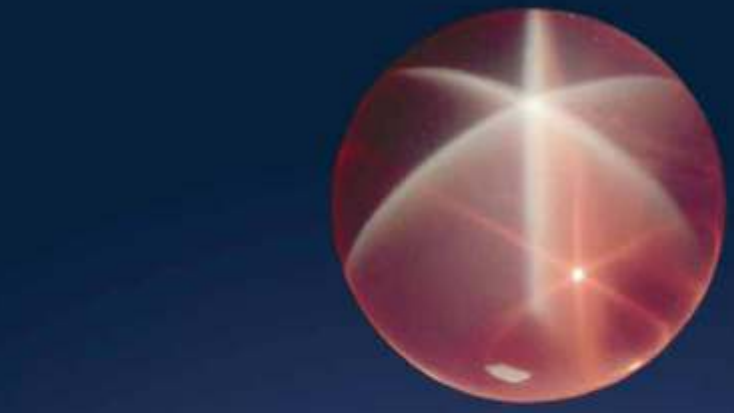
ASTERISM

Gems with a Star



Martin P. Steinbach

ASTERISM – GEMS WITH A STAR

BY MARTIN P. STEINBACH

Star of Ceylon
Photo courtesy of Richard Allan
Extraordinary blue star sapphire from Sri Lanka with 101.01 carats.

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Introduction to the Chapter „Asterism throughout History“.

Asterism Throughout History

Fig. 1: East India 1849 – historical source of star rubies and sapphires From Meyer's Zeitung-Atlas No. 54

Asterism Throughout History

Early reports of stones showing stars can be traced back to ancient Greece. They were described under various names, especially "asteria, asterius, astrion, astrodamas, astroites", but also "ceraunia, echinites, enastros". These and several other names, however, do not only designate stones showing asterism as we define it today, but also other stones with stars, like trapiche sapphires, certain fossilised species of sea lillies ("enastros") or star corals ("astroites") or (as they seem to come from the stars) even meteorites. In the course of time, all these names – as almost all old gem names – have wandered from one gem species to the other, as our forefathers did not have our mineralogical knowledge. This makes it difficult to make well-funded attributions of our modern, scientific gem species to those described in the ancient sources.

Definitions of Asterism: Historical Sources

In this chapter, we present the most important sources where asterism in the modern sense is described and discuss to which of our modern star stones those descriptions most probably correspond.

The Ancient World

Homer

According to Marcus (1936), Helena in the *Iliad*, Homer's epic poem (7th or 8th century BC), is said to possess a "magnificant star sapphire ... to which she owed all her conquests." In the Iliad, however, Helena appears only briefly in Book XXIV – the last book, which mainly tells us about the retrieval of Hector's dead body from Achilles and his funeral in Troy – and there is no mention of gems or even star sapphires at all. So Marcus's information must be erroneous.

Dionysius Periegetes

This author lived in the first century AD and wrote *Οικουμένης περιήγησης* (in Latin: Dionysii Orbis Terrae Descriptio), a description of the ancient world in Greek. He was the first who mentioned a "beautiful stone asterios" (ἀστέριος καλὸς λίθος) from the Pallenes Mountains (Παλλήνης) in Thracia (Greece). We quote the bilingual (Greek and Latin) edition by Ursinus (1705), line 327-329: "*...in scopulis Pallenae / Nascitur asterius pulcher lapis, ceu quaedam stella/ Splendens, & lychnis flammae ignis omnino similis.*" (In the Pallenes Mountains is born the beautiful stone Asterios, shining like a star and in the light of a lamp entirely similar to a flame).

Pliny the Elder

Gaius Plinius Secundus (Plinius Maior) (23 AD – August 25, 79 AD), a Roman author, naturalist, natural philosopher, naval and army commander and and friend of the emperor Vespasian (inventor of the urine tax - "Pecunia non olet"), lived in the first century and died during the eruption of Mount Vesuvius. He was already famous in his time for his masterpiece *Historia Naturalis* (circa 77-79 AD). With this work, which includes extensive treatises on "Asteria" and "Astrios", he influenced the thinking about star stones well into modern times (see Güthe 1810).
In his *Historia Naturalis* (Book 37, chapters 47-50), Pliny describes five varieties of stones with light phenomena:

Asteria: *"proxima candicantium est asteria. principatum habet proprietate naturae, quod inclusam lucem pupilla quadam continet. hanc trans-*

Fig. 2: Pliny, the Elder, copper engraving, 1820

fundit cum inclinatione velut intus ambulantam alio atque alio loco reddens. eadem contraria soli regerit candicantes radios in modum stellae, unde nomen invenit. difficiles in India natae ad caelandum. praeferuntur Carmanicae." ("Next among the white stones is 'asteria', a gem which holds its high rank on account of a certain peculiarity in its nature, it having a light enclosed within, in the pupil of an eye as it were. This light, which has all the appearance of moving within the stone, is transmitted according to the angle of inclination at which it is held; now in one direction, and now in another. When held facing the sun, it emits white rays like those of a star, and to this, in fact, it owes its name. The stones of India are very difficult to engrave, those of Carmania being preferred.") (Chapter 47).

Astrion, Ceraunia: *"similiter candida est quae vocatur astrion, crystallo propinqua, in India nascens et in Patalenes litoribus. huic intus a centro stella lucet fulgore pleno lunae, quidam causam nominis reddunt quod astris opposita fulgorem rapiat et regerat. optimam in Carmania gigni dicunt nullamque minus obnoxiam vitio; cerauniam etiam vocari quae sit deterior; pessimam vero lanternarum lumini similem."* ("Of a similar white radiance is the stone that is known as 'astrion', closely resembling crystal in its nature, and found in India and upon the coasts of Pallene. In the center of it there shines internally a brilliant star, with a refulgence like that of the moon when full. Some will have it that this stone receives its name from the fact that, when held opposite to the stars, it absorbs the light they emit and then returns it. The finest stones, they say, are those of Carmania, there being none more entirely free from all defects. They add, also, that a stone of inferior quality is known as 'ceraunia', and that, in the worst of all, the light is very similar to that given by a lamp.") (Chapter 48).

Astriotes: *"Celebrant et astrioten, mirasque laudes eius in magicis artibus zoroastren cecinisse produnt."* ("Astriotes, too, is a stone that is highly esteemed, and Zoroaster, they say, has sung its wondrous praises as an adjunct of their magic art.") (Chapter 49).

Astrobolos: *"Astolon Sudines dicit oculis piscium similem esse, radiare fulgore candido ut solem."* ("Sudines says, that astrobolos resembles the eye of a fish in appearance, and that it has a radiant white refulgence when viewed in the sun.") (Chapter 50).

John Bostock, whose translation we reproduced here, makes some interesting remarks in his footnotes. For "asteria", he states: "The vitreous asteriated crystals of Sapphire are still called by this name [= in 1855]. Ajasson, however, and Desfontaines identify this gem with Girasol opal or fire opal." Ajasson published his French translation of Pliny's *Historia* in 1829-33. Bostock refers to him again when he remarks about "astriotes" and "astrobolos": "Ajasson thinks, that it is identical with the stone next mentioned [= astrobolos]." and "It is not improbable that this [= astrobolos] was Cat's-eye, a translucent chalcedony, presenting a peculiar opalescence, or internal reflections, when cut en cabochon."
These remarks are interesting for two reasons: On the one hand, they show that the attribution of the old terms to our modern gem species is still ambiguous and therefore a matter of debate. On the other hand, we see that not all old species that are associated with stars and derive their names from ancient Greek ἀστέριος (star) can definitely be associated with our modern star stones.

Lend (1862) translates Pliny into German as follows (quoted after Bank 1989, p. 18): *"Die Asterie ist weißlich, hat in sich einen wandelnden Lichtschein: sie gibt gegen die Sonne gehalten Strahlen wie ein Stern, woher ihr Name. Die aus Indien kommende ist schwer zu schneiden. Er leuchtet von einem Punkt in seinem Inneren aus á wie ein Stern mit der Helligkeit des Mondes"* (cf. English translation above).
Lend believed that *"Nach diesen Kennzeichen namentlich nach der Schwierigkeit des Schneidens muß unsere Asterie (Sternsaphir) gemeint sein"* ("According to these characteristics, especially considering the difficulties of engraving, it must designate our asteria (star sapphire).").

Weibel (1989, p. 4) wonders whether Pliny really meant our star sapphire, whether corundum was already known in the ancient world. Did Pliny perhaps speak of our moonstone? Weibel's question is absolutely legitimate. After thorough consideration of this problem I come to the following conclusion: The stone, as quoted above, is "difficult to engrave".

Moonstone/ feldspar has a hardness of 6 to 6 ½, which differs enormously from hardness 9 of corundum, which means it could indeed be star sapphire. But: How "difficult" was "difficult to engrave" almost 2000 years ago? And furthermore, there is no "whitish" star corundum from India. They are all brown, black or red. And their crystallographical habits also differ a lot from from those of, for example, white corundum from Burma or Sri Lanka. So the "whitish" stones may indeed make one think of moonstone, as it comes from India. One might possibly even think of star moonstone (in many different colors) from Kangyam in South India, or also whitish moonstone from Sri Lanka.

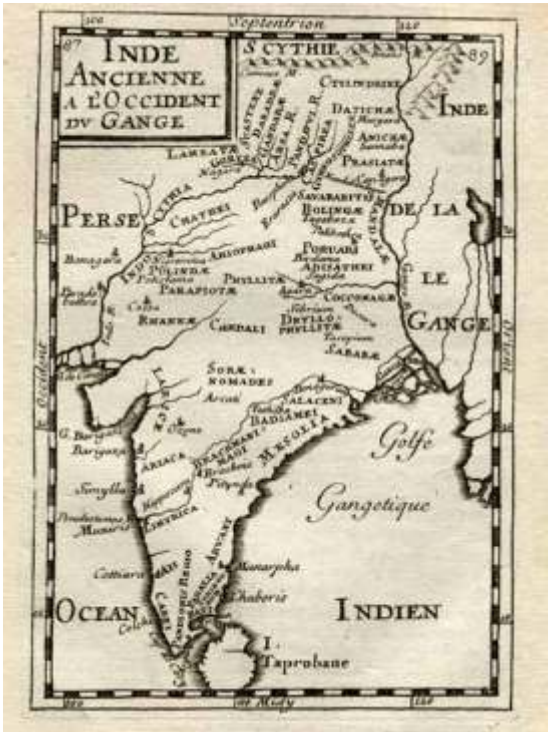

Fig. 3: India & Taprobane
(Mallet: Description De L´Universe, Copper engraving, 1683)

Or star quartz! Star quartz with a hardness of 7 on the Mohs scale is another possibility. There are numerous sources for these stones in India and Sri Lanka. Pliny further explains: "When held facing the sun, it emits white rays like those of a star, and to this, in fact, it owes its name." A stone "held facing the sun": That is what you would normally do with a star quartz or a star rose quartz to see a star in transmitted light. A star in transmitted light is in conformity with diasterism.

So indeed several arguments speak for star quartz: It is whitish, a star is visible when the stone is held against the sun, and the hardness of 7 for quartz is sufficient for a gemstone and considerably higher than that of moonstone. Weibel (1989, p. 4) argues that we don't know this for sure as the ancient world did not know the minerals and their systematic order in our modern analytical sense. He mainly puts forward two presumptions: First he asks whether Pliny really means star sapphire, and second he doubts that this rare stone was known at the time and that Pliny's description rather related to moonstone. As several arguments also speak for star quartz I want to call it into play as a third possibility.

The Oriental World

According to an ancient tradition the god Krishna and the spiritual Hindus say: "Asterism is perhaps the final mysterious phenomenon still to be fully understood and explained." Yes, this is it – for me. Thank you, Krishna!

Connellan (1983) writes the ancient Hindus believe that "the light shape hovering above the surface of a star ruby was a heavenly manifestation of the spirit of Krishna!" "According to oriental tradition, it can ward off evil men and bring good fortune to its owner, even after the stone has passed from his possession." Star sapphires were often used as a talisman to ward off the evil eye. It was also used to brace oneself for all kinds of witchcraft.
Another oriental belief is that good luck would come somebody`s way as a result of simply taking a glimpse at a star sapphire.

According to **James Prinsep and Raja Kalíkishen** (1832): "The *Jawáhir-nameh* includes among the varieties of *yaqút,* the *âyn-ul-hireh* (cat's eye) and the *turmali,* from which the latter word may, perhaps, be derived our *tourmaline,* though applied by us to a different mineral.
The *âyn-ul-hireh* (HINDU. *lahsúnia*) is evidently that variety of the sapphire which mineralogists designate *chatoyant,* or *opalescent sapphire,* and which, when cut en cabochon, shews a silvery star of six rays, and is then termed ASTERIA ....The jewellers appraise the value of the *âyn-ul-hireh* according to the number or perfection of the threads (*zanâr*) visible in it,

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Introduction to the Chapter „Star Apatite“.

2. Star Apatite

Star apatite, 6.65 ct.

2. Star Apatite

Gemmological Data

Chemical Formula	$Ca_2Ca_3(PO_4)_3F$ (fluorapatite), $Ca_5(F,Cl)(PO_4)_3$ (chlorapatite), $Ca_5(PO_4)_3(OH)$ (hydroxylapatite)
Crystal system	hexagonal
Hardness (Mohs)	5
Refractive indices (R.I.)	1.628 – 1.649
Birefringence	0.051 – 0.053
Dispersion (CF)	0.013
Optical sign	uniaxial (–)
Specific gravity (S.G.)	3.28 – 3.35
Absorption spectrum	yellow-green: rare earth spectrum because of didymium; lines, among others, at 577, 527 nm, blue: lines at 512, 507, 491, 464 nm
Fluorescence	none
Occurrence	Brazil, Canada, Germany, India, Kenya, Madagascar, Mexico, Mozambique, Myanmar, Norway, Russia, South Africa, Spain, Sri Lanka, Tanzania, USA
Occurrence of the asteriated variety	India
Colors	colorless, white, pink, yellow, green, blue, violet, brown, black, purple
Colors of the asteriated variety	green, yellowish green
Famous gems	The 6.65 carat star apatite described below (the first worldwide)

Fig. 1: The star apatite has a sparkling appearance resulting from internal features. Photo Karola Sieber, Coll. MPS.

Introduction

Apatite appears in a great veriety of forms and colors, which leads easily to wrong identifications and confusion. "Named by Werner (1786): the 'deceiver', from [Ancient Greek] ἀπατάω 'I deceive, I betray'.'Apatite bears its name quite rightly, for repeatedly mineralogists and chemists have been deceived by it.' (1813. Hausmann p. 871)."(Lüschen 1968, p. 177).
Today, apatite designates a group of calcium phosphate minerals with the members fluorapatite, chlorapatite and hydroxylapatite, of which fluorapatite is by far the most common variety.
It forms short to long hexagonal prisms, also thick tabular or low pyramids, but can also be massive, coarse granular to compact. It occurs also in globular or reniform shapes, at times with a sub-fibrous, scaly, or imperfectly columnar structure or as fibrous crusts, stalactitic, earthy and oolitic. It may also be rock-forming in beds of great extent; as nodular concretions in clays and shales or conglomeritic. (Mindat.org)

The cleavage of apatite is poor to indistinct, its fracture irregular, uneven or conchoidal.
Cat's eyes and stars occur, the colors vary from colorles to white when pure, also green, blue, pink, yellow, brown, violet, purple.
Fluorapatite was first discovered at Ehrenfriedersdorf, Saxony, Germany, in 1823. Apatite is a common mineral; gem quality apatites come (among others) from Mogok, Myanmar, but also from Madagascar, Tanzania and Durango, Mexico.

The Asterism of Apatite

Apatite with a *cat´s eye effect,* caused by hollow tubes parallel to the c-axis, occur pretty often. Cat's eye apatite is known in colors of brown, green, yellow and bright blue. Especially very beautiful cat's-eyes in "neon-blue" or "electric blue" (see Fig. 2) with a prominent line are highly demanded. Cat's eye varieties of apatite are found in Brazil, India, Russia, Sri Lanka and Tanzania.

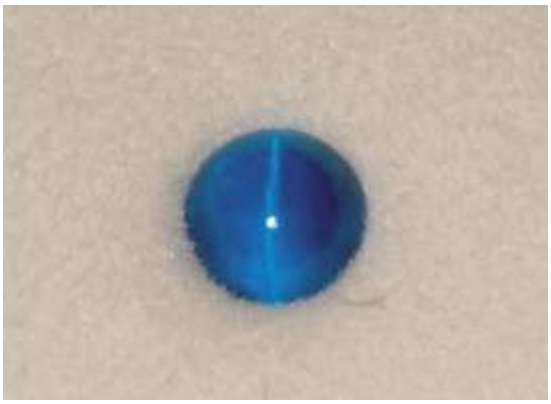

Fig. 2: Apatite cat's eye, 0.48 ct.

Star apatite occurs in a green or yellowish green color. We are talking here about the one and only stone published until today! This star apatite shows a four-rayed star. A yet unpuplished star apatite with a six-rayed star will be described later!

Here is the story of the first known star apatite in the gem world.

In 2004, the author was exhibiting at the Tucson Gem Show. Like every year at the biggest gem and mineral show in the world, I was hunting for the unusual and rare asteriated varieties among the members of the gem family.

In one of the locations a star aquamarine was offered to me by an Indian company based in Bangkok, Thailand. The gem was supposed to come from India or Sri Lanka, but the true origin is still unknown.

Aquamarine with a cat's eye effect in greenish and bluish colors in sizes up to 500 carats is relatively common nowadays. But an aquamarine with a four-rayed or six-rayed star-effect is very rare. Actually, I am really happy to have already a few star aquamarines in my collection. Remembering these star aquamarines from my mind to compare them with the offered so called star aquamarine, I thought that I hadn´ t ever seen a stone like this before.

I bought two gems and brought them back to Idar-Oberstein, Germany. They were examined by the German Gemmological Institute (EPI). Standard gemological testing of two light green cabochons of 6.65 ct and 5.63 ct showed a refractive index of 1.64 (spot) and a specific gravity of 3,18 g/cm^3. Both readings are not consistent with aquamarine. A hardness of 5 on the Mohs scale was too soft for a gem of the beryl group. With the handhold spectroscope a clear double absorption line was visible in the yellow region. The specimens were transparent enough to show the cross of an uniaxial stone under the polariscope. The dichroism was medium strong with colourless to yellowish green colours. All these gemmological properties positively identified the samples as apatite (Fig. 1).

Additional X-ray fluorescence spectroscopy (EDXRF) and Raman analyses were done by the Swiss Gemmological Institute (SSEF), Basel, Switzerland. EDXRF spectroscopy qualitatively determined that the samples consist of calcium and phosphor, with traces of chlorine (Figure 3). This result is perfectly consistent with apatite-(CaCl), formerly known as chlorine apatite.

The Raman analyses confirmed this identification with five distinct peaks at 446, 579, 963, 1030 and 1058 cm^{-1}, which matched the reference spectrum for apatite (Fig. 4).

Star Apatite has not been previously reported. The

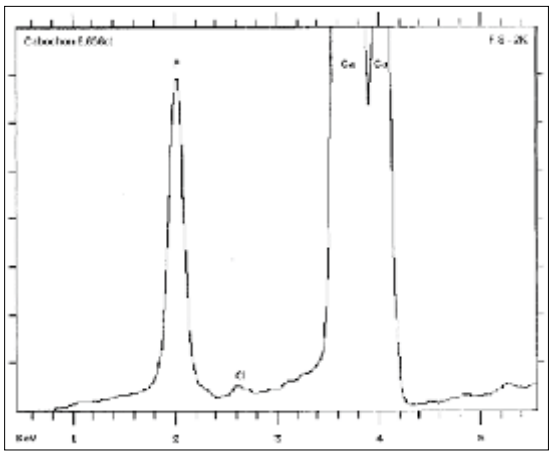

Fig. 3: EDXRF spectroscopy of the 6.65 ct star-apatite.

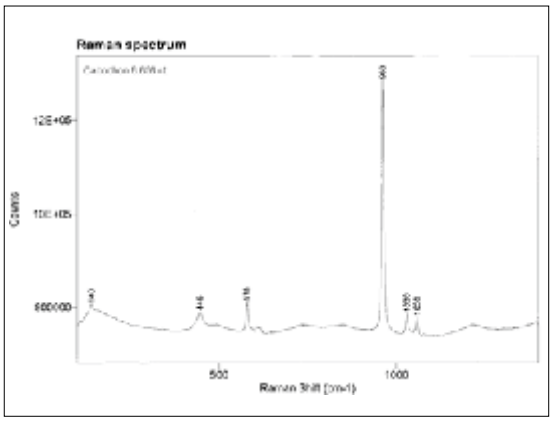

Fig. 4: The Raman spectrum confirmed the identity of the star apatite.

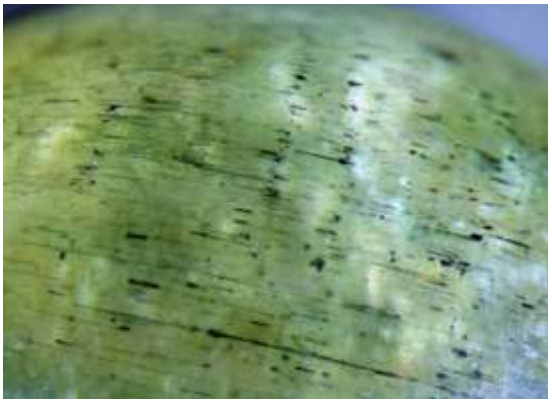

Fig. 5: Narrow tubes in the star apatite. Field of view 10 mm.
Microphotography Karola Sieber, Coll. MPS.

stone shows four rays of light when illuminated with a spotlight. Narrow, parallel tubes of irregular shape are responsible for the star effect (Fig. 5). A new star is born.

Well, this was before.
Now this four-rayed star apatite has got a brother: a six-rayed twin (Fig. 6).
This six-rayed gem is shown here (Fig. 6) for the fist time – **a world premiere**, never published before!

This rarity, is also known to come from India. The color is similar to the published four-rayed star apatite and the star is a bit broader as his sister and showing this fascinating, additional 3. ray, makes it to a six-rayed world-premiere star apatite.
Mostly welcome!

Conclusion

There is some hope, that more stones like this one-of-a-kind rare gem will show up in the collectors' world.

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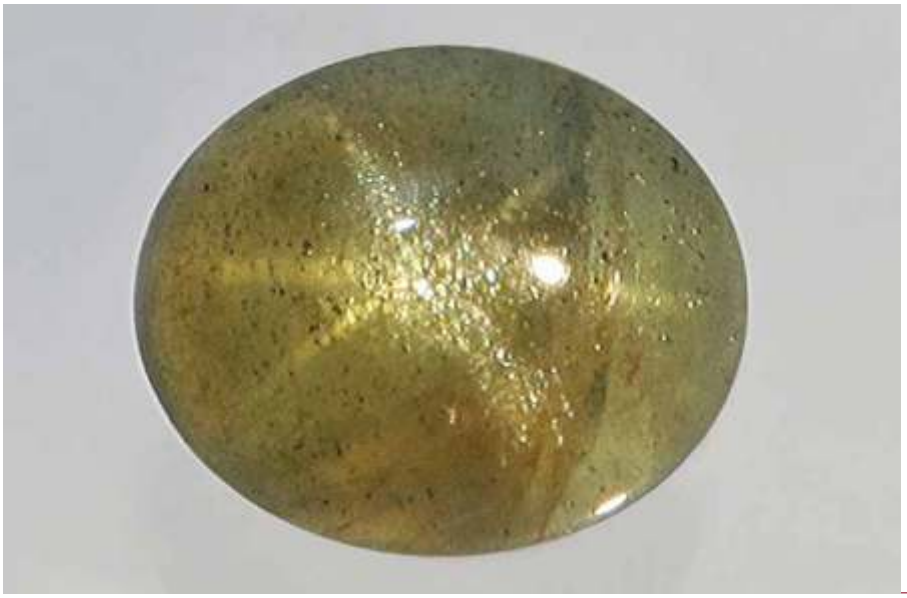

Fig. 6: The 6-rayed star apatite, 5. 63 ct. Photo Karola Sieber. Coll. M.P. Steinbach

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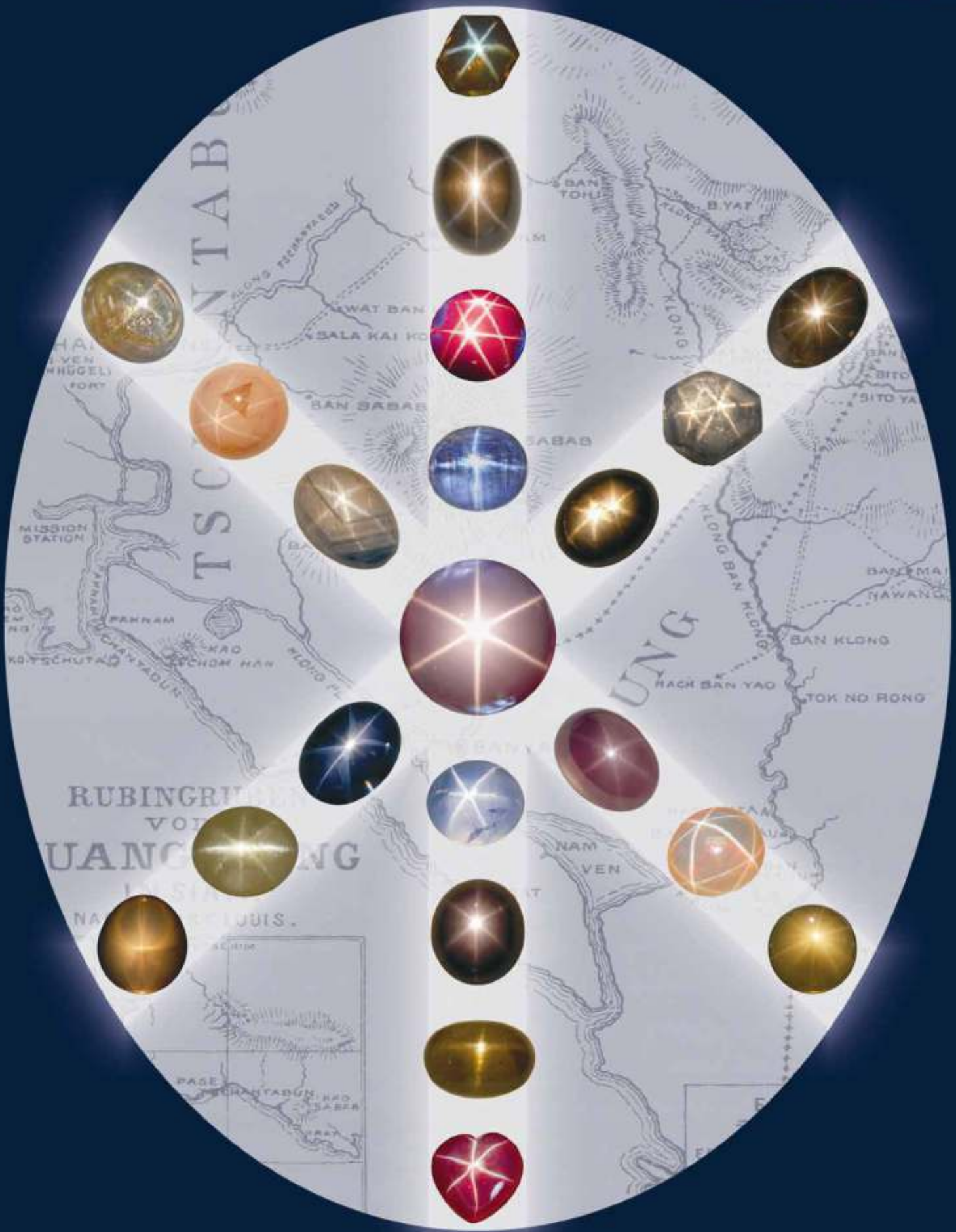

AND IN THE END, THERE IS LOVE...