Changes In Atmospheric Circulation And Paleoprecipitation In Subtropical Brazil During The Late Quaternary

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Stable oxygen isotope studies on cave stalagmites from southern Brazil have provided new insight into the understanding of changes in atmospheric circulation and rainfall regimes during the Late Pleistocene in subtropical South America. The Bt2 δ18O record from Botuverá cave (~27°S) revealed that increases in the contribution of South American summer monsoon (SAMS) and winter extratropical precipitation are consistent with periods of higher and lower austral summer insolation, respectively. Besides, more negative shifts in δ18O coincident with Heinrich events in Northern hemisphere suggest that SAMS activity is positively affected by cooler conditions in the northern hemisphere. A new stalagmite δ18O record from Santana Cave (~24°S), St8, that covers to the last 131 ky B.P. confirms summer insolation as the main forcing of seasonal changes in regional rainfall distribution. It also suggests that Northern Hemisphere glacial boundary conditions impact the convective activity of the SASM not only during H-events but also from 60 ky B.P. to 10 ky B.P., by enhancing the transport of moisture from the Amazon Basin into the region, as indicated by negative anomalies in δ18O in the stalagmite for this entire period. In contrast, the highest δ18O values from 131 and 112 ky B.P. in St8, indicate a dominance of extratropical winter rainfall and the most northward position of SAMS during Last Interglacial period. We use trace element ratios in Bt2 stalagmite to infer changes in mean annual precipitation in southern Brazil during the last 116 ky B.P. A coherent positive covariation between Mg/Ca and Sr/Ca ratios reflects changes in the level of the unsaturated aquifer above the cave, a factor that is directly dependent on local rainfall conditions. Trace element variations are very consistent with changes in δ18O and indicate wetter conditions from the excess in summer monsoon precipitation, between 70 to 19 ky B.P. and during the last 3 ky B.P. However, slight differences between trends in trace elements and δ18O reinforce the notion that the latter cannot be used to directly derive fluctuations in long-term rainfall amount.

Publication:	American Geophysical Union, Fall Meeting 2006, abstract id. PP22A-01
Pub Date:	December 2006
Bibcode:	2006AGUFMPP22A..01C
Keywords:	1041 Stable isotope geochemistry (0454; 4870); 1065 Major and trace element geochemistry; 4934 Insolation forcing; 4958 Speleothems; 9360 South America