

A REASSESSMENT OF THE SHALLOW WATER DEPOSITIONAL MODEL FOR THE TAPEATS SANDSTONE, GRAND CANYON, ARIZONA: EVIDENCE FOR DEEP WATER DEPOSITION

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The Tapeats Sandstone forms the basal Cambrian deposit of the Tonto Platform and generally has been interpreted as a shallow marine deposit. In the Grand Canyon, the sandstone was deposited on a low relief Precambrian surface broken by scattered remnant cliffs of Shinumo Quartzite and isolated granitic hills. Paleoslope measurements and sedimentological features were recorded at 63 sections from 21 localities in Grand Canyon exhibiting significant Precambrian topographic relief. At 24 of these sites, debris flows were apparently initiated by some catastrophic event that simultaneously broke up and transported Shinumo clasts in a matrix of Tapeats sand. These brecciated flows were deposited along the Precambrian surface topography from the cliff-faces basinward. Widespread preservation of the breccias along topographic relief during the deposition of the entire thickness of Tapeats Sandstone and much of the overlying Bright Angel Shale indicates that deposition of even the shallowest material was below storm wavebase. Th/U ratios from the breccia matrix in Ninety-one Mite Canyon indicate sediment deposition in a reducing environment. Such conditions are unlikely in a high-energy, nearshore facies. These submarine flows were deposited on a surface with over 140 m of vertical relief and would have required water depths in excess of 200 m below storm wave base to explain the features documented in this research. We propose that the Tapeats Sandstone was deposited as a deep-water, submarine fan complex. A reevaluation of sedimentary structures used to identify the Tapeats Sandstone as a shallow water marine facies reveals these features to be consistent with the deep water model.