0791680

INTERNATIONAL SYMPOSIUM ON GLOBAL CHANGES
IN SOUTH AMERICA DURING THE QUATERNARY:
PAST - PRESENT - FUTURE

São Paulo (BRAZIL), May 8-12, 1989

HOLOCENE FLUVIAL DEPOSITS IN SOUTHEASTERN BRAZIL: CHRONOLOGY AND PALEOHYDROLOGICAL IMPLICATIONS (1)

Kenitiro SUGUIO (2)
Bruno TURCQ (3)
Michel SERVANT (4)
François SOUBIÈS (4)
Marc FOURNIER (4)

INTRODUCTION

Fluvial deposits record changes in the hydrological budget and are important parameters in paleoclimatic reconstructions. Radiocarbon ages obtained by Bigarella (1971) show that most fluvial terraces of Southeastern Brazil have been built during the Holocene epoch. They are frequently related to paleoclimatic fluctuations during the post-glacial transition from a dry Pleistocene to a humid Holocene climate (Ab'Saber, 1980). This paper is part of the GEOCIT program, whose objective is the study of paleoclimates in intertropical regions since 20,000 years B.P. Although cores are being obtained from peats and lakes their palynological analyses are still in the beginning. Geomorphological and sedimentological data are more easily available, and their chronology allowed us to place the most important paleoclimatic events of the Holocene in a time scale.

---

(1) Agreement CNPq (Brazil)/ORSTOM (FRANCE) -
Processo CNPq 91.0880 - 87.5 (Paleoclimas Intertropicais)

(2) Instituto de Geociências (USP) - C.P. 20.899
01498 - São Paulo - BRASIL

(3) ORSTOM/Instituto de Geociências (USP) - C.P. 20.899
01498 - São Paulo - BRASIL

(4) ORSTOM - Centre de Bondy
70-74, Route d'Aulnay
93140 - Bondy - FRANCE

STUDY AREA

This work has been done in southeastern Brazil, mainly in the states of São Paulo and Minas Gerais (Fig. 1). The Precambrian shield of these areas, sometimes as smooth plateaus and sometimes as mountain ridges (Serra do Mar, Serra do Espinhaço, etc.), is covered by thick weathering mantle. The vegetation includes grass-savannas (cerrados), tree-savannas (cerradões), semi-deciduous forests and tropical rain forests (Mata Atlântica). The studied rivers have very restricted watershed and their stream order (according to Strahler) is less than 3.

ALLUVIAL DEPOSITS

The Holocene fluvial deposits in this region are distributed in one or two terraces on the valley floor, being the upper one covered by colluvial deposits. The basal portions of these deposits are composed of gravels which cover the valley floor. The gravel bed is overlain by fine sediments, ranging from mean sands to silts, locally rich in organic, matter and/or containing wood fragments and charcoal. These sequences may also be interrupted by erosional unconformities marked by lag gravel deposits associated or not with paleochannels (Fig. 2).

CHRONOLOGY OF THE EVENTS

The oldest fluvial deposit was dated from the beginning of Holocene (8,500 to 10,000 years B.P.). They form the highest terraces on the valley floor being probably correlated with the last phase of intensive colluvial deposition (Servant et al., this volume). More frequently alluvial deposits are dated between 7,000 and 0 years B.P., being commonly interrupted by erosional phases: 6,000 - 7,000 years B.P. (Gouveia, Córrego Lageado and Conselheiro Mata); 4,000 - 5,000 years B.P. (Gouveia, Poços de Caldas and Itanhandu); 2,500 - 3,000 years B.P. (Gouveia) and 0-300 years B.P. (Gouveia, Rio Vermelho and Timóteo). The most recent erosional event caused the intrenchment of the river channels as presently observed. These events are not always registered in each site because, due to the peculiarities of the catchment area (Begin & Schumm, 1984), the former deposits may not exist or be completely removed. This is the reason why our studies embraced several sites distributed through a vast region, however the available data did not allow to establish any regional differences, and apparently they presented homogeneous behaviour during the Holocene.

PALEOHYDROLOGICAL CONSIDERATIONS

Two are the main explanations for the erosional-sedimentation cycles: (a) fluctuations of the water table (Euler et al., 1979), and (b) changes in the balance between sediment supply and water discharge (Leopold & Wolman, 1957).

In the studied sites, where the catchment areas are small, and being the deposits near the headwaters, the sediment yield is than supported by local valley slope run-off. Run-off intensity and soil erodilibity depend of the rainfalls and of the type and density of the vegetation. The vegetation in this area was probably changed due to paleoclimatic fluctuations. The presence of charcoals in the sediments suggests an alternative explanation for changes in vegetation cover, related to destruction by fire.

Charcoal ages from the Amazon soils, dated by Soubiès (1980) and Saldarriaga & West (1986) show a good correlation with the depositional phases here described. The last depositional event since about 300 years B.P. could be correlated to the deforestation promoted by human occupation.

Very few is known abouth the water table changes. However, the organic deposits developed during the Holocene clearly suggest a positive water budget but further studies are needed for evaluation of their influence in fluvial sedimentation.

In conclusion, the Holocene fluvial depositional sequences of small rivers in southeastern Brazil can be correlated with increases in sediment yield by run-off. On the other hand, the erosional-depositional cycles can be attributed to: (a) changes in vegetation cover due to paleoclimatic changes or eventually to parcial destruction by fire, and/or (b) changes in rainfall quantity and distribution. The paleoclimatic changes may be related to modifications in the dynamics of cold fronts such as evidenced by Martin et al. (this volume) along the littoral zone.

REFERENCES

AB'SABER, A.N. (1980). Razões da retomada parcial de semi-aridez holocênica, por ocasião do "optimum climaticum". Inter-Fácies, Escritos e Documentos 8, UNESP, 6 p.

BEGIN, Z.B. & SCHUMM, S.A. (1984) Gradational thresholds and landform singularity: Significance for Quaternary studies. Quaternary Research, 21: 267-274.

BIGARELLA, J.J. (1971) Variações climáticas no Quaternário Superior do Brasil e sua datação radiométrica pelo método do carbono 14. Paleoclimas 1, 22p., São Paulo.

EULER, R.C.; GUMERMAN, G.J.; KARLSTROM, T.N.V.; DEAN, J.S. & HEVLY, R.H. (1979). The Colorado plateaus: Cultural dynamics and paleoenvironment. Science, 205: 1089-1100.

LEOPOLD, L.B. & WOLMAN, M.G. (1957) River channel patterns: braided, meandering and straight. U.S. Geol. Survey Prof. Paper 282 B: 39-85.

MARTIN, L.; FLEXOR, J.M. & SUGUIO, K. (1989) Ten periods of inversion in directions of dominant waves, from 5,000 years B.P. to present, recognized in the Doce river coastal plain (State of Espírito Santo, Brazil). This volume.

SALDARRIAGA, J.G. & WEST, D.C. (1986) Holocene fires in the Northern Amazon Basin. Quaternary Research, V. 26: 358-366.

SERVANT, M.; SOUBIÈS,F. ; SUGUIO, K.; TURCQ, B. & FOURNIER, M. (1989) Alluvial fans in Southeastern Brazil as an evidence for Early Holocene dry climate period. This volume.

SOUBIÈS, F. (1980) Existence d'une phase sèche en Amazonie brésilienne datée par la presence de charbons dans les sols (6000 - 3000 ans B.P.). Cah. ORSTOM, Sér. Geol., vol. XI, nº 1, 133-148.

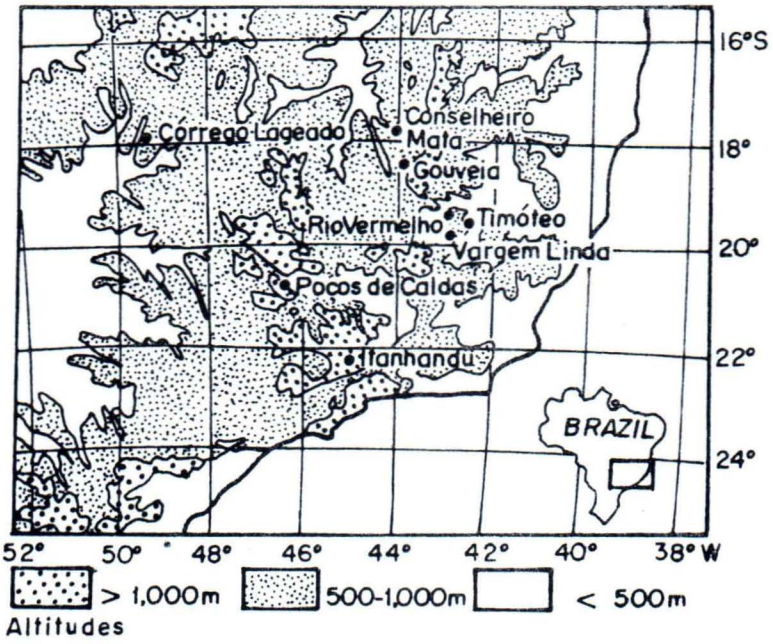
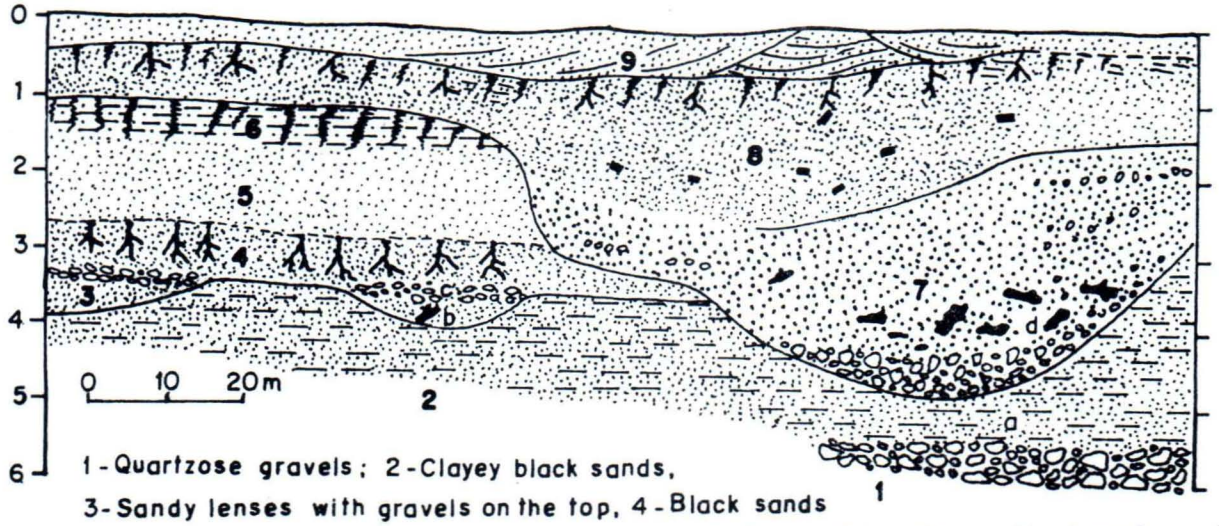


Fig. 1 - Locations of the studied sites.



1 - Quartzose gravels; 2 - Clayey black sands, 3 - Sandy lenses with gravels on the top, 4 - Black sands with in place roots, 5 - Greyish brown sands, 6 - Brown silts with vertical roots, 7 - Channel deposit with sands, gravels, woods and charcoals, 8 - Very fine grey sands with charcoals and roots on the top, 9 - Very fine white sands.

Fig. 2 - Alluvial terrace of the Córrego Contagem (Gouveia, M.G.).

$a = 32,760^{+3,540}_{-2,450}$; $b = 7,010^{+180}_{-180}$; $c = 6,450^{+340}_{-330}$; $d = 4,130^{+190}_{-180}$ years B.P.