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Characterization of a recent impact structure (Carancas crater, Peru) by integrating geomorphologic and GPR data

D. S. Ramírez Mendoza (1) and M. Ramírez Cardona (2)

(1) Instituto de Geofísica, UNAM, Mexico (dafne_mightydoll@hotmail.com), (2) Instituto de Ciencias Básicas e Ingeniería, UAEH, Mexico (mariusrazmirez1975@hotmail.com)

The significance of the Carancas impact structure lies in the fact that is the smaller and youngest crater known in Earth (September 15, 2007). The crater was originated by an H4-5 chondritic projectile. This geoform has a diameter of 13.5 and a depth about 2.5 m. The impact impinged on the phreatic level and a pond (0.6 m-depth) was consequently formed at the center of the structure. The fireball and its trajectory were witnessed by dozens of people who suggest an atmospheric passage from E to W. The impact occurred on the edge of Callacane seasonal river and the projectile collided with recent fluvial sediments and tertiary sedimentary rocks of Puno Group. The understanding or impact craters as geomorphologic signatures originated from a dynamic event lead to study its geometrical characteristics that provide essential inferred data about the precursor impact. In order to make an accurate geomorphological study of the structure, a high resolution Digital Model of Terrain (DMT) was performed. It appears as a very good tool to study the surface of that very recent structure. This model allows estimating the total volume of excavated material (102 m3), the volume of the ejecta ring (90.35 m3) and distal deposits (11.65 m3). The elongation of the actual cavity suggests an impact azimuth within the range 90-130°. Fragile and ductile deformation in shallow target materials (4 and 10 m-depth) was studied by GPR prospecting method with six 200 and 100 MHz profiles traversing the crater. Faulting derived from modification stage was detected in consolidated sedimentary rocks. Up-ward bending reflectors are shifted slightly about the center of the crater and indicate obliquity in the impact. Combining geomorphological and geophysical data provides the estimation (via Scale Laws applied to impactology) of projectile mass (2.9 ton), impact velocity (1.78 km/s), impact angle (57°) and the released energy (4.7 ton TNT equivalent).