Geophysical Research Abstracts
Vol. 18, EGU2016-1848, 2016
EGU General Assembly 2016

Long-lasting wrenching tectonism in the Fuegian Andes: An overview

Christian Sue (1) and Matias Ghiglione ()

(1) UFC besancon, UMR6249, geosciences, France, (2) Instituto de Estudios Andinos - CONICET, Departamento de Ciencias Geológicas, Universidad de Buenos Aires, Argentina.

Beyond its formal beauty, the geodynamic complexity of the connection between the Southernmost Andes and the Scotia plate, through the active Magallanes-Fagnano Fault system (MFF) and North Scotia Ridge (NSR), ask for proper geodynamic model(s), which could account for the discrepencies between long-term and actual co-seismic deformation and earthquake recurrence time. We focus here on the most recent and current deformation of the region, including a synthesis on the fault system carving the area, together with a critical review of the available kinematic and micro-tectonic data, an overview of the seismicity and paleoseismicity leading to current fault mechanism and actual seismic deformation, which then could be compared to geodetically-related deformation observed by GPS. Fault kinematic studies are coherent with main shortening consistently oriented NE-SW, without significant rotation of the axes across the orogen. These observation, together with the stability of the stress pattern and orientation of the shortening axes on a bigger scale reflects a steady E-W to NNE-SSW $\sigma 1$/shortening direction since middle Eocene times, reflecting that the global left-lateral motion between Antarctica-Scotia-South America plate circuit, is the main driving forced for the entire area and in particular for the southernmost Andes, over the last 40 or 50 Ma. In terms of seismicity, elastic rebound theory predicts that the major earthquakes on a fault are time dependent, as they are linked to a period of built-up energy (interseismic) with abrupt relaxation stages (coseismic). Regarding both the short-term geodetic and the long-term geological observation, slip rates of the MFF system are pretty low (c.a. 5 mm/yr). Therefore, the time span between major earthquakes should be larger than the one obtained over the last 2 or 3 centuries. Considering a simple tectonic setting of a pure left-lateral strike-slip fault with a constant 5 mm/yr slip rate able to generate $\sim$6 m of left-lateral maximum displacement at the surface during the largest earthquakes (effects of the 1949 Ms 7.8 earthquake), the expected time span between comparable earthquakes would be around 10 ka. Yet the time between the two most recent large earthquakes on the eastern onshore fault section of the MFF was about 70 years. Such a great discrepancy could result (i) from the presence of locked sections along the MFF; (ii) variable slip-rate history and/or tectonic loading; (iii) delayed and pulsed stress release due to steady tectonic loading and strain stored in the crust over millennium time scale; (iv) the complexities of the extensional en échelon geometry of the MFF system in the study area which could rise up discrepancies from the simple strike-slip loading model. Our results fill up the time-gap between the 1949 event and the two, possibly three, paleoearthquakes detected by trenching over the last 9 ka (Costa et al. 2006). The discrepancies between long-term and short-term velocities, that is to say between the evaluated tectonic loading and the actual recurrence time, suggest a complex mechanics on the MFF, leading to complex recurrence time history for the characteristic earthquake (M $\geq$ 7).