A BURIED PRECAMBRIAN IMPACT CRATER IN SCOTLAND.

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Introduction: The Stac Fada Member is a melt-bearing sandstone unit within the Stoer Group (Mesoproterozoic, 1.2Ga) of north-west Scotland. Once regarded as volcaniclastic in origin, it was reinterpreted as an impact ejecta deposit following the discovery in it of shocked quartz and geochemical anomalies [1]. The continuity of this impact deposit along the Stoer Group outcrop (>50km) and its substantial thickness (4-12m) suggests relative proximity (a few tens of km) to a large impact crater (tens of km diameter), but locating it has been hindered by the limited extent of the present outcrop, that is truncated by faulting and erosion. An offshore location to the west, beneath a thick Mesozoic succession in the Minch Basin, was proposed by Amor et al. [1] but various directional indicators associated with the Stac Fada Member, from ejecta intrusions along bedding planes immediately beneath it, to erosional troughs eroded into its top, consistently indicate emplacement of ejecta from the east. No surface manifestation of an impact crater has been identified but there is a remarkable correspondence between the crater's location, as inferred from these directional data, and the position of the Lairg Gravity Low, a conspicuous geophysical anomaly centred more than 50 km east of the Stoer Group outcrop [2]. Proximal-distal facies changes along the outcrop of the Stac Fada Member are consistent with this inferred relationship between the ejecta deposit and the gravity low. Drainage reconfiguration, as recorded in the post-impact fluvial sediments of the Meall Dearg Formation, suggests that a regional isostatic doming broadly centred on the Lairg Gravity Low occurred in response to excavation of the crater. Comparison with gravity data from impact craters elsewhere suggests that the Lairg Gravity Low represents a complex crater at least 40 km in diameter that now lies buried beneath a thrust sheet of Moinian (Neoproterozoic) metasediments several km thick. If confirmed, this would be the first impact crater discovered in the UK and among the fifteen largest on Earth.

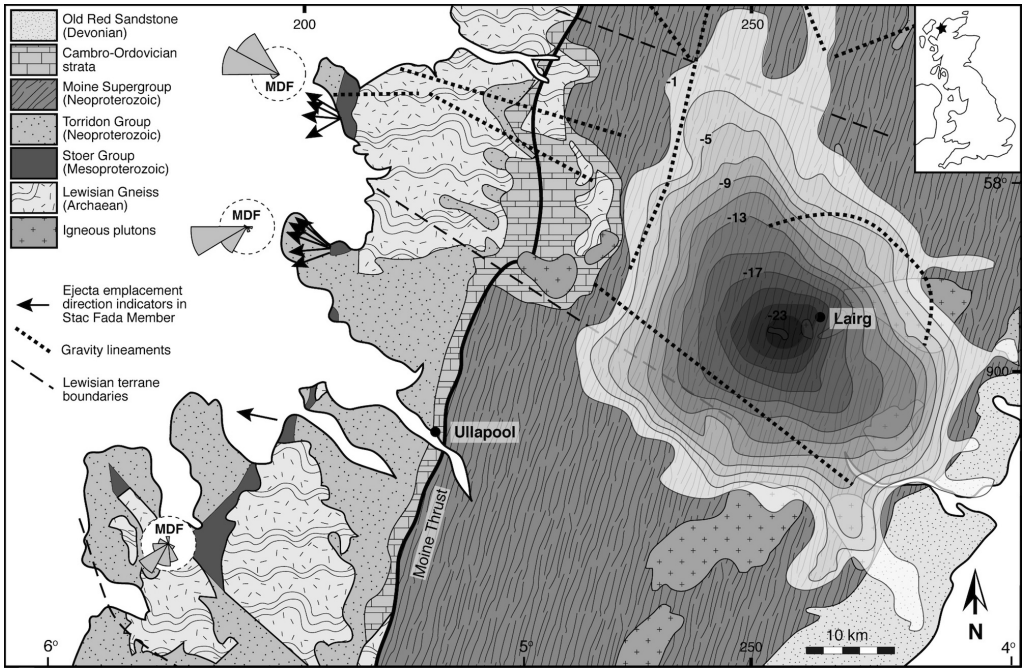

Figure: Regional geology of northern Scotland showing the outcrop of the Stoer Group, containing the Stac Fada Member impact ejecta deposit, and its relationship to the residual gravity field (contoured at 2mGal intervals) and gravity lineaments for the Lairg Gravity Low. Arrows indicate directional azimuths within the Stac Fada Member. Rose diagrams show palaeocurrent data for the post-impact Meall Dearg Formation. Inset map shows location of the study area.

References: [1] Amor, K. et al. 2008. *Geology* 36: 303-306. [2] Simms, M.J. 2015. *Proceedings of the Geologists' Association* 126: 742-761.