Accretionary and post-accretionary cooling, exhumation and tectonic history of the central and western Andes of Colombia

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The Northern Andean Segment (north of 5°S, including Ecuador, Colombia and Venezuela) comprises an orogenic system with N-S trending, sub-linear topographic ridges, referred to as the Western, Central and Eastern Cordilleras, which are separated by prominent topographic depressions. The Northern Andean Segment is divided into a continental and an oceanic province, which are juxtaposed across the Romeral-Peltetec Fault Zone (Fig. 1). The oceanic province comprises multiple terranes, mainly exposed in the Western Cordillera. The continental province consists of pre- early Cretaceous meta-sedimentary and acidic intrusive rocks that are exposed in the Central Cordillera.

Multiple phases of orogenic growth have been attributed to terrane accretion at the western South American margin. The timing of accretion of oceanic terranes, and subsequent tectonic events, has already been well established in Ecuador, (Litherland et al., 1994; Vallejo et al., in press). However, a paucity of research leading to quantitative data in Colombia imposes a significant gap in our understanding of the evolution of the Northern Andes.

Preliminary FT data in the continental province: the Eastern border of the Central Cordillera : Four preliminary AFT ages have been obtained from a Jurassic granite (Fig. 1). In this zone the ages range between ~77 and ~36 Ma. An older group of indistinguishable AFT ages (all ages within 1σ error interval) of 77±6, 68±4 (sample 05DV82) and 69±4 Ma, are representative of the region and were obtained from samples located relatively far (>8 Km) from local faults traces (e.g. Ibague Fault, Fig. 1). The younger AFT ages of 30±3 and 36±3 Ma (sample 05DV06) were yielded from samples close to sheared rocks within the Ibague Fault (Fig. 1). Three indistinguishable ZFT ages of 81±6, 81±5, 88±6 Ma were obtained from the same samples.

Inverse modelling has been performed on some of these samples, using the annealing model of Carlson et al. (1999), and the Monte-Carlo inverse modelling procedure of Ketcham et al. (1999) (Fig. 2), to constrain their potential thermal histories using the ZFT as constraint at ~250±50°C. Sample 05DV82 (mean track length of 14.54±0.76μm), located at 20 km from the Ibague Fault (Figs. 1 & 2), cooled rapidly through ≥ 250˚C to ~ 60˚C at ~ 80-70 Ma. Sample 05DV06, located closer to the Ibague Fault (Figs. 1 & 2) hosts partially annealed FT lengths in apatite (mean track length of 13.60±1.62), suggesting they may have resided for a significant amount of time within the Apatite Partial Annealing Zone (APAZ). The best fit model indicates a rapid cooling through ~ 250˚C to ~ 90˚C between 80-70 Ma followed by slower cooling from 70-10 Ma and finally renewed rapid cooling from ~ 60˚C to ~25˚C between 10Ma to present.

Preliminary conclusions

Jurassic granitoids located at the Eastern border of the Central Cordillera in Colombia yielded Late Cretaceous AFT and ZFT ages. This time period corresponds to the accretion of the Caribbean Plateau with NW South America within Ecuador, and hence it is plausible to suggest, pending additional data, that the paleo-margin of Colombia cooled and exhumed in response to the same event. The project is in an early stage of data acquisition and numerous samples from other latitudes (along strike) of the Central and Western Cordilleras in Colombia will be analysed.

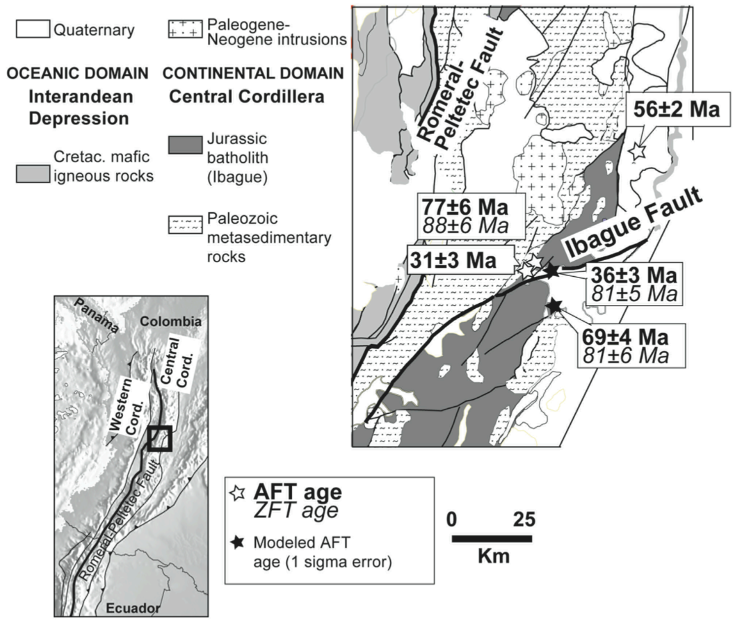

FIGURE 1:
Geological map of the Eastern border of Central Cordillera of Colombia showing the location and FT ages of samples.

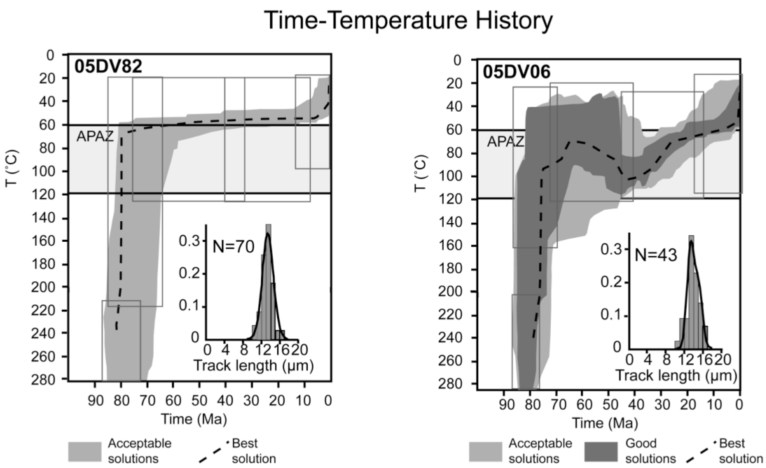

FIGURE 2:
Modeled T-t paths and track length distribution for two samples which crop out in the Central Cordillera (paleo-continental margin). Monte-Carlo inverse modeling following procedure of Ketcham et al. (1999) and Monte-Carlo inverse modeling following procedure of Ketcham et al. (1999) and multi-kinetic approach (based on Dpar) according Carlson et al. (1999).
APAZ = Apatite Partial Annealing Zone.

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