Allt Coire Chailein Fan, Argyll and Bute

[NN 320 335]

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Highlights

The Allt Coire Chailein site, within upper Glen Orchy, provides an excellent example of a compact, integrated channel system in which the effect of large-scale sediment inputs on a small upland channel can be investigated from their sources in a gullied till to the local sediment sink (alluvial fan). The site also permits an assessment of the importance of the glacial legacy as a control on the fluvial development of landscape in an area with a complex history of deglaciation.

Introduction

The Allt Coire Chailein rises within the small upper catchment of *c.* 2 km^2 draining the south-east-facing slopes of Beinn Bheac-liath (803 m) and the north-west-facing slopes of Beinn Bheag (656 m).

This site affords an example of an integrated system (see section on fluvial processes in chapter introduction) with four interrelated geomorphic units identified. There is no detailed published work on the glacial history of this area, although Sissons (1974b) provides a general account.

Description

This site comprises four distinct geomorphic units: a sediment source in a severely eroded till (unit 1); a mountain torrent which acts as a transportational reach (unit 2); a small bedrock slot gorge (unit 3); and a large alluvial fan which serves as the depositional zone (unit 4; (Figure 2.47)). In the headwaters, there are deep gullies within the outwash, resulting in localized badland-type topography. Downstream of this gullying is a bedrock-controlled reach, which grades into a small but steep-sided slot gorge within the schist. Along this section, the channel is steeper, well-confined and tree-lined. Immediately downstream of the bedrock reach, which marks the fan apex, the river undercuts a precipitous till face and this provides an additional sediment source when the river is in flood.

The lowest part of the site comprises a mountain torrent incised into a large, low-angle gravel fan and at present, only reworking a small portion of the fan's past dimensions. The alluvial fan lies inside the Loch Lomond Readvance ice limits and thus cannot pre-date the Holocene (see also Lowe and Walker, 1980). The fan is complex and formed of three separate elements, namely the present-day active channel (A), the central part which does not appear to be fluvial in origin (B), and an extensive area of coarse fluvial deposits indicating a former channel (C) (see (Figure 2.47)).

The planform of the currently active channel (trending east) is a classic sinuous channel, wandering around individual gravel bars. Clast size varies from sand-sized material up to small cobbles > 50 mm diameter. More recent adjustment and downcutting is indicated by low terraces adjacent to the channel. At the distal end of the fan, there is evidence of a network of former bars and distributary systems which have now been abandoned. A second channel alignment can be identified, with the start of the diversion at the limit of the high till terrace; the present channel having diverged and shifted extensively from this former course.

Interpretation

The severely eroded till (unit 1) formerly provided an abundant sediment source for downstream reworking in the channel. There is a pronounced aspect control in the upper part of the drainage system, since the stream network is far better developed on the northern side of the Coire where the local glacial drift is particularly well-developed. At present, very little of this sediment is being directly fed into the channel, but in the past the throughput must have been

considerable, as a large proportion of the till has already been eroded and transported downstream on to the fan. The present gullies appear to undergo periods of erosion and headwater extension followed by periods of healing (cf. Harvey, 1977 on similar gullying processes in the Howgill Fells, north-west England).

The fan clearly has a complex history of development and cannot be attributed solely to fluvial activity. The central part of the fan has an irregular surface, and tree stumps within the peat indicate that it was formerly afforested. The section exposed by incision at the distal end of the fan reveals a poorly sorted cobble/boulder unit separated by stratified sands. Palaeosols and associated organic units locally accompany these stratified sands and provide evidence of periods of stability during the formation of the fan, the chronology of which awaits radiocarbon dating. Given the proximity and nature of the sediment sources, it is likely that some of the units are debris flow deposits.

In terms of recent fluvial activity, there is evidence to suggest that at some indeterminate time, the channel followed an alternative route (trending north-east) across the fan. This may in part be related to debris flow activity. The deposition of cobble sheets across this part of the fan is extensive, with former distributary channels and bar systems clearly evident (see (Figure 2.48)). There are two possible explanations for the abandoned channel, which are not mutually exclusive. Firstly, in the past the river may have excavated and occupied a different channel across the fan. Alternatively, during a major flood or a series of past floods, the river may have temporarily switched its channel, diverting very high discharges across the fan surface.

Fan environments are typified by periodic channel switching across the fan surface (see McEwen, 1986; McEwen and Werritty, 1988). For such a small catchment with very coarse bed material, this would have required very high flow velocities, which are only likely to arise in response to intense localized summer convective storms. The likelihood of a return to this abandoned route has been lessened by the building of an artificial structure of stones (date unknown) at the upstream entrance of the old channel, making the stage required for reoccupying this former channel very high. Despite the presence of lichens (*Rhizocarpon geographicum*) with a low maximum diameter > 20 mm on clasts within channel bed material, this alignment is recorded on the First edition OS 10 560 map in 1874. The channel may since have been re-used during floods, hence further investigation to date the last occupation is required. Part of the former channel probably extends into the area which is currently afforested.

Before its confluence with the Allt Coire Chailein, the Allt Slochd channel planform is one of small-scale irregular to regular meanders with highly stable vegetated banks. After the junction with the mountain torrent, the character of the Allt Slochd changes dramatically, with a much wider, shifting, gravel-bed channel and highly erodible banks, due to the large sediment input from the Allt Coire Chailein. The longitudinal ridges and transverse dams of finger riffle bars below the confluence have been monitored by Bluck (1987) in terms of their sedimentology. The east side of the channel below the confluence is embanked to protect the railway and the former military road. The channel has incised and locally reworked its valley floor, undercutting the middle part of the fan surface, thereby exposing the sections referred to above. Since the truncation of the more northerly of the channel systems is especially abrupt and lichen cover does not suggest great age (i.e. < 500 years), the incision and reworking may be relatively recent.

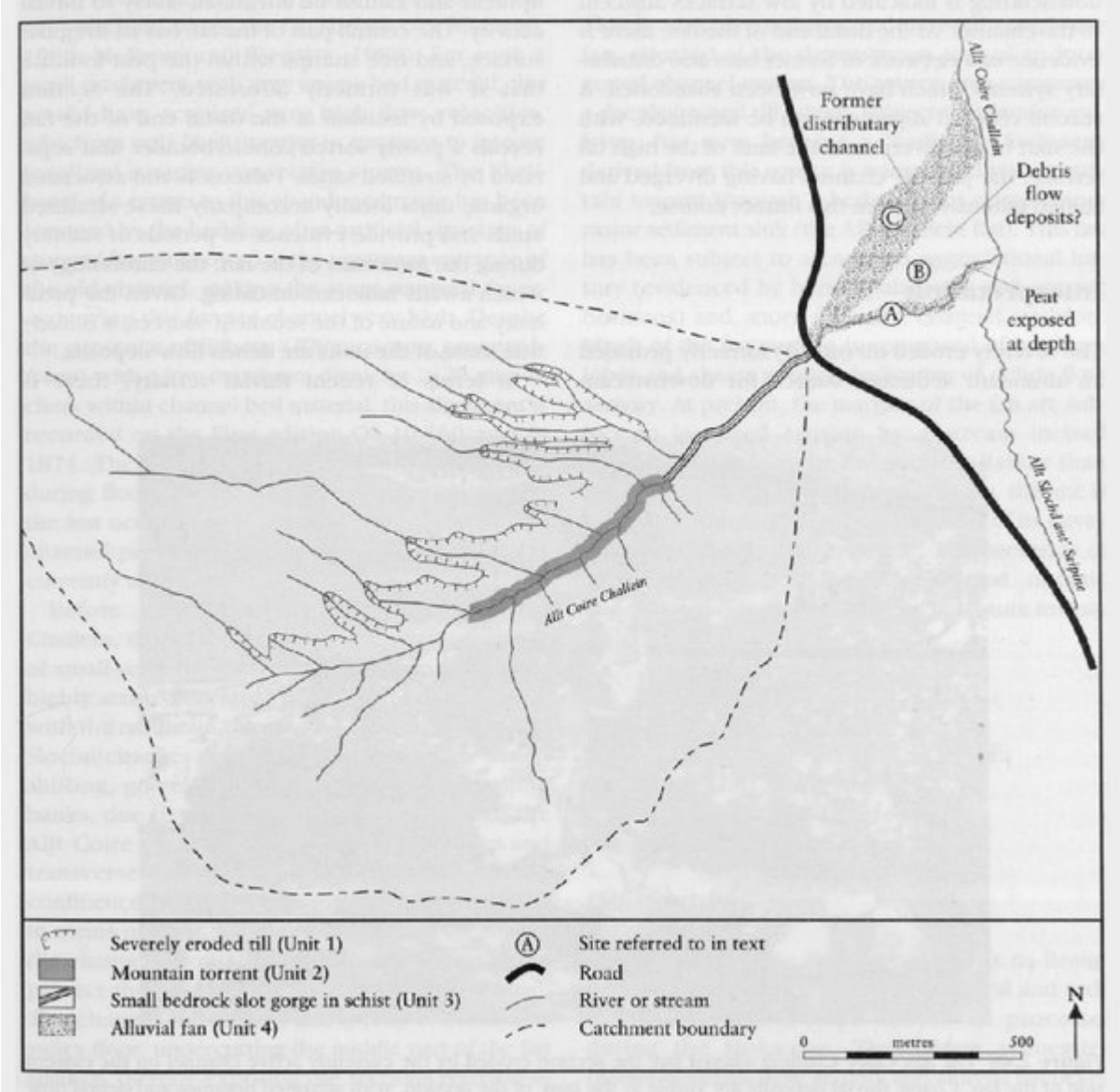
The main value of this site is the integrated nature of the fluvial system, with its range of forms from gullies in the upper source area to a complex fan, which is the sediment sink. The fan is of particular interest because of its potential for deciphering the sequence of changes through the Holocene and linking this sequence to processes in the small supply catchment.

Conclusion

This is a highly complex and unusual composite fan, situated at the downstream end of an integrated channel system. The source area comprises a deeply incised till which, subject to intensive gullying, has now become a 'badland'. Sediment derived from this source is transported via a mountain torrent through a bedrock slot gorge into a major sediment sink (the Allt Chailein fan). This fan has been subject to a complex aggradational history (evidenced by buried palaeosols and organic horizons) and, more recently, channel avulsion. Much of the fan surface is composed of bouldery lobes and sheets strongly indicative of debris flow activity. At present, the margins of the fan are subject to localized erosion by a stream incised significantly below the fan surface. Rather than being an example of a typical alluvial fan, this

site is interesting due to the complex pattern of its development through the Holocene. The presence of lichen-covered boulders and buried organic deposits provide the opportunity for future investigation of fan formation at this site.

References



(Figure 2.47) The geomorphology of Allt Coire Chailein.

(Figure 2.48) The Allt Coire Chailein alluvial fan: the section eroded by the currently active channel on the eastern side of the fan. Coarse fluvial deposits are visible at the base of the section, with stratified organics and debris flow deposits above. (Photo: A. Werritty.)