8th International Symposium
on Andean Geodynamics
(ISAG)

Geobarometry of the Jurassic plutonic rocks of the Central Cordillera of Colombia: tracking changes of crustal thickness in the Northern Andes

L. Chavarría[1], C. Bustamante[1], A. Cardona[2], M. Restrepo[1]

[1]Universidad EAFIT, Medellín, Colombia

[2]Universidad Nacional, Medellín, Colombia

The composition of magmatic arcs records thermal and fluid flux variations, as well as in the dynamics of crustal evolution through time. The Jurassic magmatic arc in the Colombian Andes is a segmented belt comprised of calc-alkaline granitoid intrusions and related volcanic rocks. This almost 1000 km belt extends in a NE direction from Mocoa batholith in southern Colombia to Sierra Nevada de Santa Marta in the north. Currently, there are two subduction models that have been proposed to explain the evolution of the arc: a slab-roll back subduction model and an oblique subduction model. These contrasting models have direct implications in the crustal evolution of the arc and the emplacement conditions of the granitoid intrusives. Because meanwhile a slab-roll back model would be related with a thin crustal thickness, an oblique subduction would imply a thicker crust.

In this contribution we use thermobarometric calculations of the Jurassic granitoid intrusions in the Colombian Andes in order to analyze the variation of the pressure and temperature emplacement conditions since 200 to 130 Ma and then determinate the magmatic evolution of the Jurassic crustal arc in the northern Andes. Barometric characteristics were calculated by using barometers based on the whole rock geochemistry (Sr/Y pseudo-barometer and the Qz-Ab-Or barometer) and the Al-in-hornblende barometric method.

The barometrical calculations based on the whole rock geochemistry were obtained from a compiled database of former studies in Jurassic granitoids from the Central Andes of Colombia. Obtained pressures varied between 0.3 to 5 kbar indicating shallow to relatively deep emplacement in the upper crust. The maximum pressures occurred in plutonic rocks with ages between 184 and 156 Ma. The Sr/Y ratios obtained were from 4.5 to 42.7 and the crustal thicknesses were from 34 to 47 km suggesting a relatively normal thickness. The Al-in-hornblende method was applied in the Santa Marta batholith at the north, the Ibague batholith, the Payandé and Mariquita stocks and the Sombrerillo batholith at the south of the Jurassic belt. Obtained pressure varies from 1.2 to 7.1 kbar. The maximum pressures were obtained for the Sombrerillo and Ibague batholith (~152 to ~140 Ma) ranging from 4.3 to 7.1 kbar suggesting that in the south of the Jurassic belt occurred some processes that led a deeper crustal granitoids emplacement. However the Payandé and Mariquita stocks (~164 and 130 Ma respectively) were emplaced at shallow pressures (~1.2 to ~1.4 kbar). Then, the emplacement pressures would record events of crustal thinning and thickening that could be related with tectonic changes along the arc. They are recording a predominant extensional tectonic style during the arc formation that could be related with the Pangea break-up and followed by a crustal thickness associated likely to an oblique convergence in the southern belt since ~150 Ma until the end of the Jurassic.

Bustamante, C., Archanjo, C. J., Cardona, A., & Vervoort, J. D. (2016). Late Jurassic to Early Cretaceous plutonism in the Colombian Andes: A record of long-term arc maturity. Bulletin, 128(11-12), 1762-1779.