Thermochronological and structural approach to reveal Gondwanic inheritance on the Andean building

MAURICIO ESPINOZA[1*] AND VERÓNICA OLIVEROS[1]

[1]Earth Science Department, Universidad de Concepción, Chile ([*]correspondance: mauricespinoza@udec.cl)

The Andean orogenic building was strongly influenced by tectonic fabrics acquired during Gondwanic processes (accretion and rifting). To unravel the specific control of such fabrics, we coupled detrital U-Pb in zircon (DZ) and ^{39}Ar-^{40}Ar in muscovites (DM) dating with structural analysis.

U-Pb data indicate the Domeyko rift (Triassic) occurred in two stages; a first from ca. 240-225 Ma opening the Sierra Exploradora sub-basin (SESB) and a second from ca. 217-200 Ma, opening the Sierra de Varas sub-basin (SVSB) and reactivating the SESB through a fault-linkage process.

DM show striking differences between both sub-basins. At the SESB, the DM ages peak (260-265 Ma) is slightly younger than the crystallization age of sources (DZ ages peak spanning 280-270 Ma). The small difference between both peaks, suggests a rapid cooling of plutonic sources at ca. 260-265 Ma, coinciding with the San Rafael orogeny in South America. On the other hand, DZ ages from the SVSB reveal a predominant Cislurian source (DZ peak at ca. 292 Ma), and minor ages ranging 250-210 Ma. In contrast, DM show a complex age distribution spanning 192-243 Ma with the main peak at ~202 Ma. The broad distribution and its much younger peak compared to the age of the primary source suggest a gradual uplift of a slowly exhumed terrain since ~243 Ma. Additionally, the main DM peak in the SVSB is younger than the depositional age of the succession (~213-210 Ma), indicating an aperture of the Ar system. The lack of strain evidence in the DM samples suggests that the partial reset was caused by a hypothetic thermal event, likely related to the initial stages of the Andean back-arc magmatism.

We explain the different cooling histories of rift sub-basins sources by the existence of a major structure segmenting the basement during the Paleozoic. This cortical structure later defined the position of a structural high separating both sub-basins. During the Eocene rift inversion, the Triassic rift architecture determined the structural style of the western Andean slope (Domeyko Range). Rift inversion was accompanied by profuse magmatism and hydrothermalism related to the settlement of the Eocene-Oligocene magmatic arc in the Domeyko Range. Despite this, DM remained closed regarding this thermal event, demonstrating the usefulness of this method in order to unravel the ancient cooling/uplift history at actively magmatic settings.