



THE CARBON ISOTOPES IN SOILS OF RONDONIA-AMAZON REGION AND RELATIONS WITH THE ECOSYSTEM FOREST/CERRADO

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Soil organic matter (SOM) is a complex mixture of different pools; from very labile compounds with very fast cycling times to refractory components which accumulate over the years (TRUMBORE, 1992). These attributes are susceptible to climate change, which will cause alterations in organic matter inputs and rates of decomposition (JENKINSON *et al.*, 1991). The cumulative response of SOM behaviour to past and future changes is a significant factor in the global carbon cycle (JENKINSON *et al.*, 1991).

The Amazon region is one of the key ecosystems that has significant influences on the climate of the southern hemisphere. Significant research efforts have been spent to understand the link between climate changes and past vegetation in the Amazon region during the Quaternary. Several approaches have involved the use of biological, botanical and geomorphologic tools (ABSY *et al.*, 1991; LEDRU, 1993). Our approach involves the use of ^{13}C analyses in SOM to infer past vegetation (and climatic) changes based on distinct isotopic composition that characterize C_3 and C_4 plants and ^{14}C was used as dating tool. This approach is being applied to soils in the south, central and north (Amazon) regions of Brazil (PESSEDA *et al.*, in press a, PESSEDA, *et al.*, in press b).

This paper presents data collected in the natural ecosystem forest-transition-cerrado located in Rondonia state, northwest of Amazon region. The soil type at the forest site, located in the northern part of Rondonia state, is Podzolic Vermelho Amarelo according to the Brazilian soil classification and Tropudults in American classification. The vegetation is a Tropical Rain Forest. The soils collected along a transect that include other three distinct vegetation communities, are Latossolo Vermelho Amarelo according to Brazilian classification and Oxisol in American classification. The transition vegetation (Tropical Forest and Cerradao) sites are located near of city of Pimenta Bueno, central-south and about 350 km from the forest site and the Cerrado at southern part of Rondonia, about 350 km from Pimenta Bueno. Soil sampling was done at 10 cm intervals to a maximum depth of 2m.

The forest and forest transition sites are characterized by typical $\delta^{13}\text{C}$ profiles (-29‰ to 24‰), indicating the predominance of C_3 plants during the past in this region. The soil under Cerradao, shows a significant change in $\delta^{13}\text{C}$ from -27,5 ‰ at the surface to -

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18.6 ‰ at 50 cm. This value changed toward more depleted $\delta^{13}\text{C}$ values, reaching a value of -30‰ at 200 cm. This trend indicates the predominance of forest type vegetation in the interval between 200 cm to 130 cm, changing to a vegetation community with a mayor influence of C_4 plants, recorded in the interval between 120 cm to 20 cm depth.

The $\delta^{13}\text{C}$ values at the Cerrado site are the more enriched compared to the other sites. The more depleted value (-21.7 ‰) was observed at the surface layer (0-10 cm). This reflects the predominance of C_4 plants in this type of vegetation communities. This site also shows a similar ^{13}C trend than the Cerradao site, suggesting a drier period during the range covered by the sampling interval 130-20 cm data. The ^{13}C data clearly indicated that there was a change in the past in the geographical position of the vegetation communities that exist in Rondonia today. The period for these changes obtained in ^{14}C data of total soil organic matter, humid fraction and charcoal, indicate that the organic matter in these soils is at least holocene in age.

❖ REFERENCES

ABSY, M.L., CLEEF, A., FOURNIER, M., SERVANT, M., SIFFEDINE, A., SILVA, M.F.F., SUGUIO, K., TURCQ, B., VAN der HAMMEN, T., 1991. Mise évidence de quatre phases d'ouverture de la forêt dense dans le sud-est de l'Amazonie au cours des 6000 dernières années. Première comparaison avec d'autres régions tropicales. C.R. Acad. Sc. Paris, t.312, Serie II, 673-678.

JENKINSON, D.S., ADAMS, D.E., WILD, A., 1991. Model estimates of CO_2 emissions from soil in response to global warming. Nature 351: 304-306

LEDRU, M.P., 1993 Late Quaternary environmental and climatic Changes in Central Brazil. Quaternary Research 39:90-98

PESSENDA, L.C.R., ARAVENA, R., MELFI, A.J., TELLES, E.C.C., BOULET, R., VALENCIA, E.P.E., TOMAZELLO, M., in press a. The use of carbon isotopes (^{13}C ^{14}C) in soil to evaluate vegetation changes during the Holocene in Central Brazil. Radiocarbon.

PESSENDA, L.C.R., VALENCIA, E.P.E., CAMARGO, P.B., TELLES, E.C.C., MARTINELLI, L.A., CERRI, C.C., ARAVENA, R., ROZANSKI, K., in press b. Radiocarbon measurements in Brazilian soils developed on basic rocks. Radiocarbon.

TRUMBORE, S. 1993. Comparison of carbon dynamics in tropical and temperate soils using radiocarbon measurements. Global Biogeochem. Cycles 7:275-290.

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