Grange Hill, Kinloss

Clive Auton

The glacial significance of the Hempriggs-Coltfield Ridge (Fig. 49), 3 to 5 km east of Kinloss, was recognised by Peacock et al (1968) during their survey of the Elgin district. They described the feature as 'an almost flat-topped ridge' that 'extends for one and a quarter miles, curving from south-north at Grange Hill (now an isolated mound) to east-north-east between Miltonhill [NJ 100 630] and Coltfield [NJ 117 637]'. They also noted that Grange Hill reaches 37 m OD and that 'the almost plane surface of the ridge' falls away from just above 30 m OD east of Brodie House [NJ 093 627] to 15 m OD at Coltfield. The lower slopes of Grange Hill and the Hempriggs-Coltfield Ridge were both modified by marine erosion, with Late Devensian and Holocene raised marine deposits developed around their bases.

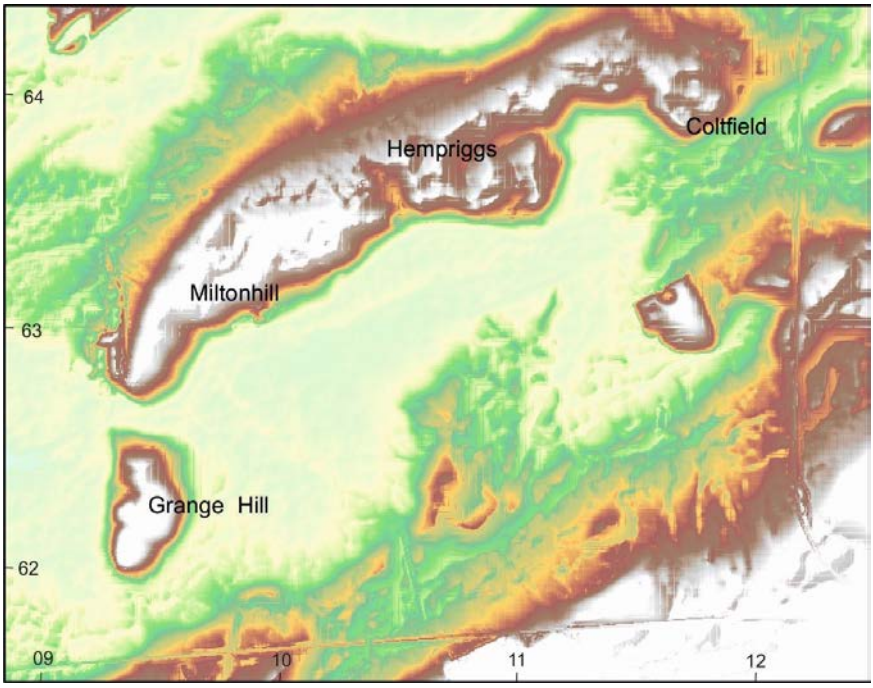

Figure 49. Hill-shaded DTM, with colour ramp, of the Grange Hill and the Hempriggs - Coltfield ridge (5 m spatial resolution) using NEXTMap Britain elevation data from Intermap Technologies.

Peacock et al. (1968) noted that 'coarse-grained brown sand with a few boulders' was visible in an old sandpit on the southern slope of Grange Hill, and that 8 m of cross-bedded sand was exposed at Miltonhill. A sequence that coarsens downwards from fine-grained red-brown silty sand, into medium grained sand was seen at the former pit in 2008.

Up to 0.8 m of 'brown boulder clay' overlying 9 m of 'sand and silt with gravel lenses and wedges and cross-bedding dipping north and east' was recorded by Peacock et al (1968) from a sandpit 200 m south-east of Upper Hempriggs [NJ 103 635]. They also noted that 'narrow fissures are filled with sandy clay, and balls of rock flour occur in the sand'. This section is no longer visible, nor is the section from another now disused quarry c. 70 m north-east of Upper Hempriggs, where up to 0.3 m of 'coarse brown sand and gravel' overlay 0.6 m of 'brown boulder clay' resting on 3 m of 'intensely contorted reddish silt and sand'. Up to 0.2 m of sandy cobble gravel overlying up to 1 m of fine-grained orange sand was also exposed in a temporary trial pit c. 90 m north-north-west of Upper Hempriggs in 2008.

Although most of these exposures are no longer accessible, they provide important clues to how the deposits and landforms of the Grange Hill-Hempriggs area formed.

Grange Hill

The Grange Hill feature (Fig. 50) rises some 27 m above the surrounding flat lying ground (typically below 10 m OD), which is primarily developed on Holocene shoreline sediments and spreads of peat. The hill has a gently rounded north-south profile, a wooded steep western face and an almost planar upper surface that slopes gently north-eastwards. Small exposures close to the top of the track that leads to the top of the hill reveal a thin brown pebbly sandy diamict overlying silty sand. Sparse boulders and cobbles occur on the ground surface on the top of the hill.

Figure 50. The western side of Grange Hill, showing steep, tree covered possible ice-contact slope.

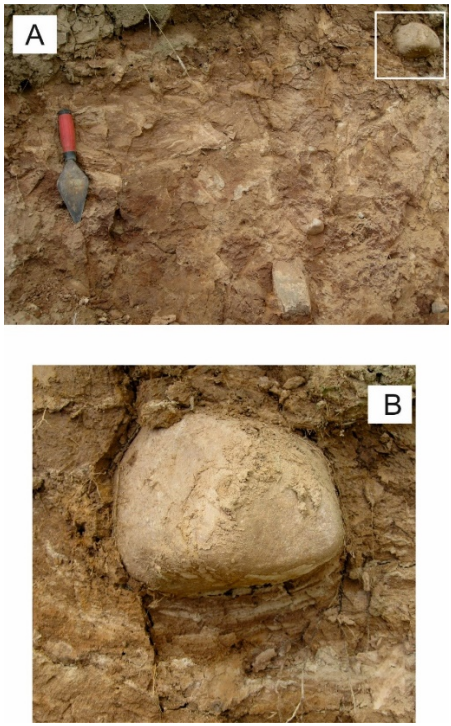

Figure 51. Exposure in a pit at the base of the sequence on the eastern side of Grange Hill. (A) compact silty sandy diamict with wispy sand laminae and isolated cobbles of metasandstone, (B) well-rounded metasandstone dropstone cobble deforming underlying sandy laminations.

The best exposures in the lower part of the Grange Hill sequence (Fig. 51) occur in a small pit on the eastern side of the feature at [NJ 096 623], where 2 m of sandy silty diamict, containing isolated rounded cobbles and pebbles of metasandstone, overlies pale yellow, fine-grained, micaceous silty sand, at the base of the working. Some angular clasts of metasandstone, partly decomposed metasiltstone and red sandstone are also present. The matrix of the deposit has a distinctive mottled appearance due to the presence of thin, wispy, discontinuous beds of laminated silty fine-grained white sand. It is suggested that these laminated sands have a winnowed or water-lain origin. Some of the metasandstone cobbles appear to be dropstones as they deform the thin underlying sandy laminated beds within the matrix (Fig. 51 B).

Miltonhill

Exposures in a temporary pit at [NJ 097 632] that was worked for sand for filling bunkers on the Kinloss Country Golf Course at Miltonhill, in 2008, provided new data regarding the top of the sequence forming the Miltonhill-Hempriggs-Coltfield Ridge. These exposures showed that the ridge is capped by a thin unit of pebbly sandy diamict that is associated with a large, isolated erratic of conglomerate [NJ 099 630] (Fig. 52). The block was encountered during the construction of vehicular access tracks across the golf course. The lithology of the erratic indicates that it is most probably from above the unconformable base of the Upper Devonian succession (rather than from above the unconformable base of Middle Devonian sequence farther inland). The bedrock beneath the Grange Hill-Miltonhill area comprises calcareous sandstones, pebbly sandstones and pedogenic limestones (cornstones) of the Alves Beds. These constitute the uppermost part of the Upper Devonian sequence in the Forres area. The nearest outcrops of Upper Devonian conglomerates occur c. 6 km south-west of Forres. This suggests erratic transport north-eastwards, into the Miltonhill area, by Moray Firth ice.

Figure 52. Erratic of Upper Devonian conglomerate on the Kinloss Country Golf Course at Miltonhill.

Figure 53. Pebbly orange-brown sandy diamict with contorted stratification overlying planar bedded sand at the top of the sequence in the sand pit at Kinloss Country Golf Course. The involutions and boudinage in the diamict are probably caused by cryoturbation and by injection of fluidised sediment from the underlying sand.

The thin pebbly brown sandy diamict (Fig. 53) that caps the ridge at Miltonhill was also exposed in a temporary working on the golf course at the top of the ridge, at c. 30 m OD. The diamict rests on planar-bedded, fine-grained sand with silt drapes, showing some minor signs of fluidization (flame structures). Some climbing ripple lamination and small-scale cross bedding is present within individual sand beds. The matrix of the diamict is contorted and boudinaged blocks of more competent silty material, which occur its base, are associated with injections of fluidized sand from below. This diamict is remarkably similar to that described by Peacock et al (1968) as the 'brown boulder clay' they mapped capping the remainder of the ridge, around Hempriggs and Coltfield.

Figure 54. Contorted silt partings and shearing in sands, Kinloss Country Golf Course sand pit.

The planar-bedded sands pass laterally into sands showing 'out-of-phase' climbing ripple bedding and anastomosing silt partings. The ripple bedded sands overlie sands with planar cross bedding and a distinctive 'sheared' appearance (Fig. 54). This is enhanced by displacements of the prominent anastomosing silt partings. The brittle and soft sediment deformation is restricted to the top 1.5 m of the sand sequence, which passes gradationally downwards into about 1.5 m of thickly cross bedded sands, exposed at the base of the working. The cross bedding indicated an eastward to south-eastward directed palaeocurrent.

Interpretation

Peacock et al. (1968) interpreted most of the sediments that underlie Grange Hill, and the ridge between Milton Hill and Coltfield, as being transported by meltwater that flowed from the high ground to the south, depositing them within a 'wide chasm in the ice, possibly a crevasse enlarged by ablation'. They suggest that the ridge could, therefore, be the remnant of a kame terrace, subsequently modified to a ridge-like form by marine erosion. This is analogous to the origin that has been proposed for the 'flat-topped ridge' associated with the **Flemington Eskers** at Meikle Kildrummie.

The morphological and sedimentary evidence presented here, however, suggests similarities with the sequences ascribed to the Ardersier Oscillation, farther west. The arcuate plan of the ridge is reminiscent of the **Ardersier Peninsula** and regional mapping suggests that the arc extends farther to the south-west to include the two, prominent, almost 'flat-topped ridges' located to the south and west of Burgie Lodge [NJ 088 600] (Fig. 13). These ridges are capped by orange brown diamict, overlying silty fine-grained sand. Both are associated with major (> 20 m deep) north-eastward draining ice-marginal drainage channels.

The sequences of sediments at Grange Hill, Miltonhill and Hempriggs include a thin diamict capping the succession, in a manner similar to the Baddock Till, which overlies the Ardersier Silts at Jamieson's

Pit, on the Ardersier Peninsula. The diamict exposed in the golf course pit resembles a debris flow deposit, modified by cryoturbation and soft sediment deformation, rather than a compact subglacial traction till. Shearing in the sands beneath the capping diamict at Miltonhill can be compared with the sheared sands that were exposed near the Contorted Silts locality at Ardersier. The observation by Peacock et al (1968) of intensely contorted reddish silt and sand, beneath the capping diamict near Upper Hempriggs, shows that such deformation is characteristic of the upper parts of the Miltonhill sequence. Their record of balls of rock flour within the sands is also important. It shows a similarity between sedimentary features present in both the Ardersier Silts and the Grange Hill Sand formations, but apparently absent from any other Quaternary deposits in the area. The presence of isolated dropstone cobbles within sandy diamict near the base of the sequence at Grange Hill suggests that the unit is probably a poorly stratified glaciomarine mud rather than till.

The record from an old water well at Milton of Brodie House [NJ 092 629] shows that an unusually thick and complex Quaternary sequence underlies the flat-lying ground just beyond the north-western margin of the ridge at Miltonhill. The sequence was unbottomed at a depth 40.6 m, indicating that rockhead occurs below -28 m OD. This is almost twice the depth to rockhead modelled from borehole records in the nearby Kinloss area. Unfortunately there are no other recorded boreholes close by, but this single record suggests some over-deepening of the substrate on the western side of the ridges, perhaps caused by a glacial advance from the west.

The sand–dominated sequence described from the Grange Hill area has been ascribed to the *Grange Hill Sand Formation* on BGS maps and in BGS Quaternary lithostratigraphical datasets and publications. It is interpreted tentatively as of glaciomarine origin based largely on the characteristics of the sediments that underlie Grange Hill and the Miltonhill-Coltfield Ridge. Both the ridges, and the sediments that underlie them, show many similarities to those features developed within the Ardersier Silts Fm around the **Ardersier Peninsula** (Fig. 13). This suggests that both were formed in a similar manner, that is, by a minor readvance of the Moray Firth glacier that interrupted its gradual

westward retreat towards Inverness and the Beauly Firth. This oscillation is named here as the *Grange Hill Oscillation*. It occurred after the Elgin Oscillation of Peacock et al. (1968), the eastern limit of which reached the coast near Buckie, some 35 km to the east, and before the Ardersier Oscillation, 32 km to the west.