GENESIS OF A TURQUOISE DEPOSIT

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I am using the geology of the Blue Bird Mine, a turquoise deposit near Austin, Nevada, as an example. This open pit mine is about 125 miles east of Reno, Nevada on US 50 and about 35 miles north on Grass Valley Rd. It has been worked under different owners since the 1920's and is currently privately owned by a Sparks, Nevada group. It is on the east flank of the Toyiabe Range, in the Reese River Mining District. (T 20 N, R 45 E, Sec.15)

The geology of the area: The valley is an alluvial fan. The mine is found at the intersection of three formations: 1. the upper is the Granite Formation, (granite); 2. the northern is the Slaven Chert formation (dark gray to black chert); and 3. the southern is the Valmy Formation (dark green, black, and red chert, vitreous quartz, green stone, pillow lavas, and shale). (#1)

A cryptocrystalline mineral, turquoise almost never forms single crystals, and all of its properties are highly variable. X-ray diffraction testing has proven its crystal system to be triclinic. Even the finest of turquoise is fracturable, reaching a maximum hardness of about 6. With lower hardness comes lower specific gravity (high 2.90, low 2.60) and greater porosity: These properties are dependent on grain size. The luster of turquoise is typically waxy to subvitreous, and transparency is usually opaque, but may be semitranslucent in thin sections. Color is as variable as the mineral's other properties, ranging from white (note 1) to a powder blue to a sky blue, and from a blue-green to a yellowish green. The blue is attributed to dichromatic copper while the green may be the result of either iron impurities (replacing aluminum) or dehydration. (#6)

Turquoise is a minor mineral produced in this district. It is sometimes found in nodules and veins up to an inch thick. These veins are found in the fracture zone of the Slaven and Valmy formations. There is some high quality blue turquoise and some white turquoise (note 1). Associated minerals are variscite and howlite. Apatite, pyrites, and copper sulfides are usually present below the deposits as well.

In the Blue Bird Mine, much of the turquoise is very hard and of gem quality. It is found with variscite, a darker green mineral, or with howlite, a brown mineral making for some unusual patterns. It is very often found with spider veins of black shale in the blue, and once in a while, blue veins in black shale. The color of the turquoise is light green to a deep blue in a very few instances. There is also a small amount of white material that is turquoise (note 1). This spider-webbed turquoise is some of the most beautiful mined in Nevada.

The genesis of the turquoise: The areas explored seem to indicate that this was a hydrothermal process in which the copper aluminum silica and other minerals were carried up toward the surface from great depths and deposited into prophyritic igneous rock to make it copper rich. This is a monzonite porphyry intrusion. Observation of the ore body indicates that after the original placement of the copper in the country rock, there were further intrusions of hydrothermal acidic water from the deeper reaches of the hydro thermal circuit. These intrusions leached the copper and other minerals and carried them away to redeposit them later at a higher level.

In a model, the hot hydrothermal water would rise toward the surface which has a cap rock layer of rhyolite that will not let the solution vent to the surface. At the same time, some meteoric water is flowing downward. This in turn lowers the temperature of the hydrothermal water causing the minerals to precipitate out. The cooled water starts to go back toward the source of the heat. In essence, it goes in a big circle. There are, however, indications that the hydrothermal water broke out to the surface several times. The turquoise was deposited in the fractures in the surrounding area. The country rock was there about 35myr ago, long before this magmatic porphyry intrusion occurred, causing alterations in the said rock. Turquoise deposits are almost always less than 100 feet below the surface at time of placement, as is the case with the Blue Bird Mine turquoise. The alteration of the country rock, the halo or altered zone, is clearly visible for 45 feet above the low grade turquoise. Below the low grade, in the next 20 feet further down, the grade improves markedly. The pit is currently about 70 feet below the present surface level, or 105 feet below placement level.

Conclusions:

1. Turquoise is almost always found in the dry desert areas such as the Southwestern U.S., Turkey, and Iran.

2. In the southwestern U.S. it occurs with monzonite porphyries related to igneous activity about 100 feet below the surface at that time, with apatite, pyrites and copper sulfides below.

3. The color is affected by the minerals present; copper makes for shades of blue, and an amount of iron ($2Fe_2O_3$) the shades of green.

4. Based on detailed study, turquoise is a late-stage hydro thermal mineral that occurs in voids and fractures in association with quartz. The source or the water was magmatic fluids, and there was metamorphic alteration of the surrounding country rock, as noted above(45 feet above the soft turquoise). The ground water and the meteoric water became acidic changing the Ph of the hydrothermal fluids and also cooling the fluids, causing the minerals to precipitate the turquoise and various other minerals.

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UPCOMING CFMS SHOWS

See additional information at cfmsinfo.org.

AUGUST

OCTOBER

October 1 - 2: BORON, CA
Mojave Mineralogical Society
Boron Recreation Park

October 1 - 2: VISTA, CA
Vista Gem & Mineral Society
Antique Gas & Steam Engine Museum

October 8 - 9: ANDERSON, CA
Shasta Gem & Mineral Society
Shasta District Fairgrounds

October 8 - 9: GRASS VALLEY, CA
Nevada County Gem & Mineral Society
Nevada County Fairgrounds (Main Building)

October 8 - 9: TRONA, CA
Searles Lake Gem & Mineral Society
SLGM Show Building

October 15: WEST HILLS, CA
Woodland Hills Rock Chippers
First United Methodist Church

October 15 - 16: WHITTIER, CA
Whittier Gem & Mineral Society
Whittier Community Center

October 22 - 23: LOS ALTOS, CA
Peninsula Gem & Geology Society
Los Altos Youth Center

NOVEMBER

November 5 - 6: ANAHEIM, CA
American Opal Society
Business Expo Center

November 5 - 6: RIDGECREST, CA
Indian Wells Gem & Mineral Society
Desert Empire Fairgrounds

November 12 - 13: SACRAMENTO, CA
Sacramento Mineral Society
Scottish Rite Temple

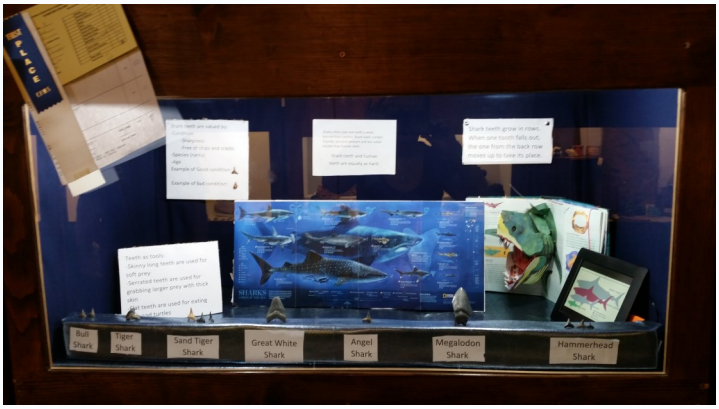
November 12—13: Yuba City, CA
Sutter Buttes Gem and Mineral Society
Yuba-Sutter Fairgrounds—Franklin Hall

November 19 - 20: OXNARD, CA
Oxnard Gem & Mineral Society
Oxnard Performing Arts Center

Mary Love

3 more first place cases!

Kevin Colvin



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GENESIS OF A TURQUOISE DEPOSIT, Continued

5. Turquoise is not likely supergene mineral because turquoise is absent in highly fractured and oxidized zones where meteoric fluids enter the plutonic rock. When found in these areas, it is chalky and is altered to propylitic. It might be noted that the supergene process is slowly destroying the turquoise deposits.

Note

1. I had an assay done by the Nevada Analytic Laboratory showing a little more than 10 percent copper which makes the white material turquoise.

References;

#1. Stewart et al. *NBMG Bull*. 88. 1977.

#2 This is partly based on field work I did in the late 1970's and 50 years of experience.

#3 *ChemEurope*

#4 Palache et al. *Dana's Systems of Mineralogy* Vol.2. 1951.

#5 George. *Minerals and Rocks, Their Nature, Occurrence, and Uses*. 1943

#6 Frye. The *Encyclopedia of Mineralogy*, Vol.4B. 1983