

Detection of aeolian dust in a sedimentary sequence at Tsujita Site

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The Tsujita site is located in Yahata Nishi-ku, Kitakyuushu City, Fukuoka. This site was excavated to clarify the historical dynamics of human migration to Japanese Islands during the late Pleistocene. Total of 9 sedimentary layers have been recognized by the conducted excavations. The observations that Layer 4 is underlain by the primary Aso-4 pyroclastic flow deposition (Layer 5) and AT was found in the middle of Layer 2 would indicate that Layers 2 to 4 correspond to the last interglacial to glacial climate change. If this is the case, Layer 2 should be composed of loess, Layer 3 of paleosol, and Layer 4 of loess. Burnt rock fragments were found from the lowest part of the Layer 3 to the uppermost part of Layer 4.

The number of oxygen vacancies in quartz measured by ESR (electron spin resonance) correlate with the ages of granitic rocks. Using this feature, there are several works that discussed the origin of the aeolian dust brought to the Japanese Islands from China. The present study aimed to find the change of the amount of aeolian dust from China deposited in the sedimentary sequence of Tsujita site.

From Layers 2 to 5 at the Babayama part of Tsujita site, 22 sediment samples were collected with every 5 cm interval. The sediment samples were treated with hydrochloric acid and hydrogen peroxide followed by grain size separation with the Stokes method into 2 to 20, 20 to 50, and 50 to 125 μm . The samples were then treated with hexafluorosilicic acid to extract quartz. By XRD analysis with calibration with silicon, the quartz content in the sample was estimated. After giving γ rays to a dose of 2.5 kGy, the extracted quartz was heated at 300 °C for 15 minutes before ESR measurement.

The number of oxygen vacancies was obtained as the signal intensity of the E_1' center in a unit of 1.3×10^{15} spins/g for the 2~20 μm grain size fractions. As the first order approximation, it was assumed that the number of oxygen vacancies in aeolian dust from China is 20 unit and the local dust is 0 in order to estimate the fraction of the aeolian component in the measured sample, from the obtained number of oxygen vacancies. Finally using that, we calculated the mass of quartz of the aeolian dust component from China and the mass was divided by the initial mass of the sediment to obtain the concentration ranging from 0 to 1800 ppm. The concentration of aeolian dust quartz component from China was found to be higher in Layer 1 and 3 while lower in Layer 2 and 4 confirming the correlation with the estimated climate change.

Keywords: Aeolian dust, Electron spin resonance