

Minerals from Kidney Stones

Rockhounds are often told that they have rocks in their head. It turns out that the human body does make lots of minerals. Bones and teeth are two obvious examples. We may argue that these aren't minerals by strict definition, because they are made by living organisms not inorganically, but they are otherwise the same as minerals found in rocks.

When I was a graduate student at Indiana University, my office mates were helping with a research project on minerals in kidney stones (which are concretions technically called urinary calculi). They received daily packages of rather disgusting samples from many hospitals which they saw fit to open and analyze in my presence. One of my old office mates, Dick Gibson, wrote up a summary of the minerals they found.

The most common minerals were, not surprisingly, phosphates. These include apatite, brushite and whitlockite. Apatite is the most common mineral in many kidney stones, forming crumbly to solid white, yellow or brownish masses. Various forms of apatite were interlayered, like the layers in hailstones. Brushite occurs as tabular to bladed yellow to white crystals typical of kidney stones formed under more acidic conditions. Whitlockite forms amber to brown coatings on some stones, and is particularly common in prostatic stones.

Two calcium oxalates, whewellite and weddellite are abundant in kidney stones. Outside the body, these minerals are rare, found most often on the deep sea floor, in coal seams and in sedimentary nodules. In kidney stones the whewellite forms globular to radiating masses of crystals while weddellite forms sharp dipyramidal crystals up to 5 mm long (ouch).

Magnesium phosphates, such as struvite and newberryite are rare minerals generally found outside the human body only in bat guano. They are apparently deposited in kidney stones by particular bacterial infections. Struvite forms colorless crystals lining cracks in the stones formed under alkaline conditions. Newberryite forms pale green to white spherules on the surface of some stones.

Some minerals found in kidney stones are more familiar to rockhounds. Calcite and aragonite are rare as granular material intergrown with the phosphates in kidney stones. Stones from the human pancreas are often calcite. Halite was found a few times and could be a contaminant from salty fluids in which the stones are stored during shipping. Gypsum was found three times as white crystals encrusting the oxalates.

Why study the minerals in kidney stones? Their composition gives doctors important clues to their treatment and prevention. For example, certain people consistently produce stones of a certain mineralogy. Sometimes these stones can be dissolved or even prevented by certain treatments. Any one who has ever suffered from these knows that an ounce of prevention is worth a ton of cure!

- Dr. Bill Cordua, University of Wisconsin-River Falls

Reference:

Gibson, Dick, 1974, "Descriptive Human Pathological Mineralogy", American Mineralogist, vol. 59, p. 1177-1182..