The Mid North Sea High is a broad, approximately east-trending structural high that extends from the coast of the Scottish Borders region to the UK North Sea median line. Recently acquired seismic reflection profiles were used to map isopach patterns of the Chalk Group (Upper Cretaceous and lowermost Paleocene), of the combined Montrose and Moray groups (Paleocene and lowermost Eocene), and of the lower Stronsay Group (lower Eocene) in UK Quadrants 38 and 39, on the eastern Mid North Sea High. In an anomalous and undrilled part of this area, the Chalk Group thins over an area broadly centred on a long lived, buried, NNW-trending structural high with a core largely comprised of Devono-Carboniferous sediments. In contrast, the combined Montrose and Moray groups and the lower Stronsay Group sediments thicken over the buried high. We informally name the buried high the α Ridge. Signal processing techniques were applied to the original stack sections to help clarify the geometry of seismic reflections, especially from within the Chalk Group and Palaeogene successions of the anomalous zone, and to interpret deep erosion at the top of the Chalk Group that probably occurred in Danian times. The area of deeply eroded Chalk was subsequently buried beneath an anomalously thick Palaeogene succession. The area of eroded Chalk is more extensive than the α Ridge and extends northwards beyond the survey area. From a regional perspective, the processes that may have controlled the observed depositional pattern are discussed. It is considered whether rapidly changing tectonic stress may have caused local 'Laramide' (mid Paleocene–Danian) uplift and erosion of the α Ridge and its immediately surrounding area, swiftly followed by enhanced subsidence (inversion) and deposition in the mid Paleocene (Danian), or whether the stratal pattern is better explained by the infilling of a large erosional hollow; mechanisms involving the local halokinesis and/or dissolution of Zechstein salt are discounted. We conclude that additional seismic and palaeogeographical information is required to fully test the models proposed in this paper.