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Active tectonics and morphology of the Rio Pilcomayo (Subandean belt)

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Recent thrust tectonics of southern Bolivia is inferred from the incision of the Rio Pilcomayo, the main river that crosses this thin-skinned thrust belt. The fluvial shear stress model, and more specifically its adaptation to calculate a nondimensional form of the excess critical shear stress (ECSS), is used to relate channel river properties to the rate of fluvial incision into bedrock. The following parameters have been compiled to apply this model: a) grain size of the bed load from field work ; b) drainage area from DEM ; c) slope of the river from 1:50,000 topographical maps and GPS measurements ; d) width of the river from field work and topographical maps ; e) water discharge from published data.

A comparison between the nondimensional shear stress (ECSS) of the Rio Pilcomayo and a structural cross-section through the southern Subandean zone shows that the ECSS increases in the hanging-wall of 3 thrust faults. These faults show field evidence of recent thrust activity, and we estimate the relative hanging-wall vertical motion for the thrusts based on the ECSS within the Tertiary sediments at their hanging-wall. This analysis indicates that the frontal structure and the third thrust at the boundary between the eastern and western zones of the Subandean belt are active, but the shortening on the second thrust (Aguarague) is more than half of the total thrust motion. An adaption of the Suppe (1983) equations is used to estimate the variation of the uplift rate through a folded structure. The ratio between uplift rate and horizontal shortening varies from 1.1 in the western flank to 0.25 in the eastern flank of the Aguarague structure. A nondimensional index of erodability (ratio between the ECSS and the horizontal shortening) is estimated from the relative uplift rate and the ECSS. This index of erodability varies weakly, from 10 ± 2 for the Tertiary sandstones to 6 ± 2 for upper Devonian rocks. The ECSS reaches its maximum at the transition between Subandean

zone and Interandean zone. This high value cannot only be driven by tectonics, and a lithological effect (low erodability) is inferred.