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Crustal Domains in the Central Andes and their control on orogenic structures

Isotopic compositions for Pb and Nd in igneous rocks in the Central Andes (13°S-28°S) reflect the compositions of the underlying basement, because the mass balance of magma assimilation at c. 15-20 per cent dominates the Pb and Nd isotopic composition of the basement through which the magmas ascend, Therefore, Andean igneous rocks can "fingerprint" distinct basement domains. We provide a map of crustal domains in the Central Andes and evaluate their control on orogenic structure and evolution.

This domain map is based on 802 Pb samples (346 published, 456 new) and Nd-Sr isotopes (150 published, 180 new) from Proterozoic to Holocene igneous,and crustal rocks as well as arc-related ore deposits. These domains (Arequipa, Clemesi, Chilenia, Cordillera Domains and and Transitional Zones) correlate with the compositional structure of the crust as revealed by a 3D density model (Tassara et al., 2006). This particular crustal structure index geometry and correlated isotope and geochemical signatures distinguish more felsic from more mafic crustal crustal blocks.

Nd isotope values further support our domain distinctions and corroborate finding based on Pb isotopes. Sr-isotope variations do not constrain the boundaries of crustal domains because the domains show less distinct Sr isotopic signatures and the mass balance relations for Sr during assimilation is less favorable for isotopic fingerprinting. The crustal domain boundaries constrain crustal heterogeneities in the segmentation, evolution and deformation pattern of the Central Andes. The Transition Zone (between 21°S and 22°S) coincides with the transition between the Altiplano and Puna segments of the Andes. Moreover, erosion products from the Andean orogeny deposited during orogeny are thicker and more continuous only in the area of the Arequipa Domain.

Paleomagnetic data of Arriagada et al. (2006) describe block rotation (clockwise up to 35°to 40°) in the forearc between 22°and 28°S during the Jurassic to Oligocene. The regions of rotation and the block boundaries follow the Chilenia Domain. In southern Peru, Roperch et al. (2006) presented paleomagnetic results of Eocene-Oligocene sediments from the forearc from 18 to 16 deg S and observed a gradient in counterclockwise rotations, between ~ 0 deg in Arica (18°S) to 50 deg in Caravelí (16°S). Additionally, on the Altiplano, i.e. on the Arequipa Domain, the Tertiary Huaccochullo and Corque basins are rotated counterclockwise as a coherent region (Rousse et al., 2005). The central Andean rotation patterns as described by Rousse et al. (2005), Arriagada et al. (2006) and Roperch et al. (2006) in fact seem to be related to individual crustal blocks with increased deformation and shear near their margins. In this scenario, the Arequipa Domain, appears to be a relatively rigid block that utimately led to the formation of the Altiplano Plateau and controlled its present location.

We conclude that crustal domains identified here based on geochemical and geophysical data are related to distinct basement domains of different ages and compositions in the Central Andes: The Arequipa Domain represents a relatively mafic and more rigid block. Its rheological identity is shown by the Cenozoic deformation pattern in the Central Andes as well as the distribution and thickness of syn-deformational sedimentary deposits. Deformations and rotations are mostly concentrated the more felsic Cordillera Domain. The Chilenia Domain is interpreted as a block with major mafic Mesozoic juvenile contribution to the crust. Juvenile addition is dominates also the Clemesi domain. Therefore we argue that the nature, i.e. the bulk composition and thus the different rheologies of the crust are an important factor that controlled the deformation pattern of the Central Andes and the localization and segmentation of the Andean plateau.

Arriagada, C., Roperch, P., Mpodozis, C., Fernandez, R., 2006, Paleomagnetism and tectonics of the southern Atacama Desert (25-28°S), northern Chile. Tectonics, v. 25, TC4001, doi: 10.1029/2005TC001923.

Rousse, S., Gilder, S., Fornari, M., Sempere, T., 2005, Insight into the Neogene tectonic history of the northern Bolivian Orocline from new paleomagnetic and geochronologic data: Tectonics, v. 24, TC6007, doi:10.1029/2004TC001760, 2005.

Tassara, A., Götze, H.-J., Schmidt, S., Hackney, R., 2006, Three-dimensional density model of the Nazca plate and the Andean continental margin: J. Geophys. Res., 111, B09404, doi:10.1029/2005JB003976.