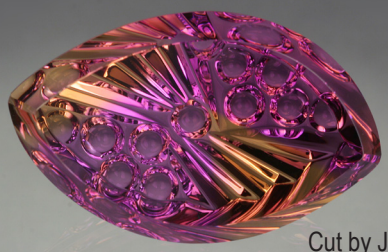


Cut by John Dyer

**GÉRARD QUINTIN** is the CEO and Director of Education for the South American Gem Academy. He is also the founder of the IGB or Gemological Institute of Bolivia. Who better to talk about Ametrine?

# The Legend of Bolivianite (Ametrine)

34.58ct fan-shaped Ametrine cut by Chris Wolfsberg
(Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)

The word 'Amétrine' comes from the contraction of Amethyst and Citrine, which was taken, respectively, from the first two and the last two syllables.

'Bolivianite' also known as Trystine is an appellation from the word 'Bolivianita' from Bolivia which must not be confused with the stannite described by the mineralogist A. Pauly in 1926 under the term 'Bolivianite'.

A Bolivian legend says that during an expedition of the Spanish in the seventeen century, through what is today the eastern Bolivian border with Brazil, a soldier called Felipe de Urriola y Goitia, fell in love with the Pricess Anahí, the daughter of the King of the Ayoreo tribe.

They were married, and as a wedding gift, the King of the tribe offered to Don Felipe a mine producing a beautiful bicolor stone, to which the conquistador didn't pay attention, deeming it not as worthy as gold, silver or emeralds.

When Don Felipe thought it was time to return to Spain accompanied by his wife, the members of the tribe saw this as abandonment and conspired to try to assassinate him to prevent him from leaving. In the course of the confrontation, Anahí was injured by her own tribesmen.

Just before dying from her wounds, Anahí offered to her husband a beautiful stone from her father's mine, a sign of her eternal love.

When Don Felipe opened his hands and saw the two-colored gem perfectly blended honey and purple, he realized that it symbolized the heart of Anahi, torn between her love for her husband and her love for her people.

The actual mine, named Anahi from the legend, is the only significant deposit of Ametrine known in the world and is situated in the western part of Bolivia at the border with Brazil in the Germán Busch province, district of La Gaiba. Occurring in veins of dolomitic limestone of the Murcielago Group standing up above the surrounding Pantanál (a natural region encompassing the world's largest tropical wetland area).

Some ametrines have been found in the Yuruty Mine 50 km north of Anahi, also in Brazil and other African and Asian countries but without economic interest.

The Anahi mine is owned by Ramiro Rivero, CEO of Minerales y Metales del Oriente S.r.l. He is also the owner of a jewelry business in Santa Cruz de la Sierra which can be seen at https://www.anahi.com

The mining exploitation started in 1989 and the extraction of 1.000 kg of ore produces about 4 kg of ametrine. The annual production is about 3.000 kg of gem-quality quartz of which 45% is amethyst, 33% ametrine and 22% citrine.

The exact location of the mining installations and the airstrip are situated 105 km. north of Puerto Suàrez, 22 km. west of lagoon Mandiore (18°03'S – 57°48' W) at the altitude of 180 metres. The mining concession covers an area of about 6.000 acres where most of the mining activity is done underground, with a small amount of production at the surface.

The Ametrine is a monocrystalline variety of Quartz which brings together in a single piece the two colors violet/yellow of the Amethyst/Citrine or purple/beige to brown of the Amethyst/Smoky Quartz.

The coloration of both the amethyst and the Citrine is due to the presence of iron in the crystal structure of quartz. The color difference between the two parts of the stone is due to different stages of the oxidation of the iron.

Belonging to the trigonal system, it has a chemical composition of $SiO_2$ (Silicon Dioxide) with a density 2.65 and a refractive index between 1.54 and 1.55.

The crystal is generally cut in a rectangular shape to ensure the two colors appear next to each other with a zone of gradual transition between the 50/50 mixture of amethyst and citrine.

Now, to add value to the faceted stone it is common to make some OMF (Optically Magnified Facets), otherwise called curved facets. The curved facets add brilliance, keep the stone looking 'alive' from a wider range of viewing angles, and create some very interesting reflection patterns within the stone. To create an OMF gem, the stone has to be faceted with flat facets, and then moved to a special machine to add the curved facets. OMF gems tend to cost more per carat because this is a very time-consuming process and the stone loses weight when the curved facets are added, but the extra beauty and brightness are worth it!

**Synthetic or Artificial Ametrine**

The synthetic monocrystalline colorless quartz, obtained by the 'Hydrothermal' method was developed in the 1950s. The colored crystals, mainly purple (amethyst) and yellow (citrine) have been grown since the beginning of the 1970s. The crystallization from a seed crystal occurs in an autoclave, at pressure and using a moderate heat, in an alkaline solution (NaOH, $Na_2CO_3$ or $K_3CO_3$) or sometimes in ammonium fluoride ($NH_4F$).

Today, the quantity of synthetic quartz of all colors produced for industrial purposes and for use in jewelry is impressive. In the absence of inclusions, it has become difficult or impossible to determine whether quartz is natural or synthetic without the aid of advanced instrumentation in a laboratory.

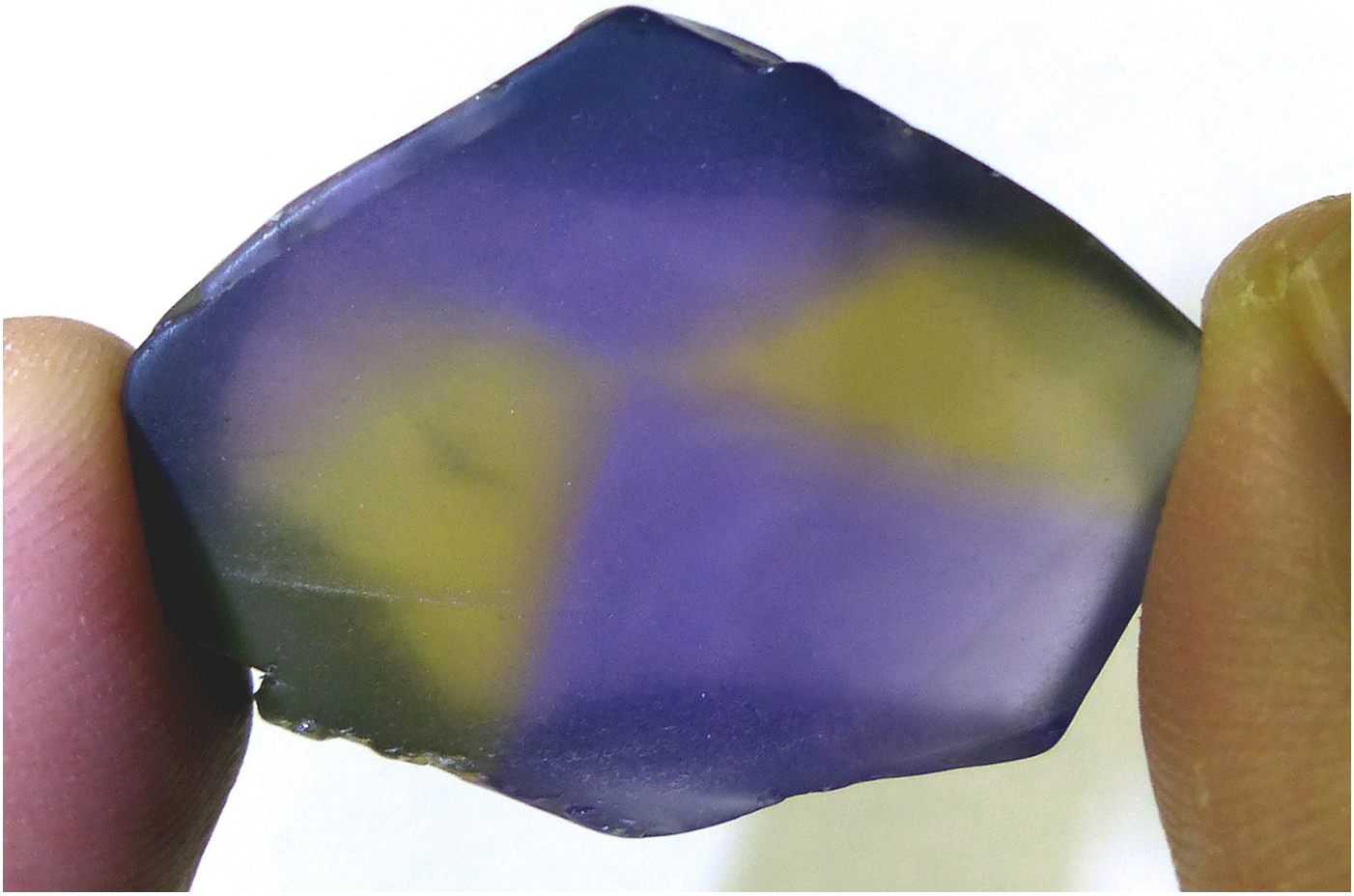
Artificial ametrine can be created by differential heat treatment of amethyst. In 1981, laboratory experiments determined that heat and irradiation can be used to convert natural amethyst into a bicolor material that has an appearance similar to natural ametrine. However this is a costly process and is not known to have produced a significant amount of treatment-created 'ametrine'.

In 1994 in Russia, the Russian Research Institute for Material Synthesis started producing small quantities of synthetic bicolor quartz from alkaline solutions using a hydrothermal process. This synthetic material was cut, mounted in jewelry and sold in the Russian jewelry market. Some of it was exported to other countries and sold as 'ametrine'. However to the trained eye, a majority of this material had a coloration that was different to natural ametrine.

Synthetic ametrine can be identified by employing a combination of techniques, such as EDXRF chemical analysis and IR spectra, inspection of twinning and color zoning using observation and conventional equipment.

The citrine and amethyst color in synthetic ametrine is often more intensely colored than that found in natural ametrine of a similar thickness. Natural ametrine commonly displays a sharp straight boundary between the citrine and amethyst portions. Synthetic ametrine, especially when cut in fancy shapes, sometimes displays a sharp bend in the color boundary. The amethyst-citrine color boundary in the synthetic ametrine is generally oriented roughly parallel to the rhombohedral faces; in natural ametrine it is oriented roughly parallel to the optic axis. The crystallographic orientations of the color zones and the rare stream-like structures in the synthetic citrine portions are distinctive. The color zones are oriented perpendicular to the optic axis, and the stream-like structures are oriented parallel to the optic axis. To locate the optic axis in faceted gems, cross-polarized light should be used in order to provide a reference for checking the orientation of color zones and stream-like structures. For these observations a polariscope with a conoscope will be helpful. In natural ametrine, the color zoning in both the amethyst and citrine portions is oriented parallel to the rhombohedral faces, and the bands usually are spaced irregularly. In the amethyst portions of natural ametrine, Brazil-law twinning is almost always present, and Brewster fringes are often observed. However, Brazil twinning can be seen only rarely in the amethyst portions of synthetic ametrine, in the form of subtle parallel twin lamellae. Due to the variety in forms and patterns displayed by Brazil twinning in both natural and synthetic amethyst this feature should not be used alone to identify a stone as synthetic. However, if a sample does show the 'ideal' curved Brazil twins with Brewster fringes it can be identified as natural. Irregular planes of two-phase (liquid-gas) inclusions are commonly observed in both color portions of natural ametrine. In synthetic ametrine, elongated two-phase (liquid-gas) inclusions are rarely seen.

With the increasing quantity of high quality synthetic ametrine in the market, caution should be of prime importance when buying faceted gems.

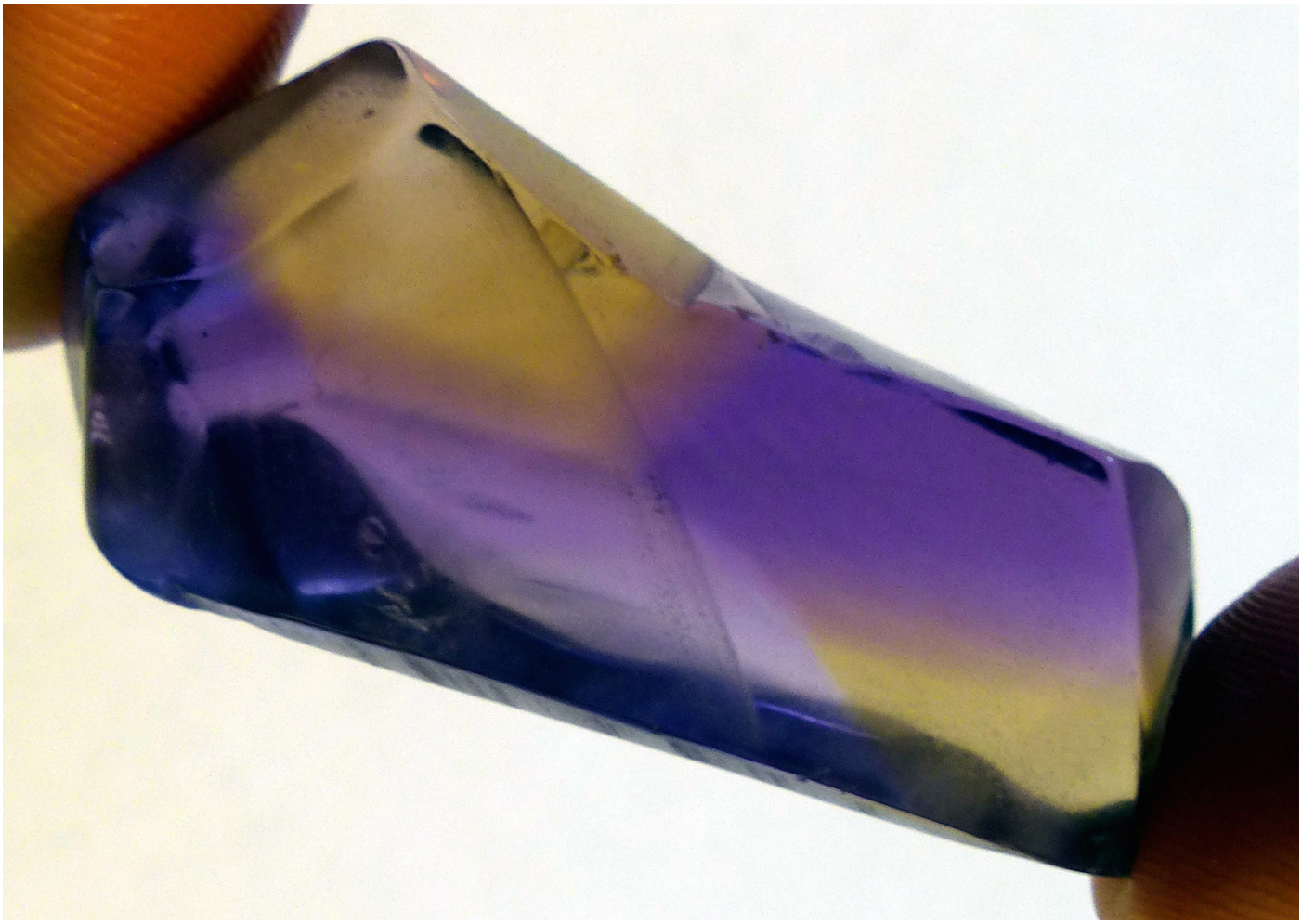


107.50 carat Ametrine Rough (Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)

70.20 carat fan-shaped Ametrine cut by Chris Wolfsberg from the above rough (Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)

119 carat Ametrine Rough (Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)

45.60 carat Ametrine cut by Chris Wolfsberg from the above rough (Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)



95.35 carat Ametrine Rough (Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)

56.64 carat kite-shaped Ametrine cut by Chris Wolfsberg from the above rough (Courtesy of L. Allen Brown/All That Glitters, Methuen, MA)

Lab-created Ametrine Crystals (Photo by Tino Hammid)

Lab-created Ametrine (Photo by Tino Hammid)