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The relationship between caves minerals and hypogene speleogenesis along the Cerna Valley (SW Romania)

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Over 100 caves are known to develop in the Jurassic and Cretaceous limestone that outcrops on both sides of the Cerna Valley in southwestern Romania. High temperature anomalies are rather uncommon in the cave environment; however, in certain caves in the lower part of Cerna Valley one can measure air temperatures as high as 40ºC. This situation is due to the presence of thermal water pooling or flowing through the caves or to the hot steam that rises along fractures from deeper thermal water pools.
During the long evolution of the thermo-mineral activity along the Cerna Valley interaction has occurred on a wide scale between the cave host rock or/and cave sediments and the ascending hot steam or/and thermal solutions of all types (mainly sulfide-rich). The present work documents the products of these processes and record the occurrence of twenty-four secondary cave minerals (both of primarily or replacement origin) precipitated under particular cave environments. Among these, glauberite, apjonite, halotrichite, pickeringite, rapidcreekite, tamarugite, and darapskite are the most interesting.

The mineral samples were investigated by means of X-ray diffraction, electron microprobe, Fourier-transformed infrared spectroscopy, and scanning electron microscope analyses with the scope of linking the cave minerals with possible hypogene speleogenetic processes. The isotopic measurements (34S) performed on sulfate speleothems contribute valuable information on both minerals and caves origin.

Apart from two minerals (i.e., calcite and gypsum), which were identified in every cave investigated so far, all the others fall into three distinct associations that have resulted from specific reactions under highly particular settings in Diana (sulfate-dominated association), Adam (phosphate-dominated), and Great Sălitrari (sulfate/phosphate/nitrate-rich association) caves. These three remarkable cave occurrences are presented along with morphological features that confirm the sulfidic hypogenic origin of these caves.