HIGH-EXPLOSIVE CRATERING EVENTS IN DESERT ALLUVIUM AT THE DSWA WHITE SANDS MISSILE RANGE/PERMANENT HIGH EXPLOSIVE TEST SITE AND COMPARISON WITH DRES CRATERING EVENTS

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This paper summarizes crater and ejecta data on morphologies, target-media deformation, and formational processes observed for a series of high-yield HE events conducted in dry desert alluvium at the Defense Special Weapons Agency's (DSWA) Permanent High Explosive Test Site (PHETS) on the White Sands Missile Range (WSMR), New Mexico. These events are compared with similar high-yield HE events conducted in dry/wet alluvium with a shallow water table at the Defence Research Establishment Suffield (DRES), Alberta, Canada.

Each of the craters at PHETS were bowl-shaped with steep crater walls, interior benches on the walls, well-defined crater rim crests, and a surrounding ejecta blankets. The ejecta was hummocky from the crater rim crest to the termini of the upward displaced original ground surface. Beyond that range the blanket was relatively smooth to the distal edges of the continuous ejecta.

Deep trench excavations were completed along several radii through each crater and its rim and showed substantial downward and outward flow of alluvium. Ejecta came mainly from the upper one-quarter of the cratered region and was deposited mainly in the coherent overturned flap.

The major differences between the PHETS and DRES events are seen in the general morphology and structure deformation, e., simple bowl -shaped craters vs. saucer-shaped craters. In addition, the PHETS craters have well-defined steep crater walls and sharp rim crests. The morphology and structural deformation are notably different in the DRES craters which commonly have flat floors with prominent central mounds underlain by extensively uplifted wet alluvial beds. In addition, DRES craters are usually surrounded by depressed inner rims underlain by inward dipping alluvial beds. lt appears that these major differences in the high-yield HE craters and ejecta morphologies are due primarily to dry vs. wet geology which in turn control the presence or absence of important liquefaction processes.

Based on the observed crater morphologies and sub-surface structural deformation in the alluvium, it appears that the early-time cratering mechanisms of downward and outward flow of material were similar at both DRES and PHETS. However, at DRES the cratering was severely modified by the saturated alluvial units below the water table. Instead of simple bowl-shaped cratering processes as at PHETS, the DRES events experienced a complex set of cratering and ejection processes, including liquefaction, that resulted in the development of flat-floors, central mounds, and subsequent collapse of the surrounding inner crater rims.

The PHETS and DRES HE explosion events provide substantial new insight into high-yield cratering and ejecta processes in both dry and wet target geologies. The identification of important similarities and differences are made possible because of similar critical pre-shot conditions. Selected reviews of these large data bases are in progress.