Heating experiment of soils from archeomagnetic site, Takabatake-Iseki, at Matsumoto city, Japan

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Baked soils from the dwelling sites unearthed at the 6th excavation of Takabatake ruin, Matsumoto city, Japan, had been investigated archeomagnetically (Hemmi and Saito, 2018). More than one hundred soil samples obtained from ancient kitchens at 23 dwelling sites were investigated. Soil samples, which seemed to be heated with higher temperature, showed strong NRM, higher susceptibility and stable remanent magnetization, yielding paleomagnetic directions and intensities with higher reliability. On the other hand, samples heated with lower temperature showed weaker NRM and lower susceptibility. Their demagnetization results showed zigzag trajectories, suggesting influence of VRM. Degree of heating is important for acquisition of stable TRM (e.g. Morinaga et al., 1999). In this study, soils obtained from Takabatake ruin were heated in the laboratory. We tried to reproduce natural baked soils and evaluate degree of heating by using rock magnetic and petrologic methods.

Our results indicated that magnetite was formed at temperatures of 600˚C because susceptibility increased and SIRM was acquired under 200mT. Hematite was formed at 800˚C because IRM was not saturated above 200mT and at the highest field of 1100mT. The longer heating time became, the more hematite was formed between 800-900˚C. At 1000˚C, magnetite in addition to hematite was formed with increasing of heating time. Soils in graphite container did not suffer so much oxidation, resulted in little hematite contribution. Compared our results with natural baked soil samples (Hemmi and Saito, 2018), baked soils from the ruins seem not to be heated with high temperature of about 800˚C because of smaller contribution of hematite. This is consistent with degree of consolidation of baked soils, which did not suffer complete coalescence. Another possibility is that baked soils from ruins may be heated under relatively reductive conditions, though it is unlikely that an open fire under atmosphere produce reductive condition.

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