The measurement of the noble gas isotopic ratios in the sedimentary rocks at the boundary site recorded the mass extinction

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The environment on the Earth is very important for all terrestrial lives. It has been constantly kept changing for hundreds millions of years. The rapid and large changes have happened every a few ten million years (My) in the past about 540My and the scale was as big as triggered a global mass extinction. The Permian-Triassic (P-T) boundary event, which was one of the most severe mass extinction, occurred about 251.4 million years ago (Ma). In this time most marine and land species have been gone. It has been considered that super oceanic anoxia resulted by changes in sea level and climate is the direct causes occurred the severe mass extinction. As the most effective trigger, two different opinions are thought; very massive volcanism and large extraterrestrial bolide impact. The former occurred by continental disruption with plate tectonics. Especially, in the End-Permian a formed supercontinent Pangea was rifted. The latter has been considered a size of the diameter more than 1km bolide (asteroidal, cometary or meteoritic etc.) impact event.

Recently Becker et al. (2001) reported an anomaly of 3He trapped in fullerene from the P-T boundary sedimentary rocks from Japan and China. Moreover distinctive 3He/36Ar and 40Ar/36Ar ratios were also shown. The extinction interval was estimated ranging from less than a half of million years (Bowing et al., 1998) to about 8 thousands years (Rampino et al., 2000). Thus it is thought that the P-T boundary event was catastrophic. If the extinction occurred by only a volcanism, its interval ought to be much longer. Becker et al. (2001) suggested that these anomalies therefore derived from extraterrestrial object impact. However, Farley (2001) denied the results of Becker et al. (2001) from the reexamination of the same sample from China. Isozaki (2001) also represented the mistake for their identification of the P-T boundary in the Japanese section. In the Triassic-Jurassic (T-J) boundary (about 208Ma) the mass extinction also occurred and reptilian species has largely changed. Olsen et al. (2002) reported that they observed a modest iridium anomaly at the T-J boundary at the same sites producing much of the new Triassic vertebrate material.

In this study, we measured the elemental abundances and the isotopic ratios of He, Ne and Ar contained in the samples to examine the evidence for an impact at the P-T boundary. We used 13 samples of sedimentary rocks (clay, limestone, chert or sand stone) at the P-T boundary, the T-J boundary and above and below their boundaries from four Hungary sections; Csövär, Balatonarács, Kemesnye and Bálvány. The measurement of the noble gas were carried out by heating the sample at 1600 oC in the vacuum tantalum furnace after they were cleaned by hydrochloric acid to remove CaCO3 in samples. We will discuss about the causes of the severe mass extinction from results obtained in the experiment.