SPECIES RICHNESS IN RODENTS AND CLIMATE

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Geographical distribution and species richness in mammals, and in particular in rodents, seem to be highly dependent on climate. The geographical diversity of several rodent sub-families has been studied and is clearly not randomly distributed. Thus, for example, the arvicolines have an holarctic distribution and are very well diversified in the most Northern areas. At the opposite, murines are only found in the old World and are particularly numerous in tropical and sub-tropical regions. And sigmodontines are distributed only in the New World. For these three rodent sub-families, the correlations obtained between climatic parameters, as mean annual temperatures or precipitations, and number of species are high.

Such relationships yielded to the construction of quantification models based on linear regression technique, and these models can be then applied on fossil faunas and used to estimate past temperatures.

Thus species richness has been compiled (1) in sigmodontines for 270 extant local faunas from North and South America, (2) in arvicolines for 250 extant local faunas from Old and New World and (3) in murines for about 180 extant local faunas from the old World with respectively the corresponding climatic data (mean annual, monthly minimum and monthly maximum for temperatures and precipitations). Local faunas represent homogeneous ecosystems and they cover surfaces ranging from 1 km^2 up to 50000 km^2, but they generally are less than 1000 km^2. Anyway, there is no correlation between areas of localities and numbers of species in the fauna. The relation between the number of species and the present day temperatures is high, with a determination coefficient $R^2 = 0.848$ for sigmodontines and $R^2 = 0.828$ for arvicolines.

To compare and validate temperature estimates based on the species richness, oxygen isotope composition of biogenic phosphates from arvicoline teeth was used. An oxygen isotope fractionation equation was determined by using present-day European arvicoline tooth phosphate, and then applied to the Late Pleistocene karstic sequence of Gigny. The oxygen isotope compositions of arvicoline teeth record variations in mean air temperatures that range from 0°C to 15°C, similar to those obtained with the species richness ranging from –2 to 12°C.

This relation to the climate is clearly higher for the small mammalian species, as rodents, than for the large ones, as ungulates, for which the determination coefficient is only equal to 0.3.