Geochronological Evidence of Flat slab Subduction in Colombia

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The tectonic setting of Northwestern South America is very complex due to interaction between the Nazca, Caribbean, and South America plates and several oceanic terranes. Of particular interest is the Nazca plate slab geometry change since the Mid-Miocene, and its tectonomagmatic effects on the overlying South American Plate. Several studies indicate that the modern Nazca slab is torn into two segments at 5.5oN in Colombia, the so-called "Caldas tear", where the northern segment dips at a shallow angle while the southern segment dips at a steep angle. This slab geometry difference is manifested in magmatic activity where only the region with steep slab shows typical subduction zone volcanism, while the one with flat slab lacks such activity. However, due to the limited number of geochronological data, the timing of this slab shallowing and tearing remains poorly understood. We conducted an extensive 40Ar/39Ar geochronology study on post mid-Miocene volcanic rocks in Colombia to study the temporal evolution of Nazca plate geometry

and its effects on magmatism in Colombia. We find evidence of continuous magmatism north and south of the Caldas tear from 10.5 Ma to 6.4 Ma, with peak activity between 9-8 Ma. This is followed by a ~4 million year magmatic hiatus, until the resurgence of magmatism south of the Caldas tear as monogenetic domes at 2.1 Ma, and continuous volcanic activity in modern composite volcanoes since 1.1 Ma. Results of this study support the presence of a complex subduction system beneath Colombia where the northern segment slab has been flat since ~6.4 Ma ago, and the southern segment has re-steepened at ~2.1 Ma. This study showcases that the Nazca slab geometry was the most important factor driving magmatism in Colombia since the mid-Miocene.

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