

Gemstones have attracted humankind since ancient times. They are minerals exhibiting great beauty, rarity and durability that, when cut or faceted and polished, can be set into jewellery. My interest in crystals started in the high school chemistry laboratory when I learned how to grow beautiful colourful large crystals. This led me into the field of mineralogy and exploration geology and the search for exotic minerals and their deposits, around the world. In this article I will try to outline some of the gemstones, illustrated on stamps, that give pleasure to the eye.



Sorting diamonds

# Exploring the Wonderful World of Gemstones

By Josef Charrach



Fig 1 Rough diamonds

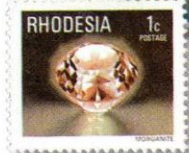
Fig 2 Brilliant cut diamond



The most highly prize jewel has traditionally been the diamond, pure carbon, found in kimberlite volcanic pipes. Diamonds vary in colour from yellow to bluish white (Fig 1) and are cut with 56 facets maximizing its optical properties to give the popular 'brilliant' cut (Fig 2). These facets are flat planes cut on a gemstone so that the reflecting planes allow for light entering from above also to be reflected back through the top, thus exploiting its reflective and refractive properties. The uppermost part of a faceted stone is called the crown, the larger, flat face on the top, the table and the bottom, pointed section is the pavilion.



Fig 3 Step cut emerald (left)  
Fig 4 Aquamarine (below)  
Fig 5 Morganite (bottom left)  
Fig 6 Heliodor (bottom right)



The Beryl group of minerals includes several gemstones. They are beryllium aluminosilicates found in granite pegmatites and skarn deposits. The colour is due to the trace element contents and hence the naming. Emerald is deep green due to chromium (Fig 3), aquamarine pale blue due to traces of iron (Fig 4), morganite pink to orange (Fig 5), and heliodor yellow due to radioactivity (Fig 6). They are usually simply cut in an Emerald or step cut, with simple facets on the crown and pavilion.

The Corundum group contains the two more precious gemstones, rubies and sapphires. They are aluminum oxides with traces of chromium giving the ruby its red colour (Figs 7, 8) and iron or titanium giving sapphires their blue colour (Fig 9). Sapphires contain fine tube-like inclusions which impart a cat's eye or star effect (Fig 10). Corundum of magmatic origin is found in syenites and some pegmatites. The gems are found in marbles and gneisses, metamorphosed sediments. Due to their hardness they are brilliant cut or if they display the star effect they are Cabochon cut to enhance these refractive properties.

Topaz is aluminum fluorosilicate (Fig 11), found in cavities in rhyolites and granite, in pegmatite dikes, and in high-temperature veins. Pure topaz is colourless, but it also occurs in a broad range of colours: yellow, blue, pink, peach, gold, green, red and brown. It is cut in a three facet cut—Rose or Mazarin cut (Fig 12).

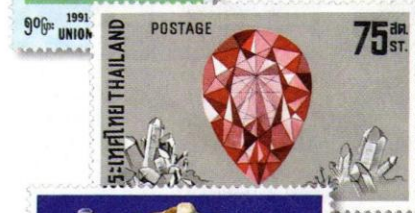
## The most highly prized jewel has traditionally been the diamond



Left to right: Fig 12 Brilliant cut topaz  
Fig 13 Alexandrite



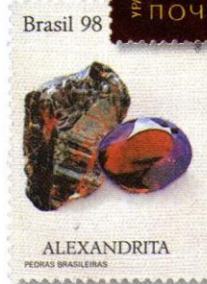
Top to bottom:  
Fig 7 Rough Ruby  
Fig 8 Brilliant cut Ruby  
Fig 9 Sapphire  
Fig 10 Cabochon cut star sapphire



Chrysoberyl is a beryllium aluminum oxide found in pegmatites and in mica schists in contact with granites. There are two gem varieties: alexandrite (Fig 13) and cymophane (cat's eye) (Fig 14). Alexandrite has great powers of absorption of certain colours; it looks green in daylight and reddish purple

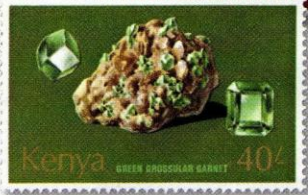


Fig 11 Topaz



in artificial light. Cymophane is yellow green and with expert cutting in the appropriate direction, a light coloured line appears which glides over the cabochon cut stone when rotated, hence the name cat's eye.

The garnet groups of minerals are silicates with differing metals like iron and manganese. Garnets come in a virtual rainbow of colours, including brown (Fig 15), pink (Fig 16), red, purple, orange, yellow, violet, green (Fig 17), colourless and occasionally black. They are typically found in regions of local or regional metamorphism. They are facet cut or cut *en cabochon*.



Top to bottom:  
Fig 15 Almandine garnet  
Fig 16 Rhodolite garnet  
Fig 17 Grossular garnet

The tourmaline group of minerals is a complex series of borosilicates with variable composition caused by multi-element substitutions in its crystal structure. Tourmaline occurs in many colours such as green (Fig 18), blue (Fig 19), yellow, pink, red, black, and clear. Green is from traces of iron, chromium and vanadium, pink from manganese. Some crystals are pink at one end and green at the other (Fig 20). They occur in pegmatites and in metamorphosed limestones in contact with granitic rocks. Tourmaline is generally facet cut.



Fig 21 Jade



Fig 22 Olivine

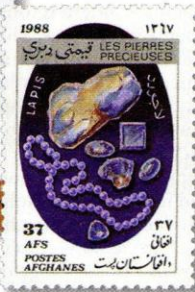
Jadeite is a silicate mineral found in very high-grade metamorphosed ultramafic rocks. The principal source of jade is from Burma which has been carved by Chinese carvers into intricate ornaments (Fig 21).

Olivine an iron magnesium silicate and is a major component of ultramafic rocks. The green variety is known as the gem peridot (Fig 22), which is facet cut.

The feldspars are the most abundant of all minerals in the crust, and are aluminosilicates with varying proportions of alkaline and alkaline earth elements. They provide only a few gem varieties of which amazonite (Fig 23) is an example that is cabochon cut.



Fig 23 Amazonite  
Fig 24 Lapis lazuli



One of the oldest known gemstones is lapis lazuli, valued for its deep blue colour and the source of the pigment ultramarine. Lapis lazuli is not a mineral but a rock coloured by lazurite (Fig 24). In addition to the sodalite

minerals in lapis lazuli, small amounts of white calcite and pyrite crystals are usually present.

Quartz is a silicon oxide that is second in abundance to feldspars in the earth's crust. Gem quality quartz is found in veins and geodes, in granitic rocks and in pegmatites. The different colours come from iron, manganese and radiation (Fig 25). They usually facet cut. Examples shown below are rock crystal (Fig 26), amethyst (Fig 27) and citrine (Fig 28).

Top to bottom:  
Fig 25 Smokey Quartz  
Fig 26 Step cut quartz  
Fig 27 Amethyst



Fig 28 Citrine

When the quartz weathers, the silica precipitates as a colloidal sediment of opal (Fig 29), which in time converts to a microcrystalline form of quartz that is

Fig 29 Opal



compact and banded, often coloured with iron oxide to give a reddish coloration, or green due to nickel. The sedimentary quartz sediments are all cut *en cabochon*. Examples shown are agates (Figs 30, 31, 32), chrysoprase (Fig 33), carnelian (Fig 34), chalcedony (Fig 35) and jasper (Fig 36).

## The feldspars are the most abundant of all minerals



Fig 30 Agate (top)  
Fig 31 Agate (above)  
Fig 32 Moss agate (left)



Fig 33 Chrysoprase (above left)  
Fig 34 Carnelian (above right)



Fig 35 Chalcedony (above)  
Fig 36 Jasper (right)



Turquoise is a hydrated copper and aluminum phosphate that is used as a gemstone (Fig 37). It is a secondary mineral precipitated from circulating waters, and occurs chiefly as an opaque, granular vein type deposit in a host rock. The colour of turquoise ranges from sky blue through various shades of green to greenish and yellowish grey. Turquoise is opaque except in the thinnest splinters, and has a faintly waxy lustre. It is cut en cabochon due to its relative softness.

Malachite is hydrous copper carbonate found in the oxidation zone of copper deposits. It is an opaque, banded stone, the colours in the bands range from a very light green to almost deep green. Malachite has been used as an ornamental stone and as a gemstone cut cabochon (Fig 38).

Zircon is a silicate mineral, zirconium silicate (Fig 39). Zircon is widespread as an accessory mineral in acid igneous rocks, it also occurs in metamorphic rocks and, fairly often, in detrital deposits.

The high refractive index and dispersion of zircon cause it to approach diamond in fire and brilliance and the colourless stone is used as a substitute for diamonds, but also comes in blue, yellow, orange, red, brown and green. They are facet cut (Fig 40).

Gem cutters choose a cut, or shape, to enhance the colour, brilliance and fire of a particular gem. For instance, the multiple symmetrical facets of the brilliant cut enhance the sparkle of a diamond, while the rounded surfaces of the cabochon cut show off the depth and colour of stones, such as cat's eyes and rubies.

Once the gems have been cut it is now the turn of the jeweller to design and make jewellery (Fig 41), setting the gems in their most enhancing manner.



Fig 37 Turquoise



Fig 38 Malachite

Fig 39 Zircon



Fig 40 Brilliant cut zircon



Fig 41 The jeweller making intricate jewellery

