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## Roddam Dene, Northumberland

[NU 018 207]–[NU 025 207]

### Introduction

The stream section at the Roddam Dene GCR site [NU 0182 2072]–[NU 0248 2073] provides the best available section of basin-margin alluvial conglomerate (the Roddam Dene Conglomerate) in Northumberland. Situated close to Wooler on the eastern side of the Cheviots, the section is critical to the understanding of the early evolution of the Northumberland Trough (Leeder, 1974a; Leeder *et al.*, 1989). Although poor biostratigraphical control prevents accurate dating, the conglomerate, which lies at the base of the Cementstone Group, is widely regarded as 'basal' to the Carboniferous succession in the Cheviot area (Lebour, 1886b; Carruthers *et al.*, 1930, 1932; Hickling, 1931; Westoll *et al.*, 1955; George, 1958; Robson, 1965; Taylor *et al.*, 1971; Johnson, 1980; Johnson *et al.*, 1995; Scrutton, 1995).

Sedimentological investigations of the Roddam Dene Conglomerate have concentrated on defining sediment origins, environment of deposition and the relationship of the deposit to the adjacent Cheviot landmass. The account that follows derives mainly from the work of Carruthers *et al.* (1930), Westoll *et al.* (1955), Johnson *et al.* (1995) and Turner and Heard (1995).

### Description

The Roddam Dene Conglomerate (Figure 3.25) is one of a number of coarse conglomerates that outcrop on the margins of the Cheviot Massif, a late Caledonian (early Devonian) igneous complex dominated by andesitic lavas arranged around an intrusive granite core.

The formation, formerly regarded as part of the Old Red Sandstone (Winch, 1817), is now generally accepted as part of the Cementstone Group and of basal Carboniferous age (Carruthers *et al.*, 1930, 1932; Westoll *et al.*, 1955; Taylor *et al.*, 1971; Robson, 1980; Johnson *et al.*, 1995) despite the absence of diagnostic fossils. Although the apparent interdigitation of the Roddam Dene Conglomerate and Cementstone Group beds, and certain lithofacies similarities between the two units, would appear to support this view (Carruthers *et al.*, 1930; Robson, 1965), Johnson *et al.* (1995) indicated that the reported similarities between the two units were entirely superficial. Furthermore, in consideration of thickness variations in the Cementstone Group, Carruthers *et al.* (1930) remarked that the Roddam Dene Conglomerate might even be slightly younger than 'basal' Carboniferous if considered in the regional context. A possible Courceyan age for the deposit has been suggested by Smith and Holliday (1991).

Although structural complexities (small faults and gentle folds) and discontinuous exposure preclude accurate measurement, the estimated thickness of the Roddam Dene Conglomerate locally is around 170 m and generally beds dip to the east at around 9° (Turner and Heard, 1995). The conglomerate occupies a deeply eroded hollow in Cheviot lavas of Lower Devonian age, but neither its unconformable contact with the underlying igneous complex nor its overlying conformable contact with the Cementstone Group is exposed in the section.

Lithologies in the Roddam Dene Conglomerate include a mix of conglomerate, sandstone, shale, mudstone and marl of various colours, but are dominated by massive reddish-coloured conglomerates (Figure 3.25) with subangular to subrounded casts ranging from pebble to boulder size (4–256 mm) set in a clay-rich sandstone matrix (Turner and Heard, 1995). The predominant conglomerate clasts are of locally derived Cheviot andesite. Rare pebbles of Silurian shale and greywacke, red sandstone and Cheviot granite, granophyre and granodiorite have also been reported (Carruthers *et al.*, 1930; Westoll *et al.*, 1955; Johnson *et al.*, 1995; Turner and Heard, 1995).

The succession includes three fault-bounded conglomeratic units unconformably overlain by a finer clastic interval. The lower conglomerate is generally poorly stratified and matrix-supported, with rare horizontal stratification, tabular cross-stratification and some imbricate pebble fabrics. Some beds appear to fine upwards. The unit gets progressively more sandy with bar-edge wedges, bar-top drapes and channel fills towards its top. Massive cobble conglomerates

occupy the middle unit while the higher conglomerate unit coarsens towards its top and is associated with both trough cross-bedded sandstones and pedogenic horizons. The overlying sandy interval consists of a fining-upward sequence of red sandstones and siltstones with plane bedding, trough cross-bedding and an assortment of asymmetric ripples and interference ripples indicative of a possible lacustrine origin. A sharp erosive contact separates this unit from the conglomerates beneath (Johnson *et al.*, 1995; Turner and Heard, 1995; B. Turner, pers. comm., 1998).

## Interpretation

The Roddam Dene Conglomerate is interpreted as the product of ephemeral stream systems that drained the deeply eroded margins of a Cheviot landmass that was exposed to semi-arid weathering conditions in Early Carboniferous times. Dramatic variations in rock fabric, grain size and sorting suggest that stream velocity; flow viscosity and sediment discharge rate fluctuated widely. While some matrix-supported conglomerates are likely to be the product of flash-flood-generated debris flows, other better-sorted intervals are likely to be the product of less-viscous stream flows.

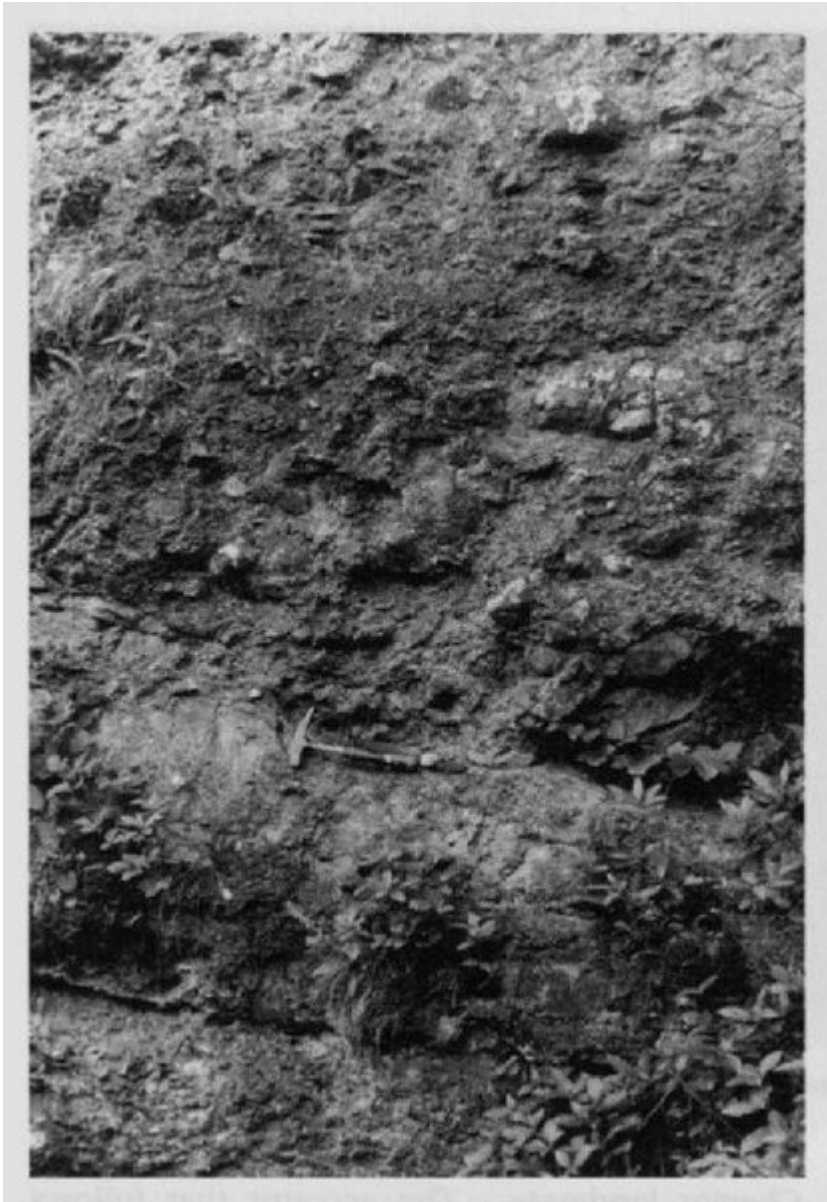
The abundance of water-worn Cheviot andesite pebbles in the conglomerate supports the view of a local source for the sediment which must have been transported by fluvial processes. Despite the very close proximity of Cheviot granite at outcrop, some 2–3 km to the west, the occurrence of rare Cheviot granite clasts in the conglomerate has been taken to indicate a northerly derivation for the material (Taylor *et al.*, 1971), and as proof that the Cheviot granite had been 'unroofed' by early Carboniferous times (Robson, 1965).

Leeder's (1974b) original view that the Roddam Dene Conglomerate represented an alluvial fan was later substantiated by others, including Turner and Heard (1995), who suggested an origin from braided streams on an alluvial fan that issued from an elevated land area to the north, edged possibly by an active basin-margin fault scarp (the Harthope Fault?) that controlled fan development. The overlying sandy lithofacies was interpreted as a product of a separate river system draining the Cheviot Block and flowing across a floodplain in an easterly or south-easterly direction after active faulting ceased (Johnson *et al.*, 1995). Supporting evidence for the suggested palaeocurrent directions is provided by imbrication fabrics in the conglomeratic lithofacies and from the orientation of ripples and trough cross-stratification in the sandy lithofacies (B. Turner, pers. comm., 1998).

## Conclusions

The Roddam Dene GCR site is the type locality for the Roddam Dene Conglomerate, the finest example of an early Carboniferous alluvial-fan deposit in north-east Northumberland. Its proximity to the Cheviot Block (Johnson, 1984), separating the Northumberland Basin from the Tweed Basin, make it a critical locality for understanding Lower Carboniferous palaeogeography and basin development in north-east England. Continued uncertainty regarding the precise age of the deposit and a lack of published material on sedimentological aspects highlights the site's potential in future research.

## [References](#)



*(Figure 3.25) Interbedded fluvial sandstones (below hammer) and flash-flood conglomerates of the Roddam Dene Conglomerate — an alluvial-fan deposit of possible Courcayan age from the Roddam Dene GCR site near Wooler, Northumberland. (Photo: B. Turner.)*