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How Quaternary climate changes build and erode sedimentary deposits in an intraplate large fluvial system: the São Francisco River, Brazil

Patricia Mescolotti¹, Fabiano do Nascimento Pupim², Francisco Sérgio Bernardes Ladeira³, André Oliveira Sawakuchi⁴, Amanda Santa Catharina¹, and Mario Luis Assine¹

¹São Paulo State University - UNESP, Institute of Geosciences and Exact Sciences, Geology, Brazil

(patricia.mescolotti@unesp.br)

²Federal University of São Paulo - Unifesp, Department of Environmental Sciences, Brazil

³University of Campinas - Unicamp, Department of Geography, Brazil

⁴São Paulo University - USP, Institute of Geosciences, Brazil

Climate, tectonic and sea level factors contribute to the geomorphic evolution of large rivers. Rivers draining settings where the tectonic activity and sea level influence are minors allow clearer signals from climate variation to be identified. Thus, rivers that run exclusively in tectonically quiescent areas and away from coastal regions are the most suitable targets to understand the climate drivers. In northeastern Brazil, the São Francisco River is one of the largest cratonic rivers in South America, with an extension of 2,900 km, and its thousand years evolution is registered by Quaternary deposits preserved as terraces. With the upper course in semi-humid settings, the São Franciscos flows northward, but with a watershed mostly under semi-arid conditions. Hence, the São Francisco River's deposits are an excellent fluvial sedimentary record to shed light on how large tropical rivers responded to climatic changes of the Quaternary. We studied a 200 km stretch of the middle course of the São Francisco in the State of Bahia by using remote sensing methods and field surveys for geomorphological and sedimentological analyses combined with optically stimulated luminescence dating (OSL). We recognized at least four phases of fluvial aggradation (>90 ka; 65 to 39 ka; 18 to 9.5 ka and 380 years to recent) and three phases of incision (I1 - 85 to 65 ka; I2 - 39 to 18 ka and I3 - 9.5 to 1.0 ka). Two aggradation events and the incision event I2 are also observed in the upper course of the São Francisco River. The river incision events agree with precession insolation cycles (~25 ka) at latitude 10° S, which influence the rainfall in the area. The incision events occurred probably due to increased fluvial discharge produced by intensification of the South Atlantic Convergence Zone (SACZ), which has great influence on precipitation over the upper São Francisco river. Thus, we conclude that the aggradation-incision cycles of the São Francisco River during the last 100 ka are likely products of millennial precipitation variation, possibly related to precession cycles. The events of high sedimentation rate in the São Francisco river mouth are partially correlated with incision phases in its middle course. This suggests that sedimentation in plains of large plateau rivers can be decoupled from the coastal area.

Keywords: Late Quaternary, fluvial response, OSL dating, aggradation-incision cycles, precession

cycles