Tectonic Relations to Chert-Forming Silicification Processes of the Leithsville Formation of Sussex County, New Jersey

Alfredo Siqueiros-Gonzalez[1], Philip C. LaPorta, PhD[2], Margaret Brewer-LaPorta, PhD[2]

[1]Indiana University Bloomington, [2]Lamont-Doherty Earth Observatory of Columbia University

The Early-Cambrian Leithsville Formation of Sussex County, New Jersey, has three members: Califon, Hamburg, and Wallkill. The Califon is shale or dolostone and the Hamburg is alternating layers of dolostone and sandstone with interspersed shale horizons. The Wallkill Member is dolostone and has chert nodules/beds in certain locations. This investigation tested a hypothesis by LaPorta (2009) that attributed chert formation to the dissolution of silica during Taconic orogeny tectonic loading. Silica sources are thought to be cratonically derived clays, bentonitic ash, and marine transgressive quartz sand sequences. The hypothesis was tested using rock fabric measurements made from field observations, rock slabs, and thin section analyses.

The presence of fracture cleavages in dolostone and chert in the Wallkill Member revises the hypothesis of tectonic loading as a chert-forming mechanism. The fractures suggest that cherts in the lower Wallkill were lithified prior to tectonic loading. However, field observation and slab analysis of the upper Wallkill cherts show a second phase of pressure solution silicification.

Upper cherts have an internal lighter silicification phase with an exterior darker phase. Early-Cambrian faulting and stylolites provided channels for silica solution movement, with fracture cleavages providing additional permeability for the second silicification phase.