TURQUOISE

The word Turquoise dates to the 17th century and was derived from the French word *torques,* because it was first brought to Europe from Turkey, from the mines in Persia. Pliny referred to the mineral as *callais* and the Aztecs knew it as *chalchihuitl.*

Turquoise is a hydrous phosphate of Aluminum and Copper, $CuO.3Al_2O_3 – 2P_2O_5.9H_2O$. Phosphorus pentoxide 34.12 , Alumina 36.84, Cupric oxide 9.57, water 19.47 = 100.
Turquoise crystallizes in the Triclinic system. The crystals are minute and in angleness near those of Chalcosiderite with which it may be isomorphous. It is usually massive, amorphous or cryptocrystalline. It also occurs reniform, stalactitic, or incrusting, in thin seams, disseminated grains and also rolled masses and nodular.

Turquoise is nearly always cryptocrystalline and massive and assumes no definite external shape. Crystals, even at the microscopic scale, are exceedingly rare.

In 1912, the first deposit of distinct, single-crystal turquoise was discovered in Lynch Station, Campbell County, Virginia. The crystals, forming a druse over the mother rock, are very small; 1 mm (0.04 in) is considered large. Until the 1980s Virginia was widely thought to be the only source of distinct crystals; there are now at least 27 other.

Turquoise may also pseudomorphously replace feldspar, apatite, other minerals, or even fossils. Odontolite is fossil bone that has been traditionally thought to have been altered by turquoise or similar phosphate minerals such as the iron phosphate vivianite. Intergrowth with other secondary copper minerals such as chrysocolla is also common.

The cleavage is in two directions in crystals, none in massive material. Fracture is small conchoidal. Rather brittle. H = 5-6 G = 2.6 – 2.83 Luster somewhat waxy to subvitreous, feeble. Color sky-blue, bluish green to apple green, and greenish grey, white to yellowish green. Streak is white to greenish. Feebly subtranslucent to opaque, but may be semitranslucent in thin sections. The blue color is attributed to idiochromatic copper while the green may be the result of either iron imputities (replacing aluminum) or dehydration.

As a secondary mineral, turquoise apparently forms by the action of percolating acidic aqueous solutions during the weathering and oxidation of pre-existing minerals. For example, the copper may come from primary copper sulfides such as chalcopyrite or from the secondary carbonates malachite or azurite; the aluminium may derive from Feldspar; and the phosphorus from Apatite. Climate factors appear to play an important role as turquoise is typically found in arid regions, filling or encrusting cavities and fractures in typically highly altered volcanic rocks,

often with associated limonite and other iron oxides. In the American southwest turquoise is almost invariably associated with the weathering products of copper sulfide deposits in or around potassium feldspar bearing porphyritic intrusives. In some occurrences alunite, potassium aluminium sulfate, is a prominent secondary mineral. Typically turquoise mineralization is restricted to a relatively shallow depth of less than 20 meters (66 ft), although it does occur along deeper fracture zones where secondary solutions have greater penetration or the depth to the water table is greater.

Although the features of turquoise occurrences are consistent with a secondary or supergene origin, some sources refer to a hypogene origin. The *hypogene* hypothesis, which holds that the aqueous solutions originate at significant depth, from hydrothermal processes. Initially at high temperature, these solutions rise upward to surface layers, interacting with and leaching essential elements from pre-existing minerals in the process. As the solutions cool, turquoise precipitates, lining cavities and fractures within the surrounding rock. This hypogene process is applicable to the original copper sulfide deposition; however, it is difficult to account for the many features of turquoise occurrences by a hypogene process. That said, there are reports of two-phase fluid inclusions within turquoise grains that give elevated homogenization temperatures of 90 to 190 °C that require explanation.

Turquoise was among the first gems to be mined, and while many historic sites have been depleted, some are still worked to this day. These are all small-scale, often seasonal operations, owing to the limited scope and remoteness of the deposits. Most are worked by hand with little or no mechanization. However, turquoise is often recovered as a byproduct of large-scale copper mining operations, especially in the United States.

For at least 2,000 years, the region once known as Persia, has remained an important source of turquoise. This deposit, which is blue naturally, and turns green when heated due to dehyration, is restricted to a mine-riddled region in Neyshabur, the 2,012-metre (6,601 ft) mountain peak of Ali-mersai, which is tens of kilometers from Mashhad, the capital of Khorasan province, Iran. A weathered and broken trachyte is host to the turquoise, which is found both *in situ* between layers of limonite and sandstone, and amongst the scree at the mountain's base. These workings, together with those of the Sinai Peninsula, are the oldest known.

Sinai - Since at least the First Dynasty (3000 BCE), and possibly before then, turquoise was used by the Egyptians and was mined by them in the Sinai Peninsula, called "Country of Turquoise" by the native Monitu. There are six mines in the region, all on the southwest coast of the peninsula, covering an area of some 650 square kilometres (250 sq mi). The two most important of these mines, from a historic perspective, are Serabit el-Khadim and Wadi Maghareh, believed to be among the oldest of known mines. The former mine is situated about 4 kilometres from an ancient temple dedicated to Hathor.

The turquoise is found in sandstone that is, or was originally, overlain by basalt. Copper and iron workings are present in the area. Large-scale turquoise mining is not profitable today, but the deposits are sporadically quarried by Bedouin peoples using homemade gunpowder. In the rainy winter months, miners face a risk from flash flooding; even in the dry season, death from the collapse of the haphazardly exploited sandstone mine walls is not unheard of. The color of Sinai material is typically greener than Iranian material, but is thought to be stable and fairly durable. Often referred to as *Egyptian* turquoise.

China has been a minor source of turquoise for 3,000 years or more. Gem-quality material, in the form of compact nodules, is found in the fractured, silicified limestone of Yunxian and Zhushan, Hubei province. Additionally, Marco Polo reported turquoise found in present-day Sichuan. Most Chinese material is exported, but a few carvings worked in a manner similar to jade exist. In Tibet, gem-quality deposits purportedly exist in the mountains of Derge and Nagari-Khorsum in the east and west of the region respectively.

Other notable localities include: Afghanistan; Australia (Victoria and Queensland); north India; northern Chile (Chuquicamata); Cornwall; Saxony; Silesia; and Turkestan.

The Southwest United States is a significant source of turquoise; Arizona, California (San Bernardino, Imperial, and Inyo counties), Colorado (Conejos, El Paso, Lake, and Saguache counties), New Mexico (Eddy, Grant, Otero, and Santa Fe counties) and Nevada (Clark, Elko, Esmeralda County, Eureka, Lander, Mineral County and Nye counties) are (or were) especially rich. The deposits of California and New Mexico were mined by pre-Columbian Native Americans using stone tools, some local and some from as far away as central Mexico. Cerrillos, New Mexico is thought to be the location of the oldest mines; prior to the 1920s, the state was the country's largest producer; it is more or less exhausted today. Only one mine in California, located at Apache Canyon, operates at a commercial capacity today.

The turquoise occurs as vein or seam fillings, and as compact nuggets; these are mostly small in size. While quite fine material—rivaling Iranian material in both color and durability—is sometimes found, most American turquoise is of a low grade (called "chalk turquoise"); high iron levels mean greens and yellows predominate, and a typically friable consistency precludes use in jewelry in the turquoise's untreated state.

Arizona is currently the most important producer of turquoise by value. Two mines exist in the state, one is the Sleeping Beauty Mine in Globe, the other is the Kingman Mine that operates alongside a copper mine outside of the city.

Nevada is the country's other major producer, with more than 120 mines, which have yielded significant quantities of turquoise. Unlike elsewhere in the US, most Nevada mines have been worked primarily for their gem turquoise and very little

has been recovered as a byproduct of other mining operations. Nevada turquoise is found as nuggets, fracture fillings and in breccias as the cement filling interstices between fragments. Because of the geology of the Nevada deposits, a majority of the material produced is hard and dense, being of sufficient quality that no treatment or enhancement is required. While nearly every county in the state has yielded some turquoise, the chief producers are in Lander and Esmeralda Counties. Most of the turquoise deposits in Nevada occur along a wide belt of tectonic activity that coincides with the state's zone of thrust faulting. It strikes about N15°E and extends from the northern part of Elko County, southward down to the California border southwest of Tonopah. Nevada has produced a wide diversity of colors and mixes of different matrix patterns, with turquoise from Nevada coming in various shades of blue, blue-green, and green. Some of this unusually colored turquoise may contain significant zinc and iron, which is the cause of the beautiful bright green to yellow-green shades. Some of the green to green yellow shades may actually be variscite or faustite, which are secondary phosphate minerals similar in appearance to turquoise. A significant portion of the Nevada material is also noted for its often attractive brown or black limonite veining, producing what is called "spiderweb matrix". While a number of the Nevada deposits were first worked by Native Americans, the total Nevada turquoise production since the 1870s has been estimated at more than 600 tons, including nearly 400 tons from the Carico Lake mine. In spite of increased costs, small-scale mining operations continue at a number of turquoise properties in Nevada, including the Godber, Orvil Jack and Carico Lake Mines in Lander County, the Pilot Mountain Mine in Mineral County, and several properties in the Royston and Candelaria areas of Esmerelda County.

Untreated turquoise, Nevada USA. Rough nuggets from the McGinness Mine, Austin; Blue and green cabochons showing spiderweb, Bunker Hill Mine, Royston

In an attempt to recoup profits and meet demand, some American turquoise is treated or *enhanced* to a certain degree. These treatments include innocuous waxing and more controversial procedures, such as dyeing and impregnation. There are however, some American mines which produce materials of high enough quality that no treatment or alterations are required. Any such treatments which have been performed should be disclosed to the buyer on sale of the material.

In 1972 Pierre Gilson introduced one fairly close to a true synthetic (it does differ in chemical composition owing to a binder used, meaning it is best described as a simulant rather than a synthetic). Gilson turquoise is made in both a uniform color and with black "spiderweb matrix" veining not unlike the natural Nevada material.

The most common imitation of turquoise encountered today is dyed howlite and magnesite, both white in their natural states, and the former also having natural (and convincing) black veining similar to that of turquoise. Dyed chalcedony, jasper, and marble is less common, and much less convincing. Other natural materials occasionally confused with or used in lieu of turquoise include: variscite and

faustite; chrysocolla (especially when impregnating quartz); lazulite; smithsonite; hemimorphite; wardite; and a fossil bone or tooth called odontolite or "bone turquoise", coloured blue naturally by the mineral vivianite. While rarely encountered today, odontolite was once mined in large quantities—specifically for its use as a substitute for turquoise—in southern France.

These fakes are detected by gemologists using a number of tests, relying primarily on non-destructive, close examination of surface structure under magnification; a featureless, pale blue background peppered by flecks or spots of whitish material is the typical surface appearance of natural turquoise, while manufactured imitations will appear radically different in both color (usually a uniform dark blue) and texture (usually granular or sugary). Glass and plastic will have a much greater translucency, with bubbles or flow lines often visible just below the surface. Staining between grain boundaries may be visible in dyed imitations.

Some destructive tests may, however, be necessary; for example, the application of diluted hydrochloric acid will cause the carbonates odontolite and magnesite to effervesce and howlite to turn green, while a heated probe may give rise to the pungent smell so indicative of plastic. Differences in specific gravity, refractive index, light absorption (as evident in a material's absorption spectrum), and other physical and optical properties are also considered as means of separation.

Hardness and richness of color are two of the major factors in determining the value of turquoise; while color is a matter of individual taste, generally speaking, the most desirable is a strong sky to "robin's egg" blue (in reference to the eggs of the American Robin). Whatever the color, turquoise should not be excessively soft or chalky; even if treated, such lesser material (to which most turquoise belongs) is liable to fade or discolor over time and will not hold up to normal use in jewelry.

The mother rock or *matrix* in which turquoise is found can often be seen as splotches or a network of brown or black veins running through the stone in a netted pattern; this veining may add value to the stone if the result is complementary, but such a result is uncommon. Such material is sometimes described as "spiderweb matrix"; it is most valued in the Southwest United States and Far East, but is not highly appreciated in the Near East where unblemished and vein-free material is ideal (regardless of how complementary the veining may be). Uniformity of color is desired, and in finished pieces the quality of workmanship is also a factor; this includes the quality of the polish and the symmetry of the stone. Calibrated stones—that is, stones adhering to standard jewelry setting measurements—may also be more sought after. Like coral and other opaque gems, turquoise is commonly sold at a price according to its physical size in millimeters rather than weight.

Being a phosphate mineral, turquoise is inherently fragile and sensitive to solvents; perfume and other cosmetics will attack the finish and may alter the color of turquoise gems, as will skin oils, as will most commercial jewelry cleaning fluids. Prolonged exposure to direct sunlight may also discolor or dehydrate turquoise. Care should therefore be taken when wearing such jewels: cosmetics, including sunscreen and hair spray, should be applied before putting on turquoise jewelry, and they should not be worn to a beach or other sun-bathed environment. After use, turquoise should be gently cleaned with a soft cloth to avoid a build up of residue, and should be stored in its own container to avoid scratching by harder gems. Turquoise can also be adversely affected if stored in an airtight container.

Metaphysical -Turquoise is wonderful for drawing out negative vibrations from a person. It is best to place it at the feet or worn inside the sock for this. It dissipates negativity as it draws from the body. It allows the negativity to go back into the ground. A good stone for helping one to bond with the spiritual. It offers much uplifting.

A truth stone, it symbolizes a time to be honest with yourself. Much will be gained when you become still, and see yourself as your truly are.

This stone is a reminder to share your vision and WALK your TALK! The truth is very motivating to those ready to hear it. By doing so, you make it okay for them to believe and follow.

This gem stone is a stone of self realization helping you to better understand yourself, your ideas and emotions. It is a wonderful aid in regards to any type of analytical thinking.

Attunes the physical to the higher realms. Aligns all chakras, creating a clear channel for the nurturing and creative energy of this sacred stone.

Like Amethyst, it protects and detoxes from alcohol, poison, pollution, x-ray/sun radiation. Works well with Chrysocolla, best with Silver.

- **Protects and blesses the user.**
- **One of the most versatile of the POWER STONES, which is why Native Americans honor it.**
- **Turquoise works at the throat Chakra enhancing communication skills**
- **Those seeking a profound healing of the spirit and soul should wear turquoise.**
- **Ancient absorber of "negativity"**
- **Helps one develop natural powers.**
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- **Excellent grounding stone.**
- **Excellent healing stone.**

- **Strengthens and calms the mind and body.**

- **Brings wisdom. Helps anorexia, headache, fear, etc. Throat, lungs, asthma, infections, teeth, TMJ, hearing, high blood pressure, creativity block, depression. Used for healing on every continent long before we has mass communication and radio waves....**
- **Turquoise helps to ground the wandering wayward spirit, while keeping their connection to the infinite open. Many people who have a lot of energy avoid "grounding stones" because they think it will "clip their wings". But Turquoise will allow that energy path to remain open. In fact, some Native cultures held the belief that by wearing it the human mind becomes one with the universe. Those seeking a profound healing of the spirit and soul should wear turquoise.**
- **Turquoise helps us communicate clearly what we want, and to then be able to communicate our desires to others in a way they can understand.**

Physical Healing Properties:

Muscle tissue. Regeneration. Stress. Headaches. Enhances healing and immune function, Tones, strengthens entire body, aids tissue regeneration, circulation, lungs, respiratory system, heals stomach and gout problems, viral infections; creates warmth and relaxes cramps.

Harry A. Wagoner