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# Origin of the Mg-Smectite at the Cretaceous/Tertiary (K/T) Boundary at Stevns Klint, Denmark

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**Abstract:** The clay mineralogy and major element geochemistry of four distinct layers within the Cretaceous/Tertiary (K/T) boundary marl (i.e., II, IIIa, IIIb, and IV) at Stevns Klint, Denmark, including " impact layer" (layer IIIa), were examined, and there was not a marked change in the clay mineralogy throughout this K/T boundary marl. A magnesium smectite (i.e., Mg-smectite) was the predominant clay mineral at the K/T boundary not only at Stevns Klint and at Nye Kløv; it was also found to be the predominant clay mineral in the K/T boundary at Karlstrup Quarry. In addition, Mg-smectite was found in a smectitic marl 32 meters below the K/T boundary at the Limhamn Quarry (near Malmö, Sweden), and it did not have anomalous concentrations of iridium or other siderophile trace elements. Given its occurrence in a Maastrichtian marl, it is therefore argued that the Mg-smectite is not derived from meteorite impact.

The rare earth element (REE) signatures of the Mg-smectites ranged from being comparable to the North American Shale Standard (NASC) to being one-half an order of magnitude depleted relative to NASC. One Mg-smectite collected from layer IIIb, immediately above the " impact/red layer," was depleted in REE by one order of magnitude relative to NASC, and these levels of REE are comparable to those of smectite and illite/smectite (I/S) formed authigenically in bentonites and K-bentonites, respectively. Thus, the REE data suggest this Mg-smectite in all likelihood was formed authigenically from a glassy precursor. The presence of the low levels of REE of the Mg-smectite in the layer IIIb has no particular significance other than to suggest that this Mg-smectite separate was the least contaminated with illite or apatite having higher REE levels. With better separation, the other Mg-smectites would be expected to have comparably low levels of REE. Given the presence of the Mg-smectite throughout the K/T boundary and in Maastrichtian and Danian marls, the Mg-smectite is thought to be of volcanic origin. However, is not certain whether the Mg-smectite formed from volcanic glass deposited at the K/T boundary or whether it was formed from volcanic glass as young as late Cretaceous.

**Key Words:** K/Ar dating • K/T boundary • Rare earth elements • Smectite

*Clays and Clay Minerals*; August 1993 v. 41; no. 4; p. 442-452; DOI: [10.1346/CCMN.1993.0410405](https://doi.org/10.1346/CCMN.1993.0410405)

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