ALAMO IMPACT CRATER DOCUMENTED. J. A. Pinto[1] and J. E. Warme[2], Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO, 80401, [1]rpinto@mines.edu, [2]jwarme@mines.edu.

Introduction: The early Late Devonian, wet-target Alamo Event at southern Nevada resulted in one of the best-exposed and well-dated impact deposits ever documented, the Alamo Breccia [1]. Because post-impact geologic processes have modified, obscured [2, 3] and perhaps wiped away its original morphological and architectural relationships, the crater stratigraphy has remained uncertain. Thus, the full Breccia distribution (Figure 1), and the crater location, has been problematic.

Carbonate breccias and associated bedrock deformation in Devonian strata exposed on Tempiute Mountain (TM) (Figure 1), exhibit a clear crater stratigraphy. Five main types of deformational units are recognized (Figure 2): (a) parautochthonous target rocks and associated monomict authigenic breccia, (b) allogenic breccia dikes and sills, (c) allogenic fall-back breccia, (d) allogenic, partially melted breccia, and (e) reworked, allogenic breccia. High-pressure, shock-metamorphic effects in minerals and rocks, including PFs and PDFs in quartz grains and conical fractures and related features in disturbed target rock also occur [4]. In addition, the apparently concomitant, ductile and brittle deformation in the upper Lower Devonian Oxyoke Canyon Sandstone (Dox) is linked to the Event.

Deformational units at TM: Above the Oxyoke Canyon Sandstone, the Middle to early Late Devonian secuence at TM bears at least five discrete, deformational breccia bodies (Figure 2). These breccias display a variety of grain-sizes, shapes, and stratigraphic relationships. Breccia clasts were derived from both recognized and unrecognized carbonate lithofacies in the area.

(1) Allogenic breccia dikes and sills. Unit 1 is comprised of irregular lenses and dikes of variably clast- to matrix-supported, cobble- to pebble-sized, polymict, dolomite breccia. Chaotic clasts are composed of several types of dolomite, quartzite and fossils, and decrease in size to the walls. The matrix (35-70% of total volume) is composed of subequal proportions of monocrystalline shocked quartz grains, and dolomictrite. The dikes pinch and swell and abruptly change direction. Unit 1 significantly differs from any other breccia in the study area and its composition, internal structure, and stratigraphic relationships with adjacent rocks have not been documented at any other Alamo Breccia localities. It is interpreted as a dike-and-sill system injected from a partially lithified sandstone upward into a fully lithified dolostone of the crater floor or wall.

(2) Parautochthonous target rocks and associated monomict authigenic breccia. This unit is ~280 m thick and comprises a succession of Middle Devonian, fossiliferous and unfossiliferous, gray to black dolomites that have been variably fractured, shattered, twisted, fluidized, brecciated, folded, faulted and pervasively injected by Unit 1. Slabs and blocks of this basal, clast-supported, dolomite megabreccia generally are tens of meters long. They exhibit indistinct or deformed edges, centimeter-scale conical fractures interpreted as shattercones. Lenses and dikes of monomict, fossiliferous, pebbly dolomite breccia occur. Their contacts are transitional with adjacent units and the material had a local source. Unit 2 is interpreted as heavily damaged target rock below the crater floor or wall.

(3) Allogenic fall-back breccia. Unit 3 is ~15 m thick, clast-supported, block- to boulder-sized limestone megabreccia. Framework constitutes 75-80% of the breccia and comprises clasts of different limestone facies partially enclosed by a finer-grained groundmass. At least eighteen lithofacies have been recognized. The lithoclasts have indistinct or deformed edges and interpenetrate. Unit 3 is interpreted as heated and weakened fallback breccia.

(4) Allogenic, partially melted breccia. Unit 4 is ~10 m thick and comprised of matrix-supported, polymict, marbly limestone breccia. Clasts vary in composition, are pebble- to cobble-sized, show preferred orientation, and most of them have been smeared out. They are embedded in a very fine-grained micritic matrix that contains scattered quartz grains. Unit 4 is interpreted as a heated and partially melted breccia overlying the fallback breccia of Unit 3.

(5) Reworked, allogenic breccia. Unit 5 is ~110 m thick and dominated by a variably clast- to matrix-supported, sand- to pebble-sized, polymict limestone breccia that was deposited as two thick, normally graded beds. It is interpreted to represent resurge or tsunami backwash into the newly formed crater.

References: [1] Warme J.E. (2004) *Geotimes, 49,* 26–29. [2] Morrow J.R. et al. (2001) *LPI Contr. 1080.* [3] Morrow J.R. et al. (2005) *GSA Spec. Pap. 384,* 259–280. [4] Pinto J.A. and Warme J.E. (2004) *GSA Ann. Meet.*, Abstract #110-5.

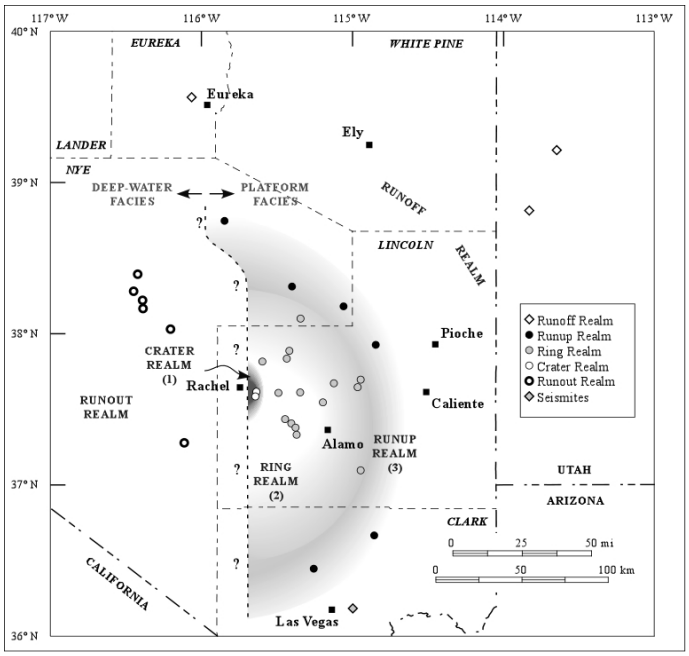

Figure 1. Map of portion of southern Nevada showing distribution of Alamo Breccia types that signify the Late Devonian Alamo Event. The realms labeled runoff, runup and ring are situated on the Devonian carbonate platform. The crater realm is present only on Tempiute Mountain, and shown in the impact stratigraphy column of Figure 2. The runout realm is known only from deepwater channels west of the platform.

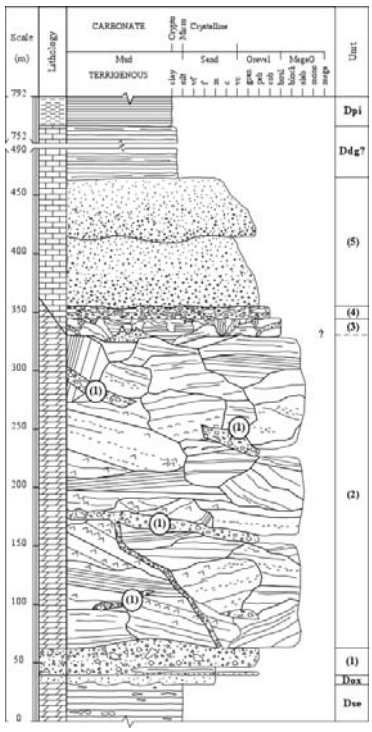

Figure 2. Crater stratigraphy at Tempiute Mountain. Dox is Oxyoke Canyon Sandstone that is relatively undeformed over the Lower Devonian Sevy Dolomite. The upper Dox is brecciated, fluidized, and injected (Unit 1) into Middle Devonian coarsely brecciated dolostone (Unit 2). Unit 3 is interpreted as fallback breccia, overlain by Unit 4 partial meltrock. Unit 5 is 2 very thick Upper Devonian well-sorted graded beds interpreted as early crater fill, overlain by passive post-Event anoxic marine limestone.