Geophysical Research Abstracts
Vol. 18, EGU2016-10950, 2016
EGU General Assembly 2016

Growth and gravitational collapse of a mountain front of the Eastern Cordillera of Colombia

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The Eastern Cordillera of Colombia is bracketed between the moderately east-dipping flank of the Central Cordillera on its western and the gently bent Guayana shield on its eastern side. It evolved as a response to a considerable displacement transfer from the Nazca to the Southamerican plate since the Oligocene break-up of the Farallon plate. One of its distinctive traits refers to its significant shortening by penetrative strain at lower and folding at higher structural levels, approximating a wholesale pure-shear in analogy to a vice model or a crustal welt sandwiched between rigid buttresses. This contrasting behavior may be explained by the spatial coincidence between Neogene mountain belt and a forebulge that shaped the foreland trough during a Cretaceous subduction cycle and was very effective in localizing a weakening of the backarc region comprised between two basin margin faults. In this paper we examine a two-phase evolution of the Eastern mountain front. Up to the late Miocene deformation was restrained by the inherited eastern basin margin fault and as the cordilleran crust extruded, a deformation front with an amplitude similar the present structural relief of up to 10.000 m may have built up. In the Pliocene convergence changed from a roughly strike-perpendicular to an oblique E-W direction and caused N-S trending faults to branch off from the deformation front. This shortening was partly driven by a gravitational collapse of the Miocene deformation front, that became fragmented by normal faults and extruded E on newly formed Pliocene thrust faults. Normal faults display displacements of up to 3000 m and channelized hydrothermal fluids, leading to the formation of widely distributed fault breccias and giving rise to a prolific Emerald mineralization. In terms of wedge dynamics, the Pliocene breaching of the early formed deformation front helped to establish a critical taper.