Review on the formation and geochemistry of the mega crystals of Naica, México.

Ana Laura Gutiérrez Gutiérrez, María de Jesús Puy y Alquiza, and Pooja Kshirsagar
Universidad de Guanajuato, Division de Ingenierías, Departamento de Ingenierías en Minas, Metalurgia y Geología, Guanajuato, México (al.gutierrezgutierrez@ugto.mx)

In the state of Chihuahua, Mexico, a mine located in Naica is one of the most important Pb and Zn deposits in the world. The region manifests several caves with varieties of gypsum crystals (Ca₄H₂O) known as selenite (the largest in the world so far, specimens up to eleven meters in length and one meter in thickness). The present abstract discusses the formation mechanism of these gigantic crystals. The review is based on the interpretations made by early workers (which includes one doctorate thesis and two Bulletins).

The interpretations were made on 19 samples of anhydrites that were collected at a depth of -345 meters. At this depth the early workers also found microscopically alternating dark dolomite and light bands of anhydrite. The dolomite-anhydrite association is generally associated with mineral recrystallization events. With the geological review carried out, two sources of sulfates were identified: one is La Virgen Formation and the second in the stratiform anhydrite of the Aurora Formation. Formation of hydrothermal anhydrite during the last stage of mineralization has been attributed to the formation of selenite mega crystals due to its dissolution. Hydrothermal minerals, such as hydrothermal anhydrite and sulphides. The most common sulfides in mineralization are galena, sphalerite, to a greater extent, pyrite and chalcopyrite. In case of weathering of these, they would generate their oxidation and result in the presence of sulfate.

According to the early workers the anhydrite was available in the late hydrothermal stage after mineralization of the mineral. The temperature during the growth of the crystals was maintained slightly below 58 °C, the value in the solubility of the anhydrite is equal to that of the plaster. Giant selenite crystals grew from low salinity solutions with isotopic compositions compatible with the crystals formed by dissolving the anhydrite found in the mine. The kinetics of gypsum nucleation implies induction times longer than 1 m.y. for the typical temperature (54 °C) and ~ 1 k.y. for low temperature episodes (up to 47 °C). This mechanism provides a super saturation level that is not only small and maintained over time but is also virtually free of fluctuations (even small amplitudes).

Recent contributions have speculated that there are other caves with similar selenite or even with larger crystals exist among the tangle of underground galleries in the area of the Naica mine.