THE REMARKABLE METEORITE IMPACT EVENT ON SEPTEMBER 15, 2007, CARANCAS, PERU: WHAT DID WE LEARN?. T. Kenkmann[1], N. A. Artemieva[2], K. Wünnemann[1], H. Poelchau[1], D. Elbeshausen [1], H. Nunez del Prado[3], [1]Museum für Naturkunde, Mineralogie, Humboldt-Universität Berlin, Germany, [2] Institute of Geospheres Dynamics, Russian Academy of Sciences, Moscow, Russia, [3]Instituto Geológico Minero y Metalúrgico (INGEMMET), San Borja, Lima, Peru, Peru, thomas.kenkmann@museum.hu-berlin.de

It is a widely accepted view that stony meteorites below a threshold size of ~100 m undergo major disruption and deceleration during their passage through the atmosphere as their strength is less than the aerodynamic stresses that occur in flight. The small fragments that result from break-up rain down at terminal velocity and are not capable of producing impact craters. The Carancas cratering event, however, demonstrates that metre-sized stony meteorites indeed can survive the atmospheric passage under specific circumstances. An H4-5 chondrite [1] struck the Earth south of Lake Titicaca in Peru on September 15, 2007, and formed a crater 14.2 m across. It is the first impact event on Earth of which the impact trajectory as well as the impact itself were witnessed. We present results of a detailed crater survey (Fig. 1) and reconstruct the crater formation. By modelling the atmospheric traverse we demonstrate that a low cosmic velocity (11-14 kms^{-1}), a very shallow entry angle (8-15°), and a low projectile mass (<5 tonnes) are prerequisites for the survival of stony meteoroids with a strength of a few MPa. The Carancas projectile was decelerated to terminal velocity of 200-300 ms^{-1}, insufficient to produce a shock wave with associated deformation features. The impact occurred at a steep angle (70-75°) and transferred an energy of ~62 MJ into the target. Aerodynamic and crater modelling are consistent with field data, microscopic inspection, and observations by witnesses. The probability of such impacts on Earth is about one event every one hundred years.

[1] Meteoritical Bulletin Database, Meteoritical Society: http://tin.er.usgs.gov/meteor/ (2008)

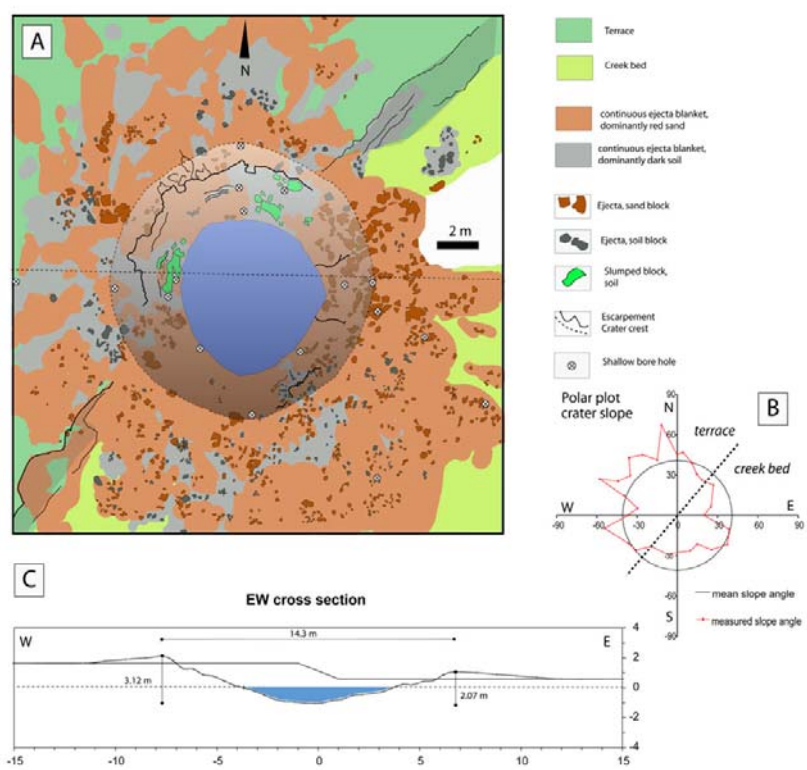

Fig. 1 A, Geological map of the crater. The stippled line delineates the crater crest. Two ejecta lithologies were distinguished: reddish sand and dark soil. Blocks were separately mapped at sizes >0.2 m.. B, Polar plot of the crater slope at the target level showing steep slopes in the NW sector. C, E-W profile through the crater indicates a depth/ diameter ratio of the crater of 0.18 when averaging the altitude differences between the terrace and the creek bed. A parabola fitted to this profile was used to estimate the excavated crater volume, which is about 160 m^3.