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# Evidence of active tectonics during Holocene climate changes in the Subandean Zone of Bolivia

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The Subandean belt accommodates most of the compression associated with the subduction of the Nazca plate under the South America plate .....(Jordan et al., 1983). However, in the North Bolivia Subandean fold and thrust belt, the deformation seems to be very weak. The seismicity and GPS data show a very weak tectonic displacement .....(Kendrick et al., 2001). The catchment of the Beni River is situated in this area. We investigated geomorphic markers, including terraces distribution, rivers deviation and fan translations, in order to understand and quantify the quaternary tectonic activity in the front of the Subandean Zone.

In the frontal fault bent folds, the San Miguel Syncline shows three stepped aggradations terraces. The younger terrace (T3) deposition was $^{14}$C dated using charcoals interlaced in pebbles. This data show a long period of lateral accretion, at least between 10 ka $^{14}$C BP and 4 ka$^{14}$C BP. T3 terrace is affected by a thrust showing 3m reverse displacement witch shows that thrusting has been active since 4 ka$^{14}$C BP. This deformation is weak but has a regional extend: a frontal alluvial fan is also affected by a thrust of 1m reverse displacement; this fan accumulation was dated at 10 ka $^{14}$C BP.

The T3 depositional period could be correlated with climatic changes. At 10 ka$^{14}$C BP

the glaciers retrocede rapidly .....(Argullo and Mourguiart, 1995), it provoked a high sediments supply to the Beni River. Then, a dry climate takes place in the region between ca.10 and 4 ka$^{14}$C BP, the forest changes to savannahs .....()(Freitas et al., 2001; Mourguiart and Ledru, 2003). The less protecting vegetation facilitates the erosion, especially in the steep sided valleys. Between ca.10 and 4 ka$^{14}$C BP, the Beni River carries a high sediment flux that overcome his transport capacity. After ca. 4 ka$^{14}$C BP, the climate become wetter .....().....(Freitas et al., 2001; Mourguiart and Ledru, 2003), forest and soil development protect the substratum and the river sediment flux decreases, terrace incision occurs.

However, in the San Miguel syncline, top of T3 is 24m above the actual pebble bar. The incision rate from the top of the terrace pebbles to present-day river is at least $\sim$5 mm/yr. When compared with that of the same terrace in the inner Subandean Zone ($\sim$1mm/yr) .....(Hérail et al., 1995), this frontal incision is five times greater. The Beni River foredeep zone has a constant slope during the quaternary, as show by the constant sinuosity of the quaternary abandoned meanders of the Beni River .....(Dumont, 1996). Therefore, this differing incision rates in the several zones cannot be due to a regional base level fall, witch implies a differential uplift that can only be explained by uplift of the frontal thrust related anticline. The two thrusted terraces testify of active tectonics located on the frontal thrust related fold (Subandean front), during the climate changes.

As a conclusion, the study of the geomorphic markers of the Beni catchment area show that from a regional point of view the incision of the terraces is related to climatic change. On a local point of view, this incision is enhanced by thrust related tectonic uplift.

.Argullo, J. and Mourguiart, P., 1995. Los climas cuaternarios de Bolivia. In: J.Argollo,P. Mourguiart (Editor), Climas cuaternarios en America del Sur, La Paz, pp. 135-155.

Dumont, J.F., 1996. Neotectonics of the Subandes-Brazilian craton boundary using geomorphological data: the Marañon and Beni Basins. Tectonophisics, 257: 137-151.

Freitas, H.A. et al., 2001. Late Quaternary Dynamics in the South Amazon Basin Infereed from Carbon Isotopes in Soil Organic Matter. Quaternary Research, 55: 39-46.

Hérail, G., Sharp, W., Viscarra, G. and Fornari, M., 1995 La edad de la formacion Cangalli: nuevos datos geocronologicos y su significado geologico, Memorias del XI Congreso Geologico de Bolivia.

Jordan, T.E. et al., 1983. Andean tectonics related to geometriy of subducted Nazca

plate. Goelogical Study of American Bulletin, 94: 341-361.

Kendrick, E., Bevis, M., Smalley, R. and Brooks, B., 2001. An integrated crustal velocity field for the central Andes. Geochemistry Geophysics Geosystems, 2: 2001GC000191.

Mourguiart, P. and Ledru, M.-P., 2003. Last Glacial Maximum in an Andean cloud forest environment (Eastern Cordillera, Bolivia). Geology, 31(3): 195-198.