Mineralogical study on bur-shaped pyrite in SK050 volcanic ash in Uonuma Groupe, Niigata Prefecture

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Sedimentary pyrite shows a variety of morphologies and textures from euhedral crystals to framboidal, radiating and colloform aggregates depending on the formation environments. Here we report a very unique case of pyrite morphology, “bur-shaped” aggregate, found in microscopic pyrite occurring in SK050 volcanic ash, which is one of the many tephra layers intercalated in the Uonuma formation, Niigata Prefecture.

SK050 volcanic ash and the under- and overlying muddy sediment samples collected from the outcrop along the Shibanomata River in Oguni Town contain microscopic pyrite which can be divided into three types by morphology, (1) framboidal, (2) polyframboidal, and (3) bur-shaped aggregates. Framboidal and polyframboidal aggregates occur in all the sediment samples collected, while bur-shaped aggregates are found exclusively within the SK050 volcanic ash, where the relative proportion of framboidal aggregates is very low. Bur-shaped pyrite is characterized by spheroidal shape with a number of spines and shows a normal size distribution ranging from 20 to 60 μm in diameter, which is more or less larger than that of framboidal pyrite (10-50 μm). SEM observation on the cross-sections through the core prepared by FIB revealed that bur-shaped pyrite always has a framboidal pyrite in its core from which columnar pyrite crystals grew in a radiating manner. Each columnar crystal is terminated by a pyramidal apex, which corresponds to the spines observed on the outer surface of bur-shaped pyrite. These observations suggest that bur-shaped pyrite is a unique product of pyrite overgrowth around a framboidal pyrite core. Sulfur isotope analysis of the SK050 volcanic ash containing bur-shaped pyrite showed very heavy isotopic ratios ($\delta^{34}S$= ca. +20 ~ +25‰), which are clearly distinct from those of the under- and overlying sediments containing framboidal pyrite (ca. 0 ~ +15‰). It seems that bur-shaped pyrite formed as a result of an extensive overgrowth of pre-existing framboidal pyrite when a fluid highly saturated with pyrite penetrated into the SK050 volcanic ash layer which has a much higher permeability than the under- and overlying sediments.

Keywords: Pyrite, Framboidal pyrite

