Quantitative assessment of the exhumation history of Eastern Australia’s Great Escarpment at the Atherton Tablelands, Queensland and the Dorrigo Plateau, New South Wales using apatite and zircon (U-Th)/He thermochronology

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# ABSTRACT

Eastern Australia is a type example of an elevated passive margin (EPM), consisting of an inland plateau separated from the coastal plain by the “Great Escarpment” (Ollier, 1982). Escarpment formation requires considerable erosion, making low temperature thermochronology useful for tracking the history of eastern Australia’s EPM development. Abundant apatite fission-track (AFT) data along the length of Australia’s EPM (e.g., Gleadow et al., 2002) consistently return Cretaceous dates for the coastal plain and older dates on the plateau. This pattern is consistent with EPM formation during rifting of Zealandia from eastern Australia. But the Great Escarpment itself is not bounded by a normal fault, suggesting that it reached its current position via scarp retreat (i.e., the “backwearing” hypothesis). This hypothesis predicts a landward-younging trend in AFT dates, which is not observed. This lack of an AFT date pattern has led to the competing “downwearing” hypothesis, which posits that the Great Escarpment formed in its current location via vertical exhumation, not by scarp retreat. The AFT technique records a rock’s passage through ~120-70°C, so it is insensitive to exhumation magnitudes less than ~1.5-3 km. The Great Escarpment is <1 km high in most locations, so the erosion that accompanied local scarp formation may be undetectable using AFT.

To quantify the entire history of EPM development and Great Escarpment formation, we analyzed samples from the two tallest, most precipitous Great Escarpment segments using both apatite and zircon (U-Th/He) dating (AHe and ZHe, respectively). Use of these techniques complements the existing AFT data because the ~70-30°C closure temperature of AHe makes it sensitive to smaller exhumation magnitudes and the ~200-180°C closure temperature of ZHe allows us to quantify larger total exhumation magnitudes when compared to AFT. Our Dorrigo Plateau, New South Wales study area possesses 1400 m of local relief and faces the Tasman Sea, where the oldest seafloor formed at ~82 Ma. The Atherton Tablelands, Queensland has 1500 m of relief and faces the Coral Sea, which did not open until 62 Ma. Here we compare the exhumation histories of these two Great Escarpment segments separated by ~1500 km.

# REFERENCES

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