SETP23

Impact of meteoric fluid flow on the thermal evolution of the Gotthard Massif: insights from Alpine railway tunnels

Arnost, D.R.[1], Stockli, D.F.[1]
danielarnost@utexas.edu
1. Jackson School of Geosciences, The University of Texas at Austin, Austin, TX

The Gotthard base tunnel provides a unique window into the subsurface of the Swiss Alps and into the complex thermal evolution of the Gotthard Massif. The 57 km tunnel trends north south, providing an orogen perpendicular cross section through the backbone of the Swiss Alps, Aar and Gotthard massifs. The modeled temperature profile in the tunnel mimics topography, increasing from 11°C at the north entrance to 42°C in the middle where overburden exceeds 2.5 km. A 15°C negative temperature anomaly exists 37 km south of the Erstfeld portal at the intersection of the Piora zone aquifer. The Piora zone is a syncline comprised of a heavily deformed and kartsified Triassic dolomite that overlies the gneissic basement of the Gotthard Massif. This aquifer is a conduit that funnels cold Alpine meteoric water deep into the massif. The water absorbs heat from the adjacent bedrock, creating an advective thermal regime and a local negative temperature anomaly. The proposed study will describe spatial and temporal evolution of this anomaly using apatite (AHe) and zircon (ZHe) (U-Th)/He thermochronometry from the Gotthard base tunnel and its surface line. The main objective is to observe an anomaly in the AHe and ZHe ages that corresponds to the thermal perturbation. The results will prove that these thermochronometers are sensitive enough to analyze near surface, fluid induced thermal perturbations and will also provide age constraints on the anomaly. The AHe and ZHe ages within the perturbed zone are expected to be older than surrounding samples outside the perturbed zone. The resulting data will reveal the shape of the paleoisotherm at the two closure ages thereby chronicling the evolution of the thermal depression.

Keywords: Thermochronometry, Swiss Alps, apatite, zircon