PRIMARY EJECTA, TSUNAMI REWORKING, TECTONIC DISMEMBERMENT: RECONSTRUCTING THE LATE DEVONIAN ALAMO BRECCIA AND CRATER, NEVADA. J. E. Warme[1] and A. K. Chamberlain[2], [1]Department of Geology and Geological, Engineering, Colorado School of Mines, Golden, CO 80401, jwarme@mines.edu, [2]Cedarstrat, P. O. Box 36, Hiko, NV 89017.

The Alamo Breccia is the formal middle Member of the Upper Devonian (Frasnian) Guilmette Formation in southern Nevada. The Breccia crops out in 15 or more mountain ranges over an area of 10,000+ square kilometers, distributed in a eastward-extending semicircle centered approximately 150 km north of Las Vegas. Its thickness ranges from about 130 m in the center to a feather edge of less than 1 m, averaging about 50 m. Its volume probably exceeds 500 cubic kilometers.

The Guilmette Formation represents a shallow-water carbonate platform, exhibiting approximately 150 typical shallowing-upward cycles. The Alamo Breccia was first recognized as a stratigraphic anomaly within the Guilmette. The Breccia commonly forms a massive cliff containing countless whole and fragmented stromatoporoids that were previously interpreted as reef and reef debris. The presence of a spectrum of lithoclasts ranging from gravel-sized to slabs hundreds of meters long, and the absence of obvious reef mounds, warranted investigation of the origin of the Breccia. The anomalous occurrence, apparent catastrophic nature, and discovery of a mild iridium anomaly, disseminated shocked quartz, and spectacular beds of carbonate impact spherules, that superficially resemble volcanic lapilli, all confirmed the impact genesis of the Breccia.

The Alamo Breccia has been divided into three lateral zones. The central Zone 1 occurs only in one range and contains the thickest (130 m) but relatively finest-grained deposit. The largest clasts at the base are about 20 m in maximum dimension, and the main body of the breccia is a thick cobble- to mud-sized graded unit. In the intermediate Zone 2 the Breccia averages about 60 m in thickness and contains the largest clasts. Some are as much as 500 m in length; one documented example is 100 thick, occupying 95% of the height of the Breccia. In many localities the large clasts, which are the shattered remains of the in situ carbonate platform, are discontinuous, and the entire thickness of the Breccia is comprised of smaller clasts and matrix. In the peripheral Zone 3 the Breccia thins from approximately 6 m to a feather edge, and is an overall graded bed.

Recent analysis of the Breccia texture showed that internally it is composed of a chaotic lower segment and an overlying series of graded beds that become thinner and finer-grained upward. The thicker lower segment contains a spectrum of clast sizes in a matrix that is commonly muddy and highly variable in texture and fabric. Many of the clasts were preserved in the process of disintegration whereby their margins have dilated and transformed into matrix. Some clasts are internally fractured, dilated and deformed. This unit is interpreted as primary ejecta. Overlying it are as many as 4 graded units, especially well developed over much of Zone 2. Each unit has a sharp base that is commonly deformed by loading from the overlying unit and injected by the underlying one, ascribed to penecontemporaneous dewatering processes. These units are well sorted, graded and clast-imbricated. They are interpreted as sequential tsunami deposits of diminishing force.

Interpretation of the Alamo Breccia, and the location of the crater, has been hindered by the puzzling semicircular distribution of the deposit. The character of the facies of the encompassing Guilmette Formation, and unraveling of the complicated regional structure provides a solution. Zone 2 contains two dominant facies overlying the Breccia. In some Zone 2 localities the Guilmette contains abundant sandstone beds interbedded with the carbonates but no stromatoporoid reefs. In others it contains reefs and little or no sandstone. A balanced cross-section that restores the stacked thrust faults in the region to their original position places the sandstones west of Zone 1 and leaves the reef facies to the east. Zone one, which is highly altered under the fresh-appearing Breccia, is interpreted as a thrust slice containing a portion of the crater. The provenance of the sandstones is interpreted to be a subdued highland fringing the west margin of the platform, perhaps as an early stage of the Antler Orogeny that began in the Late Devonian. The reefs are interpreted to occupy the deeper parts of the platform, which contained one or more depressions.

Upon restoration, the distribution of the Alamo Breccia approaches circular. In this analysis, the regional Alamo Breccia Member is used to constrain tectonic solutions for this complicated region, and the surviving tectonic test explains the current lopsided distribution of the Breccia.