

INTRODUCTION

RUBY: the red variety of the mineral species **Corundum**.

The term **corundum** comes from the Indian word **korund**; the word **ruby** is derived from the latin **ruber**, meaning red.

A chemical analysis by spectrograph shows that corundum consists mainly of aluminum oxide with 1-3% of other metallic oxides, which create the different colours. Chromic oxide replaces alumina in the crystal lattice to produce the rich red colour of ruby. Ferric oxide is often added in the production of synthetic ruby.

Ruby belongs to the trigonal crystal system and generally occurs in crystals of six-sided prisms in metamorphic rock types. It has no cleavage and is usually tough, but faceted stones may be brittle. Corundum's density is between 3.99 - 4.1 (increases slightly with the depth of colour) and with it's exceptional hardness of 9, it is one of the best of gemstones for use in jewellery. Ruby's optic sign is uniaxial negative with refractive indices usually quite constant at 1.760 - 1.768; birefringence of .008 - .009. The dispersion of ruby is low (.018) so it does not display much "fire", but it does have very pronounced pleochroism: strong purplish red/orangy red. Both the luminescence and absorption spectrum of ruby is very distinctive and diagnostic, although not diagnostic for country of origin or natural origin.

CURRENT SOURCES

The mineral corundum is found all over the world, but few sources produce much gem material. The crystals found in each particular location usually have their own identifying characteristics, such as colour and certain internal inclusions, but one should never rely on colour to any extent in placing the origin of a stone; inclusions provide a far more certain conclusion.

Historically, the finest rubies have always come from the Mogok district in Upper **Burma**. These stones are that which all other rubies are compared to in terms of colour, quality and value. Up until recently, high-quality rubies from Burma have been extremely rare. The hue of Burmese stones ranges from purplish red to orangy red, with the tone ranging from medium to medium dark. There is usually hardly any gray or brown present, resulting in a highly saturated stone - often with pink overtones. Characteristic inclusions of Burmese stones include silk consisting of hollow tubes; short rutile needles that intersect at 60 angles; crystals of spinel, rutile, garnet, mica, calcite and zircon crystals with halos; and often colour swirls.

One of the main producers of the rubies found on the market today is **Thailand**. These stones are usually darker than Burmese, with a tone ranging from medium dark to very dark, but the hue is still in the purplish red to orangy red range. There is often more gray, brown or black masking the hue, and there also tends to be a lot of black extinction. In Thai stones rutile is absent and they are more often characterised by feathers; flat, brownish cavities; twin planes; and crystals of apatite, almandine, niobite, and pyrrhotite.

Rubies from **Sri Lanka** are not considered to be as good as Burma material, and are generally pale with a hue ranging from purplish red to red and a tone normally from medium to very light. Colour zoning is very common in these stones and internally they are characterised by long rutile needles; feathers; healing cracks; crystals of spinel, apatite, graphite, ilmenite and zircon crystals with halos; as well as flakes of biotite and phlogopite.

A small mine in **Kenya** has produced some excellent rubies (often sold as Burmese) that usually have a red to orangy red hue and are medium to medium dark in tone. Most often, stones from this locality are characterised by thick fingerprints and needle inclusions, causing low transparency.

Pakistan has produced some ruby of fine quality, with the colour very similar to Burmese material, but it is usually heavily flawed with crystals of spinel, rutile, pyrite, calcite, magnetite, chlorite and phlogopite.

NEW DISCOVERIES & REVIVAL OF AN ANCIENT ONE

Tanzania used to supply mainly translucent or opaque material of fine quality and colour with a peculiar purplish red hue. Recently, however, a new find has emerged from the Morogoro area. These new stones have many features in common with those from Burma, including some types of inclusions thought to be characteristic only to Burmese rubies. Some of the similarities between material found at the two locations are the colour; coarse rutile; and sets of thin twin lamellae parallel to one, two, or three rhombohedral faces. Some characteristics that may help in distinguishing the new rubies from Morogoro are distinct straight or angular colour zoning parallel to the r , a , and r' faces, and lower amounts of trace elements vanadium and gallium.

Another recent discovery (1987) of rubies was found near the town of **Luc Yen, Vietnam**. Fine stones from this locality are also said to rival the best stones found in Burma. An even more recent mining operation (1990) has been established at **Quy Chau, Vietnam**.

The material found in Luc Yen range in colour from medium to dark red to purplish red. Most of the material so far recovered from Quy Chau is less included and more transparent than that from Luc Yen, but most is pink to a lower saturation of red. Some characteristics found in these Vietnamese rubies that are not seen in material from other locations include the presence of distinct medium dark to dark blue colour zones. Pink, orangy pink, and near colourless zones are also sometimes noticeable. Zoning is often so distinct, it is visible to the un-aided eye. Another internal feature characteristic to Vietnamese stones are two types of "clouds". In the first type, the cloud is irregular to angular in shape and consists of very small, whitish particles placed quite evenly throughout. This cloud appears to have a bluish cast. The other type of cloud has a less distinct outline and contains larger whitish particles. It also has a wispy appearance due to areas of varying densities.

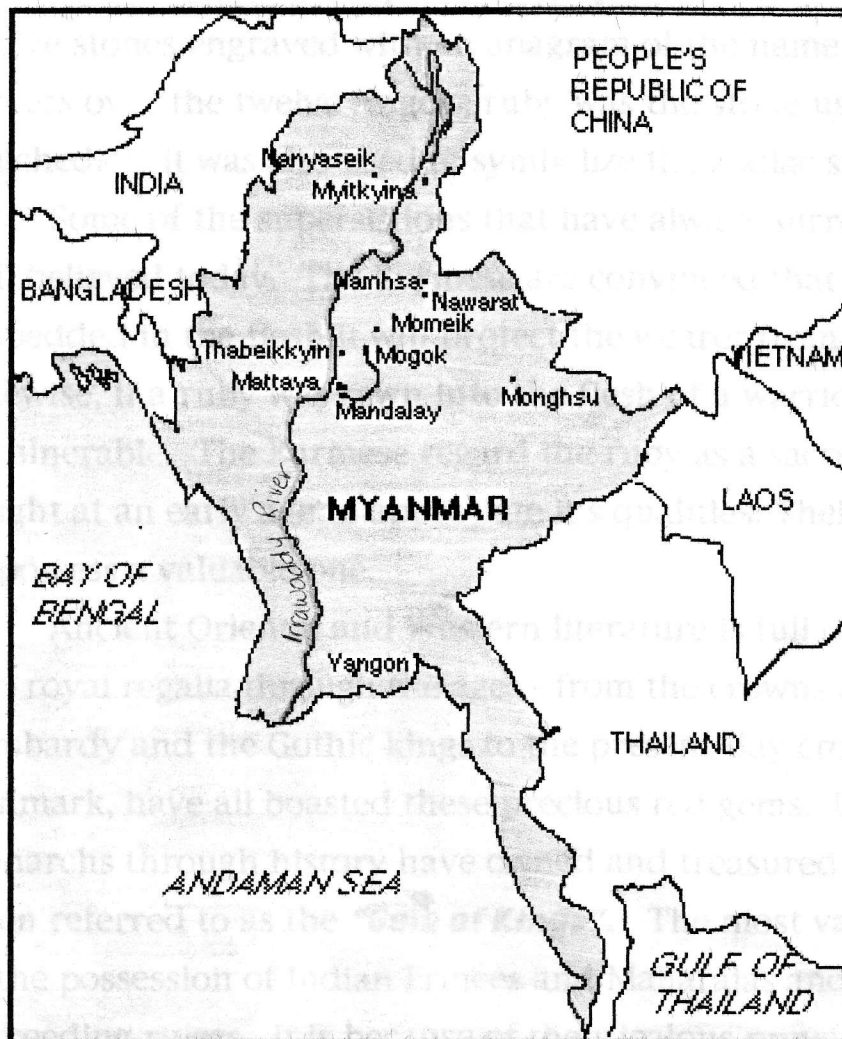
Due to the discovery of corundum in other regions of Vietnam, it is anticipated that this country could very possibly become a rich source of fine rubies.

Myanmar, formerly referred to as Burma, has always been considered as the main supplier of the finest rubies. For the last three decades, the famous Mogok Stone Tract has suffered from very limited gem production. Now, however, it is experiencing more mining activity and possibly the largest production of than ever before. Some of the traditional mining techniques are still being used at some of the mines, but contemporary mechanized mining is also being employed and may certainly be a contributing factor in the more abundant production.

One of the more recent, and quite possibly the most important, new ruby source is the Nawarat Stone Tract, also in Myanmar. This location is already known for its' production of exceptionally large crystals, at least three of which weighed between 500 - 600 carats each.

Approximately 15 km north of the Nawarat Stone Tract is another recent, promising discovery; Namhsa. One more location , the Monghsu Stone Tract in the Saihlian region of Monghsu Township, also holds high hopes for prosperous ruby production.

The future of ruby mining in the ancient location known now as Myanmar looks better and brighter than ever before. It will be interesting to see what lies ahead.



Ruby has been treasured even before the time of written history. Some mining artifacts found in the Mogok district of Upper Burma dates as far back as the Bronze and Stone Age. One of the most ancient sources of ruby was in the Badakshan district of Afghanistan. Some of the vast treasures of the great mogul Akbar, of the sixteenth century, are said to have come from these mines. It is very hard to find specimens from this locality today, even in museums.

Even in the ancient times, both before and after the birth of Christ, early Christians and Jews related certain gemstones to the twelve Tribes of Israel and to the twelve Apostles. Early Jewish Cabalists believed that twelve stones engraved with an anagram of the name of God had mystical powers over the twelve Angels; ruby was the stone used for the angel Malchediel. It was also used to symbolize the zodiac sign Capricorn.

Some of the superstitions that have always surrounded the ruby are still believed today. The Burmese are convinced that if a ruby is embedded in the flesh it will protect the wearer from bodily harm. Likewise, if a ruby was sewn into the flesh of a warrior it would make him invulnerable. The Burmese regard the ruby as a sacred gem and are taught at an early age to appreciate it's qualities. Their great aim in life is to possess a valuable one.

Ancient Oriental and Western literature is full of references to ruby, and royal regalia through the ages - from the crowns of Hungary, Lombardy and the Gothic kings to the present-day crowns of England and Denmark, have all boasted these precious red gems. In fact, so many Monarchs through history have owned and treasured fine rubies that it is often referred to as the **"Gem of Kings"**. The most valuable rubies remain in the possession of Indian Princes and Maharajas and are passed on to succeeding rulers. It is because of their jealous prevention of fine rubies

leaving the Eastern Countries that has made large sized rubies extremely rare in the Western world.

Back in 1367, the fourteenth century Spanish king, Pedro the Cruel, awarded the formidable English warrior Edward, the Black Prince, with a large ruby for returning him to his throne after he had been driven from his own country. That gem is still known today as the “Ruby of the Black Prince.”

In 1665, Jean Baptiste Tavernier was the first European to view part of the Mogul of India's vast treasure, which included the famed Peacock Throne encrusted with 108 rubies, the smallest of which weighed 100 carats. The throne also contained 116 large emeralds.

In the sixteenth century, the ruby began being used in a new type of wedding ring called a gimmel, or twinned , ring. The ring consisted of two or three bands which, when fitted together, had the appearance of a single ring. One of the bands would contain a bezel set diamond to symbolize endurance and strength, and one contained a bezel set ruby, symbolizing exalted love. In the seventeenth century, the ruby continued to be used as the symbol of love, often along with diamonds, in the shape of a lovers' knot.

Long before the days of manufactured abrasives, corundum, because of its hardness, was used in the crude granular form known as emery and was one of the most popular and efficient grinding agents known.

In his book of 1896 entitled **Precious stones**, German minerologist Dr. Max Bauer stated, “A clear, transparent, and faultless ruby of a uniform deep red colour is at the present time the most valuable precious stone known.” Besides red diamonds, this statement still holds true today. Because good colour and quality rubies are very rare, when one is found over 10 carats in weight it is considered to be among the world's rarest gems and may exceed in price that of a diamond of equal weight and quality.

IMPORTANT RUBIES

Only about half a dozen cut rubies have been recorded as important enough to be given names. Two of these can now be found in the United States: the 100 carat De Long star ruby, considered to be the largest star ruby of gem quality. It was mined in Burma and purchased by the American Museum of Natural History in New York City. The oval cabachon is about 1 1/2 inches long by 1 inch wide. The Smithsonian in Washington boasts possession of the 138.7 carat Rosser Reeves ruby.

Perhaps the best known of the older rubies is the Timur ruby. Some of its many owners' names have been inscribed on its face. It is said to weigh some 360 carats and has been known in the East for at least six centuries. It was once taken by Tamerlane from Delhi when he invaded India, and was brought from India to the Great Exhibition of 1851, where it was later presented to Queen Victoria.

The former Russian crown jewels possessed a ruby of considerable size that was given to Catherine of Russia in 1777. It had been brought originally from China by Prince Gauragine, a governor of Siberia. It was also once in the possession of Prince Menzikoff.

The Mineral Gallery of the British Museum boasts a fine ruby crystal weighing 163 carats, and included in the crown jewels of England is the 167 carat Edwardes ruby. Also famous are the Chhatrapati Manick and the 43 carat Peace Ruby.

One of the few large, fine rubies allowed to leave India was presented to film star Rita Hayworth as an engagement ring from Aly Khan in 1949. It was the size of a pigeon's egg and was the coveted *pigeon's blood* colour.

IMITATIONS & SYNTHETICS

Because of the vast popularity, rarity and value of fine quality rubies, many less expensive red stones are given names which suggest to the uninformed buyer that they are a variety of ruby. Red garnets are sometimes marketed as American Ruby, Arizona Ruby, Montana Ruby, or Cape Ruby; rose quartz is sometimes sold as Bohemian Ruby; pink topaz as Brazilian Ruby; and for centuries red spinel was sold as Balas Ruby. In fact, the famous *Ruby of the Black Prince* in the British crown jewels was later discovered to be only red spinel. Along with these 'genuine' imitations, composite stones using both genuine material and synthetic material has also been used to imitate ruby.

Ruby was also the first gemstone to be synthesized and is still one of the most mass produced. The synthesis of ruby began as far back as the 19th century by French chemist Gaudin. His technique, combined with that of another chemist, formed the basis of the modern-day flux-melt process used by Carroll Chatham (1960), Kashan (1969), and by J.O. Crystal Company (1983). Large scale production of synthetic ruby began right around 1900 by Frenchman Vernueil, who devised the furnace used in the flame-fusion method. This method is used by various producers to produce both transparent synthetic crystals and synthetic star rubies. The Czochralski pulling method was developed in 1918 by J. Czochralski, and is now used mainly to produce high-purity ruby crystals for optical and laser industries. Kyoto Ceramics began using this method to produce synthetic ruby in 1979. Some of the more recent processes used to produce synthetic ruby are the float-zone method (Seiko, 1983) and the flux-solution method, thought to be used by Knishka (1980) and by Lechleitner (1983).

Throughout history, the incomparable ruby has been sought after, fought over, and treasured above all others. As world sources are slowly depleted, or political interventions make deposits unattainable, there is little doubt that the ruby will continue to be the rarest, most costly, and by far the most popular of all the red gemstones.

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