Late Quaternary weathering, sediment production, erosion, and alluvial fan deposition in hyperarid Nahal Yael, Israel

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A conceptual model for geomorphic response to Pleistocene-Holocene climate change (Bull and Schick, 1979) was applied to the hyperarid (<30 mm yr^{-1}) Nahal Yael. It included an event chain following this change: reduced vegetation cover, increased sediment yield from slopes, aggrading terraces and forming an alluvial fan. The model is revaluated here with data acquired in Nahal Yael over the 30 years since the original model was proposed. Recent studies indicate hyperarid late Pleistocene climate; the transition from semiarid late Pleistocene to hyperarid Holocene did not occur. The revised chronology reveals a 35-20 ka episode (probably already beginning at ~50 ka with lower rates) of accelerated weathering and sediment production and distinct talus accretion on slopes. Coeval with accretion on slopes, sediments were also transported and aggraded in terraces and alluvial fans, without noticeable lag time or a chain of discernable events. This intensified sediment production and delivery phase is unrelated to the Pleistocene-Holocene transition. The depositional landforms were rapidly incised (20-18 ka); since this ~LGM incision, sediment yield is from storage in these depositional landforms and is not produced from bedrock in significant quantities. We propose that in hyperarid environment, the main operators are individual extreme storms; here specifically, an episode of frequent storms/floods is the driver of change regardless the mean climatic conditions. It created a pulse of intense weathering due to numerous cycles of wetting and drying on slopes and sediment transport to fluvial terraces and alluvial fans; its impact continues all the way to the present. We suggest that even if aspects of the original conceptual model of Bull and Schick (1979) are correct, it has been applied too frequently, too generally, across very diverse arid climates and settings, and for too long in lieu of collecting new data at a full basin scale and testing the model

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Extending flood records in Irish and Welsh river catchments using high-resolution geochemical analysis of floodplain sediment sequences

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Extended records of riverine flooding are required to constrain the magnitude-frequency relations of high-magnitude flood events in order to produce accurate assessments of present and future flood hazard. Analysis of vertically-accreted floodplain sediment sequences provides a means of obtaining records of major flood events through the late Holocene. We report on an investigation using high-resolution geochemical analysis to identify the deposits of major flood events within floodplain sediment sequences from catchments in Ireland and the UK. Itrax XRF core scanning is used to obtain profiles of variation in the abundance of a range of chemical elements in cores from palaeochannels and stable mid-channel islands. The effects of variation in XRF scan settings and count times on the precision of the resulting element profiles are tested. Lithogenic element ratios are employed as proxies for sediment grain size which acts as an indicator of varying flood magnitude. The suitability of the lithogenic element ratios for application as grain size proxies at each site, and the accuracy and precision of the reconstructed variability in sediment grain size are assessed through the comparison of the geochemical results with independent grain size data from laser granulometry and SEM image analysis. Instrumental and historical flood data from the study catchments provide a means of assessing the accuracy of the records of flooding derived from floodplain geochemistry. The project reports on spatial and temporal variations in flood magnitudes and frequencies during the late Holocene and historical periods.