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Climatic fluctuations and tropical troglobitic evolution

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Allopatric speciation (which is considered to be the most probable model of speciation in general) of cave organisms requires geographic isolation as a result for instance of local extinction of epigean populations. A classical model proposed to explain the origin of terrestrial troglobites in temperate zones (e.g., Barr, 1968; Culver, 1982) relates this local extinction to long-term climatic fluctuations, such as Pleistocene glacial cycles. From this model, it is predicted that: 1) Regions subject to more frequent and accentuated fluctuations will present a higher ratio troglobitic/troglophilic species, especially in the case of terrestrial fauna. 2) Dry, arid or semi-arid areas will bear the most specialized troglobites.

This model can be applied to the origin of tropical troglobites as well, especially for terrestrial organisms. Evidences of Quaternary climatic changes in tropical South America are indisputable, indicating drier climates related to glacial periods (Figs. 1 and 2). Moreover, preliminary comparative data on the composition of Brazilian cave fauna seems to fit those predictions (for discussion, see: Gnaspini & Trajano, 1994; Trajano, 1995).

For instance, relatively few terrestrial troglobites are found in those areas in Central Brazil (n° 1 in Figs. 1, 2) which remained covered by a cerrado vegetation similar to that of the present time during the last glacial period.

Highly specialized troglobites and some "relictual" hygrophilic organisms (for instance, see Gnaspini et al., 1998) have been found in caves of northeastern Brazil (n° 2 in Figs. 1, 2) (and in the Argentinian Patagonia as well – see Trajano, 1991). These animals may have colonized the subterranean biotope during the short periods of higher humidity (possibly near the interglacial maxima) and became isolated for long periods since then (including the glacials and part of the interglacials).

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Less specialized troglobites are found in areas now covered by humid vegetation but that had dried during glacial periods, as seems to be the case of the southeastern Brazil (n° 3 in Figs. 1, 2). It probably happened because the total time of isolation is shorter (all or part of the glacials).

Unfortunately, there are some areas in Brazil which are still scarcely surveyed from the biospeleological point of view (such as numbers 1 and 2 in Figs. 1, 2), when compared with southeastern Brazil (n° 3 in Figs. 1, 2). A more intense study of the latter areas (and of other tropical areas as well) will probably result in a larger number of highly specialized tropical troglobites and more data to corroborate the hypotheses discussed herein.

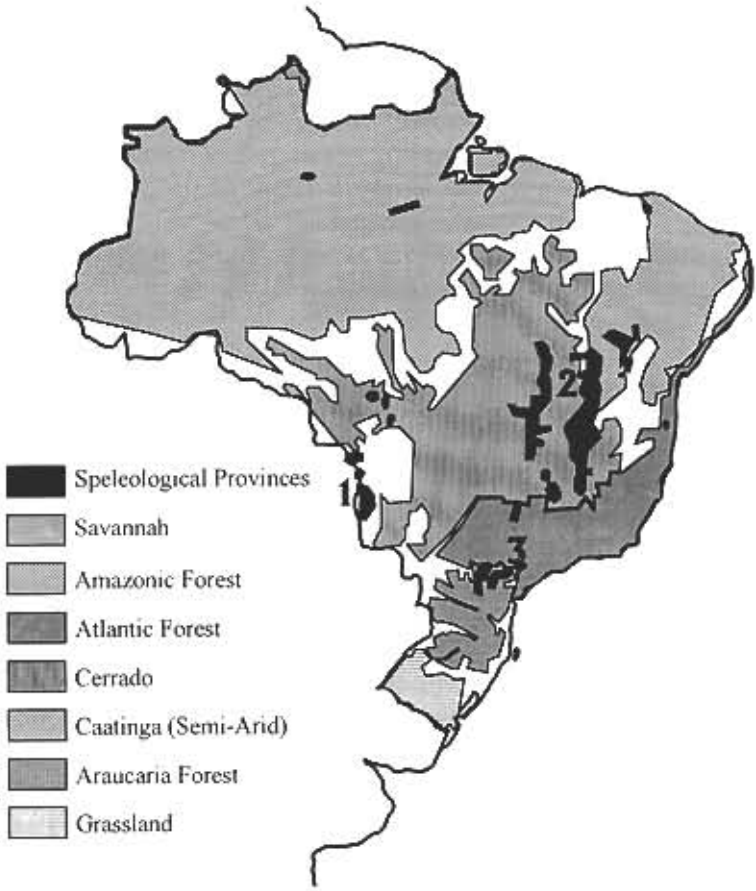

Fig. 1 – Present morphoclimatic domains in Brazil (modified from Ab'Saber, 1977a). The Speleological Provinces (modified from Trajano & Sanchez, 1994) are placed in the same map. (1) = Bodoquena Ridge Speleological Province; (2) = Bambui Speleological Province; (3) = Ribeira Valley Speleological Province.

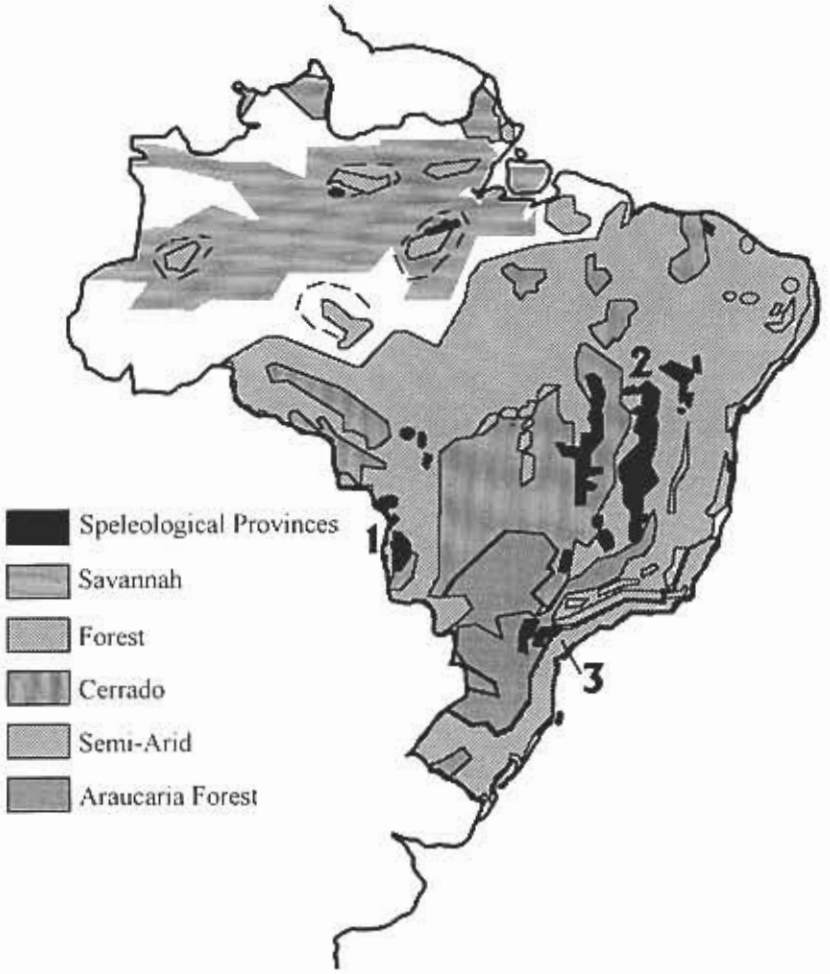

Fig. 2 – Past (between 13,000 and 18,000 years b.p.) morphoclimatic domains in Brazil (modified from Ab'Saber, 1977b). The Speleological Provinces (modified from Trajano & Sanchez, 1994) are placed in the same map. (1) = Bodoquena Ridge Speleological Province; (2) = Bambui Speleological Province; (3) = Ribeira Valley Speleological Province.

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