Piecing Together the Puzzle of a Heliodor Crystal's Past

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Some specimens come to us fresh from the ground, but others may have histories extending far into the past—histories which can easily become lost and never reconstructed. Once in a while, historical research into the provenance of very old specimens can reveal a fascinating story that adds richness and depth of interest to a specimen—and to the collector experience.

This is the story of a beautiful mineral specimen whose history was put back together, like assembling a complex puzzle from pieces that lay buried in the past. The specimen is a heliodor (yellow beryl) crystal from the Adun-Chilon Mountains of Transbaikalia, in Siberia, Russia. To describe this specimen in words is going to be a challenge, because only when you hold it in your hand can you truly understand its magnificence. It is small, at just over 15 grams and less than 5 cm tall, but what it lacks in size it makes up for in perfection and quality. It is unrivaled in this regard by any other heliodor I am aware of.

I first encountered this specimen when I was shown a video of French collector Eric Asselborn's mineral collection in March of 2004. Eric is a sophisticated collector and had numerous treasures in his collection. Among those treasures were two incredible gem crystals: a small euclase crystal from Colombia and a small, single heliodor crystal from Russia. Both exhibit everything you could desire in a fine mineral, including deep saturation of color, incredible crystal form with wonderfully sharp facets on both the prism and termination faces, and nearly flawless interiors. The two crystals were breathtaking to behold, especially side by side. It is interesting to note that both specimens are quite small. The euclase is 3.3 cm across and the heliodor is about 3.8 cm tall. But the value and importance of a mineral specimen is not solely a function of its size. Some of the finest minerals in the world are as small as a large walnut! There was no doubt that the two pieces were prizes of his collection.

In 2004 Rob Lavinsky and Wayne Thompson purchased a large suite of specimens from the Asselborn collection, and I had the opportunity to acquire many of the best ones. Eric was unwilling to sell all of his treasures, though; he did not want to part with the euclase and the heliodor. However, after much persistence and persuasion from Rob and Wayne, Eric agreed to let the euclase go while retaining the heliodor. I acquired the euclase and had the pleasure of handling one of the finest minerals I have ever held; ultimately, of course, it was sold. I pressed Eric at the time to sell me the heliodor but he would not even entertain offers; the answer was simply "no."

In 2010 Eric decided to concentrate almost entirely on French and Alpine minerals, and was ready to sell another group of fine specimens from his worldwide collection. In this group, at last, was the Russian heliodor. Wayne Thompson handled the sale for Eric and sold the heliodor to Sandor Fuss. The specimen traded quickly at that point from Sandor to Stuart Wilensky and finally to me, each of us becoming a small entry in the specimen's provenance.

When I acquired the specimen I was told that it had a history of some kind, but no details were available from Sandor, Stuart or Wayne, other than the rumor that the crystal had been illustrated in some publication in the early 20th century. Eric told me that the publication was Victor Goldschmidt's famous *Atlas der Krystallformen* (1913–1923). Fortunately I have that nine-volume set in my reference library, so I went to look it up.

Goldschmidt was an incredibly bright scientist. He published many books in his career, and in 1888 he founded the Mineralogical and Crystallographical Institute at the University of Heidelberg, where he was a faculty member. Goldschmidt's *Atlas* is a work of passion and great labor: a comprehensive encyclopedia of crystal morphology gathering together, organizing and reproducing every crystal drawing that had ever been published in the history of mineralogical literature up to that point! The task required a decade to complete and is a tribute to Goldschmidt's perseverance. (See

Figure 1. **Heliodor (yellow beryl) crystal, 4.3 cm, from the Adun-Chilon Mountains, Nerchinsk, Chitinskaya Oblast, Transbaikalia, Eastern Siberian Region, Russia. Jon Sigerman collection; James Elliott photo.**

Wendell Wilson's 1990 article, "Victor Goldschmidt and his Atlas of Crystal Forms.")

Eric said that the beryl crystal appeared as illustration number 105 in volume 1, and I scoured the atlas again, but to no avail. He said that he had acquired the specimen through a trade with the Humboldt Museum in Berlin. During World War II the museum had been damaged by Allied bombing, and some of the areas where the mineral catalogs and labels had been stored were destroyed. The specimens that had lost their history, now devalued in the eyes of the curators, had been transferred to a general collection called the "director's collection." The curators were free to use the specimens for student instruction or trade them for other specimens. Among them was the Russian heliodor.

There was more yet to be revealed, however, regarding the heliodor's provenance. I collect (and have commissioned) mineral paintings by the German artist Eberhard Equit, and by coincidence I acquired one of his original paintings from Ulrich Burchard which includes the heliodor in a group of four specimens from the collection of Gilles Emringer. The painting is reproduced in Equit's book, *The World's Mineral Masterpieces* (2002), a spectacular work with paintings depicting some of the world's greatest mineral specimens, including, on page 213, the heliodor. The painting had originally been commissioned to document some of the finest specimens in Gilles's collection. Gilles and Eric were close friends and often partners in mineral collecting, so the specimen must have gone from one to the other and back again. This added another "chapter" in

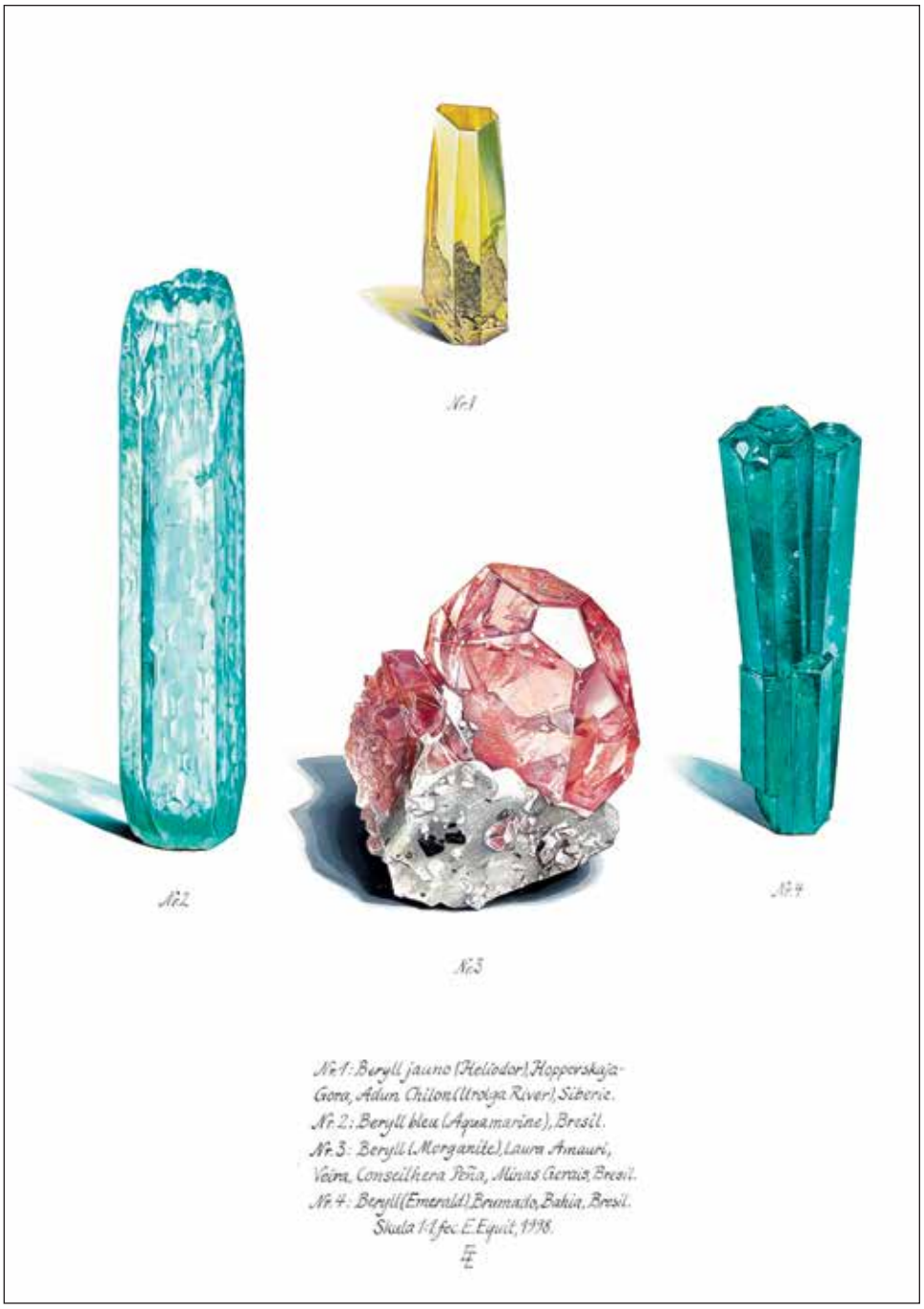


Figure 2. **A painting of four beryl crystals from the collection of Gilles Emringer, by Eberhard Equit, published in his *The World's Mineral Masterpieces* (2002). The Russia heliodor is at the top-center. Emringer attributed the heliodor crystal to Hoppevskaja Gora, a synonym for Adun-Chilon peak.**

the specimen's history. Eager to learn more, I used a scan of the painting to rattle the minds of mineral historians, just to see what fragments of memories would fall out.

Frustrated at not finding the crystal in Goldschmidt's *Atlas*, I called on the Oryctics group (a Google study group), to see if anyone recognized the crystal. The Oryctics group includes some of the most well versed and experienced mineral historians, curators, scientists, and collectors of everything having to do with the history of mineralogy, the science of minerals, and mineral collecting. I applied for membership when I began collecting antiquarian mineral books and instruments, and I was accepted into the group. I have used the group as a rich resource and incredible learning tool, as the cumulative knowledge of the group is profound. The response was immediate. It turns out that I had been confusing the German word *Tafel* ("plate") with "Figure," and had been looking on plate 105 instead of locating Figure 105! And there it was!

Goldschmidt was meticulous in referencing the source of every crystal drawing in the *Atlas*, and the citation for the heliodor drawing was given as *Müller, Zeitschr. Kryst. 1888, 14, 75.* In response to my inquiry to the Oryktics group, Jörgen Langhof, who is Curator of Minerals in the Department of Mineralogy at the Swedish Museum of Natural History, looked the drawing up in Goldschmidt's index as

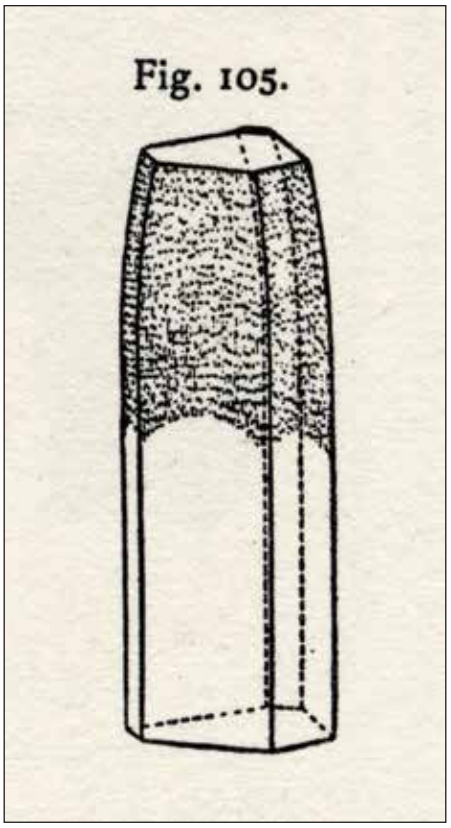


Figure 3. **The drawing of the heliodor crystal as it appears in Goldschmidt's *Atlas der Krystallformen* (1913). Mineralogical Record Library.**

well, and then located the reference containing the original drawing. His email read as follows:

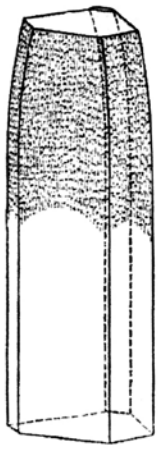
> I checked W(ilhelm) Müller's short note in *Zeitschrift für Mineralogie*, vol 14, page 75 (1888): the title of the article is "Ueber eine Beryll mit eigenthümlich gekrümmten Flächen." ["About a beryl with oddly curved faces"] The crystal was part of "Rittergutsbesizters" Herrn A. von Janson's collection at his Gerdauen Estate in East Prussia. I have located the printed catalogue of A. von Janson in the Hjalmar Sjögren off-print collection in our archive at the Department of Mineralogy here at the museum in Stockholm. The collection was for sale around 1892, and Dr. Wilhelm Müller was hired to catalogue and dispose the collection for Mr. Janson and hence among the interested buyers was the wealthy geologist/mineralogist and collector Hjalmar Sjögren (1856–1922), who was offered the whole collection (500 different minerals in 13,000 specimens). In the catalogue (page 127) Müller counts 130 specimens of beryls only from Aduntschilon!! Interestingly Janson's grandfather was the wealthy and well known German banker and mineral collector Dr. Friedrich Tamnau (1802–1879). I can send you some scans of the *Zeitschrift* note and parts of the catalogue if you want?

Well, *that* was exciting! Indeed one of the characteristics that make this crystal so unique is the curved and bent faces that begin about two-thirds of the way up from the base and continue to the termination. It is a very unusual feature which adds brilliance and an attractive optical effect to the crystal. I call the crystal a gem as it is totally internally flawless as well. When I obtained a copy of the *Zeitschrift* article I found not only the description but also another illustration! A translation of the pertinent portion of the text reads as follows:

> The collection of Mr. von Janson [Alfred von Janson, 1852–1943], owner of the Gerdauen Estate in East Prussia, houses

3. W. Müller (in Berlin): **Ueber einen Beryll mit eigenthümlich gekrümmten Flächen.**

In der Sammlung des Rittergutsbesitzers Herrn von Janson auf Schloss Gerdauen in Ostpreussen befindet sich ein Beryll vom Gebirge Adun-Tschilon, der wegen seiner ungewöhnlichen Ausbildungsweise einer besonderen Erwähnung werth erscheint.



Der von seiner Matrix entfernte Krystall besitzt eine Länge von 4,3 cm, in seiner grössten Dicke einen Durchmesser von 1,5 cm, hat eine ausgezeichnet blassgelbgrüne Farbe und ist vollkommen klar und durchsichtig.

Sein Eigengewicht beträgt 15,7452 g und sein Volumgewicht 2,6983.

Der Krystall — den nebenstehende Figur in seiner natürlichen Grösse wiedergiebt — wird an seinem unteren Ende, mit welchem er aufgewachsen war, von dem Prisma I. Ordnung $\{10\bar{1}0\}$ begrenzt, dessen Flächen glatt und schön spiegelnd sind, so dass die Messung mit dem Reflexionsgoniometer genau Winkel von 60^0 ergab. Dabei sind drei abwechselnde Flächen gross, die zwischenliegenden nur in etwa der halben Breite von jenen ausgebildet.

Figure 4. **The original drawing of the heliodor crystal in Müller's 1888 description published in *Zeitschrift für Krystallographie und Mineralogie.***

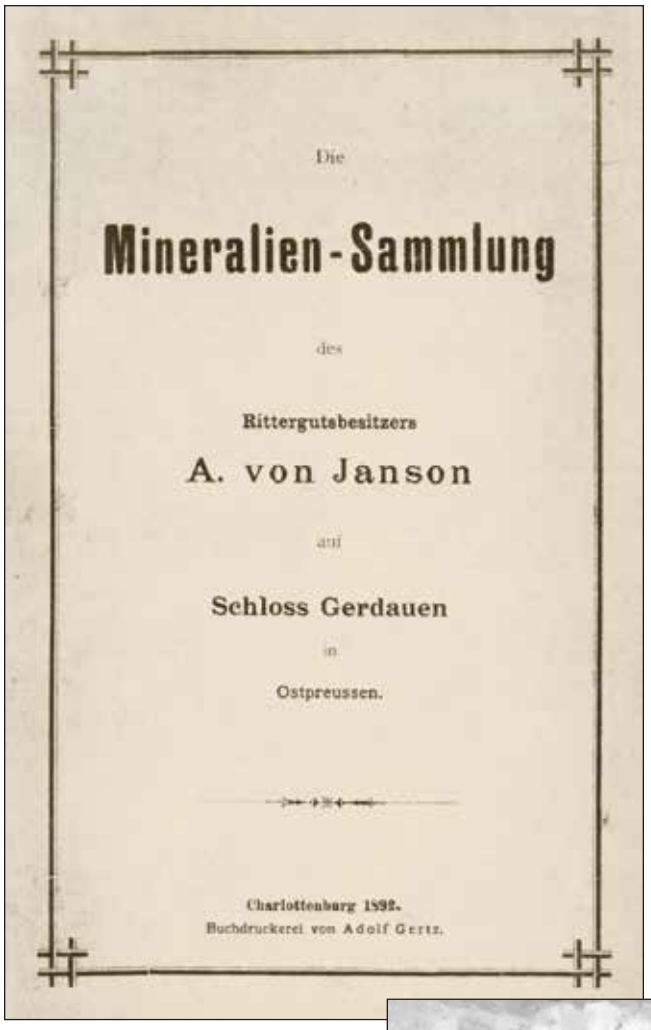


Figure 5. **Alfred von Janson (1852–1943).**

Figure 6. **Cover of the catalog of the Janson collection prepared by Wilhelm Müller (1892).**

Figure 7. **Alfred von Janson's Gerdauen Estate where he kept his mineral collection.**

a beryl from the Adun-Tschilon Mountain Range, which is worthy of mention owing to its unusual shape. The single crystal measures 4.3 cm long and 1.5 cm at its largest diameter. It has an exceptional pale yellow-green color, and is absolutely crystal-clear and transparent. It weighs 15.7452 grams and its volume weight [specific gravity] is 2.6983.

The crystal—pictured here in its natural size—is terminated on its bottom end where it was attached to matrix, by a first-order prism $\{10\bar{1}0\}$ with smooth and mirror-bright faces. Measurement with a reflecting goniometer yielded exactly 60° with three large, alternating faces, separated by faces that are only approximately half the size of the former.

At about half the length of the crystal, the prism faces abandon their vertical orientation in a peculiar way, converging

No.	Fundort	Stück	Bemerkungen
19	desgl.	1	Beryll.
20	Aduntschilon-Gebirge bei Nertschinsk, Sibirien	130	aufgewachsene u. lose Kryst. von seltener Schönheit u. Grösse (bis 11½ cm lang) 2 Stück geschliffen.

Figure 8. **The entry in the Janson catalog for the lot containing 130 beryl crystals "of rare beauty and size" from the Adun-Chilon Mountains.**

in a gradual warp towards the main axis [c-axis] and form an exceptional pointed pyramid with rounded faces seemingly fitted on top of the prism. The pyramid shows faint, irregular parquet structures with small polyhedral bumps.

On the upper end of the crystal, the base {0001} occurs as a reflective surface and on one side with one pyramidal face {10$\bar{1}$0} only, which was determined by measurement. On {0001} a fine concentric striation shows, only just visible with the unaided eye. This striation can easily be explained by the gradual growth in girth of the crystal. The inclination angle shows the degree to which the prism faces, rounded towards the upper termination, deviate from their vertical position.

Calculation based on these measurements [a table is provided] indicates the pyramid {18.0.$\bar{1}$ $\bar{8}$.1} 18*P*. Such a pyramid, however, is hardly likely. Even though the reflections of the curved faces were not perfectly focused [in the goniometer] and could only be adjusted to the maximum brightness, the angular difference seems to be more caused by the natural formation of the crystal, which easily explains the irrational axis ratio of the allegedly pointed pyramid to the primary pyramid {10$\bar{1}$1}. Hence a case of real curvature is at hand. An explanation for the curvature of this very well-formed beryl crystal might be that during a gradual increase in girth of the crystal the successively accumulating concentric layers receded more and more until only the lower half of the prism formed normally, while the upper half [of the prism] appeared with curved faces.

So Alfred von Janson assembled a collection of 13,000 specimens and Wilhelm Müller (1855–1907), curator of the mineral collection of the Institute for Chemistry and Metallurgy of the Technical University in Berlin, was recruited to catalog the entire collection to ready it for an anticipated sale. Amazingly (as I will illustrate from the Janson catalog), out of 13,000 specimens in the collection and 130 examples of beryl (presumably heliodors and aquamarines) all from the Adun-chilon Mountain Range, Wilhelm singled out this very special example!

An email from another historian, Johan Kjellman, informed me that the von Janson collection had been acquired by the Humboldt University Museum in 1899, tying in with what Eric had said about having acquired the specimen from the Humboldt Museum. So I contacted Ralf-Thomas Schmidt, the current curator there, and asked him about the piece. Mr. Schmidt kindly indicated that he did indeed have a record in the museum catalog of an exchange for an unidentified beryl, but would need an accurate weight for confirmation. I told him my crystal weighed exactly 15.74 grams. He replied as follows:

> There was an exchange with Eric Asselborn in May 1992 of a beryl sample with a weight of 15.78 g. This sample should have a green label with the number 26 on it. This beryl sample had no known location and origin as well as no old labels at the time of exchange. This beryl sample was until 1968 part of the so-called "directors collection" of the mineralogy department which was stored in the directors' working room of the mineralogical museum and was used mainly for student examinations. Later this collection, including the beryl sample, was handed over to the research collection. No additional information is available at the Museum of Natural History for this sample.

Figure 9. **Typical Janson collection label for specimens in the collection of Humboldt University in Berlin. Courtesy of Herb Obodda.**

Imagine this treasure being used for student examinations and study! It is a miracle that it remains unscathed!

At this point nearly all of the pieces of the puzzle were in place. Next I wanted to document whatever I could about Alfred von Janson and his extensive mineral collection. Herb Obodda, one of my dear friends and mentors, had also sent an email saying that an online digital copy of the entire Janson collection catalog was available for download from Google Books. He further announced that he personally had handled some specimens from the Janson collection in the past, and that although he did not have a specific label for this piece he did have an example of an original blank Janson label that he could give me for fun.

The catalog is more or less a simple listing of the collection organized by species, then by locality, and finally by the number of examples from that location. The catalog has a cover, a foreward, and most importantly a direct reference to the 130 specimens of beryl from Adun-Chilon. The foreword (translated) is as follows:

Foreword

> The hereinafter recorded mineral collection of [Alfred] von Janson at the Gerdauen Estate in East Prussia grew out of an extensive stock of duplicates that he inherited from his grandfather, Dr. Tamnau, whose collection, well-known to professionals, was bestowed to the Royal Technical University of Charlottenburg [*Berlin*].

Figure 10. **The Museum für Naturkunde at Humboldt University in Berlin was established in 1810, and is the largest museum of natural history in Germany. The museum's mineral collections date back to the Prussian Academy of 1700. The building shown here was built in 1883–1889. The Alfred von Janson collection, including the Russian heliodor, arrived here in 1899. Its catalog records were destroyed during World War II, resulting in the loss of provenance information for the heliodor crystal, which was traded to Eric Asselborn in 1992.**

Extensive acquisitions, especially from the mineral dealerships of C. F. Pech in Berlin, Dr. Schuchardt and Dr. Riemann in Görlitz, Dr. Krantz in Bonn, Dr. Eger and Dr. Böhm in Vienna, as well as partly from direct sources, have expanded and completed the collection such that it can justifiably be considered one of the best private collections. Even compared to public collections, only larger university collections surpass this collection in terms of numbers of specimens and value. Professor Dr. Th. Liebisch from Göttingen, who became familiar with the collection, will gladly confirm this assertion.

Currently the collection contains more than 500 well-characterized species with about 13,000 specimens, organized after Naumann in 17 large cabinets with glass tops. The collection not only houses many exceptionally magnificent show and display specimens, but also the most interesting crystallographic pieces and many rarities. The focus of the collection above all was the acquisition of well-crystallized specimens. Pieces of massive minerals are very rare.

The richness and beauty of the Russian minerals—topaz, beryl, tourmaline, and magnificent crystallized gold—must be emphasized especially. Minerals from the Harz, Saxony, Austria, Italy, Scandinavia, and England are notable among the many locality suites.

The owner estimates the value of his collection to be 300,000 Marks. Having the intention to sell the collection, the author was entrusted with the compilation of the present catalog. It is the favored wish of the owner that the wonderful collection might be preserved in our fatherland or even might be acquired by the state.

Gerdauen Estate, September 15, 1892
Dr. Wilhelm Müller

Under "Beryl" on page 127 is the following entry:

Lot 20. Aduntschilon mountain range, near Nerchinsk, Siberia: 130 crystals, on matrix and loose, of exceptional beauty and size (to 11½ cm long); and 2 cut stones.

Thus nearly the entire story behind the specimen had become clear, traced to the Janson collection with certainty by multiple references, putting its latest likely date of discovery at about 1880. It is certain to have accompanied the collection when the whole was sold to the Humboldt Museum in 1899, and it remained there until 1992—its history lost. Before the museum acquired it, the specimen was illustrated and singled out for special mention in a mineralogical journal of the day, *Zeitschrift für Mineralogie*. Goldschmidt then included it in his *Atlas*, which was somewhat unusual in that the vast majority of his illustrations are idealized crystal drawings whereas this was a naturalistic drawing of a specific specimen. It was traded in 1992 because it had lost its history during the War, going from the Humboldt Museum to Eric Asselborn and then further back and forth between Gilles Emringer and Eric. Later it was sold to Wayne Thompson, then to Sandor Fuss and finally to me. During my process of discovery documenting the story of this piece, I sold the specimen to collector Jon Sigerman, a relatively new collector on the scene from Mill Valley, California. Jon and his son Max both love minerals and have developed a small but extremely fine collection of thumbnails and miniatures. Thus the specimen now has a documented history spanning at least 133 years!

Now, if that was not enough provenance to fill an article in the *Mineralogical Record*, there is one more speculation in which to indulge. As the Janson catalog states, the core of Alfred Janson's

continued on page ?????????

Adun Chilon

Wendell E. Wilson
The Mineralogical Record
4631 Paseo Tubutama
Tucson, Arizona 85750

The Siberian locality known for centuries as Adun Chilon has been a prolific producer of aquamarine and other beryl colors as well as topaz, smoky quartz, and an array of other associated species. The vast majority of the beryl production has been cut into gemstones, but many rare old specimens survive in museums and private collections around the world.

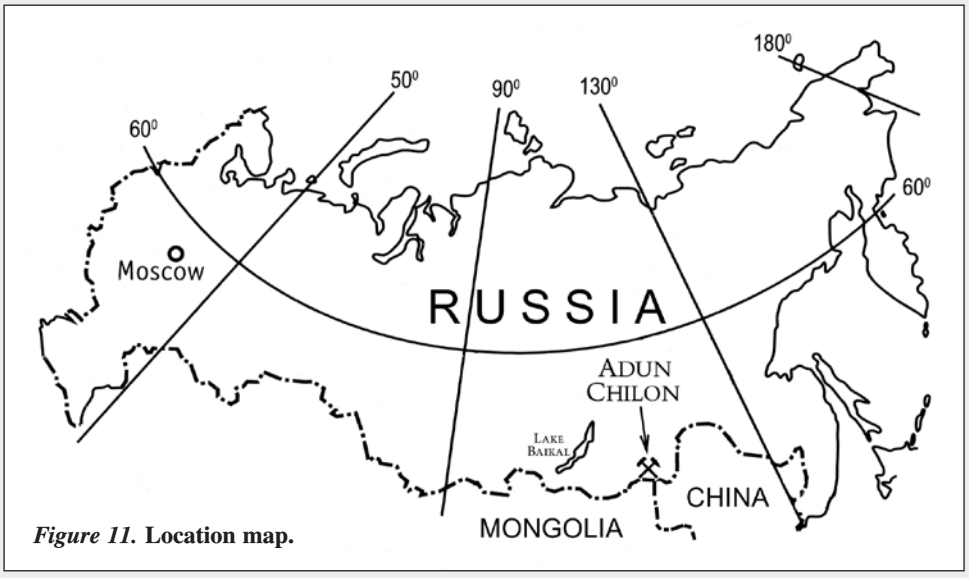


Figure 11. **Location map.**

LOCATION

Adun Chilon* refers to a mountain peak, part of the Onon-Borzinskaya Range, located 171 km due south of Nerchinsk in the Chita Oblast (Transbaikalia Region) of Siberia, Russia. Gem mines in the immediate area are located on two peaks of the same massif: (1) Adun Chilon, also called Hoppevskaya Gora ("Schorl Mountain"), and (2) Sherlova Gora to the east-northeast (Sinkankas, 1981). The central east-west ridge of Adun Chilon, with spurs extending to the south and southeast, is so honeycombed with pits and tunnels that, as Koksharov (1853) said, "one can scarcely find upon it an undisturbed place."

Originally both the Adun Chilon and Sherlova Gora areas were referred to together as Adun Chilon, but Empress Catherine the Great, herself a mineral collector, decided to give the eastern peak the name of Sherlova Gora in the latter 1700s because of a rich deposit of schorl crystals she owned there. Nevertheless, specimens from the Sherlova Gora workings continued to be labeled generally as Adun Chilon throughout the 19th century (even in Government documents). Consequently, for the older specimens, it may be impossible to tell whether "Adun Chilon" on a label refers to Adun Chilon peak or Sherlova Gora peak.

HISTORY

The Nerchinsk gem field (a broader area including Adun Chilon) was said to have been discovered by Ivan Gerkov, a cossack from Nerchinsk, around 1723, although it may simply

*Adun Chilon is the most commonly used spelling. Also spelled Adun Chelon (Адун Челон) or Adun Cholon (Адун Чолонг), with or without hyphenation. The meaning, in the Mongolian language, is "colony of stones," "stone herd" or "stones resembling a herd of horses." Old labels of German origin typically use spellings such as "Adontschelon," "Aduntschilon" or "Adun-Tschilon," often adding "bei Nertschinsk, Sibirien." In some cases specimens are labeled only "Netschinsk" or "Sibirien."

Figure 12. **The village of Nerchinsk in Siberia in 1710, 13 years before the aquamarine deposits were discovered in the mountains south of the town (Ides, 1710). Maastricht University Library.**

Figure 13. **Aquamarine on smoky quartz from Adun Chilon, 10 cm, hand-colored engraving painted by Jacques Deseve and engraved by Gérard-René Le Villain, depicting a specimen brought back from Russia by Eugène Patrin; published in Patrin's *Histoire Naturelle des Minéraux* (1801).**

be that he was the first to officially report what other locals had long known but considered insignificant. Gerkov received a reward of 5 rubles from the Mining College in St. Petersburg for his report. According to Pallas (1788), the local Buryat people had long collected the crystals in substantial quantities to use as children's toys. No records have survived regarding any gem mining at Adun Chilon for over 50 years following Gerko's discovery, but in 1776 systematic gemstone mining was officially begun.

Yurgenson and Kononov (2014) have reviewed the history of the area in great detail, summarized here. Adun Chilon attracted the notice of European scholars, including Peter-Simon Pallas (1772) and Eugene Louis Melchior Patrin (1791), who reported that aquamarine was scattered randomly everywhere, and that extraction was currently under way at three locations at Adun Chelon: one yielding chrysolite, one aquamarine, and the third emerald. In 1785–1786, a great many heliodor (yellow beryl) crystals were mined from a spur off the main ridge which, as

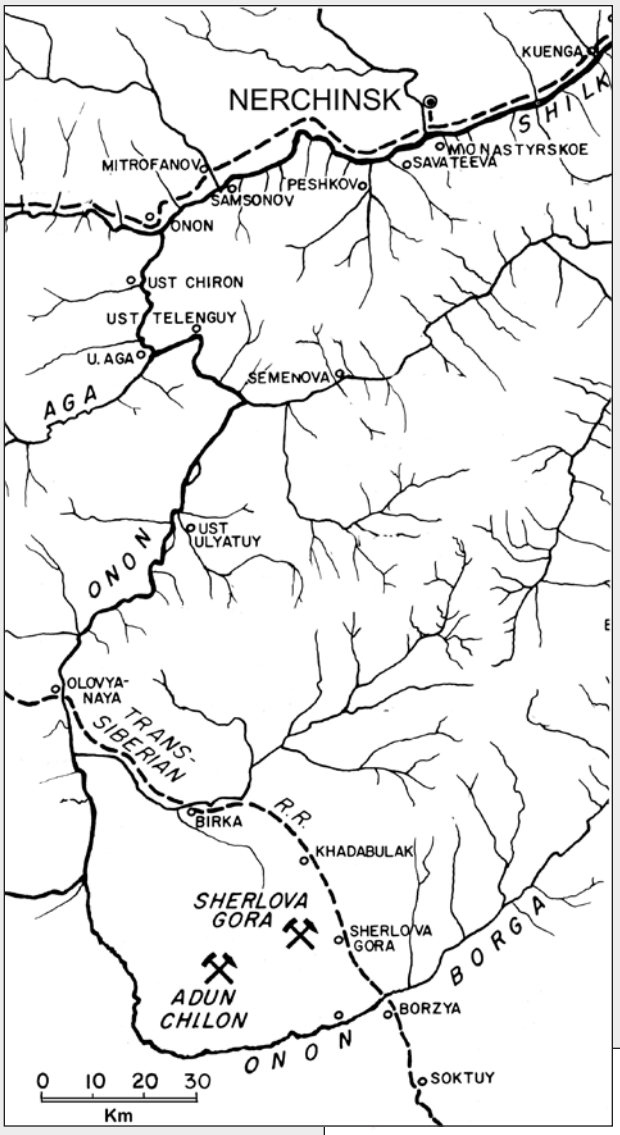


Figure 14. **Location of the Adun Chilon and Sherlova Gora workings**

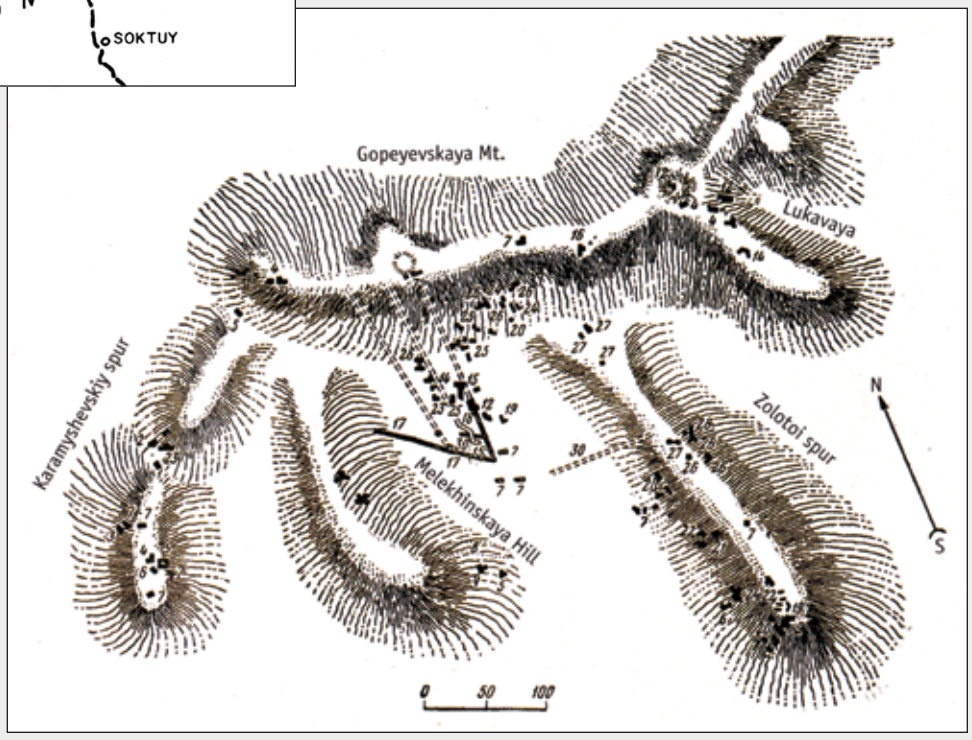


Figure 15. **Some of the ridges and gem workings in the Sherlova Gora area, Adun Chilon. From Kulibin (1829).**

a result, was named the *Zoltai* ("Golden") spur. In 1787 nearly a ton of aquamarine crstals were extracted and shipped to St. Petersburg.

In 1788, a new exploration team was sent to Adun Chilon to reopen the old mines, survey new areas and establish a winter camp near the most promising workings. On June 11, 1788, Egor Barbot-de-Marni, who was head of the Nerchinsk silver smelter, decided that it was time to establish a formal mineral museum in Nerchinsk. The collection, he said should include specimens of the beautiful topaz, beryl and quartz crystals coming from the Adun Chilon mines. Pyotr Kirgizov was commissioned to undertake a specimen-mining operation and deliver the specimens to the museum. By September of the same year, Kirgozov reported that schorl crystals and matrix specimens with crystals of aquamarine and other minerals had been recovered. Barbot-de-Marni also wasted no time in building his own personal collection of Adun Chilon specimens, including aquamarine crystals on matrix, smoky topaz crystals penetrated by aquamarine crystals, quartz crystals and schor1, 12 especially fine aquamarine crystals, and a white topaz crstal cluster with black smoky quartz and black schorl (Myasnikov, 2006).

During three days in 1796, a member of the Nerchinsk Mining Expedition named Tomilov, ordered a trenching operation across Adun Chilon ridge and down into what was called plow-land. Over 4 kg of aquamarine crystals were recovered, and over 80 kg were collected there during the rest of the season.

By the end of the 18th century, mineral collecting had become popular throughout Europe and western Russia, and specimens from Adun Chilon were in high demand. Private Russian collectors like V. M. Severgin and P. A. Kochubei added specimens to their collections, as did institutions such as the Mining Museum in St. Petersburg. But mining methods remained primitive: shafts were sunk to maximum depths of around 6 meters, with a few cross-cut tunnels, but were soon abandoned and became filled

Figure 16. **Crystals of green beryl and aquamarine from Sherlova Gora, Adun Chilon. Peter Huber photo; collection of Simone and Peter Huber.**

Figure 17. **A box of small heliodor crystals from Adun Chilon (labeled simply as "Sibirien") from the F. Krantz dealership in Bonn. The label style suggests a date between 1890 and the 1920s. Tony Gill collection and photo.**

with rubble. Production went undocumented. Mining engineers from Nerchinsk managed to extract 180 kg of aquamarine from 1810 to 1819.

With the discoveries of placer gold and gemstones in other deposits drawing away miners and geologists, activity at Adun Chilon dwindled in the 1830s. In 1849 and 1850 another exploration party was sent out from Nerchinsk, bringing back over 57 kg of gem crystals, including what were referred to as crystallographically remarkable crystals of aquamarine weighing up to a pound; these crystals were sent back to St. Petersburg with the caravan of Count Maximillian von Leichtenberg, but apparently were never delivered. No records exist of official gem mining at Adun Chilon after the 1850s. By that time almost the entire weathered zone down to unaltered granite had been exploited, and hardrock mining was beyond the capability of the local miners. Contract miners may have visited the area in succeeding years, and market availability of crystals around 1910 hints at some unofficial production. However, exploitation for bismuth, tin and tungsten took over after the turn of the century, and some fine aquamarine crystals were discovered as byproducts of that mining.

During World War II, the Transbaikal Frontline was established in the area, as a defense against possible Japanese incursions. Many productive beryl and topaz pockets were encountered during the construction of the underground headquarters. The material ended up on the dumps, which were rediscovered and searched by local collectors after the 1990s. Several renewed exploration attempts in the 1950s and 1960s concluded that, although gem material certainly remained in the ground, it would be uneconomical to mine. And despite a great deal of investigation in the 1970s, no good geological indicators for the likely presence of crystal pockets could be developed. Nevertheless, new veins continued to be found. In 1993, for example, a productive vein in the Podnebesnykh area was encountered during exploration work on loose sediments. Very high-quality faceting-grade aquamarine was uncovered, as well as crystals up to 10 cm in length.

Since 1996, no authorized gem mining has taken place at Adun Chilon, but the local inhabitants continue to collect crystals from the surface and sub-soil areas as well as from placers and shallow pits and underground workings.

GEOLOGY

A French mineralogist, Germain Henri Hess (1802–1850), visited Adun Chilon in 1826 and observed that aquamarine and topaz crystals with smoky quartz occur lining the walls of clay-filled fissures at the margins of granite bodies. He also noted the presence of cassiterite and wolframite, but no schorl tourmaline, suggesting that at least some of what had previously been called "schorl" (a catch-all term in those days) might be some other black species such as cassiterite.

The pegmatite bodies take the form of small stocks and vein-like bodies. Erosion has created eluvial deposits along the flanks of the mountains that are typically cemented or coated by porous to earthy limonite. Reviews of the geology by Kievlenko (2003) and Yurgenson and Kononov (2014) are summarized here.

The deposits are classified as rare-metal greisens (self-altered granites and pegmatites) associated with the Sherlova Gora granite massif, an apical cupola of a large Mesozoic pluton known as the Kukulbeisky Complex. The greisen bodies are roughly lenticular in shape, pinching and swelling along strike. They occur in semi-parallel swarms extending over zones several hundred meters long by up to 80 meters across. The central portion of the greisen bodies consists of granular quartz with embedded prismatic beryl; in the widest portions, open crystal-lined vugs with volumes of up to 3 cubic meters occur. Wolframite and cassiterite-bearing veins closely related to greisens and situated in their exocontact zones have also produced good crystals of beryl and topaz.

MINERALS

The pegmatite bodies are extremely rich in beryl, primarily aquamarine but also colorless, green, sky-blue and pale yellow to wine-yellow. Thin color zones parallel to the basal plane are common, as are surface striations parallel to the *c* axis. Some beryl crystals are intergrown with smoky quartz or pale blue topaz. An extraordinary specimen found in the 19th century consists of a wolframite matrix measuring 9.5 × 13 cm, on which are scattered yellow beryl crystals to 5.8 cm (Lapparent, 1896). A beautiful, transparent prism of aquamarine measuring 5 × 31 cm is in the collection of the Natural History Museum in London. Many other older museums have fine specimens as well.

Topaz occurs as granular masses and as free-growing crystals ranging from a colorless or white to blue color, with very pale blue being the most common color. Generally it is not of gem quality, but in combination with other minerals can make spectacular specimens.

Smoky quartz of a very dark shade often forms matrix associations with beryl and topaz. Some attractive clusters of green fluorite crystals to several centimeters on matrix with topaz and smoky quartz crystals are known.

Other than these minerals, there are few species occurring at Adun Chilon in display-quality specimens. Siderophyllite occurs in clusters of irregular brown crystals to several centimeters with siderite and beryl. Clusters of lustrous, bipyramidal crystals of cassiterite were found lining vugs. And black, striated crystals of wolframite to several centimeters have been known at Adun Chilon since 1791. Only in the 20th century was it recognized as a possibly economical ore of tungsten. Yurgenson and Kononov (2014) and Kasatkin *et al.* (2014) provide a complete listing.

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collection was a large number of "duplicates" that he inherited from his grandfather, the mineralogist Frederick Tamnau (1802–1879)—about whom an entire additional article could be written. Janson then built on that core with extensive acquisitions from the most prominent mineral dealers of his day. The rest of Tamnau's collection was donated to Humboldt University upon his death, and there it was curated by Wilhelm Müller, who also ended up curating Janson's collection when it was donated to the University. Tamnau's biography (Hope, 2003) includes the following passage:

The Donation of the Duplicates to his Grandson

> Tamnau has not counted his stock of duplicates as part of the collection [that was donated to the university]. He left it to his grandson, Alfred von Janson, and remarked that an exceptional mineral collection can be made from this stock. This transfer has been made and the initial stock [given to Janson] has been completed, especially by acquisitions from mineral dealerships in Berlin, Görlitz, Bonn, and Vienna. The collection grew to over 500 mineral species with a total of about 13,000 specimens. The result has been published in a catalog in 1892 for the purpose of the sale of the collection. The owner von Janson estimated the value of the collection at 300,000 Marks. It was offered to the Mineralogical Institute, which by then had moved into the Museum of Natural History. Thanks to the catalog, there were no problems [compared to the issues Tamnau had selling his first—uncataloged—collection], and the collection, which had grown to 13,963 specimens, was sold for the large amount of 150,000 Marks. A directive by the Ministry of Education and Cultural Affairs diverted parts of the collection to the museum in Posen and the Universities of Königsberg, Göttingen, Greifswald and Danzig. Subsequently, approximately 11,000 specimens remained for the Museum of Natural History.

It is entirely possible that the heliodor crystal which is the subject of this article was obtained by Janson from his famous grandfather,

Frederick Tamnau. We can never be sure, but it is quite fun to speculate that the specimen could be closer to 175 years old rather than 135! Either way, the connections between the two—Tamnau and his grandson Janson—are interesting from a historic standpoint and are fun to speculate about.

The only part of the story that still remains lost (probably permanently) is the personal narrative of the excited Russian pegmatite miner who pulled the heliodor crystal out of the ground. He must have taken good care of it, because its fine condition testifies that it was not tossed in a bag with other gem rough. Somehow he made a sale to a buyer, a middleman, a dealer or a collector—perhaps involving some intrigue that we will never know. Finally it passed to Tamnau or Janson and its recorded history began.

How many other such old specimens have fascinating histories that we will never know? It behooves us all to carefully preserve whatever we know of the histories of our own specimens—which may very well still be around centuries from now, when their histories will be far more fascinating to future collectors than they are to us today.

CONCLUSION

I doubt if I will ever handle a specimen with such a pedigree as this one again. But, more importantly, the exhilaration of piecing together the puzzle of its history will certainly never be matched. There is a certain rise in your pulse when you see a beautiful mineral specimen, antiquarian book, or scientific instrument, especially when you understand immediately that it is an outstanding example, but rarely does the chase for provenance elicit the same feeling as it did in this case. The incredible history and outstanding quality of this specimen combine to make it a marvel of the mineral world.

I hope you enjoyed the trip . . .

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