

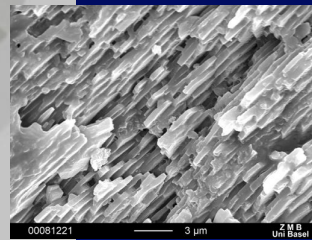
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The „orient“ of pearls



Due to multiple Bragg-reflection (thin film interference) and scattering of light (diffraction) on tiny regular stacked aragonite platelets.



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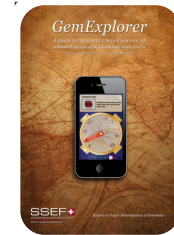
Pearl farm in Ras-Al-Khaimah:

Pinctada radiata



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A guide to the world 's major sources of coloured gemstones, diamonds and pearls.

for more details see www.gemexplorer.org

also as a free App available in iTunes,

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**Thank you for
your attention**



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