

Finger print minerals for provenance estimation of Atamadai type pottery (2500-1500 BC) from Hinoki site (Tochigi, Japan) using powder XRD

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Atamadai type pottery, a kind of Jomon pottery, had been distributed in eastern Kanto region of Japan in the Middle Jomon Period (2500–1500 BC). This pottery is thought to have been made from mixture of clay as a raw material and granite fragments as a temper[1]. Generally, the chemical composition of ancient pottery is useful for provenance estimation. However, it is hard to geographically characterize this ‘added pottery’ because the temper may have different locality from raw material. Actually, 77 Jomon pottery shards (including 59 Atamadai type potteries)[2] excavated from Hinoki site, Motegi city, Tochigi, Japan, were difficult to be characterized by their mean chemical composition using X-ray fluorescence spectrometry. Thus, we focused on X-ray diffractometry (XRD) which can conduct not only qualitative and quantitative analysis of minerals constituting pottery but also estimation of solid solution composition based on peak shift. In this study, Atamadai type pottery shards from Hinoki site were analyzed by powder XRD for select of ‘finger print minerals’ appropriate to their provenance characterization.

The following Jomon potteries[2] from Hinoki site were selected in this study: Atamadai I type, Atamadai II type, Atamadai III type, Atamadai IV type, Daigi type, and Kasori EI type. The samples (about 1 g) which were obtained from each pottery shard using a router, were finely ground with an agate mortar and pestle. The powdered samples were analyzed by XRD using a Rigaku SmartLab diffractometer.

The XRD patterns showed as follows. All samples contained quartz and plagioclase which are major mineral component. Additionally, all Atamadai types had biotite originated from granite temper[1]; in contrast, Daigi and Kasori-EI types had no biotite. This result presents the biotite can show difference between Atamadai types and the other types from Hinoki site. On the other hand, some XRD patterns of Atamadai type potteries indicated characteristic peaks originated from kaolinite which is a kind of clay mineral. The kaolinite may be useful for estimation of not only geological characteristics but also firing technology because kaolinite’s peaks disappear by heating at 500–600°C[3].

[1] Y. Shimizu: *Res. Bull. Chiba Archaeol. Res. Cent.*, **8**, 80 (1984) (in Japanese).

[2] M. Kasai, T. Matsumoto, S. Ichikawa, T. Nakamura, K. Kobayashi, M. Tsukamoto: *Res. Bull. Tochigi Archaeol. Res. Cent.*, **22**, 7 (2014) (in Japanese).

[3] T. Broekmans, A. Adriaens, E. Pantos: *Nucl. Instrum. Meth. B*, **226**, 92 (2004).