The K/T Boundary of Gams (Eastern Alps, Austria) and the nature of terminal Cretaceous Mass Extinction

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1. The Gams stratigraphic sequence is characterized by a clearly pronounced transitional layer at the K/T boundary and many peculiarities of this layer were first studied. The lower part of the sequence notably differs from the upper part by high concentrations of As, Zn, Cu, Pb, Cr, Ir, Co, V, Ni. In the upper portion of the transitional layer, the content of these elements decreases significantly.
2. Four Ir anomalies were found: the large well expressed anomaly at the K/T boundary, two other anomalies above and one anomaly below the boundary. The Ir enrichment in clays at the K/T boundary layer is not necessarily of impact origin, but may have originated from plume volcanism [Zoller et al., 1983; Officer et al., 1987]. As Keller (2008) has shown recently, iridium anomalies are not unique and therefore not infallible K/T markers.
3. The lower part of the transitional layer has a smectite content of >65%, which decreases gradually upwards, whereas the percentage of illite increases to 20%.
4. Variations in the concentrations of rare earth elements in the Gams sequence are insignificant. The flat configuration of the NASC-normalized REE patterns is typical of the rocks of Mesozoic and Cenozoic continental margins.
5. The study of minerals in the transitional layer at the K/T boundary in Gams provides an explanation of the distribution of trace elements. Our data indicate that there are two distinct populations of minerals in the transitional layer and therefore two different stages in the deposition history. The first one includes the sedimentation in anaerobic conditions due to the spreading volcanic aerosol. The volcanic activity is related to the mantle plume (existence of native platinum, rhenium, sulfides, barite and titanomagnetite).The environments of sedimentation have changed drastically during the deposition of the upper portion of the layer. The paragenesis of hexagonal polymorph of diamond (lonsdaleite) with pure nickel spherules which were discovered here proves an asteroid (meteorite) fall.
6. The ratio $^{3}He/^{4}He$ in the Gams section changes from the bottom to the top of the transitional layer. The difference between the lowermost and uppermost units is significant and (by more than ten times) exceeds the measurement uncertainty (5%) considerably. 7. The variations in ^{18}O and ^{13}C in the vertical section show a pronounced shift toward negative values at the K/T boundary. It is important to emphasize that the minimum ^{18}O and ^{13}C values are characteristic of the transitional layer occurring below the unit corresponding to the impact event. The most remarkable fact is that no microfauna was found in these units. These anomalies in ^{18}O and ^{13}C ratios in the Gams sequence are close to the analogous variations documented elsewhere.
8. The distribution of foraminifera in the K/T boundary in the Gams section shows that the extinction of genera began well before the accumulation of the layer J. The deterioration may have resulted from an input of arsenic and other toxic elements from volcanic aerosol, which resulted in poisoning from these toxic metals in the anoxic environments. The barren interval (dead zone) was detected in the middle part of the transitional layer below the appearance of impact material.
9. Our research eliminates the need in opposing volcanism to an impact event. Both took place, but the changes in the biota were related to volcanism, as it was the case with the Ir anomaly itself. The cosmic body fell only some 500–800 years later!

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