Excursion Reports 2021

Slump folding in Kirk Stile Formation, Wythop Woods

Leader: Phil Davies 9 June 2021

The purpose of the two-hour evening excursion was to examine the Ordovician age Kirk Stile Formation (part of the Skiddaw Group) which is exposed in ten forestry roadside rock cuttings. This trip followed on from an earlier excursion carried out in 2019, which covered the outcrops between Woodend Brow and Lothwaite Side. The 2021 trip focused on detailed examination of sedimentary and structural features at scales of millimetres to tens of metres as well as intrusions present within the main forestry area.

This was the first excursion and the first face-to-face meeting of the Society following a long hiatus necessitated by restrictions related to the coronavirus pandemic.



Phil pointing out sole structures at NY 21648 27695 (Photo Myles Hamilton)

The marine sediments of the Kirk Stile Formation comprise mudstone, siltstone and sandstone reflecting the turbidite deposition common in the Skiddaw Group. Most of the cuttings seen were sandstone-dominated. Strata have been strongly affected by slump folding, probably influenced by later tectonic folding as well. Some of the slumps are fairly dramatic 'crumples'. At least one plunging fold has a neat 'v' shape, somewhat out of character with the other crumpled / curved slump folds. That doesn't mean it isn't also a slump feature! Slump folding seemed to dominate at these exposures but the differentiation of slump structures from crustal / tectonic effects in the Skiddaw Group is a long running topic of debate. The sequence has certainly been subjected to Acadian stresses – a few clear occurrences of cleavage (making an oblique angle to the bedding) were noted.

Most bedding dips are either towards the SE or towards the NW and the common NE to SW strike is reflected in the trends of the axes of small folds that were seen in the cuttings. Fold axes generally plunge at shallow angles. The exposed limb of one fold was examined, and its axis observed to be curved in the horizontal plane. BGS solid geology sheet 29 (Keswick) shows that this excursion lay within the area of ENE/WSW trending folds, deduced to have a plunge towards WSW on the basis of the pattern of outcrops.

Faults of unknown displacement were seen or deduced in some of the cuttings, these juxtaposing rock units of different bedding orientation.

The group discussed ‘way up’ issues, noting that in such a complicated environment it is possible that beds could be inverted. Although some beds were slightly overturned at subvertical slump structures, a normal ‘younging upwards’ situation was confirmed wherever ‘way up’ could be identified. Evidence included graded bedding and the presence of flute casts on the exposed overhanging bottoms of sandstone beds. These aren’t immediately obvious, but the more we looked, the more we saw!

One cutting showed two igneous intrusions, assumed to be andesite on the basis of the BGS map, which shows various andesite bodies present around Wythop Woods. The rock was brown in colour, quite fine grained but clearly crystalline, and with black spotting, thought to be due to the presence of rotted pyrites crystals. The intrusions feature quartz veining, this reflective of the behaviour of relatively massive and strong rock having been ‘cracked’ under tectonic stress. A smaller suspected dyke was seen nearby, its margin cutting across the bedding of the laminated strata adjacent.

Most rock surfaces were seen to be affected to some extent by weathering/discolouration or lichen growth. However, one exposure situated just south of Beck Wythop carpark was relatively clean, this fortuitously allowing a zone of intense shearing and disruption to be examined. This zone is tightly cemented or recrystallised.

Rather damp and misty conditions didn’t prevent maximum use to be made of the geologist’s playground of Wythop Woods.