



Localisation of brittle and ductile lateral thrust ramps and culmination walls above reactivated steep basement shear zones, Caledonian Moine Thrust Zone, NW Scotland

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The west-vergent Caledonian (Silurian) Moine Thrust Zone (MTZ) in NW Scotland is a world class example of thrust geometry and tectonics. New BGS mapping and structural analysis highlights previously unappreciated abrupt north-south lateral variations in both thrust architecture, and in the internal configuration of individual thrust sheets. We can now link these lateral variations to pre-, syn- and post-thrust displacements on reactivated sub-vertical faults and shear zones occurring in the Precambrian crystalline basement to the stratigraphical successions deformed in the MTZ. These discrete discontinuities in basement are a consequence of repeated Precambrian (2500 & c.1800 – 1600 Ma) deformation phases and typically trend WNW-ESE. They are thus aligned (sub)-parallel to the regional transport direction of the superimposed Caledonian thrusting. Analysis of piercing point displacements reveals that some basement shear zones experienced brittle reactivation prior to thrusting but after deposition of the Cambro-Ordovician sedimentary cover sequence and then again, both during and after thrusting. Thus, a layer-cake architecture had clearly been faulted prior to thrusting, creating a series of WNW-ESE trending steps of the order of 100 m high or more.

In the Assynt Culmination of the MTZ, these steps strongly controlled the emergent thin-skinned thrust architecture in the sedimentary units, as well as the occurrence and limits of thicker (0.5 – 1 km) thrust sheets which also transport the basement gneiss. Both thin- and thicker-skinned architecture is compartmentalized along steep WNW-ESE trending brittle-ductile lateral culmination walls at intervals of 5 – 8 km;

for example, the thickness of basement gneiss is reduced stepwise towards the south in the Ben More thrust sheet.

At structurally higher levels in the hanging wall of the Moine Thrust, a km-scale WNW-ESE trending ductile steep culmination wall in metasediments is identified as the lateral termination of the Oykel Culmination. This culmination wall marks the termination of a *c.* 5 km thick thrust sheet and coincides with a steep gradient at the south-western limit of a deep regional gravity low. That gradient is believed to indicate the existence of a (long-lived) km-scale step in basement.

In conclusion, transport-parallel steps in a pre-thrusting template can strongly control lateral complexities at a variety of scales throughout the evolution of a thrust belt.