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Late Miocene and Pliocene large land mammals and climatic changes in Eurasia

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Abstract

The fossil teeth of land mammals offer a powerful tool to map the regional details of past climate change in the terrestrial realm. We use mean plant-eater hypsodonty (molar crown height) of late Neogene mammal localities to map late Miocene and Pliocene palaeoprecipitation on the Eurasian continent and, with higher temporal resolution, in Europe. The results show that the mid-latitude drying in Eurasia affected the central parts of the continent first and that the drying of western Europe after about 7–8 Ma seems to have coincided roughly in time with a return to more humid conditions in eastern Asia, with a return to a drier east and more humid west in the Pliocene. Within Europe, the hypsodonty-based palaeoprecipitation maps suggest that the sequence from MN 9 to MN 12 (ca. 11.1–6.8 Ma) was dominated by an east–west (continental-marine) humidity gradient, which gradually intensified and with a shift of dryer conditions eastwards in MN 12 (ca. 7.5 Ma). This was partly overlain

from MN 13 onwards by a north–south oriented gradient, which persisted at least to the end of the Pliocene. The maps for both the earliest late Miocene (MN 9, ca. 11.1–9.7 Ma) and the earliest Pliocene (MN 14, ca. 4.9–4.2 Ma) show very low regional differentiation, possibly suggesting perturbed phases in the evolution of the mammal communities. Analysis of hypsodonty and dietary structure of the mammalian plant-eater community in Europe during the entire interval shows that the Miocene–Pliocene boundary was marked by a strong decrease in mesodont species and mixed feeders, and an increase in brachydont species and omnivores. In this view, the shift in the latest Miocene from east–west to partly north–south-polarised hypsodonty patterns corresponds mainly to an increase in hypsodont species and grazers. It seems probable that the east–west gradient was primarily driven by precipitation, while the north–south gradient would also have been strongly influenced by temperature-related effects of humidity.



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Keywords

Late Neogene; Fossil mammal community; Herbivory; Hypsodonty; Palaeoprecipitation

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