Allt a' Choire, Highland

[NH 866 375]

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Highlights

Allt a' Choire comprises an integrated drainage system in which the production, transport and deposition of sediment takes place within *c.* 1.5 km^2 (cf. Schumm, 1977). The site represents an excellent location within which to establish the relationships between Holocene environmental change and geomorphic response in the northeastern Grampian Mountains.

Introduction

There are relatively few studies of Holocene sequences of erosion and deposition in upland Scotland (Brazier *et al.,* 1988; Brazier and Ballantyne, 1989; Ballantyne, 1991b). The Allt a' Choire site, in the northeastern Grampian Mountains of Scotland, provides such a site, with its excellent record of episodic erosion and deposition throughout the Holocene. Two small catchments dissect late Pleistocene glacial sediments and supply a large Holocene alluvial fan complex. At least four fan segments can be identified and differentiated by relative age on the basis of soil development. In two feeder catchments the slopes are deeply dissected by gullies. In the larger, southern catchment (Figure 2.45) the gullies have long since stabilized, but appear to have been the major sediment source for the earlier phases of fan sedimentation. In the smaller, eastern tributary catchment, currently active gullies feed debris flows and fluviatile sediments to the most recent fan segments.

Description

The Allt a' Choire is a small south-bank tributary of the River Findhorn, draining a catchment of *c.* 1.5 km^2. The underlying bedrock is Moine schist adjacent to a younger granite intrusion (Brown, 1991). The drift cover comprises a thick Devensian till, the upper part of which has been soliflucted downslope in the last cold phase of the Pleistocene (Auton, 1990), and is locally capped by blanket peat. The two main headwaters are deeply incised into the till and locally into the bedrock. This, in turn; has resulted in intense gullying of the adjacent hillslopes. The gullies feeding the larger, southern headstream have long been stabilized and revegetated, and supply little sediment to the main stream. By contrast, the gullies supplying the smaller, eastern headwater are active, with the basal and soliflucted till being deeply dissected ((Figure 2.46)(a)).

The active gullies supply the headwater channel with sediment by surface wash and mass movement. This sediment is then transported by debris flow processes into a large cone at the confluence between the eastern and southern headwaters. This cone in turn comprises the proximal part of a large alluvial fan that extends to the confluence with the River Findhorn. Downstream of this cone, the transport processes switch from domination by debris flow processes to fluvial processes. This occurs because of the dilution effect generated by the relatively sediment-free water entering from the southern stabilized gully system. The alluvial fan is composed of multiple surfaces ((Figure 2.46)(b)) with individual segments related to successive development stages. The oldest of these segments is set into the Late Pleistocene solifluction surfaces, and thus appears to post-date the end of solifluction activity. Earlier depositional phases are probably related to sediment sources in the now stabilized gully systems forming the southern headwaters, whereas the younger phases relate to the currently active sources in the gullied eastern section.

The different surfaces of the fan complex display differing degrees of soil development. Similarly, the various phases of incision and gullying in the southern headwater can be differentiated in terms of soil development. Of particular interest is the local peaty podzol capping the soliflucted till in the eastern headwater (Figure 2.46)(a) and currently exposed by

gullying. This soil is buried by a variable thickness of aeolian sands, the source for which is the now revegetated gullies of the southern headwater, upwind of the podzol site. It seem likely that the aeolian deposition was contemporaneous with exposure of the till by active gully erosion in the southern headwater stream.

Interpretation

Many studies in other parts of the British uplands have demonstrated two distinct phases of geomorphic activity: an active glacial/periglacial landscape in the Late Pleistocene which was succeeded by a developing woodland vegetation cover as the hillslopes finally stabilized in the Early Holocene (Harvey, 1985a). During the later Holocene there was a partial destablization of the hillslopes as the woodlands were replaced by open heath and moorland vegetation in response to climatic fluctuations and human activity. This site provides an excellent opportunity to examine this sequence of events within the Scottish Highlands.

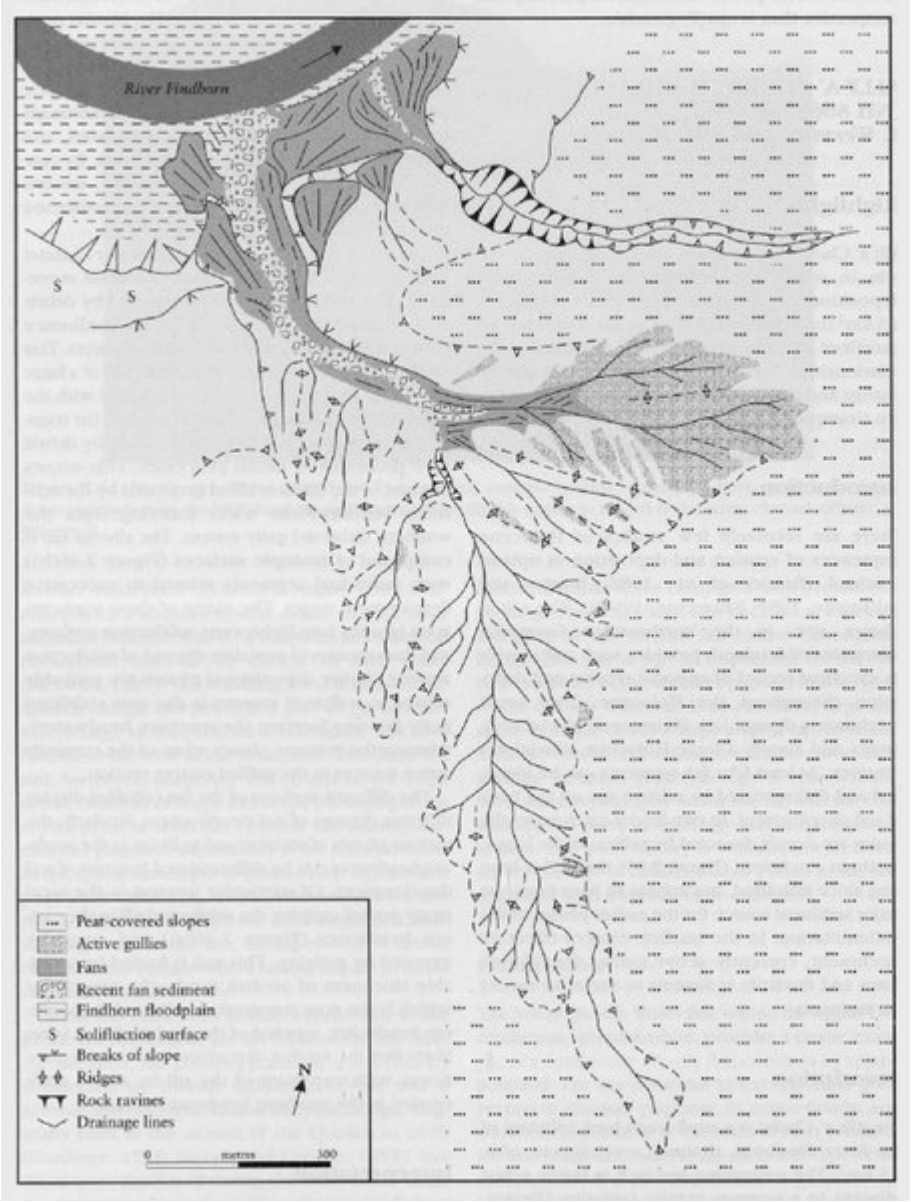
The relative influence of human- and climatically induced geomorphic change is a continuing source of debate (Harvey *et al., 1981;* Brazier *et* al., 1988; Ballantyne, 1991a). Both may have influenced sediment generation and river flood regimes, and both may have had differential local and regional effects. It is possible that in the Scottish Highlands, where the human settlement sequence differs from that further south, the presence of high-energy environments may have increased the susceptibility of the geomorphic system to climatically induced destabilization. The presence of the aeolian sands capping the palaeosol points clearly to a period of destabilization; and the existence of large amounts of charcoal in the organic rich sands above the palaeosol are suggestive of human activity as the agent of destablization. There is, however, also good evidence of the role of extreme storms as destabilizing agents on the surrounding slopes, as reported in Lauder's (1830) eyewitness account of the catastrophic Moray flood in 1829. Further investigation and radiometric dating are needed to resolve the relative roles of climatic and human agency in terms of landscape development at this site.

The great attraction of this site for such an investigation is the proximity (within a few km) of the sediment source (gullied hillslopes) and the downstream sediment sink (alluvial fan). Because of this close linkage between source and sink, any change in the release of sediment from the former should, in theory, be registered in the development of the latter. Thus it should be possible to relate the chronological development of the multiple surfaces comprising the fan to the exposure of the reworked till units in the upstream sources. The rapid transition from debris flow dominated to fluvially dominated transport processes within the transport reach is also noteworthy. Such a transition has already been recorded in similar sites in the Howgill Fells (north-west England), destabilized by a major storm in 1982 (Wells and Harvey, 1987).

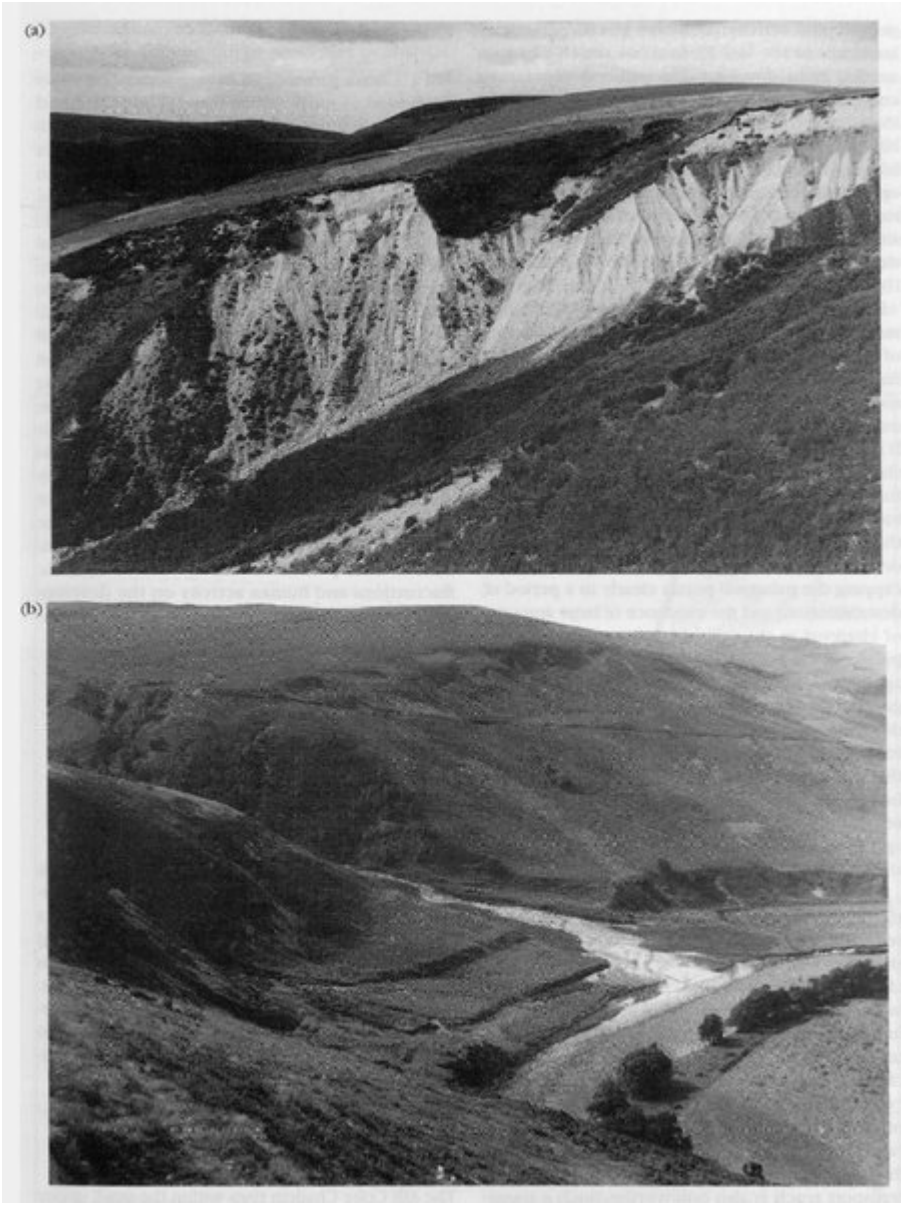
Conclusion

Allt a' Choire provides an excellent example of an integrated channel system (see section on fluvial processes in chapter introduction), in that the sediment sources (deeply gullied tills) are linked by a short transportation reach to the sediment sink (an alluvial fan). This site has developed since the deglaciation of the middle Findhorn (*c.* 14 000–13 000 BP), the main part of the alluvial fan having been formed before 10 000 BP. During the Holocene, the hillslopes immediately upstream were subject to periodic destabilization by climatic fluctuations and/or human activity resulting in episodic gullying of the underlying tills. The impact of this episodic erosion is also registered in the complex sequence of alluvial units which comprise the alluvial fan. The rapid transition from debris flow dominated processes in the source area to fluvial transport on the alluvial fan is especially noteworthy. Further investigation of this site should yield important insight into the linkage between the sediment sources and their downstream sink, plus the relative roles of climatic fluctuations and human activity on the development of this site during the latter part of the Holocene.

References



(Figure 2.45) A geomorphological map of Allt a' Choire.



(Figure 2.46) Allt a' Choire. (a) Actively gullied and deeply dissected till in the eastern headwater. (b) An alluvial fan with three distinct surfaces to the left of the currently active channel which flows into the River Findhorn. (Photos: A. Werritty.)