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Imbricate stacking on a highly oblique ramp, but no antiformal culmination - the Dundonnell sector of the Caledonian Moine Thrust Belt, Northwest Highlands of Scotland.

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Abrupt lateral changes in the structural geometry of ductile thrust stacks occur in many contractional fold-and-thrust belts. Such transverse zones are not widely studied and reported but are commonly thought to be related to kinematic responses to irregularities generated across pre-existing, sometimes re-activated, basement faults. Antiformal culminations, often much greater in amplitude than any irregularity identified in the basement below, are frequently associated with such transverse zones; risk evaluation of any hydrocarbon play in such a setting presents a complex challenge. In many cases, the causative structure is concealed, either by distal parts of the thrust belt or the foreland basin. Breaching focussed above the weakness in basement further complicates assessment of the structural integrity of the setting.

In NW Scotland, the classic Caledonian WNW-vergent Moine Thrust Belt exposes excellent examples of the structural architecture in such transverse zones. One such example, the Dundonnell Culmination has been interpreted as the type example of an antiformal-stack duplex in a fold-and-thrust belt (Boyer & Elliot 1982). This interpretation derives from the primary Geological Survey of the region (Peach et al. 1907) which identified a WSW-ENE elongate antiformal structure formed in Neoproterozoic (Torridonian) and Cambro-Ordovician sedimentary strata immediately beneath the Moine Thrust. The Moine Thrust was shown to be deformed by this structure, the antiformal axis was shown to be aligned oblique to the trace of the Moine Thrust Belt, and to the (top-to-WNW) thrust transport direction.

New geological mapping does not support an antiformal-stack duplex at Dundonnell. There is no folded repetition of the stratigraphy or lithology across the culmination; instead moderate to steep SSE-dips are observed right across the structure. On the south side of the structure, clastic rocks immediately beneath the Moine Thrust are intensely mylonitic; in contrast on the north side undeformed, massive sandstone dominates, within which there is little or no evidence for ductile deformation. We instead interpret the Dundonnell structure as a steeply-inclined imbricate stack, lacking antiformal upright folding. The imbricate stack bulges up and displaces both the ductile and brittle Moine Thrust.

The northern limit of the Dundonnell imbricate stack is defined by a brittle or brittle-ductile fault breaching the Moine Thrust; the Loch an Daimh Fault. The Loch an Daimh Fault clearly displaces the Moine Thrust but does not displace the structurally lowest thrust plane at Dundonnell, instead it flattens and roots southwards into the brittle base of the thrust pile. This fault continues WNW and also defines the northern limit of a 200 m wide linear belt of transpressional mylonitic deformation belt in the structurally higher Moine rocks. We argue that the Dundonnell stack and the transpressional deformation in the Moine rocks are located on a (highly) oblique lateral ramp.

North of Dundonnel, the Ullapool Thrust Sheet comprises Archaean gneisses and Neoproterozoic sedimentary rocks; this thrust sheet terminates southwards at Dundonnell. We propose that the Dundonnell Stack, and the transpressional flower structure in the Moine rocks, are constrained by the oblique lateral ramp corresponding to the southern limit of this thrust sheet. The degree of obliquity with respect to the thrust transport direction may control the architecture of tranverse zones with higher angles of obliquity favouring imbrication and breaching rather than antiformal folding.