ORIGIN OF CRETACEOUS TERTIARY BOUNDARY IN MONCADA, WESTERN CUBA AND ITS RELATION TO K/T EVENT. Y. Nakano[1], R. Tada[2], T. Kamata[1], E. Tajika[2], T. Oji[2], S. Kiyokawa[4] ,H. Takayama[2], K. Goto[2], S. Yamamoto[2], K. Toyoda[5], D. Garcia[3], R. Rojas[3], M. Itturalde-Vinent[3] and T. Matsui[1], [1]Dept. of Earth and Planet. Phys., University of Tokyo, JAPAN (Hongo 7-3-1, Bunkyu-ku, Tokyo 113-0033, Japan, nakano@geoph.s.u-tokyo.ac.jp, matsui@geoph.s.u-tokyo.ac.jp, tomoka@geoph.s.u-topkyo.ac.jp), [2]Geological Institude, University of Tokyo, JAPAN (Hongo 7-3-1, Bunkyu-ku, Tokyo 113-0033, Japan, ryuji@geol.s.u-tokyo.ac.jp, tajika@geol.s.u-tokyo.ac.jp, oji@geol.s.u-topkyo.ac.jp), [3]Museo Nacional de Historia Natural, Cuba (Capitolio Nacional, Habana CH-10200, Cuba, Iturralde@mnhnc.inf.cu), [4]Department of Geology , National Science Museum, JAPAN (Hyakunin-cho 3-23-1, Shin-jyuku-ku, Tokyo 164-0078, kiyokawa@kahaku.go.jp), [5]Division of Material Science, Graduate School of Environmental Earth Science, Hokkaido Univeresity, JAPAN (N10, W5, Sapporo 060-0810, Japan, kazuhiro@high.hokudai.ac.jp)

Abstract: In contrast with a thin boundary clay (KTB) in Europe [1], KTB in the Gulf of Mexico and Caribbean regions are characterized by a thick sandstone with abundant impact derived materials [2][3]. However, total amount and distribution of ejecta from Chicxulub crater is not well understood. Ejecta blanket of crater is observable on Moon and Mars, but hardly on Earth because of rarity of large crater and erosion after formation on Earth. Therefore, it is important to investigate distribution of ejecta from Chicxulub crater for understanding the mechanism of terrestrial impact.

We found a 2m thick KTB layer in Moncada, western Cuba. The locality belongs to Guaniguanico Terrain, that is considered to have been located on the slope along the southeastern margin of Yucatan Peninsula during the latest Cretaceous[4], and later scraped off from the margin and accreted to the Cuban Island in association with northeastward migration of the Caribbean arc in Paleogene time [5]. Thus, the locality is the one of the closest sites from the Chicxulub crater at the time of the impact. In addition, KTB from the southeast side of Yucatan Peninsula has not been reported. Therefore, KTB in Moncada offers good opportunity for understanding the distribution of ejecta from Chicxulub crater.

The KTB layer in Moncada overlies dark gray bedded limestone of Maastrichtian Pons Formation, and consists of a 185 cm thick sandstone unit that is overlain by a 4 cm thick siltstone to claystone unit. The sandstone unit is normal graded as a whole, and consists of alternations of coarse to medium grained, thicker (22 to 76cm), olive gray sandstone layers and medium to fine grained, thinner (9 to 17 cm) light to dark gray, calcareous sandstone layers. The olive gray sandstone layers are either massive or parallel laminated, whereas dark and light gray calcareous sandstone layers are generally cross laminated. Rip-up clasts of cherts and limestones are occasionally found near the base of a 76 cm thick olive gray layer, which develops at the base of the unit. The 4 cm thick siltstone to claystone unit consists of a 2 cm thick purplish brown claystone with thin fine sandstone lenzes, a 1 cm thick light brownish claystone layer, a 1 cm thick olive gray fine sandstone layer, and a 1 cm thick yellowish brown clay layer in ascending order. The upper siltstone to claystone unit grades upward into gray fissile limestone (marly limestone), which is 35 cm thick, and then to dark gray bedded limestone of Paleocene Ancon Formation. (Figure 1)

Ir and Ni anomaly was found in the clay layers of the upper unit. Peak concentration of Ir is 0.89 [ppb] (Figure 1), approximately equal to the value at Mimbral, Mexico (0.92 [ppb]) [6] and 10 times higher than average concentration in crust [7]. Maximum Ni anomaly was estimated as approximately 30 [ppm]. Quartz grains with planar deformation feature (PDF) were found throughout the formation (figure 2). We measured the angle between the c-axis and the pole to PDFs using universal stage. Figure 3 show that these features correspond to the crystallographic orientations characteristic of shock produced lamellae. The ω, π and ξ crystallographic orientation of these feature were prominent. This indicates our quartz grains were derived from several pressure zones. The strata of Guaniguanico Terrain are moderately deformed and weakly metamorphosed. Moderately sheared spherule-like grains are found at 30 to 70 cm level from the bottom. We measured chemical composition of the spherule-like grains, but different from the spherules of Beloc and Mimbral. Especially Si concentration of our sample is much lower. We consider it to be because of diagenetic alteration. These evidences, such as Ir and Ni anomaly, quartz with PDF, and spherule-like grains, support the relation with the K/T impact.

We analyzed major element composition of the bulk samples and conducted Q-mode factor analysis using it to identify possible source materials. Three factors can explain 97.9% of the variance. Factor 1 is characterized with higher Al, Fe, Si, Ti, K and Mg, Factor 2 with higher Ca, P and Mn, and Factor 3 with higher Na, respectively. Bulk mineral composition is also analyzed to characterize the factors. Factor 1 has strong positive correlation with smectite and illite, Factor 2 has positive correlation with calcite, and Factor 3 has positive correlation with plagioclase, respectively. Since loading of Factor 1 are higher in olive gray sandstone layers that are characterized

with abundant spherule-like grains, whereas loading of Factor 3 are higher in light and dark gray calcareous sandstone layers that are characterized with abundant quartz and feldspar grains, and since quartz grains in the sandstone unit are dominantly of shocked quartz origin, we consider Factor 1 and 3 as representing impact ejecta dominated by tektite and shocked quartz, respectively. On the other hand, Factor 2 probably represents limestone fragments whose origin is currently under investigation.

References:

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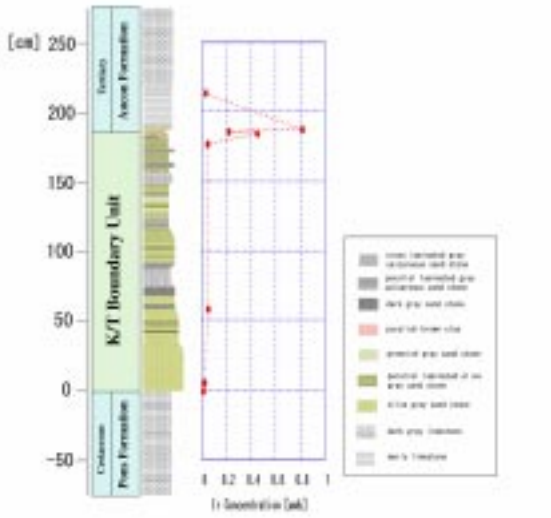

Figure 1
Columnar section of KTB in Moncada and stratigraphy of Ir concentration.

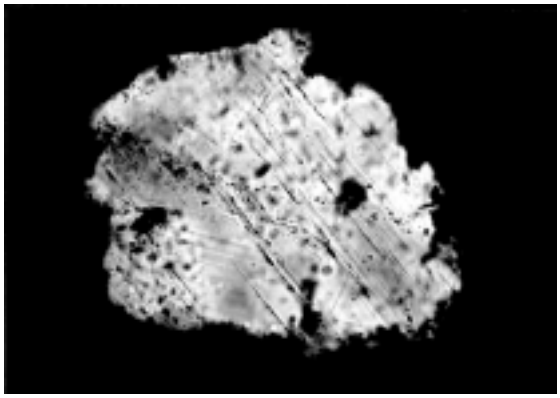

Figure 2
A quartz grain showing at least 3 sets of PDFs. (Cross-polarized light) .

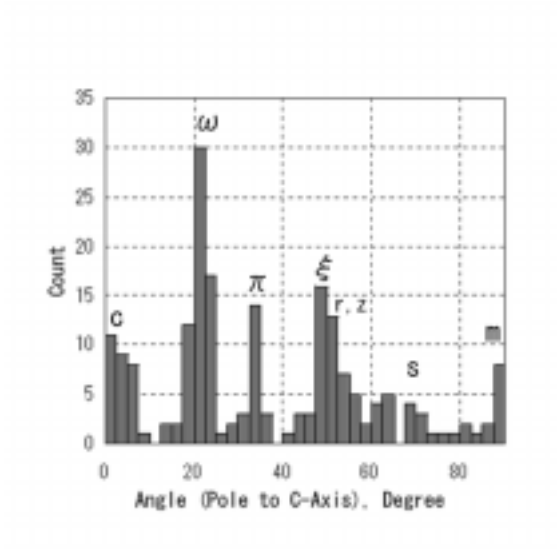

Figure 3
Histgram shows variations in the angle between the c-axis and the pole of PDF. The pattern strongly suggests shocked origin of the quartz grains. The angle of 196 sets of PDFs are measured.