Here, we provide the first integrative study of the macroevolutionary fate of charismatic extinct mammals from South America across the Eocene-Oligocene using the fossil record. Interestingly, our results challenge the occurrence of a continent-scale mass extinction of mammals at the EOT (30), contrary to what has been suggested for other regions of the world (e.g., 22). Rather, we showed that the SAMs underwent a temperature- and diversity-dependent gradual diversity decline during the Eocene, followed by an Oligocene waxing-and-waning associated with the build-up of the Andes and other diversity-dependent effects. Remarkably, we found that lineages inhabiting tropical and extratropical areas had very different macroevolutionary histories, supporting Wallace’s theory of tropical stability (38). Unraveling the past of this enigmatic fauna will provide key insights into the origin and dynamics of one of the most species-rich regions of the world, a central and historic topic in the field of macroevolution.

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