



Sediment transfer in upland streams: source areas, step lengths and transit times in historic floods

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Headwater tributaries draining north and west from the Northern Pennines into the South Tyne valley, north east England, are characterised by small, steep moorland catchments with flashy flow regimes. A number of these have experienced high rates of channel and floodplain activity in the late Holocene, with major transformation of valley floors in the late Roman period, eleventh century and late eighteenth century. Present day valley floors contain prominent coarse cobble-boulder flood deposits which have provided a detailed palaeoflood record, covering the past 300 years or so. Lichenometric dating provides the age control, and shows distinct clustering of flood events in the late eighteenth century, late nineteenth century and mid twentieth century. The flood record has been interpreted in the context of climatic and catchment land-use changes, and shown to closely correspond with major hydroclimatic fluctuations since the late eighteenth century. This paper looks in more detail at the size and spatial distribution of boulder flood deposits in an attempt to disentangle more clearly source area-deposit relationships and their evolution over time. A number of SouthTyne tributaries have experienced episodic channel bed incision in the late Holocene, with particularly high rates recorded in the late eighteenth century, while others have had relatively stable channel beds over this time period. A key issue, therefore, is the impact of contrasting channel bed vertical tendency on sediment supply and downstream transfer. Three main types of sediment source are identified: (1) colluvial material (including soliflucted till) supplied from active slumps and landslips where river channels directly undercut hillslopes; (2) alluvial material entrained from eroding channel banks; and (3) blocks of bedrock resulting from channel bed incision. More recently these have been augmented by material derived from higher

on hillsides, associated with rapid erosion of moorland grips emplaced in the latter half of the twentieth century. In combination, these sources supply a wide variety of sediment to stream channels, ranging from fine sand to boulder size, and directly control the location and type of flood deposit. Results show an overall decrease in flood deposit largest boulder size since the late eighteenth century in all basins. In detail, however, there are important differences in the downstream pattern of flood deposit characteristics between basins, reflecting the dynamics of changing source areas and types in incised and stable reaches.