論文内容の要旨

論文題目：Morphological evolution of extant sika deer molars with reference to wear and hypsodonty.

（現生ニホンジカにおける大臼歯の磨耗と形態進化に関する研究）

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Evolution of hypsodont cheekteeth in grazing ungulates is an extensively investigated subject in paleontology and evolutionary biology. Hypsodont molars, as well as other craniodental characteristics such as broader snouts, larger areas for the insertions of the masseter muscle and higher mandibular corpora, have been interpreted as adaptations to ingesting and masticating a larger amount of less nutritious and fibrous graminoids. Increased hypsodonty has been considered to allow more abrasive food to be eaten without decreasing an animal's life span, though empirical data supporting this idea are scarce. If the correlations between diet and craniodental morphology obtained in interspesific comparisons actually reflect adaptation to grazing, the same trends should be observed under the species level, under sufficient conditions of selection. In the present paper, I first investigated dentognathic morphology of extant sika deer (*Cervus nippon*) populations with distinct food habits and various habitat environments in order to clarify 1) whether the correlations between diet and dentognathic morphology were held under the species level, and 2) whether diet or other ecological factors influence molar wear rates and whether a faster wear rate results in increased hypsodonty. It was shown that the subspecific sika deer lineage inhabiting northern Japan had significantly larger and more hypsodont molars than the southern sika deer lineage, and that such

differentiations were not observed among the ecologically different populations within the same lineage. Molar wear rate was shown to associate with grass consumption and external abrasive matters ingested during feeding, with significant variation in wear rate among the observed sika deer populations. The variation in wear rate, however, did not correlate with the degree of hypsodonty, except for the case of possibly a single population (the Kinkazan Island) which had the most rapid molar wear rate and the most hypsodont M_3 among the investigated sika deer populations. The molar wear rates of the sika deer were further used to develop an age estimation method from molar height, and the method was applied to extinct deer remains from the Pleistocene deposits of Okinawa Island to reconstruct mortality profiles of that species. Finally, combining the morphological and demographic data, I tested whether longer duration of molar functionality positively associates with longer longevity (life expectancy) in the sika deer. It was shown that longer molar durability in the M_3 positively associated with longer longevity, especially in the older age sika deer. This gives support for the expected, but not tested, relationship between increased hypsodonty and longevity. The possible reasons why correlations between diet or molar wear rate and the degree of hypsodonty among the populations were not obtained are as follows: 1) selection for increased hypsodonty, as expressed by current molar wear rates, is not strong enough to bring about noticeable adaptive change in molars, 2) selective pressure has not been of sufficient duration since the divergence of the populations, 3) genetic factors other than natural selection, i.e. genetic drift and/or gene flow, may have obscured slight differentiation among the sika deer populations, and 4) the observed correlation between molar durability and longevity is not causative. The present results, that showed a positive association of increased hypsodonty with longevity (and therefore animal's fitness), support the hypothesis that adaptive change in hypsodonty occurs under the species level or at the population level. In environments with low predator-induced mortality, the evolution of hypsodonty could be accelerated, because selection for molar functionality may be enhanced with increased longevity. This offers a new interpretation for the increased hypsodonty in insular ruminants, which is conventionally regarded as an adaptation to more abrasive diet in resource limited island environments.