CARBON SOURCE FROM LIMESTONE TARGET BY IMPACT REACTION AT THE K/T BOUNDARY. Y. Miura, H.Kobyashi , M.Kedves and A.Gucsik . Department of Chemistry and Earth Sciences, Faculty of Science, Yamaguchi University, Yoshida, Yamaguchi 753-8512 Japan. yasmiura@po.cc.yamaguchi-u.ac.jp

Introduction: Alvarez et al. (1980) [1] reported that main origin of Cretaceous-Tertiary (K/T) geological boundary is considered to be formed by iron meteorite with ca.10km in size hit to the Earth. Main reason of iron meteorite hit on K/T boundary is anomalous amount of Ir content, shocked quartz, tektites, microtektites, stishovite, Ni-rich spinels and platinum-group elements (PGE) found at the K/T boundaries in the world by many researchers[1,2]. Recently buried large impact crater was found Chicxulub impact crater, Yucatan Peninsula,Mexico as main impact crater of meteorite hit on the K/T boundary [2], though there is possible explanation of multiple impacts around the K/T boundary [3,4,5,6,7]. However large amount of carbon at the K/T boundary is explained by wildfires [8,9].Miura et al. [10] reported that carbon can be acuumulated from target-rock of limestone by meteoritic impacts found at natural meteoritic impact craters and artificial impact experiments. The main purpose of this study is to elucidate new source of carbon from limeston of the K/T boundary.

Probable carbon source around the K/T geological boundary: Wolbach et al. (1985) explained [8,9] that main source of carbon of the K/T boundary is (a) extra-terrestrial origin of meteorite itself, (b) target rock of fossil organic carbon, or (c) wildfires as most plausible source. However Miura et al. [10] reported that large carbon blockes around the Barringer meteorite crater , Arizona, U.S.A. can be formed from Kaibab limestone by impact reaction including vaporization because it contains Si from Coconino sandstone and Ca from limestones on the target rocks. Similar carbon materials can be found at impact craters with limestone target rock, such as Ries, Germany, and Odessa,Texas, U.S.A as shown in Table 1. Artificial impact experiment supported that shocked graphite carbon can be found after railgun impact on limestone by X-ray diffractometer [10] (cf.Table 1).

Caculation of carbon content. Average content of carbon at the K/T boundaries of Denmark, New Zealand and Spain, 0.021 (g/cm^2), shows total amount of carbon as 1.0×10^{17}(g) on the world, which is larger than that of wildfires reported by 0.7×10^{17}(g) [11], though wildfires with reduction condition started from small fire around 10^3km of meteorite impact near middle America covered by ocean water is difficult to explain all carbon content in the world. In this meaning carbon formed by reduction condition can easily be found at impact reaction within vapor plume without oxidation.The present model of limestone contribution for carbon shows that all evaporation carbon from limestone (with 3km in depth and 40km in diameter) is 6.2×10^{17}(g) of carbon. From data of the previous craters, solid carbon formed under reduction condition of impact is from ca.12% (in total) to 0.1% of total carbon from limestone. This suggests that carbon from limestone by impact can explain carbon content of the K/T boundaries. Calculation of plasma density at the meteoritic craters indicates huge production of plasma condition inse the crater which can produce huge carbon with reduction stae during the impact reaction. [11]

Impact model of K/T boundary : Based on the above-mentioned carbon source the following impact model mainly for impact materials is proposed [7,10,11] (Table 1).

1) Single Fe-rich asteroid of ca.10 to 15 km in size are collided to the Earth finally after splitting to many fragments near the Earth.

2) The Main fragment with ca.8 to 10 km in size finally hits to limestone of shallow water of present Yucatan Peninsula,Mexico, though Tertiary limestone can be found after formation of crater to produce present buried crater.

Conclusions: The following results can be summarized as follows[10].

1) Amount of carbon from limestone by impact can explain anomalous data of carbon at the various K/T boundaries.

2) Extraterrestrial objects of the K/T bolides are explained by iron-rich meteorite because it hits to

limestone target rock with carbon. Comets and carbon-rich chondritic meteorite is considered to be broken before making large impact crater on hard rock of the Earth with thick atmosphere. This conclusion can support that Ir-anomaly is maily from iron meteorite source.

3) Carbon evaporated from target rock by impact reaction is found as carbon solid materials, though it is difficult to find it in melted or solid fragments of impact as tekite or spherule by melt condition.

References

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Table 1. Carbon formation at various impact events [7,10,11].

Impact event	Carbon materials
1) Barringer crater, U.S.A.	Graphite, Moissanite (diamond)
2) Ries, Germany	Graphite,. Lonsdalite
3) Odessa, Texas, U.S.A.	Graphite, Moissanite
4) Impact experiment (on limestone)	Graphite
5) K/T boundaries	Carbon