

BLUE SAPPHIRE: THE BACKBONE OF THE US COLORED STONE INDUSTRY.

Corundum is an aluminum oxide mineral that occurs in the earth's crust in abundance. It has been known as a common abrasive called "emery" when found mixed with magnetite. Gem quality corundum is rare and better recognized by its variety names as ruby and sapphire. Pure corundum (Al_2O_3) is colorless. Blue sapphire is colored by trace elements, titanium and iron. It forms the backbone of the US colored stone industry as the most popular of colored stones sold at retail in the US Market. Dealers report that all sizes and qualities are saleable, especially the larger and finer stones, which are mostly sought out by collectors. However, it is worth noting that the actual average sapphire in the market is estimated at 3mm.

Gem quality corundum has been prized by many cultures for millennia. Sri Lanka, Burma and Thailand are the oldest known sources. Today, approximately 20 countries around the world are known to produce ruby and sapphire. By sheer volume, the most important of these has been Australia, which accounts for approximately 50% of production. Burma, Cambodia, Kenya, Madagascar, Tanzania and Sri Lanka account for 35%. However, it must be noted that combined, Burma, Sri Lanka and Madagascar account for a disproportionate majority of gem grade material. Although Montana sapphire production and popularity is increasing, their volume within global production is very small.

Despite the increasing production, rough that permits the fashioning of transparent faceted gems is exceptionally rare and the global demand far exceeds supply. As a result, the industry is dependent on gem treatments to increase supply and try to meet the

demand for gemstones of specific qualities. In commerce, it is important to determine if corundum is treated or not. Rarity results in very high prices for untreated ruby and sapphire. During the last quarter of the twentieth century, the use of treatments to convert low grade, mostly non-gem material into more desirable gem quality products became increasingly relied upon. The implications of accepting such stones as "gem quality" is apparent. Treated corundum varieties are available in much bigger quantities at lower cost compared to untreated ones.



The Buddha Blue, 15.23ct Ceylon Sapphire fashioned between 13th to 15th century.
Photo by Stuart Robertson.

Heating and other methods used to enhance the appearance of corundum are having a profound effect on the market. The sale of treated corundum has dramatically increased the supply of products sold as ruby and sapphire. The most common treatment that is applied to sapphire is heating. However, heating may also be used to add foreign elements (such as beryllium, titanium or even chromium) in a process known as lattice diffusion. It must be noted that, although not commonly detected, oiling in ruby is an old and common treatment method, too.

Heat treatment is achieved at different levels of temperature, under both reducing and oxidizing environments. The same process can result in different modifications due to the geological origin of the starting material. Gemological labs quantify heat treatment as achieved at relatively lower and relatively higher temperatures.

Diffusion treatment of corundum is succeeded at extremely high temperatures and involves adding certain elements to the process. The diffusion of Beryllium into corundum results in more desirable yel-

low, orange, blue and red colors depending on the starting material's geological origin. Detection of this treatment has been an issue in the trade since its discovery in the early 2000s. The only positive testing method of Be-Diffusion is using LA-ICP-MS and LIBS which are highly advanced and expensive spectroscopy techniques. On the other hand, diffusion treatment involving titanium is detectable via careful observation with magnification since titanium is a coloring agent. Shallow penetration creates a thin blue colored layer. Since the blue layer is very thin and mostly removed by re-polishing on the facets, color concentrations can be observed on the facet edges and around the girdle when the stone is examined face down in immersion.

It is also worth mentioning that a vast amount of diffused blue star sapphires exists in the market. The starting material is very low grade but the diffusion treatment creates a deep blue color and a very sharp star. Most retailers and consumers are not fully aware of this material, so it is possible for them to buy the diffused star sapphires as commercial grade natural stars. ♦

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