WORLD-WIDE IMPACT STRATIGRAPHY AT THE K-T BOUNDARY: IMPLICATIONS FOR THE CHICXULUB IMPACT ANGLE. C. Lana[1], J. Morgan[1], [1]Earth Science and Engineering, Imperial College London, Consort Road, London. SW7 BP. c.lana@imperial.ac.uk

Over the past few decades, results from stratigraphic, paleontological, geochemical and isotopic investigations have provided a considerable dataset that indicates a temporal link between the Cretaceous-Tertiary (K-T) mass extinction and a world-wide deposition of macro- and microscopic particles with an extra-terrestrial (impact) signature [1]. A large amount of stratigraphic, geochemical and geochronological data, indicate that the 200-km-wide Chicxulub impact structure is the most likely source for the K-T layer [2, 3, 4], although Keller et al. [5] disagree. The K-T layer contains zircons of Pan African basement age, and the size of the ejected particles shows a clear increase towards Chicxulub, suggesting the K-T impact site must be in the same region of the Earth as Chicxulub [2-4].

The impact-related particles (here as K-T impactites) are commonly described as fragments of rock and minerals and melt droplets that were formed from the impacting meteorite, as well as the sedimentary and crystalline target rocks, and ejected around the globe [2-4]. Their world-wide geographical distribution indicates that they possessed significant kinetic energy [6, 7] which, along with their high state of shock, implies that they might have been ejected early in the excavation stage, when high energy release produced shock pressures of tens to hundreds of GPa [6, 7]. Recent studies [7] also suggest that the impactites were accelerated during expansion of a CO_2 and H_2O vapor plume released from volatile target rocks. There is, however, uncertainty about the angle of impact which, in turn, might have affected the direction of ejection of the particles and their distribution across the globe. Although there is evidence of coarser shocked quartz grains at longitudes to the west of Chicxulub, leading several authors to suggest an impact direction towards the northwest [8], abundance and size of shocked quartz in the known K-T sites have not been systematically quantified.

Here, we present preliminary results of on-going investigation of the distribution, concentration and grain-size of impactites as well as degree of shock metamorphism in quartz from the K-T ejecta horizon exposed across the world. Samples collected so far are from the Western Interior (USA), Spain, Italy and Brazil. The impact related particles were extracted from samples of 100 grams each, following methodology by Montanari and Koeberl [9], and were grouped according to type and grain-size. Shocked quartz grains were mounted in thin sections and had their planar deformation features (PDF) measured for pressure condition estimates at the time of ejection. The results are currently being combined to understand the mechanism in which the quartz and spherules were ejected from the impact site, and how they were deposited across the world. Future work will be directed at establishing the angle of impact based on the overall distribution and abundance of shocked quartz grains.

References: [1] Alvarez L. et al. (1980) Science 208, 1095-1108; [2] Smit J. (1999) Ann. Rev. Earth Planet. Sci. 27, 75-113; [3] Claeys P. (2002) GSA Spec Pap. 356, 55-68; [4] Hildebrand A. (1991) Geology 19, 867-871; [5] Keller G. et al. (2004) PNAS 101, 3753-3758; [6] Melosh J. (1980) Ann Rev. Earth Planet. Sci. 8, 65-93; [7] Alvarez W. et al. (1995) Science 269, 930-934; [8] Schultz P. and D'Hondt S. (1996) Geology 24, 963-966. [9] Montanari A. and Koeberl C. (2000) Lect. Notes Earth Sci. 364pp.