Geophysical Research Abstracts, Vol. 7, 04070, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04070


# The non-plateau evolution along the southern Andean limb - plate motions, mantle flow and climate

**T. Vietor** and H. Echtler
Geoforschungszentrum Potsdam

The tectonic shortening of the South American upper-plate that formed the Andean subduction orogen shows significant along-strike variations in timing and magnitude. Shortening in the Central Andes started in the Eocene. In contrast, the contraction of the Southern Central Andes at 30°S started only in the Early Miocene and then migrated either smoothly or stepwise to the South. At the beginning of the Pliocene contraction in the Southern Central Andes significantly slowed and eventually changed to transtensional conditions south of about 33.5°S, the intersection of the Juan Fernandez Ridge. The southward decreasing duration of contraction and the slower average deformation rates explain the observed decrease of the absolute Neogene shortening from 160 km at 30°S to 15 km at 38°S. From correlation of the Neogene upper-plate deformation rates with ancillary data sets we conclude that the variations in timing and magnitude of shortening can be explained by the temporal changes of the (1) absolute velocity of South America and the along-strike variations of (2) the upper-plate strength, (3) plate-interface strength, (4) the subslab-mantle flow. The southward migration of the onset of shortening in the Southern Central Andes during the Miocene is positively correlated with the increasing westward velocity (overriding) of South America in the hot-spot reference frame. This suggests that contraction of the upper plate in the more southerly regions required faster motion of South America towards the subduction zone. This is most likely the result of easier roll-back in the South which is enabled by the proximity of the Drake Passage or - after the initiation of the Chile Rise triple junction at 14 Ma - the opening of slab windows under Patagonia that facilitate the transfer of mantle material from the sub-slab region to the super-slab wedge. Once contraction had started, it became focused in pre-Andean sedimentary basins. Shortening rates in these basins were twice higher than in thick-skinned belts. Hence, we confirm that upper-plate inherited soft regions accelerate orogenic short-

ening. Upper-plate shortening is also accelerated by thermal weakening as a result of subduction-zone shallowing. Almost simultaneous post-Miocene slowing of upper-plate shortening south of the Juan Fernandez Ridge intersection can be best explained by Late Cenozoic increased sediment flux to the trench that ultimately reduced the strength of the plate interface. The exhumation of the main source area for trench sediments in the Patagonian Andes was closely followed by the north-ward migrating Chile rise collision. Hence, the Middle to Late Miocene exhumation was apparently tectonically controlled. However, the rapid spreading of Patagonian ice sheets on the previously uplifted topography after 7 Ma most likely lead to a sudden increase of the average erosion rates and the sediment flux into the trench. Thus, the coeval slowing of upper-plate contraction south of the Juan Fernandez ridge can be linked to the onset of glaciation in the Northern Patagonian Andes and a resulting lubrication of the plate interface.