

# Nanometer-Sized Iron Sulfides Biomineralized by a Deep-Sea Hot-Vent Gastropod

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A novel gastropod has been discovered from a mid-ridge-system in the Indian Ocean and found to be peculiar, because it has scale-shaped sclerites composed of hard proteins and iron sulfides that covered the sides of the foot. We conducted here the detailed crystallographic characterization of the sclerites by using transmission electron microscopy coupled with sample preparation with a focused ion beam system. It was revealed that nanometer-sized (1) mackinawite+greigite, (2) pyrite and (3) amorphous FeS and mackinawite formed in distinct layers from the outer to inner parts of the sclerites. Pyrite was demonstrated for the first time to occur in nature as exceedingly small crystalline nanoparticles (~3 nm in diameter) that are attached sharing a crystal orientation. These results suggest that the nanometer-sized pyrite may be used as a chemical fossil.