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Floodplain degradation and settlement history in Wadi al-Wala and Wadi ash-Shallalah, Jordan

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ABSTRACT

This study investigates a Mid-Holocene cycle of stream aggradation and incision in Wadi al-Wala and Wadi ash-Shallalah, western Jordan. Aggradation took place sometime between 7 ka and 6 ka, followed by stability as evidenced by a floodplain soil that was mantled by colluvial deposits between 4.6 and 4 ka. Stream incision around or after 4 ka eroded the floodplains. A second cycle of aggradation and incision occurred in the late Holocene, but this cycle is not synchronous between the two streams. Causes of the stream incision around 4 ka are hypothesized in the context of local geomorphological and hydrological characteristics, regional climatic change, Dead Sea level changes, and cultural landscape changes interpreted from archaeological and pollen records. In the context of available local and regional evidence, this study discusses the relation between Early Bronze Age settlement and stream degradation.

1. Introduction

Late Quaternary cycles of stream aggradation and incision have been reported in several valleys of the Levant. Unfortunately, a region-wide chronology of fluvial events cannot be established yet because of the small number of streams studied and to scarcity of data, particularly numerical ages. Nonetheless, observations on stratigraphic sequences already pointed to fluvial event synchronicity in some streams of southern Israel, the Negev, and the northern Sinai (Goldberg, 1994) and along streams draining the eastern side of the Jordan Valley (Mabry, 1992). The paucity of radiocarbon dating, due in part to the scarcity of organics, and the use of other dating methods in the region, have retarded a comprehensive chronology.

Interest in establishing a regional chronology of fluvial aggradation–incision cycles in Jordan began with the work of Claudio Vita-Finzi (1964, 1966), who identified two alluvial fills he correlated with the "Older" and "Younger" fills that he had previously identified elsewhere in the Mediterranean region. Based on associated archaeology the Older Fill occurred sometime in the Late Pleistocene, while the Younger Fill occurred in the Late Holocene, probably during Roman–Byzantine times. In the ensuing decades, extensive research in many localities around the Mediterranean Basin proved that the chronology of alluvial fills was more complex than Vita-Finzi's two-fill model (Grove, 1997; Beach and Luzzadder-Beech; Casana, this volume).

In Jordan, Vita-Finzi's model eventually evolved into a four-fill system, which as the original two-fill system (Copeland and Vita-Finzi, 1978), lacked the support of numerical dating. The alluvial localities studied by Vita-Finzi in Jordan were studied in more detail by Schuldenrein and Clark (1994, 2001) in the Wadi al-Hasa and by Mabry, (1992) in the Jordan Valley.

Schuldenrein and Clark (1992, 2001) identified more than two fills, pointing to the drying of Pleistocene Lake Hasa and tectonic dislocations as events that complicated the development of cut-fill cycles along the Wadi al-Hasa.

In the wadis draining the east side of the Jordan Valley, Mabry, (1992) identified fifteen Late Quaternary alluvial fills, eight of which are Holocene. He attempted a correlation of these fills with alluvial deposits reported elsewhere in the Levant. Despite the scarcity of numerical dates, Mabry, (1992) correlated the Holocene cut-fill cycles with regional cultural developments. One of the main aspects of this correlation focuses on the Middle Holocene, a period encompassing the Chalcolithic and Early Bronze periods, which is also the subject of other studies in southern Israel (Rosen, 1986, 1995, 1997a) and the Dead Sea area of Jordan (Donahue 1981, 1984, 1985; Donahue et al. 1997). In addition to other alluvial chronology studies, these studies pointed to a dramatic change in fluvial geomorphology of wadis in the Levant during the Chalcolithic and Early Bronze Age (Fig. 1; Table 1).

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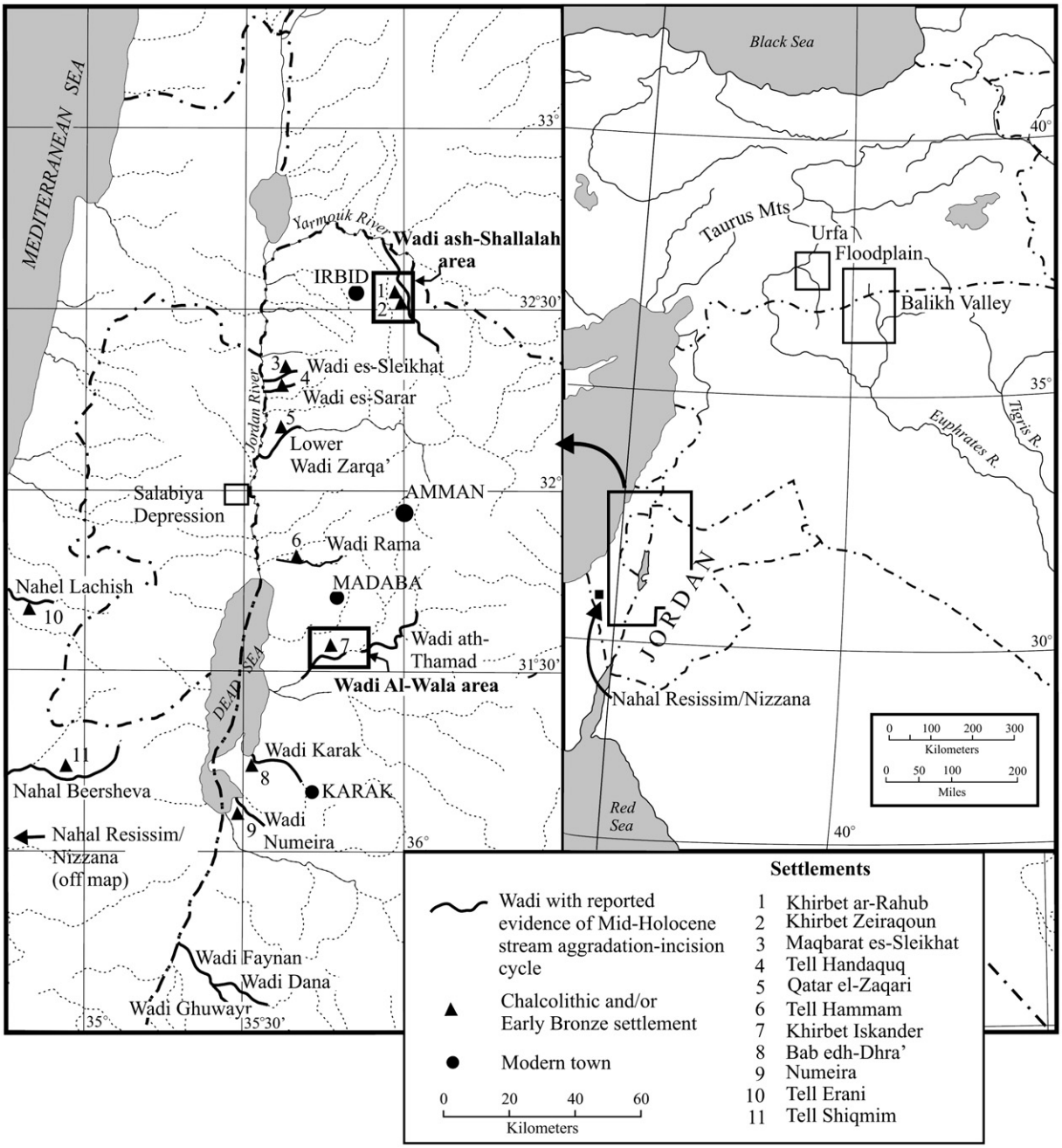

Fig. 1. Study areas and reported Mid-Holocene stream incision in the Levant and other localities mentioned in the text. Circles indicate locations of paleoenvironmental data mentioned in the text. See Table 1 for sources of alluvial records.

In Wadi Beersheva and Wadi Lachish (Israel), Rosen (1995, 1997a) observed that alluvial fills containing Chalcolithic and Early Bronze Age material were incised sometime at the end of the Early Bronze. The main causes of stream incision hypothesized by Rosen suggest that water table drop in the floodplain is associated with a series of environmental changes involving extreme climatic cycles. Similar events elsewhere, however, have not always been associated with climate or other environmental changes. In the wadis near the sites of Baba dh-Dhra' and Numeira, Donahue (1981, 1984, 1985) attributed stream incision in the Middle Holocene to tectonic changes prompted by earthquakes at the end of the Early Bronze age. Years later, Donahue et al. (1997), however, associated incision with lowering of base level prompted by the decline in Dead Sea levels, previously reported by Frumkin et al. (1994).

Without denying the effects of climate change, Mabry, (1992) reaches the conclusion that the rapid sprawl of settlements and agricultural intensification during the Early Bronze Age prompted incision that eventually eroded floodplains of the valleys along the streams draining the east side of the Jordan Valley. Furthermore, Mabry, (1992) implies that most of the declined settlements were associated with the floodplains degraded by this event. Such a hypothesis builds upon an observation made by Albright (1925) regarding the geographical proximity between Chalcolithic–Early Bronze settlements and stream valleys, which was interpreted as high dependence on floodplain irrigation. The rationale of Mabry's study implies that stream incision degraded the floodplains that provided these towns with fertile soils and flood irrigation.

Although these studies lack numeric dates, the sediments of the degraded floodplains contain Chalcolithic and Early Bronze Age archaeological remains, which suggests that the floodplain degradation occurred sometime around 4 ka (Table 1).

The study presented here examines the Holocene geomorphological history of Wadi al-Wala and Wadi ash-Shallalah, both of which