Chrysoberyl Species and Variety

"Alexandrites are, on the whole finer than the Uralian emeralds, the columbine red colour seen in artificial light being especially beautiful... Its colour by daylight was a fine sap-green with a trace of red, while in candle-light it appeared a full columbine-red, scarcely distinguishable from a purplish-red Siamese Spine."

Max Bauer

The name chrysoberyl is derived from the Greek words chrysos and berullos, meaning "golden" and "gem crystal". Despite the similarity of their names, chrysoberyl and beryl are two completely different gemstones. Members of the beryl group include emerald, aquamarine, and morganite while members of the chrysoberyl group include chrysoberyl, cymaphane (cat´s eye) and alexandrite. Beryl is a silicate with chemical composition Be3Al2(SiO3)6 and chrysoberyl is an oxide with composition BeAl2O4. Although both beryl and chrysoberyl contain beryllium, they are separate gemstone species unrelated in any other way. Beryl crystallizes hexagonally while chrysoberyl crystallizes in orthorhombic arrangements. Chrysoberyl will crystallize at higher temperatures than beryl. With cooling temperatures and increasing water activity, it will react with K-spar to form beryl + muscovite. Thus after chrysoberyl crystallizes in Be-rich pegmatites that intrude ultramafic hosts, tectonometamorphic events often result in metamorphic overprint. During crystallization of the pegmatite, much beryllium can be accommodated into the common rock-forming minerals of the pegmatite leaving little of the metal to form minor amounts of either beryl or chrysoberyl.

Abraham Gottlob Werner

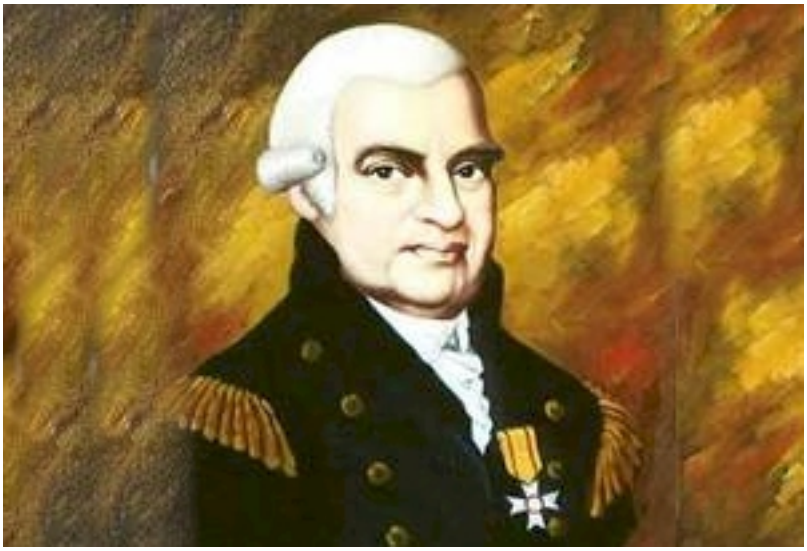

Fig. 8.: German mineralogist and geologist who discovered and first described chrysoberyl in 1789.

Chrysoberyl was discovered in 1789 and described and named by Abraham Gottlob Werner (1749-1817), in 1790. Werner worked at the Freiberg School of Mining from 1790-1793 and was well known as one of the most outstanding geologists of his time. He is best known today as the loser in the battle of the Neptunists and Vulcanists that raged in the 1780s. Werner theorized that the features of the earth´s crust had been laid down when a primitive ocean subsided and this debate led to the birth of modern geology. Werner developed techniques for identifying minerals using human senses and his practical classification system appealed to a broad audience. The stone scapolite, also known as Wernerite, was named in his honor.

Chrysoberyl was formed as a result of pegmatitic processes that occurred at least 250 million years ago. High temperatures and pressures from the outer layers of the earth´s mantle forced molten magma towards the surface. As the main magma body cooled, water originally present in low concentrations became more concentrated in the molten rock because it could not be incorporated into the crystallization of the localized minerals. Consequently, the remaining portion of the molten magma was water rich. It was also rich in rare elements and silica that still had not solidified. When this water-rich magma was expelled in the final stages of the crystallization, it solidified in cracks and crevasses to form a pegmatite.

If the pegmatite magma was rich in beryllium, crystals of beryl and chrysoberyl could form but for alexandrite to form, some chromium would also have had to be present. Since beryllium and chromium are extremely rare elements in rocks, this is only process which could have concentrated these unusual elements in an environment where crystallization could occur.

See Alexandrite Tsarstone collectors guide, Chrysoberyl Species and Variety, http://www.alexandrite.net/viewpage.html?id=ALXS-002-00006 (Information about the chrysoberyl mineral, it's properties, varieties and history) (as of).

The high water content of the magma made it possible for the crystals to grow quickly, so pegmatite crystals are often quite large and this is of course important for gem specimens. Chrysoberyl is always accompanied by quartz. It occurs in granite pegmatites and mica schists and in contact with metamorphic deposits of dolomitic marble. It is also recovered from river sands and gravels in alluvial deposits with corundum, spinel, garnet and tourmaline.

Chrysoberyl

Fig. 9.: Chrysoberyl is normally yellow, yellow-green, or a brownish gemstone, unknown in its own right due the confusion between chrysoberyl and beryl.

Chrysoberyl is normally yellow, yellow-green, or brownish with its color being caused by the presence of iron. Spectroscopic analysis will usually reveal a strong band where the violet takes over from the blue. As the color darkens from bright yellowish-green to golden-yellow to brown, this band increases in strength. When the stone has a strong color, two additional bands can be seen in the green-blue. The most common inclusions are liquid-filled cavities containing three-phase inclusions. Stepped twin planes may be apparent in some cases. Some very rare minty bluish-green chrysoberyls from Tanzania owe their color to the presence of Vanadium. These stones are quite rare and exceptional specimens can command prices as high as alexandrite.

All varieties of chrysoberyl are hard and tough, with a high luster. Because of its high degree of hardness (8.5), chrysoberyl can be highly polished with very flat facets and sharp facet junctions. Uncut crystals of chyrsoberyl may display cyclic twins called trillings. These crystals appear hexagonal but are the result of a triplet of three twins, with each twin taking up 120 degrees of the cyclic trilling.

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Chrysoberyl is relatively unknown in its own right due the confusion between chrysoberyl and beryl and the alexandrite variety is much more widely recognized. For such a hard and durable material, yellow chrysoberyl is relatively obscure and the low prices don´t seem to reflect its utility as a gemstone. The only natural stones harder than chrysoberyl are corundum and diamond.

There are two main varieties of chrysoberyl: cat´s eye or cymophane, and alexandrite. Although yellow chrysoberyl was referred to as chrysolite during the Victorian and Edwardian eras, that name is no longer used in the gemological nomenclature. Chrysoberyl that does not show a color change or a cat´s eye is known simply as chrysoberyl.

Cymophane

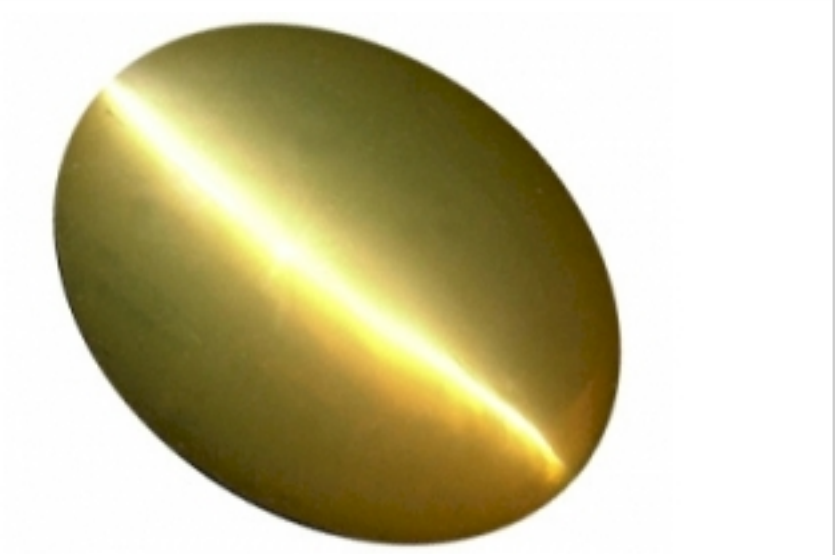

Fig. 10.: Translucent yellowish chatoyant chrysoberyl with microscopic needle-like inclusions inside the stone reflect a streak of light known as a cat´s eye.

Translucent yellowish chatoyant chrysoberyl is called cymophane or cat's eye. Its name is derived from the Greek words cyma and phanes, meaning "wave" and "appearance". Microscopic needle-like inclusions inside the stone reflect a streak of light known as a cat´s eye. The cat's eye's inclusions are aligned parallel to the crystallographic axis and they are always cut as cabochons with the fibrous need-like inclusions running across the narrow part of the stone as this is the only way to display the effect properly. The effect becomes most apparent under a spotlight or direct sunlight. A thin bright band of light will appear and open and close as the stone is rotated -- hence the eye like effect. This phenomenon is also known as chatoyancy, which comes from the French chat for cat, and oeil for eye. Chrysoberyl lacking the silky inclusions required to produce the cat´s eye effect is usually faceted. An alexandrite cat´s eye is a chrysoberyl cat´s eye that changes color. Although other minerals including tourmaline,

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beryl, scapolite and quartz may also display the cat´s eye effect, these stones are referred to as tourmaline cat´s eyes or quartz cat's eyes etc., and only chrysoberyl is referred to as "cat's eye" with no other designation.

Milk and honey is a term commonly used to describe the color of the best cat's eyes. The effect refers to the sharp milky ray of white light normally crossing the cabochon as a center line along its length and overlying the honey colored background. The honey color is considered to be top by many gemologists but the lemon yellow colors are also popular and attractive. Cat´s eye material is found as a small percentage of the overall chrysoberyl production wherever chrysoberyl is found.

Alexandrite

Fig. 11.: Chrysoberyl that displays a color change from green or blue-green in daylight to purple-red under incandescent light.

Alexandrite is the variety of chrysoberyl that displays a color change as a function of the light source. It is the presence of chromium that is responsible for the color change in alexandrite. The two colors are usually blue-green in daylight and purplish-red under incandescent light. Stones with a weak change or better are identified as alexandrite while stones with a faint change should be identified as chrysoberyl.

Alexandrite results from the small scale replacement of aluminium by chromium in the oxide resulting in alexandrite´s characteristic green to red color change effect. Its rarity is due to the requirements for two kinds of minerals, - one providing aluminium and beryllium and the other providing chromium oxide.

Only chrysoberyl displaying a distinct change of color should be designated as alexandrite. This means that chrysoberyl and alexandrite can be difficult to differentiate. Since stones with a weak change may be called alexandrite or chrysoberyl, the determination can be

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subjective. As the color change in alexandrite is due to the presence of chromium, and the color of yellow or brown in ordinary chrysoberyl is due to the presence of iron, spectroscopic examination will reveal these differences and help with identification. Chrysoberyl usually shows no fluorescence. The red fluorescence of alexandrite is evident using the "crossed filter" method.

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