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Age and Significance of the Great Escarpments

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Escarpments are prominent geomorphic features of many, but not all, passive continental margins. They generally occur at intra-plate locations that are at considerable distances from tectonically active plate margins. The timing and mechanism of formation of these anorogenic features are much debated. For example, are they ancient structures associated with continental break-up, or are they much more youthful phenomena caused by mantle convective dynamics? Here, we present a general analysis of great escarpments with a view to reassessing their age, evolution and geodynamic significance. First, we show that escarpments generally coincide with present-day positive dynamic topographic anomalies and, to some extent, with negative shear wave tomographic anomalies. A combination of fluvial landscape modeling and thermochronologic observations can be used to provide quantitative constraints for the timing and rate of escarpment exhumation and retreat. There is some evidence that some great escarpments have a Neogene history, which suggests that mantle convection may play a moderating role in their formation.