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# Oligocene subsidence and subsequent erosion in the Arauco forearc basin, south central Chile – a local or more regional uplift event?

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This study aims to shed further light on the thermal and tectonic development of the coastal Cordillera between 37° and 38° S (the Arauco Peninsula and Isla Santa Maria) using fission-track (FT) thermochronology. Coal is present in Eocene strata at shallow depths in the Arauco basin today, but the timing of the post-Eocene, coal-forming temperature event has been unknown. Vitrinite reflectance (VR) data from wells penetrating the basin reveal maximum paleo-geothermal gradients below 30° C/km , indicating significant sedimentary loading and subsequent erosion (Kuhn et al 2009). The thermal heat flow was probably higher during the Oligocene, both due to the trenchward broadening volcanic arc and an acceleration of the convergence rate between the Nazca and the South American plates that was significantly higher than today. But when was the sedimentary cover thick enough to cause enough heat for coal formation? The Oligocene deposits found on the shelf today are very minor, and the early Miocene deposits on top of truncated Eocene successions contain very little volcanic material. Hence, there is no sedimentological evidence for major Oligocene sedimentary loading of the present-day forearc. In contrast, the Miocene successions are up to 3 km thick in some other basins at the Chilean shelf but only a couple of hundred meters thick and truncated by an angular unconformity, or completely eroded, at the Arauco Peninsula.

Here we present apatite FT data for core material from six wells in the basin. A decreasing apatite FT age trend with depth was received for two wells. Additionally, late Oligocene apatite FT ages were obtained for units with late Cretaceous depositional ages in all six wells. Track length distributions confirm that totally annealed samples have been obtained from depths where little or no present-day annealing occurs today nor has occurred in the past. Moreover, inverse modelling of the apatite FT and VR data combined indicates rapid cooling to near-surface temperatures during late Oligocene times.

Our apatite FT results constrain the timing of onset of cooling from c 120° C to near-surface temperatures during the late Oligocene. Furthermore, they confirm the hypothesis of an antecedent km-scale sedimentary burial and subsequent erosion (Kuhn et al 2009). However, they are difficult to reconcile with the general belief of a general extensional regime during Oligocene to early Miocene times in the region. Based on our data several questions emerge: What was the age and provenance of the missing sedimentary section? Was the missing section deposited and eroded locally, ie only in the Arauco basin with surroundings, or did it reach a more regional extent along the forearc? Despite available geological archives our thermochronology data forward discussion on a possible cycle of rapid subsidence and subsequent inversion/erosion of an Oligocene forearc basin, similar to the well documented Late Miocene to Pliocene evolution in the area. Another switch from tectonic erosion to accretion could fit the surprisingly stationary nature of the south-central Andean forearc during the Cenozoic.

Reference:
Kuhn, P. P., Echtler, H., Littke, R. and Alfaro, G., 2009: Thermal basin modelling of the Arauco forearc basin, south central Chile – Heat flow and active margin tectonics. Tectonophysics), doi:10.1016/j.tecto.2009.07.026