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Study of ESR signals and TLCIs from natural quartz for sediment provenance

Aiko Shimada[1*], Masashi Takada[2], Shin Toyoda[3]

[1]JEOL.Ltd, [2]Nara Women's University, [3]Okayama University of Science

Introduction

Quartz is one of the most abundant minerals on the surface of the earth. ESR dating of quartz, therefore, has been applied to a wide variety of samples, such as fault gouge, volcanic tephra, sediments, and flint artifacts [1]. Another direction of studies is to utilize the ESR signals as a marker of the samples like isotope analysis. The intensity of the E1' center in quartz is shown to be a useful parameter to investigate the provenance of Aeolian dust as well as of sediments [2]. As the intensity correlates with the age of the host granite in the range 10 Ma to 1 Ga, it is possible to distinguish quartz grains of Tertiary origin from those of Cretaceous. The Al, Ti-Li and E1' center signal intensity of natural quartz grains were irradiated with 2.5kGy gamma doses, as a means of estimating sediment provenance [3]. Samples were prepared various the host rocks and the sediments of Tertiary and Quaternary around Kizu River and Saho River. In this study, it will be discussed to estimate those sediments provenance. If this technique is established, it will be useful to elucidate the provenance of river basin and the encroachment of mountain.

Sample preparation and experiments

Quartz grains for ESR measurements and TLCIs were extracted from the host rocks and the sediments. The samples were irradiated 2.5kGy gamma dose, then heated at 270 degree Celsius for 15minutes to ensure that the intensity of E1' center signals approaches to the maximum. ESR spectra recorded on an ESR spectrometer (JEOL TE-100, FA200; X-band), operating amplitude of field modulation was 0.1mT at 100kHz modulation frequency. The ESR signals of E1' center signal were observed using a microwave power of 0.01mW at room temperature. The ESR intensities of the Al and Ti-Li centers were measured with a microwave power of 5mW at 77K.

Temperature range of TLCIs measurement were 200-400 degree Celsius to provide a heating rate 30 degree Celsius/s.

Result and discussion

The ESR signal intensities were found useful to distinguish the sediment provenance. The results in TLCIs were well correlated to the ESR results. The combination use of the ESR signal intensities and the characteristics of TLCIs were effective to investigate the fine-grained sediment provenance.

References

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