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Late northern Andean Cenozoic to recent magmatism: A geochronological, petrographical and geochemical review

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The North Andean Block (NAB) is the result of a complex interaction between the Caribbean, Nazca, and South American plates, causing a complicated tectonic setting and a subduction related mantle-derived magmatic activity. With geochronological, petrographical and geochemical studies, various Late Paleogene – Neogene magmatic events were recognized along the Central Cordillera (CC), Inter-andean Cauca Valley (CV), and the eastern flank of the Western Cordillera (WC). These events are a) Plutonism at 24 Ma, b) Hypabyssal porphyritic magmatism from 17 – 6 Ma, c) Combia volcanism from 12 – 6 Ma, d) Cauca and Eastern Cordillera volcanism at 6 – 3 Ma, and e) Recent volcanism from 3 Ma to present.

The petrographic and geochemical characteristics indicate that the primary magma for the Late Paleogene – Neogene magmatism was generated by the interaction of the subducted components (e.g. altered oceanic crust, sediments), the mantle wedge, undergoing processes of dehydration/partial-fusion, partial melting and mixing at the Pb-radiogenic lower crust level, which may be related to the Cretaceous crustal make-up of the NAB. In a global perspective for the understanding of the volcanic zones of the Andean cordilleras, we can conclude that assimilation of lower crust is a common process in this continental arc, and it is not only related to the thickness of the crust, but primarily related to the gradients of temperature, pressure, H2O content and melt fraction developed at the hot zone in the upper-mantle and lower-crust transition. Thus, assimilation of different crustal domains in terms of Pb isotopic composition beneath the Andean cordilleras such as: the Cretaceous domain at the North Volcanic Zone (NVZ); the Proterozoic domain in the northern portion of the Central Voclanic Zone (CVZ); the Paleozoic to early Mesozoic domain in the southern portion of the CVZ, South Volcanic Zone (SVZ) and Austral Volcanic Zone (AVZ), may explain the along-arc variation in the Cenozoic Andean magmatic suites. The different subduction components, together with the various thermal regimes at each zone, may explain the variability of primary magmas across the Andean arc.