
Aldons Quarry

[NX 198 896]

Potential GCR Site

Introduction

Although not a confirmed GCR site at the time of writing, Aldons Quarry is described as a potential site because it is of regional importance in the succession of the Girvan district from a stratigraphical and palaeoenvironmental point of view and is internationally important palaeontologically. The site is the type locality for a large number of fossil species of markedly Laurentian aspect. It also provides both sedimentological and palaeoecological evidence for the profound effects of basement faulting in the accumulation and distribution of sediment in the Ordovician of the Midland Valley Terrane.

The abandoned quarry at Aldons (Figure 14.6), 7 km south of Girvan, exposes the Stinchar Limestone, one of two limestone formations in the Ordovician of the Girvan district, and the overlying Superstes Mudstone and Benan Conglomerate. When viewed in its wider context, the succession at Aldons helps demonstrate the significance of basement faulting during the Ordovician, including progressive northward overlap by the sedimentary cover sequence over the eroded Ballantrae Complex across a series of major NE–SW faults (Figure 14.1). Aldons Quarry lies less than 1 km to the northwest of one such, the Stinchar Valley Fault.

In his classic work on the Girvan succession (when considering the Stinchar Limestone — part of his 'Stinchar calcareous series'), Lapworth (1882, p. 573) provided the first detailed description of Aldons Quarry. A further brief description was given by Peach and Horne (1899, p. 495), who disputed the faulted contact between the Stinchar Limestone and the underlying Ballantrae Complex postulated by Lapworth and suggested that it may be an unconformity, a view subsequently endorsed by Williams (1962), Ince (1984) and Ingham (1992a). Williams (1962) provided a modern description of the Aldons brachiopods, and Tripp (1967, 1976) described the trilobite faunas. Most recently, Ingham (1992a, p. 393) described and interpreted the site in a field guide to the Girvan district. The lithological divisions and their thicknesses given below are largely taken from that work.

Description

Aldons Quarry lies on the southern limb of a large fold known as the Aldons Anticline, with the beds in the main quarry dipping fairly gently to the ESE. However, in the smaller, south-eastern, quarry the dip is reversed as the beds are folded around a NE-plunging syncline truncated against a NE–SW fault (British Geological Survey, 1988b).

In the north-west part of the main quarry, spilites of the Ballantrae Complex are overlain by a 1.5 m thick conglomerate, with angular clasts almost entirely of spilite. Some 17 m of dark-green pebbly sandstones overlie this conglomerate and are succeeded by 1.5 m of grey cobbly limestones with sandstone partings, followed by 1.5 m of cobbly and pebbly limestone. Many of the limestone cobbles are nodules of the calcareous alga *Girvanella*, which also coats most of the litho- and bioclasts. The following 6 m of cobbly limestone and 28 m of grey nodular and platy limestone are also rich in *Girvanella*. The Stinchar Limestone is capped by over 12 m of thinly bedded, grey, platy limestone and calcareous mudstone yielding a rich shelly fauna. In addition to calcareous algae, the Stinchar Limestone at Aldons contains, especially in its upper part, a diverse shelly fauna, including trilobites (Tripp, 1967, 1993), brachiopods (Williams, 1962), gastropods (Reed, 1920; Longstaff, 1924), ostracods and echinoderms (Peach and Horne, 1899, p. 690). Bergström (1990, p. 24, fig. 3) extracted a sparse conodont fauna, probably belonging in the *Pygodus anserinus* Zone, from an unspecified level in the upper part of the formation. He was able to identify the base of this zone in the middle of the Stinchar Limestone in the section at Benan Burn (Bergström, 1990, p. 6).

The Stinchar Limestone is overlain by the richly fossiliferous Superstes Mudstone: up to 1.8 m of sheared mudstone with calcareous nodules, seen on the south-east wall of the main quarry (Figure 14.6). Elsewhere, the Superstes Mudstone contains a graptolite fauna indicative of the lower part of the basal Caradoc *Nemagraptus gracilis* Zone (Rushton *et al.*, 1996b, p. 23). The Superstes Mudstone is overlain by the Benan Conglomerate, the base of which shows slickensides. Although some tectonic movement has clearly occurred on this surface, Ingham (1992a, p. 395) considered that most of the Superstes Mudstone was removed by channelling prior to the deposition of the Benan Conglomerate, leaving only the basal part of the mudstone formation. To complicate matters, large blocks of the Benan Conglomerate have slumped down the quarry face, partially covering the Superstes Mudstone outcrop and obscuring the site whence Tripp (1976) had recovered an exceptionally diverse trilobite fauna.

Interpretation

The sedimentary units exposed at Aldons Quarry form part of the Barr Group, the full succession of which extends from the middle Llanvirn Kirkland Conglomerate through the Confinis Formation and its equivalents up into the Stinchar Limestone, ending with the thick (up to 640 m) Benan Conglomerate of early Caradoc age (Figure 14.1). Ince (1984) interpreted the two conglomerate units as fan complexes and the Stinchar Limestone as an intervening fan-abandonment phase. All but the uppermost part of this succession is older than the lowest parts of the cover sequence in the block to the north, where the uppermost part of the Benan Conglomerate overlies the Ballantrae Complex (Figure 14.1). That area was therefore not drowned until well into the early Caradoc, and the area to its north was exposed until the mid-Caradoc (see the Craighead Quarry site report). Although the lower beds above the Ballantrae Complex at Aldons may be equivalent to part of the Confinis Formation (Ingham, 1992a, p. 394), the lowest parts of the Barr Group are absent at Aldons, indicating the effect of basement faults within the one major fault block (see Ingham and Tripp, 1991, fig. 3). Tectonic instability is further demonstrated by the episode of deep channelling prior to the deposition of the Benan Conglomerate in the Aldons area (Williams, 1962; Ingham, 1992a). Thus, whereas around Benan Burn, 5 km to the north-east of Aldons, the Superstes Mudstone is about 40 m thick, its uppermost parts interfingering with the Benan Conglomerate (Ince, 1984, p. 230), in Aldons Quarry less than 2 m of Superstes Mudstone is present, and a few hundred metres to the north the Benan Conglomerate rests directly on the Ballantrae Complex.

The faunas of the Stinchar Limestone and Superstes Mudstone are particularly illuminating. Their palaeobiogeographical affinities are wholly Laurentian (Williams, 1962; Bergström, 1990; Tripp, 1993), indicating the location of the Midland Valley Terrane on the 'North American' side of the Iapetus Ocean. The trilobite fauna from the upper part of the Stinchar Limestone is very similar to that of the platy upper Stinchar Limestone elsewhere and comprises 27 species (Tripp, 1967). It represents a fairly shallow-shelf assemblage, assigned by Ingham and Tripp (1991) to the illaenid–cheirurid type of association, although Tripp (1993) considered it to be a deeper-water fauna than the illaenid–cheirurid association of the lower Stinchar Limestone.

Trilobites are by far the most abundant elements of the fauna of the Superstes Mudstone at Aldons. The whole fauna was described most recently by Tripp (1976), who also reviewed taxa described previously by Reed, Lamont and Begg. The fauna is remarkably diverse, comprising 69 species belonging to 52 genera. Twenty-one species have their type locality at Aldons, and Tripp (1993, fig. 4) showed the broad taxonomic composition of the fauna, based on 3261 specimens. That 5% of these specimens are referable to the genus *Nileus* led Ingham and Tripp (1991) to assign the fauna to a 'borderline *Nileus* association', indicating a deepening from the environment of deposition of the Stinchar Limestone. They assigned 42% of the trilobites in the Superstes Mudstone at Craigneil, some 6.5 km to the south-west of Aldons, to *Nileus*, thus indicating a fully developed *Nileus* association there. The deeper water indicated by the trilobite fauna at Craigneil is also explained in terms of fault-induced subsidence (Ingham and Tripp, 1993, fig. 3).

Conclusions

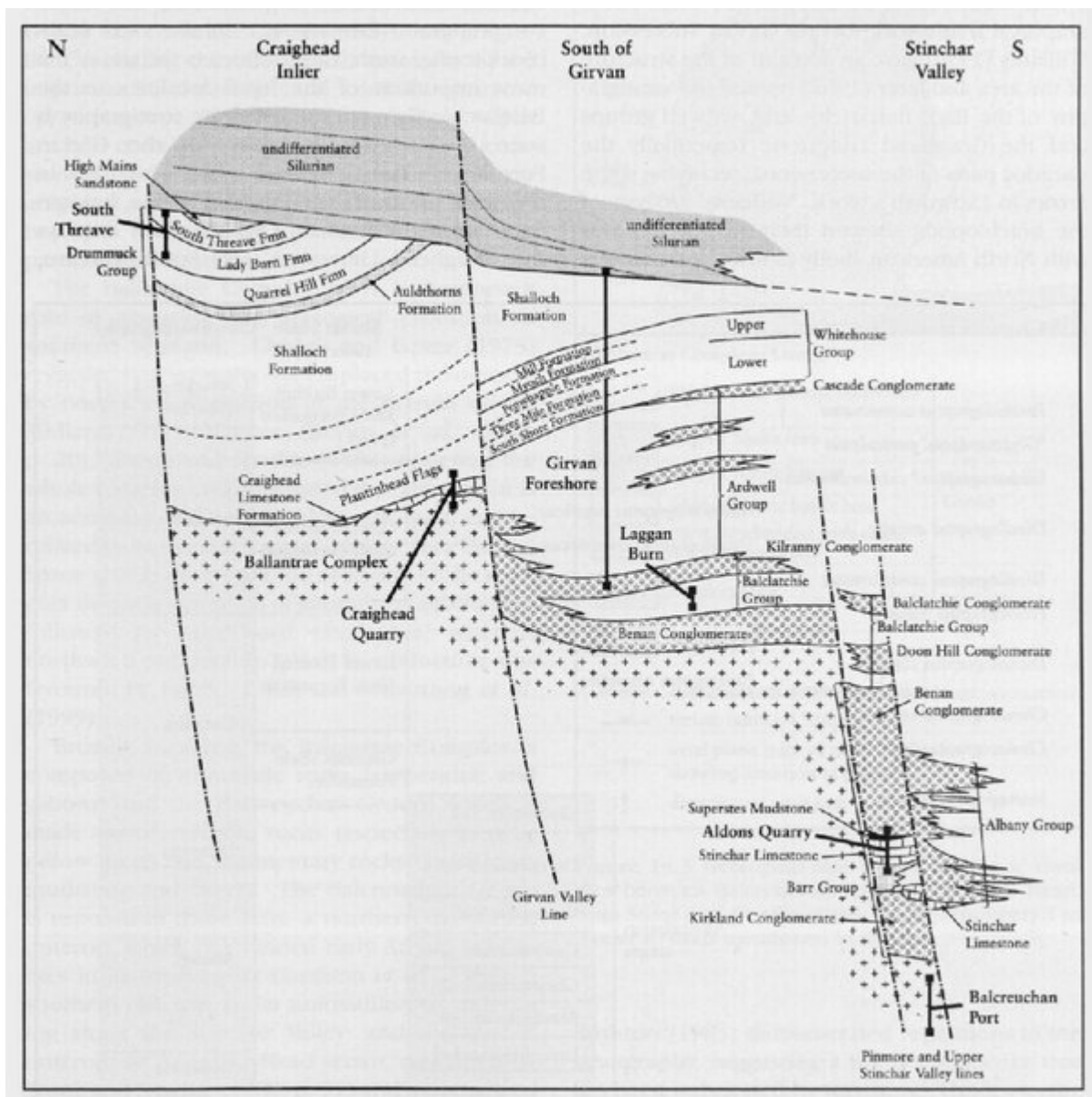
The rock succession at Aldons Quarry and the changes in water depth indicated by its fossils help to demonstrate the importance of basement faulting in the Girvan district during the Ordovician. This included the progressive northward extension of sedimentation through time over the eroded Ballantrae Complex, across a series of major NE–SW faults. Aldons is also the type locality for a large number of fossil species, all of which have very strong affinities to those of

North America, indicating the greater proximity during the Llanvirn and early Caradoc of the Midland Valley Terrane to the low-latitude Laurentian plate than to the Avalonian microplate, which included England and Wales.

References



(Figure 14.6) The south-east face of Aldons Quarry showing the Benan Conglomerate overlying the thin Superstes Mudstone (<2m thick), which in turn overlies the Stinchar Limestone. (Photo: A.W. Owen.)



(Figure 14.1) Schematic cross-section in the Girvan area to show the stratigraphical and structural relationships across the major south-facing growth faults. The GCR sites are shown in bold type. After Ingham (1992b, fig. 30.5).