8th International Symposium
on Andean Geodynamics
(ISAG)

Reappraisal of the Andean subduction initiation: trenchward arc migration during the Rhaetian in the SW Gondwana Margin

V. Oliveros[1], P. Vásquez[2], C. Creixell[2], H. Arvizu[1]

[1]Departamento de Ciencias de la Tierra, Universidad de Concepción, Casilla 160-C, Concepción, Chile

[2]Servicio Nacional de Geología Minería, Av. Santa María 0104, Providencia, Santiago, Chile

The traditional models for the evolution of the SW Gondwana margin north of the present-day 40ºS, that involved subduction termination sometime during the Permian or Triassic periods, has been recently challenged by several studies that increased the number geochronological, geological and geochemical data for Late Paleozoic and Early Mesozoic igneous rocks cropping out in the High Andes of Chile and Western Argentina (Principal, Frontal and Domeyko Cordilleras). Thus, the continuous plate convergence in a continental arc setting since the Carboniferous has become a very likely scenario for the evolution of the Proto-Andean margin. This hitherto more robust model of continuous subduction has highlighted a particular feature of the exposed arc-related magmatism: a sudden migration of the arc front during the Rhaetian up to 150 km trenchward that was preceded by volumetrically restricted Norian magmatism of transitional to alkaline affinities. Pre-210 Ma igneous rocks are concentrated in the present-day High Andes and ca. 210-100 Ma igneous rocks crop out largely in the Coastal Cordillera. The magmatic axis migration from 300 to 210 and from 210 to 100 Ma did not exceed 50 km in the trench-arc direction. A striking feature of this migration is that it was accompanied of a marked transition in the geochemistry of the magmatism, such as a decrease in the SiO2 content, Sr/Y, chondrite-normalized La/Yb, and initial Sr-Nd isotopic ratios. All these parameters are related to the crustal component of magmatism and therefore indicate that post-210 Ma magmatism involved juvenile (mantle-derived) additions rather than recycling of preexistent crust. The geological record suggests that such process took place along 1500 km of the margin from present-day central Chile to southern Peru, representing thus a significant portion (~10%) of the global arc activity at the time. Therefore, such migration might have had an impact in the net rate of crustal growth during the Jurassic.

In this work, we propose that the process traditionally interpreted as the beginning of Andean subduction is better explained as the migration of the arc front due thermal erosion of the lithosphere and intense magmatization of the crust, from the Carboniferous to the Early Triassic, that could have had an impact in the corner flow of the asthenospheric wedge. Slab roll-back from the latest Triassic onwards may explain the extensional deformation in the continental crust and it is consistent with recent plate reconstructions for the Mesozoic. The tectonic changes that triggered arc migration are not entirely clear but they resulted in a long-lived channel of mantle input to the crust (Early Andean arc) that might have increased the net growth of the South American continent.