

Post-Caledonian normal faults in Western Ireland.

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Outcrop and regional scale studies of faults from the Connemara area and from Clew Bay, in particular, suggest the existence of large-scale (up to 850m throw) Carboniferous normal faults. Some of these structures juxtapose Carboniferous against Lower Palaeozoic rocks and were previously considered to be Tertiary normal faults, whilst others juxtapose Lower Palaeozoic rocks at outcrop level, and were previously interpreted as high angle Silurian thrusts. The reinterpretation of these structures as Carboniferous normal faults, in which outcrop level juxtapositions derive principally from Carboniferous displacements, does not rule out either an origin from reactivation of earlier Caledonian structures or some minor component of Tertiary reactivation.

Previous studies of post-Caledonian faults in Connemara argue for a significant phase of Tertiary normal faulting to explain the present day terrain and the offset geometry of the base Carboniferous unconformity. The latter indicates a series of ENE-E striking faults with vertical displacements ranging up to 850m. Here we review existing constraints and present new data on the geometry and timing of these faults. We suggest that the most parsimonious interpretation of the available data is that these faults are of Dinantian age, although some minor Tertiary reactivation cannot be ruled out. The main lines of evidence are:

- 1) The geometry, scale and associated strains of these normal faults are comparable with those of the Dinantian faults along strike to the north-east (i.e. those with associated syn-depositional effects and Zn-Pb mineralisation).
- 2) Tertiary faults of similar scale or orientation are not seen in seismic datasets from offshore West of Ireland and cannot be demonstrated from outcrop constraints further to the northeast. For example, the vertical displacements on faults offsetting the Tertiary/Cretaceous sequence of the Antrim Plateau are significantly lower (< 250m) than the displacements of Carboniferous rocks (ca 1000m).
- 3) There is no compelling evidence in the West of Ireland for significant fault-related displacement of other Tertiary structures (e.g. dykes).
- 4) Differential erosion of sequences across 'dead' faults provides 'resequent fault scarps' (e.g. in Western USA and northern England). We suggest that the significant difference in response to erosion of Carboniferous sediments and of underlying basement could generate the present-day terrain, with no requirement for Tertiary faulting.

Our interpretation of the existence of Carboniferous normal faults in the West of Ireland, and in the Clew Bay area in particular, has a number of significant implications. Uplift and erosion has exposed the deeper levels of Carboniferous faults, the structural definition of which has eluded all previous studies in the poorly exposed Carboniferous successions of the Central Plains of Ireland. Analysis of these faults may provide useful constraints on the fluid flow systems underlying and sourcing fault-controlled Carboniferous Zn-Pb mineral deposits. The presence of post-Caledonian structures entirely contained within Caledonian rocks at outcrop level arises from the localisation of Carboniferous normal faults within and adjacent to the Caledonian Fair Head-Clew Bay line and reinforces the importance of Caledonian structure on later structural development.