
South Threave

[NS 251 038]

Introduction

The upper Drummuck Group east of South Threave includes the world-famous Lady Burn Starfish Beds, which contain a Rawtheyan shelly fauna of unrivalled diversity and excellence of preservation. The wealth of taxonomic literature on the many phyla represented in the fauna gives it international significance beyond that due its stratigraphical age and palaeogeographical position.

This site exposes some of the youngest Ordovician rocks in the Girvan area. The Lady Burn Starfish Beds, known only from this site, provide the fullest census of Rawtheyan neritic benthos from the Laurentian margin and include the most diverse trilobite fauna of that age from anywhere in the world. They are also regarded as an echinoderm Lagerstätte, comprising the 'most diverse and important echinoderm fauna in the British Ordovician' (Donovan *et al.*, 1996) and include a fully studied fauna of the controversial calcichordates, which share both echinoderm and chordate features.

South Threave lies within the Craighead Inlier, in the most northerly part of the Girvan district (see the Craighead Quarry site report), where the Ordovician succession extends to much higher levels beneath the Llandoverly unconformity than in the area to the immediate south of Girvan (see the Girvan Foreshore site report). It is the type area for the uppermost formation of the Drummuck Group, the South Threave Formation, of late Rawtheyan age.

Harper (1982a) re-mapped a substantial part of the Craighead Inlier and established a formal lithostratigraphy within the Drummuck Group of Lapworth (1882), thus building on the work of Lamont (1935). Harper divided the upper Drummuck Group into the Lady Burn and South Threave formations. The base of the latter was defined to the immediate south-west of the site, and the formation was subdivided into, in ascending order, the Farden, Cliff and Waterfall members. The last two of these have their principal exposures within the site, and the upper part of the Farden Member, including the Starfish Beds (see also Harper, 1982b), is exposed only here. The site is also included in a field guide to the Girvan district (Ingham, 1992c). The faunas of the Starfish Beds were made famous by the Gray family's extensive collections, made at the end of the 19th century and during the early decades of the 20th and now largely housed in the Natural History Museum, London (Cleevely *et al.*, 1989). The Starfish Beds were studied in detail by Begg (1946) and re-excavated by Harper (1982b). The abundant and well-preserved shelly fossils (Figure 14.14) have been the subject of a multitude of monographic studies, and the numerous illustrations of shelly fossils from the Starfish Beds in the recent guide to British upper Ordovician fossils (Harper and Owen, 1996) are testimony to their diversity, importance and fine state of preservation.

Description

The site comprises a section of Threave Glen, through which the Lady Burn flows, some 500 m ENE of South Threave Farm. The beds dip to the north at 35°, and lower horizons within the upper Drummuck Group are exposed in the burn and adjacent fields between the farm and the site (Figure 14.15).

The upper part of the 40 m thick Farden Member of the South Threave Formation is exposed in the banks of the Lady Burn at the western end of the site, where the grey-green silty mudstones and siltstones typical of the member are interbedded with green sandstones, including the Starfish Beds. Harper (1982a, b) described three such beds, 10–25 cm thick, in his excavations on the south-east side of the river. He considered the lowest to be the horizon intensively sampled by the Gray family but was unsure as to how his three beds equated with the four discussed by Begg (1946), or even whether the latter author was referring to individual beds or fossiliferous horizons within beds.

The well-bedded green mudstones at the top of the Farden Member are succeeded by massive, blue-grey siltstones and silty mudstones of the Cliff Member. Within this 10 m thick unit, shells (including enrolled trilobites) are commonly found

in concentric bands around mud 'nodules' suggesting entrainment during down-slope movement. Harper (1982a) noted that similar features are also seen in the Glenmard Member of the Quarrel Hill Formation in the lower Drummuck Group. Floyd *et al.* (1999) figure a specimen of the graptolite *Paraorthograptus pacificus* (Ruedemann) from the Cliff Member, indicating correlation with the *pacificus* Subzone of the *anceps* graptolite zone. The Cliff Member is followed at the waterfall at the eastern end of the site by well-bedded, grey-green muddy siltstones of the poorly fossiliferous Waterfall Member. Only a few metres of this highest member of the South Threave Formation are exposed beneath the Llandoverly Mulloch Hill Conglomerate here. The conglomerate shows a marked westward overstep within the Craighead Inlier, such that, only 1.5 km to the east of the site, higher levels within the Waterfall Member and sandstones of the Hirnantian High Mains Formation are exposed beneath it (Harper, 1981, 1982a). These sandstones contain somewhat unusual latest Ordovician shelly faunas that are a mixture of forms normally associated with the typical *Hirnantia* Fauna (see the Cwm Hirnant site report) and local Laurentian relicts (Harper, 1981; Owen, 1986).

Interpretation

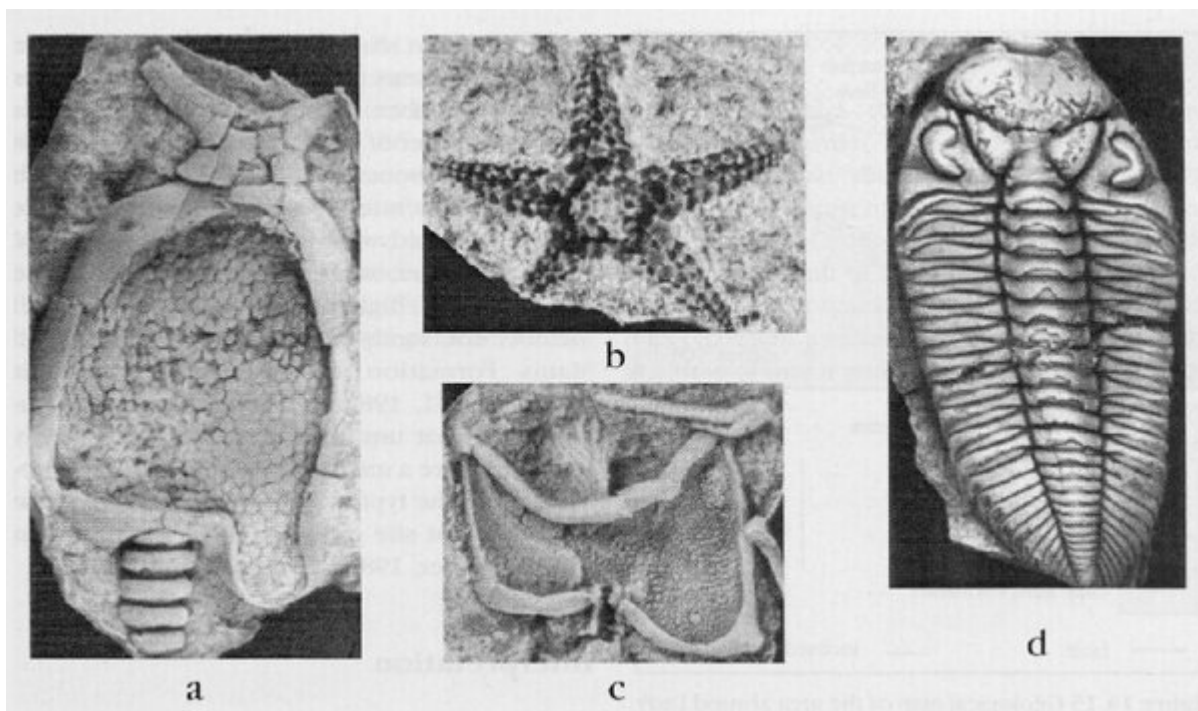
A great many species (including type species of several genera) have the Lady Burn Starfish Beds as their type horizon. Harper (1982a, p. 254) listed the many taxonomic works involving the shelly faunas of the beds. More recent works include his own monograph on the brachiopods (Harper, 1984–1989), works on echinoderms (Donovan and Paul, 1985; Donovan, 1986–1995), on the enigmatic calcichordates (Jefferies, 1990; Daley, 1992b) and the ostracods (Floyd *et al.*, 1999) and the listing of the 47 previously named species of trilobite (many in need of modern revision) by Thomas *et al.* (1984, fig. 19). The taxonomic, morphological and stratigraphical importance of the faunas of the upper Drummuck Group in general and the Starfish Beds in particular cannot be overstated.

The late Rawtheyan faunas of the Starfish Beds are a mixture of relict Laurentian taxa and more cosmopolitan species, reflecting the breakdown of provincialism consequent on the narrowing of the Iapetus Ocean by the late Ordovician. Goldring and Stephenson (1972) concluded that the excellent preservation and abundance of the Starfish Beds faunas indicated rapid burial in a shallow-water environment. However, Ingham (1978) and Harper (1979, 1982a) argued for the mass transport of material from a variety of outer-shelf settings into deeper water. Such a catastrophic movement of sediment would have entrained, buried and killed the living benthos (see Jefferies, 1990, p. 35) and thus provided a census of the shelly faunas involved. Harper (1982b, p. 31) noted differences in the faunal compositions of his three Starfish Beds that he interpreted as reflecting their provenance from slightly different sea-floor environments. Recent excavations have been undertaken under the auspices of the Hunterian Museum, University of Glasgow, with a view to establishing the precise location, extent and composition of the various Starfish Beds. This should clarify and enhance their palaeoenvironmental significance.

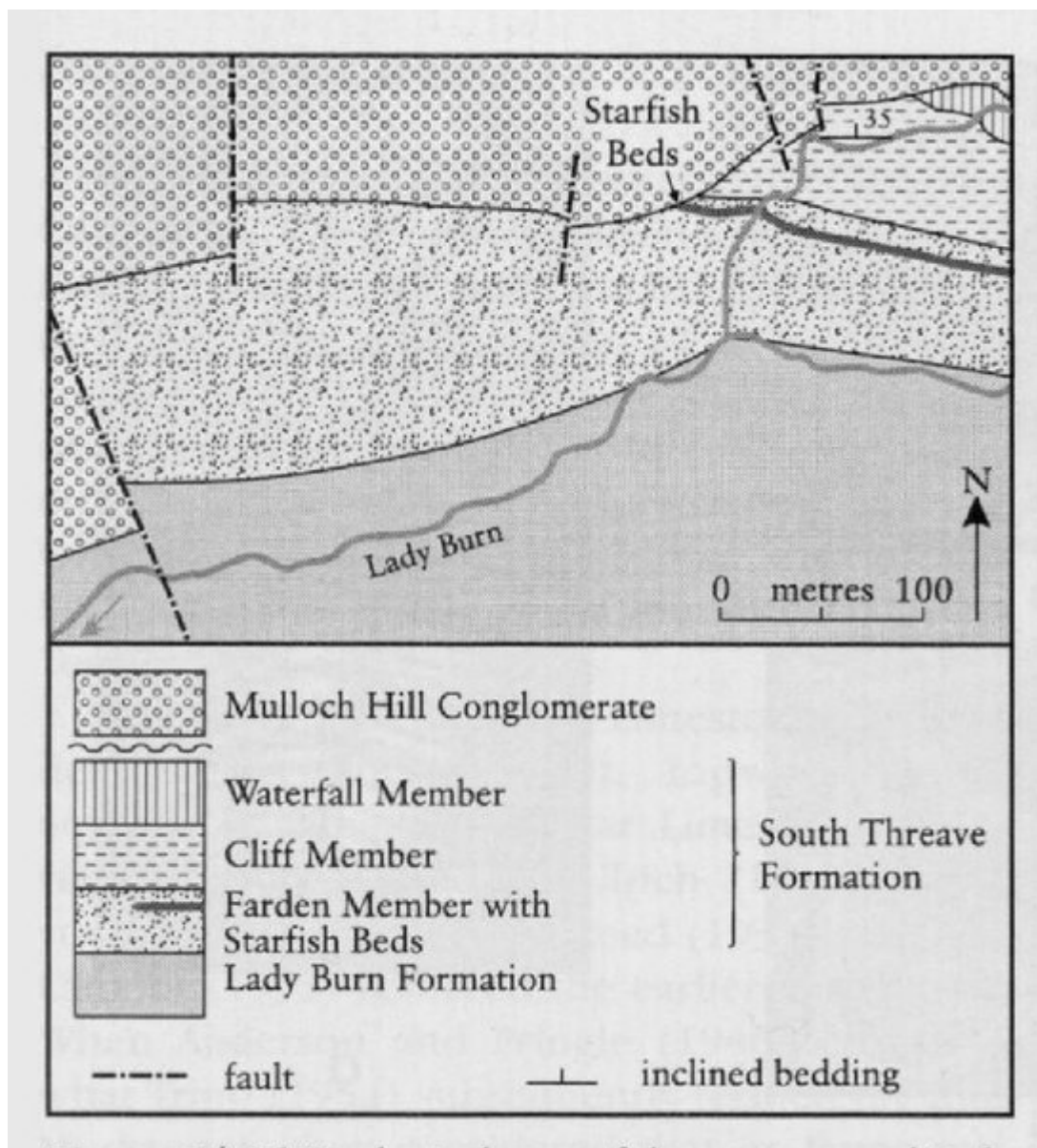
Conclusions

This site includes the internationally known Lady Burn Starfish Beds, which contain an extremely diverse, abundant and well-preserved fossil fauna representing virtually all the main groups of late Ordovician animals. The strata formed as a result of catastrophic movements of sediments and organisms into deeper water and thus represent a series of instant 'census' events at a time of major global faunal change.

[References](#)



(Figure 14.14) Fossils from the Starfish Beds, South Threave. (a) Rhombiferan cystid *Pygecystis quadrata* Bather, x 2. (b) Asteroid starfish *Mesopalaeaster primus* (Spencer), x 4. (c) Cornute calcichordate *Scotiaecystis curvata* (Bather), x 1.5. (d) Trilobite *Toxochasmops bisseti* (Reed), x 1.5.



(Figure 14.15) Burn, east of South Threave farmhouse showing divisions of the upper Drummuck Group, after Harper (1982b, fig. 11). Note the marked overstep of the Mulloch Hill Conglomerate, the local base of the Silurian.