

BALLANTRAE ophiolite as a separately emplaced HEO in a new frame for the post-Grampian tectonic sequence in the British Isles: early Tremadoc to Siluro-Devonian crunch

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It will be shown that my Hot-Emplaced Ophiolite (HEO) model (Gondwana Res. 2001; GSA Ann Mtg 2001; TSG Leicester 2002) fits Ballantrae into a tightly timed interpretation of the Caledonian tectonic/stratigraphic/magmatic sequence, including the action under both Iapetus margins of two other processes; basal subduction tectonic erosion (STE) and post-subduction magmatism (PSM). Timescale from Gradstein et al, Episodes, 2004.

The primary Grampian tectonic sequence was immediately followed by two plate-splitting/MOR-initiating events; the first (A) was along the Highland Border; the second (B), perhaps only 10Ma later, was at some distance (= the Southern Uplands proto-Northern Belt (NB) basin) to the S of the continental shelf of Cockburnland (strictly à la Walton 1963, 1965), a now-buried southern extension of the Midland Valley terrane, forming the NW passive margin of the main Vendian(?) Iapetus Ocean. Split A was the progenitor of the Taconian closure. Initiation of Split B at ~481Ma (late Tremadoc) produced the Ballantrae Ophiolite and emplaced it across the proto-NB basin onto the Cockburnland shelf.

At the SE margin of Iapetus, intra-Llanvirn subduction STE-undercut, for ~200km, the Manx-Welsh and Irish sectors but not the Lake District/English one. PSM ensued while, at end Llanvirn (=base Caradoc=base *gracilis*=461Ma), subduction swapped sides, closing the Highland Border first. This produced S-vergent thrusting, conglomerates and intraplate volcanism in the terrane and basin to the south; it also strike-slipped an ancient arc terrane, Novantia, into position along the southern side of the proto-NB basin. Subduction then (late *gracilis*) jumped to the south of Novantia and immediately proceeded to STE-undercut it, the NB basin behind it and that part of the Cockburnland shelf upon which Ballantrae Ophiolite was sitting.

In late Llandovery (late *sedgwickii* = 437Ma) the accretionary front of this subduction zone encountered Iapetus' southeastern continental rise. Temporary holdup there resulted in progressive imbrication and uprighting of the entire undercut northern margin, reaching the Ballantrae Ophiolite in early Wenlock (428Ma), when plate closure was briefly transferred to the WNW-directed Moine and Outer Isles thrusts, with a sinistral component at the Great Glen Fault. This done, the SU accretionary front succeeded in surmounting the edge of the English sector shelf (former Ordovician forearc) and the SU Southern Belt was then accreted, finally halting nearer the Lake District in early upper Wenlock (late *lundgreni*=425.5Ma).

Reactivation of the old SE-dipping subduction interface under northern England then offered further plate closure options and the now-imbricated SU-Ballantrae assemblage was further backthrust onto Cockburnland in the early Devonian (413Ma?).

The previous shelf-encounter events had slowed, and eventually halted, the NW-ward subduction, giving time for reheat of the slab; so PSM set in, starting in NW Highlands (Rogart) at ~430Ma and migrating S-ward (a diagnostic of PSM) to 396Ma (Criffel) through the now-backthrust SU.

In the Manx-Welsh and Irish sectors, the previous STE-undercutting of them completely transformed the resulting crunch tectonics. In the Manx-Welsh sector there was SE-vergent imbrication of the thinned margin (NW Manx, Carmel Head), the latter being multiply constrained by sedimentation and stratigraphy to early *turriculatus* (436Ma). In the Irish sector, the Longford-Down part of the SU pushed under the southern margin, so acquired no Southern Belt and was overturned to the NW. *Lundgreni*-age subduction-type volcanics in Dingle and the 423+/-3Ma Carnsore (Point) granite support the much earlier reversal of subduction vergence in this sector.