

Reconstruction of horse movement and management in the Kofun period

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Introduction

The horse management was fundamental steps, contributing to great civilizations. In Japanese archipelago, the founder population of horse was introduced from Continental region during the Kofun period (3th-7th). A number of the Kofun, the large tomb in Japanese archipelago, was constructed by numerous people, and it is possible that the early great civilization started from the Kofun period. On the archaeological contexts in this period, it is thought that the horse management was similar to Continental region, and horses were generally supplied to the urban area from the outer suburb. This relocation system is crucial to establish the large government and nation in Japan.

Recently, the isotope analysis was applied to number of archaeological researches. Especially, the isotope analysis of heavy elements could provide zooarchaeological remains with the information about habitation area and movement history. As effective technique to the reconstruction of mammal habitation area, strontium isotope analysis of hard tissue (tooth enamel) was applied to a number of archaeological researches. In archaeological researches, the strontium isotope ratio has been used for information to distinguish local individual and non-local individual based on the archaeological hypothesis such as introduction and movement of mammals. In this study, we tried to reconstruct the horse movement using stable isotope analysis, and demonstrated the horse management in the Kofun period.

Materials and Methods

To reconstruct the movement pattern of horses in the Kofun period, the mammal remains excavated from Saragunjori site in Osaka Prefecture was analyzed using strontium isotope analysis. The sample powder was sampled from nine horse enamels, two dog enamels and two wild boar enamels using tungsten bur drill. The local range of bio-available strontium isotope ratio was defined on dog and wild boar remains, to detect the introduction of the horse from outside regions to this site. Mammal enamels were purified by the pretreatment with 0.1N acetic acid buffer and the column extraction which filled a cation exchange resin. The strontium isotope ratio of sample was measured using thermal ionization mass spectrometer (TRITON, Thermo Fisher Scientific). The strontium isotope ratio ($^{87}\text{Sr}/^{86}\text{Sr}$) was normalized by $^{88}\text{Sr}/^{86}\text{Sr}$ to natural abundance, and $^{87}\text{Sr}/^{86}\text{Sr}$ was corrected by NBS987 (certified value; $^{87}\text{Sr}/^{86}\text{Sr}=0.710250$). The internal measurement error (standard error) was 3.66 ppm (0.000005).

Results and Discussion

The mean of the strontium isotope ratio in the horse enamel from the Saragunjori site showed 0.708911, the standard deviation 0.000897, maximum 0.710968 and minimum 0.707903 (Figure). The mean of the strontium isotope ratio in the dog and wild boar enamel from the same site showed 0.708929, standard deviation 0.000787, maximum 0.709644, and minimum 0.708245.

To identify the outlier of horse from the Saragunjori site, the strontium isotope ratio of the horse enamel was compared with the local mammals from the same site. If the strontium of the enamel was more various than the local, it indicate that the individual was introduced from the other regions. To test statistically the difference between the variation of horse enamel and dog and boar from the site, F-test was carried out by dividing two groups (the horse group and the dog group). As a result, the variation of the horse enamel was insignificantly higher than the local mammal ($P>0.05$). Therefore, it was indicated that the Saragunjori horse was not supplied from the larger habitat than the dog and wild boar. Since the range of strontium isotope ratio is 0.708-0.713 based on geochemical background around this site, the population was managed in a local area. This result indicates that there was not yet relocation system in this region for Kofun period.

Keywords: Strontium isotope analysis, Horse, Mobility

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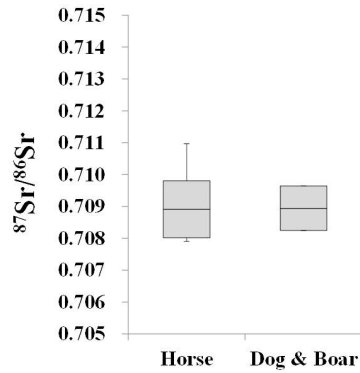


Figure 1. the strontium isotope ratio of mammal remains in Saragunjori site