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The Nacimiento Mine east of Cuba, in Sandoval Co., NM, is well-known among New Mexico collectors for its copper sulfide-replaced fossil wood and for azurite/malachite nodules. However, Nacimiento hosts a broad suite of microminerals that have not been extensively documented, though familiar to interested collectors.

During the Triassic Period (~230 MYA), a large logjam of conifers, which had burnt during a forest fire, formed along one of the channels of the Chinle River system and was quickly covered with mud. This wood was eventually substantially replaced by copper sulfides, primarily chalcocite. The overall mineralized formation is the Agua Zarca Member of the Chinle Formation, consisting of sandstone and conglomerate (Antony 1972). Later oxidation, perhaps during the uplift of the local Nacimiento mountains, led to the formation

Figure 1. Fossil wood in a large sandstone boulder – note rims of malachite surrounding the fossil wood. Scott Braley photo, 2021.

of secondary copper minerals, such as malachite and azurite (Fig. 1).

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The replacement itself is significantly more involved than a simple replacement by chalcocite, with plant cell structures preferentially mineralized by marcasite, hematite, and aragonite (Mustoe 2018) in addition to chalcocite, bornite, and djurleite.

The deposits were first documented in the 1860's, but were probably rediscovered repeatedly by native peoples, Spanish explorers, and Mexican prospectors prior to the area becoming part of the United States. The mine was initially operated sporadically on a small scale as an underground mine but was converted to an open-pit mine until it became unprofitable (with an interesting side-venture into in-situ leaching via sulfuric-acid injection, which is still being cleaned up today) (Mustoe 2018). Currently, the mine pit is partially water-filled, and the old dumps have been substantially remediated, limiting collecting opportunities.

While most attention is given to the fossil wood and azurite/malachite nodules, local collectors have been well-aware of the other minerals found at the mine. Pyrite and gypsum crystals have been commonly found. Septarian nodules and concretions originating in a different, overlying member of the Chinle Formation and unrelated to the copper mineralization have been widely collected at the mine site. Micro collectors have noted several less-common copper secondaries, such as spangolite and libethenite. Small clusters of hollow concretions ("knobby concretions," Fig. 2) with calcite crystals lining the cavities
are also sought out.

Figure 2. "Knobby concretions" – small, often-hollow nodules. Scott Braley photo, 2022.

This work surveys the microminerals found at the Nacimiento mine, divided between 1) the copper secondaries and other minerals associated with the fossil wood, and 2) the minerals found in the "knobby concretions."

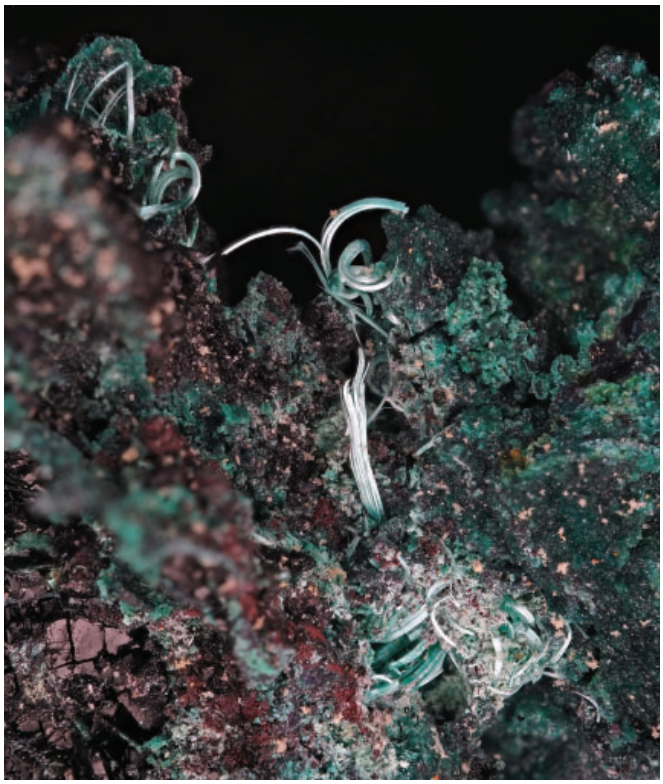

Figure 3. Malachite curls on chalcocite-replaced fossil wood. Jay Penn specimen. Scott Braley photo. FOV is 5 mm.

Secondary copper minerals positively identified include malachite, azurite, spangolite, libethenite, and cyanotrichite. Of special note are the malachite curls (Fig. 3). The "knobby concretions" produce an interesting suite of photogenic minerals including calcite, celestine (Fig. 4), quartz, and barite.

Figure 4. Pale blue celestine on calcite in a "knobby concretion". Scott Braley specimen and photo. FOV is 8 mm.

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