The United States Postal Service Mineral Stamps

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On two occasions the United States Postal Services (USPS) has issued sets of four stamps devoted to minerals. The first was in 1974 and the second in 1992. The authors of this article wish to discuss the minerals portrayed on the stamps and a little about minerals in general.

A mineral is a naturally occurring solid inorganic substance. Minerals often have very attractive appearance and are considered desirable for both their looks and their monetary value. Minerals can be represented by a chemical formula and have specific atomic structures. They are different than rocks, which are usually heterogeneous aggregates of minerals and other substances, and have no specific chemical formula or structure. Minerals are usually abiogenic, meaning that they are not the result of the decay of a living organism.

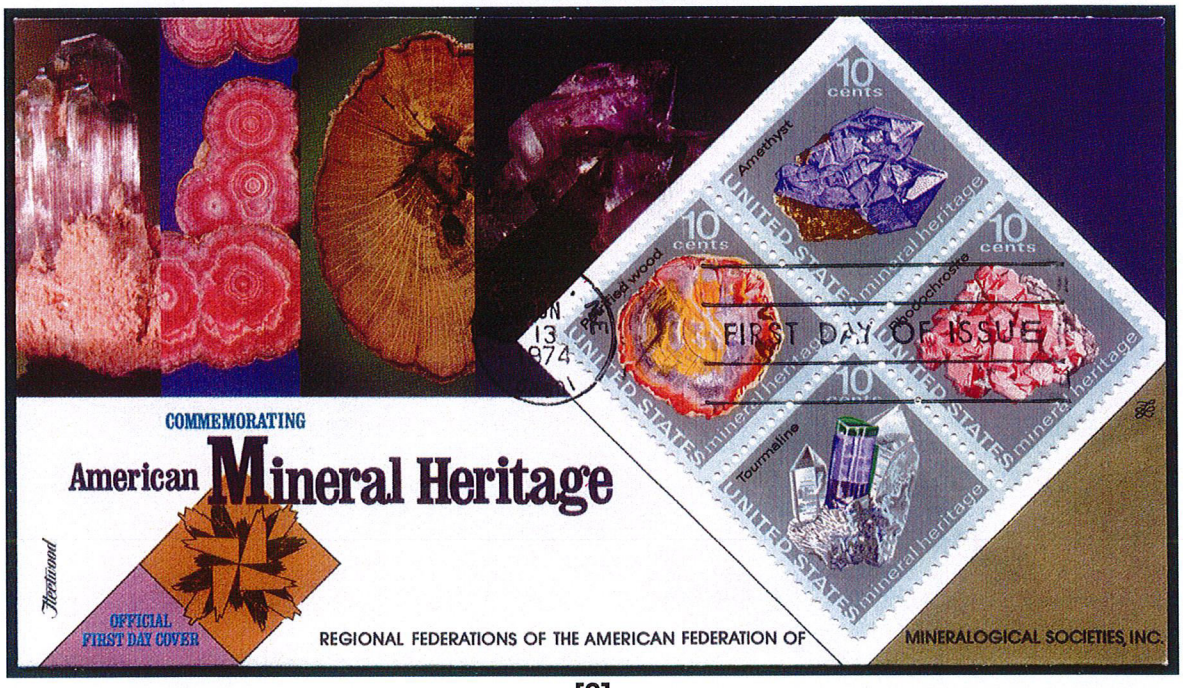
The Mohs scale (created by the German geologist and mineralogist Friedrich Mohs in 1812) is an important measure of the relative hardness of minerals, and ranges from 1 (talc) to 10 (diamond). It is a simple, quick diagnostic tool for the identification of minerals in the field. If one mineral will scratch another without being scratched itself, it is harder. But it does not tell of a material's real hardness. If quantitative, diamond would have a value of about 40.

Because of the popularity of minerals with the general public, many countries have issued stamps featuring minerals, their chemical structures, and the their uses. The mining of minerals and metallurgy are two related topics that have also been featured on a fairly large number of postage stamps.

Mineral Heritage, 1974

The Mineral Heritage set of four stamps was issued on June 13, 1974 **[1, 2]**. The block of four square stamps depicting samples of petrified wood, tourmaline, amethyst, and rhodochrosite, described in more detail below, make up a rhombus or diamond.

[1]



[2]

Petrified wood [3, 4]

Petrified wood (from the Greek root *petro* meaning "rock" or "stone"; literally "wood turned into stone") is a specific type of mineral formed by the complete mineralization of terrestrial vegetation, with all the organic material having been replaced by minerals, primarily silicates. Petrified wood can preserve the original structure of the plant or tree's stem and often details such as tree rings can be observed. When agatized, petrified wood can be very beautiful. Huge logs of this form are strewn over a wide area at Petrified Forest National Park in northeastern Arizona.

[3]

[4]

Tourmaline [5, 6]

Tourmaline is a crystalline boron silicate mineral compounded with other elements such as aluminum, iron, magnesium, sodium, and lithium. An empirical formula for it is $(Al,Fe,Li,Mg,Mn)_3(Al,Cr,Fe,V)_6(BO_3)_3(Si,Al,B)_6O_{18}(OH,F)_4$. The variation in metals included has a tremendous impact on its color and value as a gemstone. Black, iron-rich "schorl" is probably the most common, while sodium-lithium-aluminum bearing elbaite is commonly green, and a gemstone. Pink rubellite, a prized lithium tourmaline, was abundant at Pala, San Diego County, California, where some stones colored from pink to colorless to green have been found. Foot-high specimens of these are on display in the Smithsonian Institution in Washington D.C. as well. Tourmaline also has commercial value for its piezoelectric property in high-pressure sensors.

[5]

[6]

Amethyst [7, 8]

Amethyst is a variety of quartz whose empirical formula is SiO_2. Its hue is the result of the presence of only a few parts per million (ppm) of Fe^{3+} ions incorporated into its crystal structure. The presence of more iron oxide makes it opaque, and it is called red jasper. Although quartz is the most common mineral in the earth's crust, amethyst is fairly scarce. Its purple color is lost if heated to about 300 °C, but will return if exposed to strong radioactivity. Used as a gem since antiquity, it was prized by the ancient Egyptians. Crystals weighing over 200 lb have been found.

[7]

[8]

Rhodochrosite [9, 10]

Rhodochrosite is a manganese carbonate mineral whose empirical formula is $MnCO_3$. Mostly rose-pink, some crystals or cut masses can be a bright blood red in color. Large crystals of rhodochrosite abound in Colorado, which officially named it as its state mineral in 2002. It is also Argentina's "national gemstone". Rhodochrosite has an interesting chemistry: it is insoluble in cold hydrochloric acid, but it dissolves when the acid is hot. Heating the crystals drives off CO_2 and all that remains is the dull, black manganese(II) oxide.

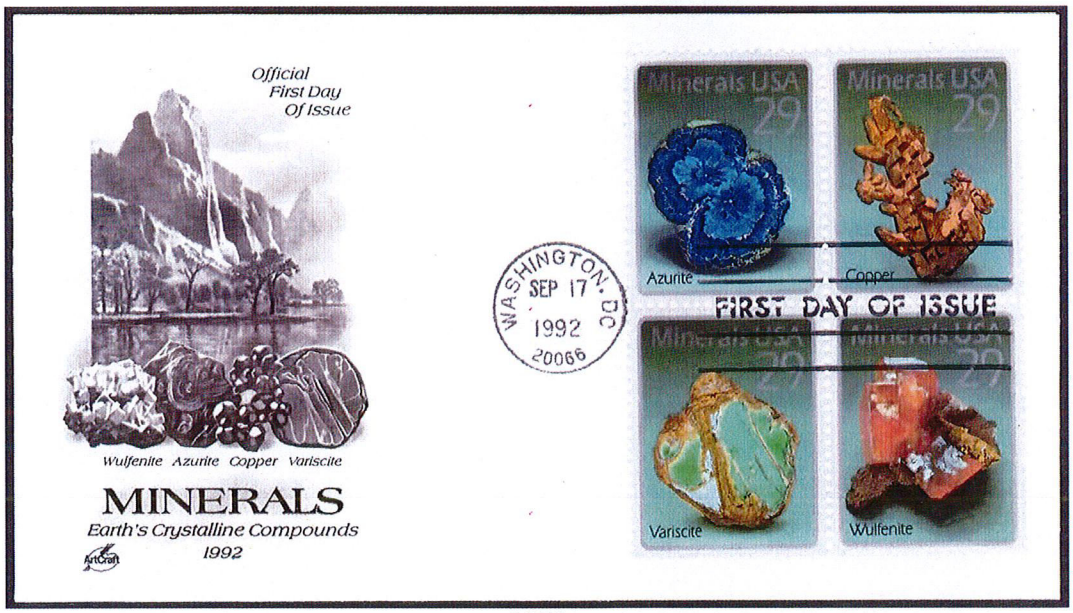
[9]

[10]

Minerals, 1992

The Minerals set **[11, 12]**, released on September 17, 1992, was one of the most attractive issues the USPS produced up to that date. The stamps showing specimens of azurite, copper, variscite and wulfenite, were on display at the United States Bureau of Engraving and Printing for many years as an example of printing techniques.

[11]



[12]

Azurite [13, 14]

Azurite is a soft deep blue copper mineral produced by the weathering of copper deposits. The formula for azurite is $Cu_3(CO_3)_2(OH)_2$. Mined since ancient times, the Greeks and Egyptians used it as a source of copper and in blue glazes. In the Middle Ages it was pulverized and used in oil paints. Its close "relative" malachite is green, far more abundant, and a very important copper ore. Chemically speaking, azurite is decomposed by heat, losing carbon dioxide and water to form black, powdery copper(II) oxide, CuO. As happens with many metal carbonates, specimens effervesce upon treatment with hydrochloric acid.

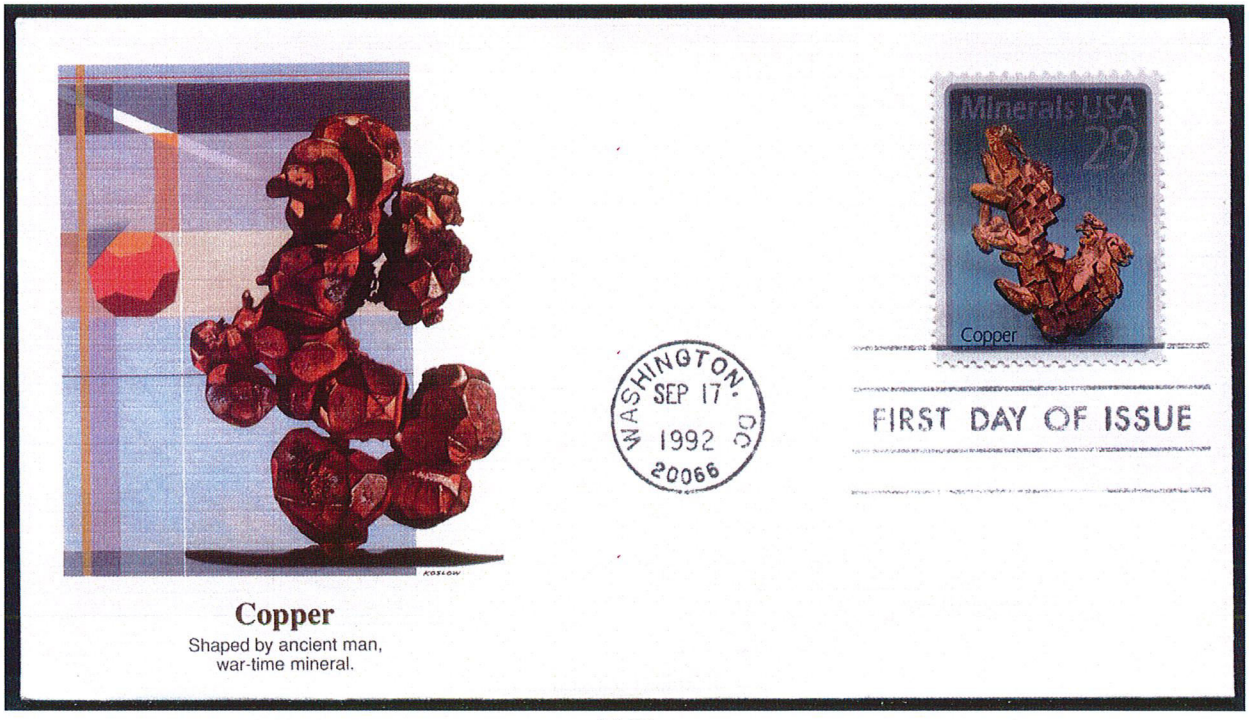
[13]

[14]

Copper [15, 16]

Copper is the element that, when melted with tin, forms bronze, the first alloy of importance in human history. Copper is a very valuable metal to humans because of its variety of uses. It is quite malleable and ductile. Its good conductance and ductility has made it the majority of electrical wiring in use today. Its malleability has also made it quite popular in jewelry making especially among Native American cultures. Because of its relative lack of reactivity copper is quite popular in home building for pipes carrying water. This has also led to its being very popular among thieves who target construction sites for unattended copper wiring and pipes.

[15]

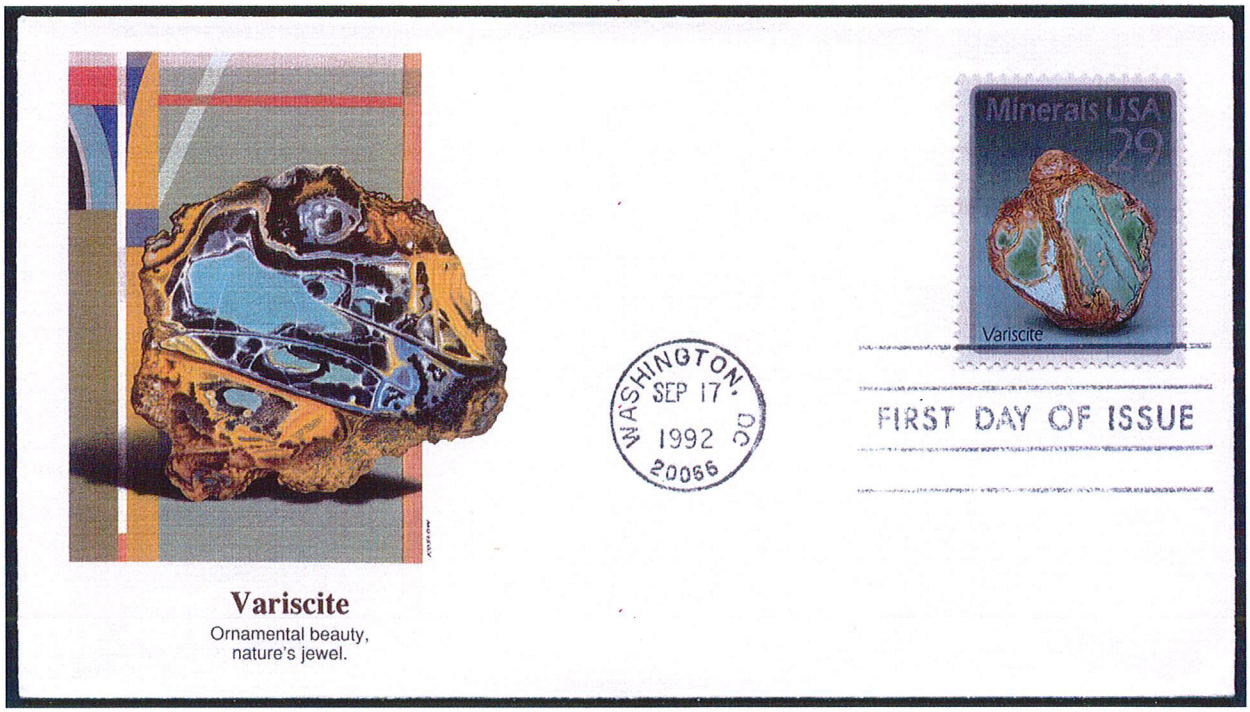


[16]

Variscite [17, 18]

Variscite is hydrated aluminum phosphate of chemical formula $AlPO_3 \cdot 2H_2O$. Variscite is a secondary mineral formed by direct deposition from phosphate-bearing water that has reacted with aluminium-rich rocks in a near-surface environment. It occurs in Germany, Czechoslovakia, Zaire, Austria, Australia and Utah. It almost never exists with any visible crystal structure. Used as a semi-precious stone, variscite is a bit soft for the job. Its waxy green appearance is delightful, but changes markedly when in contact with the oils of the skin.

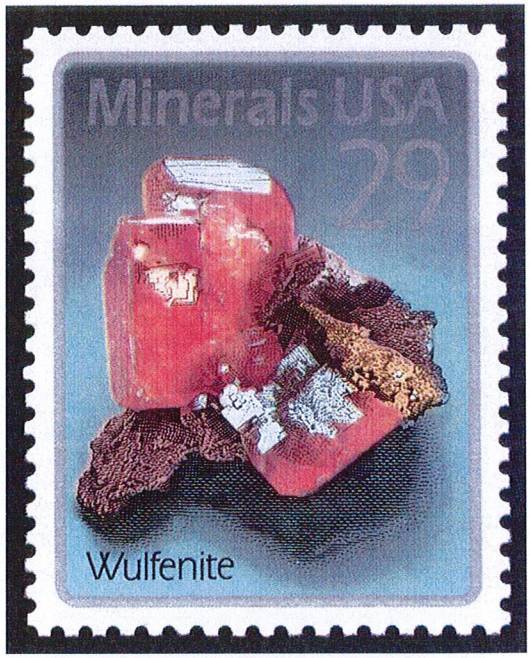
[17]



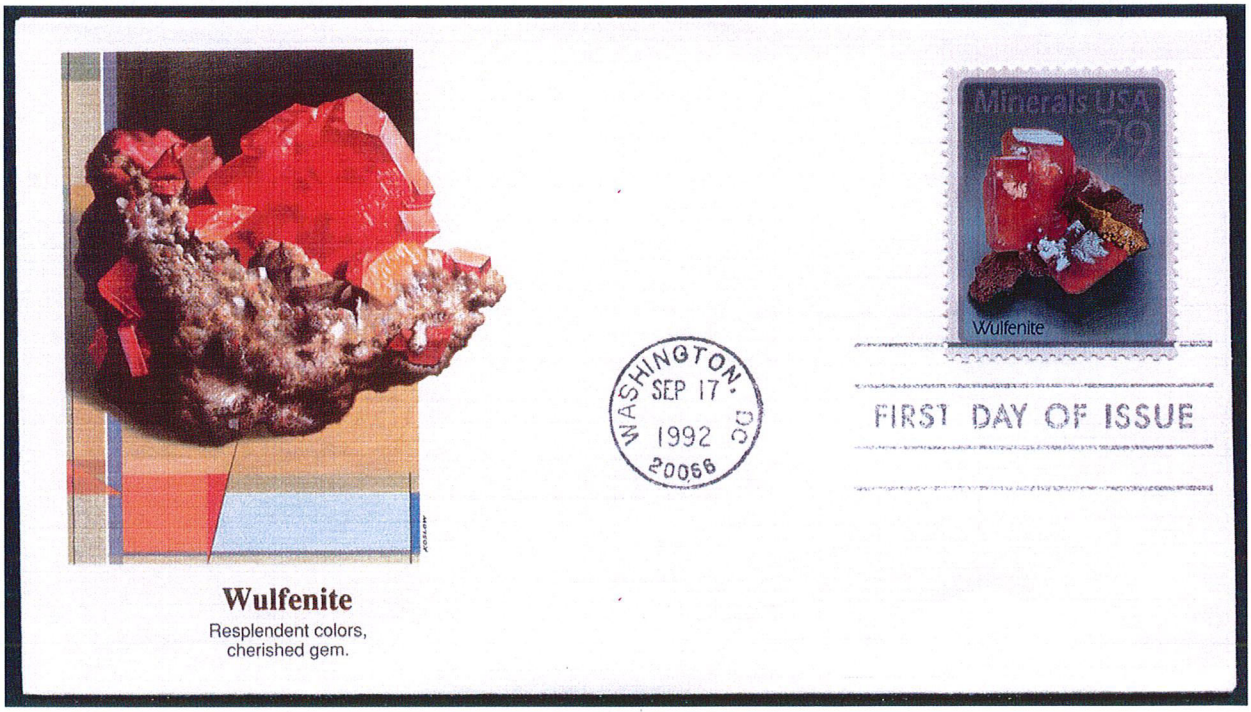
[18]

Wulfenite [19, 20]

Wulfenite is a lead molybdate mineral with chemical formula of $PbMoO_4$, named in honor of the Austrian mineralogist Franz Xaver von Wulfen. Wulfenite is prized for its glassy, tabular (or plate-like) crystals. It is found in many localities, often associated with lead ores. Crystalline samples of wulfenite are almost always bright yellow, but specimens from Arizona (for example, from the Red Cloud Mine in Yuma County) are often deep red and take on unusual shapes. It is a minor source of the transition metal molybdenum.



[19]



[20]

Concluding remarks

The United States mineral stamps were not part of an ongoing series and there is no way to know if they are going to appear again on USPS stamps. However, many other countries have issued an impressive collection of mineral-related stamps that are very popular with topical collectors and the authors may submit further papers dealing with some of the international issues.

Identification of the Stamps

No.	Country	Issued	Scott #	Description *
1	United States	6/13/1974	1541a	*Mineral Heritage* block of four stamps
2	United States	6/13/1974	1541a	block of four First Day Cover
3	United States	6/13/1974	1538	petrified wood stamp
4	United States	6/13/1974	1538	petrified wood stamp FDC
5	United States	6/13/1974	1539	tourmaline stamp
6	United States	6/13/1974	1539	tourmaline stamp FDC
7	United States	6/13/1974	1540	amethyst stamp
8	United States	6/13/1974	1540	amethyst stamp FDC
9	United States	6/13/1974	1541	rhodochrosite stamp
10	United States	6/13/1974	1541	rhodochrosite stamp FDC
11	United States	9/17/1992	2703a	*Minerals* block of four stamps
12	United States	9/17/1992	2703a	block of four First Day Cover
13	United States	9/17/1992	2700	azurite stamp
14	United States	9/17/1992	2700	azurite stamp FDC
15	United States	9/17/1992	2701	copper stamp
16	United States	9/17/1992	2701	copper stamp FDC
17	United States	9/17/1992	2702	variscite stamp
18	United States	9/17/1992	2702	variscite stamp FDC
19	United States	9/17/1992	2703	wulfenite stamp
20	United States	9/17/1992	2703	wulfenite stamp FDC