

Subduction tectonic erosion, forearc collapse and post-subduction magmatism: implications for Siluro-Devonian evolution of the Southern Uplands and adjacent regions

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Subduction tectonic erosion (STE) advances the position of the subducting plate downbend shallowly arcward, carving away the lower crust of the forearc. In active examples (SW Alaska, NE Japan, NE New Zealand) inferable downbend advance exceeds 200 km. Continued subduction may cause the forearc sheet to collapse horizontally by imbrication. The vergence will be arcward (ie "backthrust") if collapse is triggered by the arrival beneath the forearc of more-buoyant crust (eg the opposing oceanic margin). When subduction ceases, conduction heating of sediments along the deep subduction interface could produce a burst of post-subduction magmatism (PSM), or arc affinity.

Suggested implications for the Southern Uplands (SU) are as follows. Late Wenlock turbidites shed southeastward into England and central Ireland mark the closure of Iapetus here. Previous STE beneath its NW margin had probably undercut much of the forearc and SU accretionary prism. Following Iapetus closure, continued plate convergence thrust the thinned SD prism NW over the now-vanished Ordovician arc terrain, as suggested by Midland Valley conglomerates and seismological evidence. Further NW vergent thrusting carried the former SE margin of Iapetus over the SU and Ballantrae (causing NW-overtained structures) and disturbed the old SE-dipping ("English") mid-Ordovician Benioff zone enough to cause the Lake District and Leinster granites by delayed PSM. Meanwhile, early Devonian PSM occurred in the Midland Valley and Grampians from the former NW-dipping "Scottish" Benioff zone.