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# Clunas

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## Highlights

The stream section at Clunas illustrates the effects of differential weathering processes in a Devonian conglomerate. The survival of the weathered bedrock also highlights the relatively low intensity of glacial erosion in this area.

## Introduction

The site at Clunas [NH 907 446] is a stream exposure of weathered conglomerate at an altitude of 210 m OD on the Muckle Burn, 12.5 km south of Nairn. It is important for studies of deeply weathered bedrock, which is unusually widespread in both sedimentary and crystalline rocks to the east of Inverness and more especially in north-east Scotland (FitzPatrick, 1963; Hall, 1985, 1986; Hall *et al.*, 1989a). In particular, Clunas is a good example of deep weathering of a Devonian conglomerate, which is part of a small outlier of Middle Old Red Sandstone age (Horne, 1923). The site also gives important insights into the processes of differential weathering. The conglomerate contains large boulders of a variety of rock types and allows study of the chemical alteration of different rock types under identical environmental conditions. The only detailed study of the site is by Wilson *et al.* (1971).

## Description

The conglomerate is exposed to a depth of up to 5 m and is overlain by up to 2 m of glaciofluvial gravel of probable Devensian age. The conglomerate contains large rounded boulders up to 1 m in diameter in various stages of weathering. Boulders of banded metaquartzite, metamorphosed grit and silicified volcanic rocks remain fresh, whereas boulders of granite and quartz–biotite–granulite are more or less decomposed to a clayey gritty sand.

The clay mineralogy of the weathered boulders has been studied in detail by Wilson *et al.* (1971). Feldspars, with the exception of microcline, are altered to montmorillonite. Kaolinite, derived from muscovite, is also present in smaller amounts. The presence of carbonate minerals lining microfractures in the weathered boulders indicates that these transformations occurred under a relatively closed, alkaline weathering system.

## Interpretation

Chemically weathered rock is preserved at many sites in north-east Scotland and this reflects the relatively low degree of glacial erosion in the region. Deep weathering of Devonian sedimentary rocks is relatively rare (Hall, 1986), although several sites do occur around Elgin (Peacock *et al.*, 1968), Turriff (Hall, 1983) and between New Aberdour and Pennan (J. D. Peacock, unpublished data). At Clunas, the low degree of chemical alteration of the granite and granulite boulders is characteristic of the *grus* weathering type recognized by Hall (1985), which developed under humid temperate environments prior to the first regional glaciation, as well as during interglacial periods. The precise age of the weathering at Clunas, however, is presently unknown. The possibility that weathering of the boulders may have started soon after deposition in the Devonian has not yet been investigated, but is suggested by the presence of carbonate minerals infilling microfractures.

The site has interest for both regional pre-Pleistocene and Pleistocene geomorphology and also for its clay mineralogy. The survival of weathered bedrock demonstrates that the last, and probably the earlier, ice-sheets have failed significantly to lower the bedrock surface in the Clunas area. If the weathering is of pre-Pleistocene age, then minimal Pleistocene erosion has occurred (see Pittodrie) and the form of the pre-glacial landsurface can be reconstructed. The dominance of montmorillonite and the evidence of a relatively closed weathering system suggests that only the poorly drained base of the former weathering profile has been preserved. Elsewhere in north-east Scotland alteration of

feldspars in granitic rocks generally gives kaolinitic clays (see Hill of Longhaven and Pittodrie) (Hall, 1983; Hall *et al*, 1989a) and the abundance of montmorillonite at Clunas is therefore unusual. Its coexistence with small amounts of kaolinite, derived from alteration of muscovite, is also noteworthy as it demonstrates the importance of small-scale equilibria in clay mineral genesis (Wilson *et al*, 1971).

## **Conclusion**

Clunas forms part of a network of sites showing deeply weathered bedrock, one of the principal features of the geomorphology of north-eastern Scotland. The example at Clunas is particularly interesting as the bedrock is a conglomerate in which pebbles of different lithologies show different degrees of alteration. Not only does the site provide insights into the processes of rock weathering, it also indicates minimal erosion by ice, a characteristic of this area during the Quaternary glaciations.

## **[References](#)**