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# Redox Conditions During Early Diagenesis Inferred from the Mode and Occurrence of Pyrite in the Upper Ordovician Point Pleasant Limestone of Southwestern Pennsylvania and Northern West Virginia, Appalachian Basin, USA

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## ABSTRACT

The mode and occurrence of pyrite, specifically diagenetic euhedral grains and framboidal pyrite has often been used to assess the redox conditions of bottom and pore water in ancient and recent sediments. Framboids, spherical aggregates of microcrystallites, form at or just below the sulfide chemocline. Here ferrous iron species, sulfide species, and suitable electron receptors such as oxygen are available in enough quantity to promote the precipitation of iron-monosulfide (FeS) minerals such as mackinewite and greigite. The magnetic properties of greigite result in the rapidly forming microcrystallites attracting to one another to form spherical aggregates. Upon passing out of this zone, FeS reacts with H2S to form pyrite. With this understanding it is possible to use the size distribution of framboidal pyrite to infer the position of the sulfide chemocline at the time sediments were accumulating. Framboids precipitating in the water column generally can grow to 3-6 11m before their mass precludes suspension in the water and they sink away from the chemocline and growth is arrested. Sediments accumulating under these conditions are characterized by very small framboids with a narrow size range. Conversely, when the chemocline resides at the sediment-water interface or within the sediment, framboid growth is only limited by the availability of reactants. These sediments are characterized by a diversity of framboid sizes often hosting large framboids >10 11m. Finally, diagenetic pyrite grains form under more protracted rates from the direct interaction of reactive iron and hydrogen sulfide contained within pore waters. This pyrite takes the form of euhedral grains, void-fill, and/or overgrowths on framboids. The mode and occurrence of pyrite, alongside inorganic and organic geochemical data in the Upper Ordovician Point Pleasant Limestone was assed to better understand the redox conditions under which it accumulated.