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琵琶湖とその周辺域に分布する石英粒子のESR/TL信号特性

Characteristics of ESR/TL signals from quartz grains in and around Lake Biwa

高田 将志[1*], 島田愛子[2], 嘉味田裕樹[3], 豊田新[3], 竹村恵二[4]

Masashi Takada[1*], Aiko Shimada[2], Hiroki Kamita[3], Shin Toyoda[3], Keiji Takemura[4]

[1]奈良女子大学, [2]日本電子株式会社, [3]岡山理科大学, [4]京都大学大学院

[1]Nara Women's University, [2]JEOL, [3]Okayama University of Science, [4]Kyoto University

1. Introduction: We used the ESR Al , Ti-Li and the maximum ESR E1' center signal intensities of quartz grains, which were irradiated with 2.5 kGy gamma doses, as a means of estimating sediment provenance (Simada and Takada, 2007). We were able to distinguish between the ESR signal intensities of Tertiary and Cretaceous igneous rocks collected around Lake Biwa, Japan's largest lake. We also measured the ESR/TL signals of quartz extracted from the 1422 meters sediment core in the lake, to discuss sediment provenance and depositional conditions at the drainage scale.

2. Samples and experiments: Quartz grains for ESR/TL measurements were extracted from the samples as follows. First, the samples were gently crushed, if necessary, sieved and soaked in 6M HCl overnight. Then they were treated with a 1% HF and 1% HNO3 acid mixture solution for 12 hours twice and treated with 46% HF solution for 40 minutes to dissolve contaminant feldspar. Magnetic minerals were then removed using a magnetic separator. Finally, the grains were soaked in 6M HCl overnight, rinsed with distilled water, and dried.

The ESR signals of the E1', Al, and Ti-Li centers were then measured for each sample. A total of 100 or 150 mg of quartz grains was used for ESR measurements. ESR spectra recorded on an ESR spectrometer (JEOL TE-100; X-band), operating amplitude of field modulation was 0.1 mT at 100 kHz modulation frequency.

The E1' center signal was observed using a microwave power of 0.01 mW at room temperature. The width of the magnetic field was 2.5 mT, with a scan time of 8 minutes and a time constant of 0.3 second. The ESR intensity of the Al and Ti-Li centers were measured at the temperature of liquid nitrogen (77 K). The signals of the Al and Ti-Li centers were observed with a microwave power of 5 mW. The width of the magnetic field was 25 mT, with a scan time of 0.5 minutes and a time constant of 0.03 second.

We irradiated samples with radiation of a dose rate of ca. 52 Gy/h with a ^{137}Cs source. Following a gamma ray dose of 2.5 kGy, we heated the samples at 270 degrees Celsius for 15 minutes to ensure that the intensity of the E1' center signals approaches to maximum.

We also measured the 110 degrees Celsius TL signal sensitivities of the samples by the pre-dose

technique (Bailiff and Haskell, 1984).

3. Results and discussion: We are able to distinguish the ESR signal intensities of the analyzed samples of Tertiary and Cretaceous igneous rocks. Furthermore the ESR signals of quartz extracted from the middle Pleistocene lake sediments (ca.1.0-0.4 Ma) show different intensities in terms of stratigraphy. The 110 degrees Celsius TL signal sensitivities of the samples also show different characteristics in terms of stratigraphy. It suggests environment changes affected provenance of sediment. Further discussions on sedimentary conditions at the drainage scale in and around the lake will be presented in the poster.

References:

Bailiff, I. K. and Haskell, E. H. (1984): Use of the pre-dose technique for environmental dosimetry. Radiation Protection Dosimetry, 6, 245-248.

Shimada, A. and Takada, M. (2007): Characteristics of Electron Spin Resonance (ESR) signals in quartz from igneous rock samples: a clue to estimating sediment provenance. Annual Reports of Graduate School of Humanities and Sciences, Vol. 23, 187-195.

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