

ANOMALOUS TOTAL DOSE OF ESR DATA IN DANISH CALCITE AT K-T BOUNDARY; Y. Miura, Department of Mineralogical Sciences and Geology, Faculty of Science, Yamaguchi University, Yamaguchi 753, Japan.

The electron spin resonance (ESR) dating method has been established in the calcite-group minerals so far [1]. The study of the degree of crystallization or anomaly of the natural radiation will be possible in an older sample more than one million years ago, if a series of layered samples are treated [2,3].

The purpose of the study is to elucidate the great terminal Cretaceous extinction by applying the ESR dating method to the key mineral of calcite collected from the typical Danish Cretaceous-Tertiary (K-T) boundary which has few effect of the terrestrial event of volcanism.

Experimental: The samples used in this study are two localities of SK-1 and SK-2 series from the sea-cliff of Stevns Klint, Copenhagen, Denmark [2,4,5,6]. ESR spectra of the samples SK series of 100mg each in weight with 100 kHz field modulation have been obtained at the room temperature before and after the artificial irradiation from the source of ^{60}Co [2].

Results and discussion: The higher peak of radical signal C ($g=2.0010$) is obtained in the samples SK-2-3 and SK-1-4 before artificial irradiation. The sample SK-2-3 shows relatively higher total dose of natural radiation (TD) of 1613 (± 2944) krad after the artificial γ -ray irradiation. The anomalous higher TD of the SK-2-3 corresponds to about thirty times (the largest is about eighty-five times) the TD of the other samples in the SK-2 series if the sample SK-2-3 has normal TD in the successive samples of the SK-2 series between the SK-2-2 and SK-2-5. The anomalous behaviour of the calcite in the sample SK-2-3, as shown in Fig. 1, indicates that (i) an abrupt influx of the radioactive elements or the cosmic rays to the Earth, or (ii) increase of formation of the structural defect or the trapped CO_3 ion. The former case which may produce the anomalous peak in Fig. 1 is considered by the supply of extraterrestrial materials, because the terrestrial volcanism is difficult to play an important role in an "anomalous higher content" of the radioactive elements only to the sample SK-2-3 in the successive layers of the fish clays. The latter case which may result in the defect signal C is caused by the structural defect of calcite formed by rapid changing of physical condition (such as sudden and rapid temperature rise) or by formation of the radical CO_3 ion combined with the other cations (i.e., trivalent impurities etc.). The major content of the radioactive elements and trivalent impurities could not find in the Danish K-T boundary so far [7]. The structural defect of the calcite in the sample SK-2-3 is supported by rapid change of the cell-parameters and by the electron micrograph of the wormy texture. The worldwide event of the K-T boundary can be supported by the delayed effect of the deformed calcite on sedimentation in the Danish SK series, resulted in the "delayed" anomalous peak found in the lower middle of the fish clay of the SK-2-3 (Fig.1).

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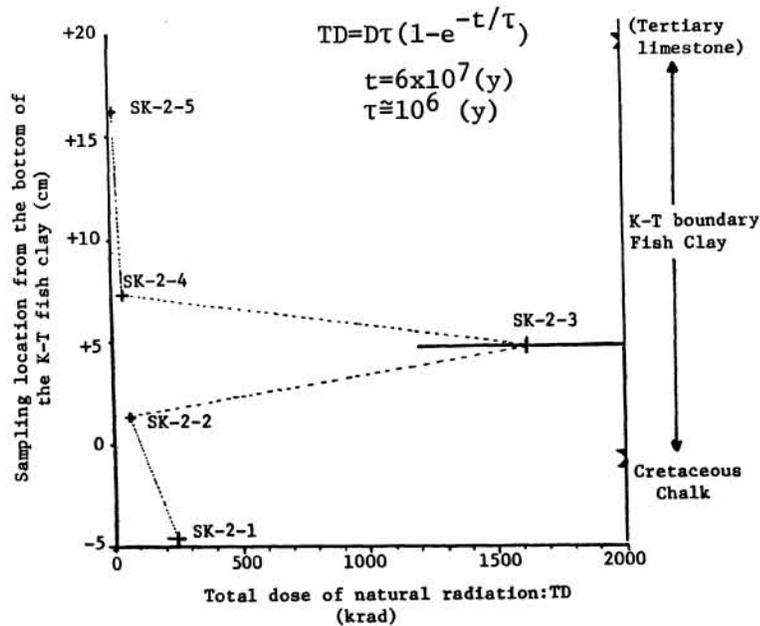


Fig. 1. The relation between sampling location of the SK-2 series from the bottom of the K-T fish clay (cm) and total dose of natural radiation:TD (krad). The sample SK-2-3 shows anomalous higher peak of about thirty times (average) the TD of the SK-2 series from the SK-2-2 to the SK-2-5.

The helium ratio $^3\text{He}/^4\text{He}$ [8] in the samples SK-2-3 and SK-2-4 shows relatively higher values ($2 \sim 9 \times 10^{-5}$) of ten times the terrestrial values. The higher helium ratio in the fish clay of the K-T boundary is nearly consistent with that in the deep-sea sediments, resulted in the possible supply from extraterrestrial materials [9].

Thus, an abrupt physical and chemical change might have occurred at the terminal Cretaceous extinction [2,7,10,11], though the definite extraterrestrial materials cannot be specified in this study.

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