zircon crystal metamictization and date-eU trends suggested similar or divergent thermal histories among samples. With these patterns in mind, we ran inverse models on HeFTy given known geologic constraints on the region's thermal history (e.g. Thompson et al 2010, Thompson et al 2003). In addition, forward modeling data in HeFTy helped us iterate on possible time-temperature paths. Taken in combination, these data point to a narrow band of possible thermal histories.

Results Obtained

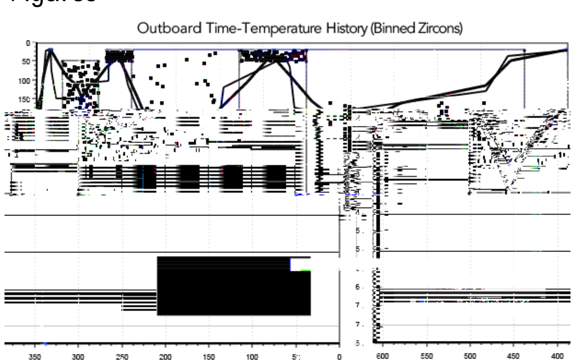
Two distinct thermal histories emerged from our analysis. Data from samples taken outboard of the Avalon accretion zone (to the north and east) suggest near-surface thermal histories between 550 and 300 Ma, then imply a rapid reheating (300-200 Ma) up to 250°C. After this peak, the samples likely cooled slowly to surface conditions by the present. Such results are supported by clear negative date-eU trends and visual metamictization that increases with eU concentrations, which are both suggestive of reheating below 250°C and slow cooling. In contrast, the sample to the southwest, nearest the Avalon accretionary zone, yielded reheating above 250°C between 300 and 200 Ma, then likely cooled rapidly to surface conditions by 150 Ma. This history is supported by a flat date-eU trend and uniform visual metamictization across a ~1800 ppm eU range, which both suggest reheating above 250°C and rapid cooling.

Significance and Interpretation of Results

We interpret these divergent patterns as signatures of differential burial and unroofing across the Avalon terrane. Farther from the accretionary zone (which lies in present-day Rhode Island and Connecticut), we conclude samples were buried to a depth of up to 8 kilometers between 300 and 200 Ma. The sediment overlying the present-day erosional surface likely came from upland sources in New England, though provenance could also be attributed to Gondwanan sources during the Alleghanian orogeny. The present-day Narragansett Basin and other sedimentary basins are likely remnants of a large Avalon basin covering the entire region. Timing of burial of Avalon batholith coincides with the collapse of the Acadian plateau hypothesized by Hillenbrand and colleagues (2021).

On the southwestern side of the terrane, however, we conclude that one sample was buried much deeper than the others between 300 and 200 Ma. It is conceivable that this segment of the terrain was underthrust beneath the overriding peri-Laurentian terranes. While subjected to intense friction and pressures that created metamorphic rock adjacent to the site, this sample would have reached temperatures far in excess of 250°C before being rapidly uplifted in isostatic rebound as the overlying crust was eroded during the collapse of the Acadian plateau. In total, our interpretations align with other recent thermochronology studies in New England and add a crucial data point to tectonic histories of eastern North America.

Figures



Inboard Time-Temperature History (Zircons, Sample 715)

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