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# ウィーン超深層ボーリングにおけるジルコンの長時間アニーリング

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# Natural long-term annealing of the zircon fission-track system in Vienna Basin deep borehole samples: constraints upon the partial annealing zone and closure temperature.

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Fission-track (FT) analysis of zircon from Cretaceous and Tertiary sandstone samples in Vienna Basin boreholes has provided constraints for the thermal stability of the zircon FT system over a geological timescale. Confined track lengths and ages were measured for samples from depths of ~1.5 km to 7.5 km, the deepest with a present environmental temperature of ~200℃. Mean track lengths range from 10.3 to 10.8 μm, indistinguishable within error from the unannealed reference length of 10.7 ± 0.1 μm (±1 standard error), thus showing no sign of systematic downhole reduction. Central zircon ages are consistently older than stratigraphic ages of parent rocks, with no single-grain ages significantly younger than their respective stratigraphic ages. Such FT age and length evidence strongly suggests that the tracks have not been significantly annealed since sediment deposition. Because the present geothermal regime as well as sample burial depths have been near-constant for at least the past 5 m.y., the lower temperature limit of the zircon FT partial annealing zone is >200℃ for a heating duration of the order of 5-10 m.y. Such evidence from long-term natural annealing is compatible with a zircon FT partial annealing zone of ~200-350℃ derived by the extrapolation of laboratory annealing results based on confined track length measurements, but cannot alone discriminate between different annealing models. For the zircon FT closure temperature, a perhaps over-simplified concept, these results are consistent with the oft-quoted temperature of ~250℃ for cooling rates of ~10-100℃/m.y.

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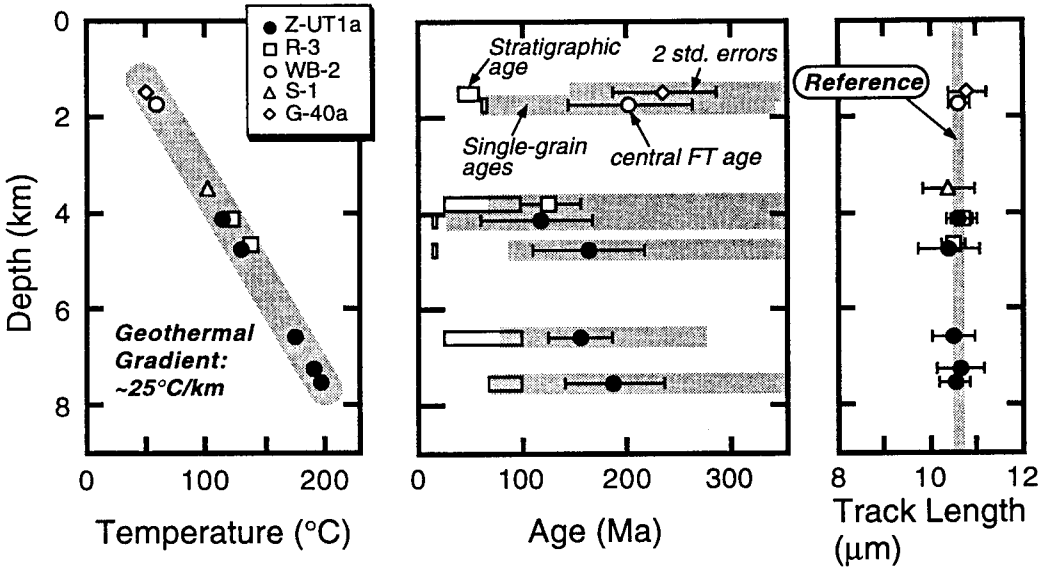


Fig. 1 Present borehole temperature (left), zircon age (middle) and track length (right) profiles against depth. Errors of ages and lengths are shown at 2 S.E. The 'Reference' in the length-depth diagram denotes the mean reference length of unannealed tracks in zircon age standards (Hasebe et al., 1994). No signs of track partial annealing are observed down to 7.5 km, at which the temperature reaches 197°C. Note that a sample of ~4 km depth from the R-3 borehole is plotted slightly upward in the age-depth diagram for clarity. Z-UT1a = Zistersdorf UT1a, R-3 = Ringelsdorf 3, WB-2 = Windisch Baumgarten 2, S-1 = Stillfried 1, G-40a = Gosting 40a.