GSA Data Repository Item 2018196

Stevens Goddard, A.L., Larrovere, M.A., Carrapa, B., Hernán Aciar, R., and Alvarado, P., 2018, Reconstructing the thermal and exhumation history of the Sierras Pampeanas through low-temperature thermochronology: A case study from the Sierra de Velasco: GSA Bulletin, https://doi.org/10.1130/B31935.1.

Data Repository

Table DR1: AHe data, AFT Raw Counting Data

EXTENDED METHODS

Apatite Fission Track Analysis

Samples in this study were analyzed at the University of Arizona fission track lab using the external detector method (Hurford and Green, 1983). Apatite mounts were etched in 5.5 M HNO_3 for 20 seconds at 21 °C following the methods outlined in Donelick (2005) and irradiated at Oregon State University. Mica sheets affixed to the apatite mounts before irradiation were etched after irradiation in 49% hydrofluoric acid for 15 min at 23 °C (Donelick, 2005). Twenty grains were counted for each sample to produce a central AFT age and the zeta calibration was used for age determination (Hurford and Green, 1983). Additionally, we measured horizontal, confined, track-in-track lengths for samples analyzed for age determination. For each sample between 60 and 100 lengths were counted along with measurements for the angle between the confined length and the C-axis orientation to account for track measurement bias (Ketcham et al., 2007a). Kinetic characteristics of each sample were acquired by measuring D_{par}, a measurement of etch pit length and width that serves as a proxy for the relative Cl and F content of an apatite grain which controls the annealing behavior of an individual grain (Green et al., 1986; Carlson et al., 1999; Ketcham et al., 2007a,b).

Apatite (U-Th-Sm)/He Analysis

Whole apatite grains with minimal visible inclusions were measured, photographed, and packed in 1 mm Nb tubes. Laser heating was used to extract He atoms. The apatite grain and niobium tube were dissolved in HNO3 spiked with nitric acid of U and Th by heating the contents for ~1 h. U, Th, and Sm isotopes were measured from this solution by ICP-MS.

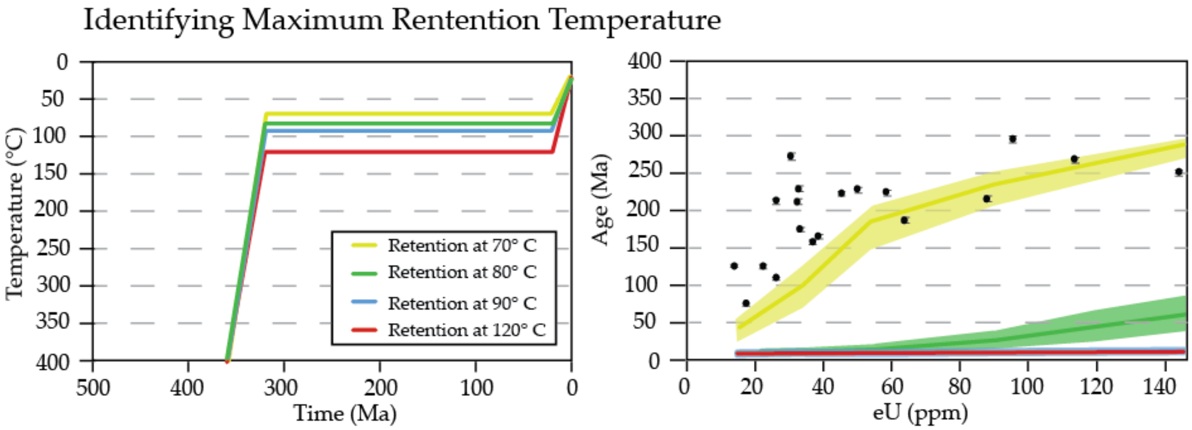
Microprobe Analysis

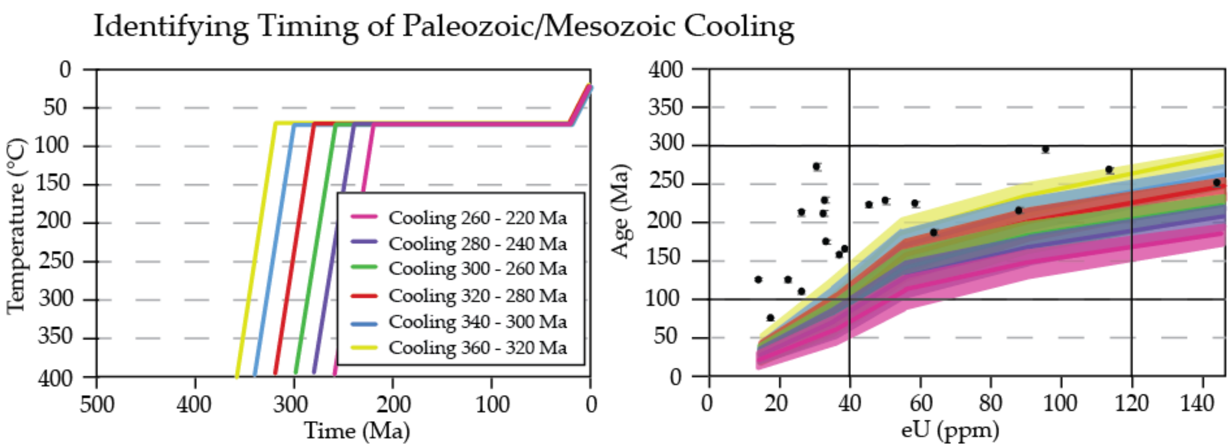
Samples were mounted in epoxy, polished, coated with carbon and analyzed using a CAMECA SX100 at the University of Arizona. Five grains from each sample were analyzed using a 5-μm beam size with 15 keV, and 10 nA. Two spot locations per grain were tested for compositional zonation and variations within the grain. Elemental composition data was collected for F and Cl content.

EXTENDED THERMAL MODELING CONSTRAINTS

Step 1: Forward Modeling AHe age-eU relationship

Ten additional simple forward models of the age-eU relationship of data from Sierra de Velasco supplement the four simple models discussed in the main text (Fig. 5). For details of this diagram refer to the main text and Figure 5.





Step 2: Inverse modeling AFT dates

Inverse modeling of AFT ages and length data is designed to provide the maximum range of thermal histories and parameters are thus left intentionally broad. The model allows for three changes in cooling or heating rate in an individual time temperature path every 100 My. The ending condition for each thermal history requires the model to resolve at 20 °C ± 10 °C, temperatures consistent with modern surface values. The forward model was run until 100 good fit paths were identified where good fit paths required ≥ 0.5 degree of fit for both age and length data. Unlike the forward models for AHe dates, we model AFT samples separately to independently confirm consistency between the samples.

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