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Deriving the complete history of eroded batholiths from magmatic cooling to exhumational cooling using multiple numerical models, Antioquia batholith in the Central Cordillera of Colombia case study

M-A. Bermúdez[1], M. Bernet[2], M-I. Marín Cerón[3], G. Toro Villegas[3]

[1]Escuela de Ingeniería Geológica, Facultad Seccional Sogamoso-Colombia, Universidad Pedagógica y Tecnológica de Colombia

[2]Institut des Sciences de la Terre, CNRS, Université Grenoble Alpes, Grenoble Cedex 9, France

[3]Departamento de Geociencias, Universidad EAFIT, Medellín, Colombia

The Antioquia batholith of the Central Cordillera in the Northern Andes of Colombia forms a high plateau (~2400 m). The plateau is deeply incised by the Río Medellín, creating 1000 m of relief. Zircon U-Pb dating of quartz-diorite and granodiorites that make up the batholith, show that this is a composite batholith formed between about 94 and 60 Ma. We compiled Zircon (ZFT), Apatite Fission-Track (AFT) and Apatite (U-Th)/He across the study area. Most thermochronological data are grouped into different age-elevation profiles throughout the study area. However, there is a high age dispersion, which is why reaching any conclusion about the exhumation of this batholith result complex. In this research, we present 7 new AFT ages with their respective fission-tracks length distributions, and 6 new ZFT ages. We combined these new data with the existing database in order to use inverse geo-thermochronologic (4DTherm), 3D thermokinematic (Pecube) and thermal (HeFTy) modelling, this with the objective to try to explain ages distribution (dispersion), and to make inferences that allow us to explain the high dispersion of the data across the study area, discriminate emplacement depth and relief change phases. The main magmatic phase occurs between 95-73 Ma, however, for the modelled area, the 4DTherm model suggest that the emplacement depth is very shallow (< 4km), two different stages of magmatic cooling were differentiated with rates of 705.08 ºC/Myr for the first stage between 73 and 70 Ma, a second magmatic cooling with rate closer to 51.41 ºC/Myr between 70 and 65 Ma was discriminated. After this, between 65 to ~45 Ma the PeCube model predicts a post-magmatic cooling by exhumation with rates close to 0.8 ± 0.5 km/Ma. From 45 to 25 Ma the exhumation rate decays to 0.4 km/Ma possibly in this phase an important period of isothermal relaxation occurs, in this time interval at least 60% of the current topography is created. From 25 Ma to the present PeCube predicts an increase in exhumation rates by cooling at rates between 0.7 to 0.9 km/Ma, this acceleration in exhumation rates is linked to the collision of the Panama-Coco block with north-western South America.