

Desert agricultural terrace systems at EBA Jawa (Jordan) – Layout, water availability and efficiency

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Located in the arid basalt desert of northeastern Jordan, the Early Bronze Age (EBA) settlement of Jawa is by far the largest and best preserved archaeological EBA site in the region. Recent surveys in the close vicinity revealed well-preserved remains of three abandoned agricultural terrace systems. In the presented study these archaeological features are documented by detailed mapping and the analysis of the sediment records in a multi-proxy approach. To study the chronology of the terrace systems optically stimulated luminescence (OSL) is used. In order to evaluate the efficiency of the water management techniques and its impact on harvest yields, a crop simulation model (CropSyst) under today's climatic conditions is applied, simulating crop yields with and without (runoff) irrigation. In order to do so, a runoff time series for each agricultural terrace system and its catchment is generated, applying the SCS runoff curve number method (CN) based on rainfall and soil data. Covering a total area of 38 ha, irrigated terrace agriculture was practiced on slopes, small plateaus, and valleys in the close vicinity of Jawa. Floodwater from nearby wadis or runoff from adjacent slopes was collected and diverted via surface canals. The terraced fields were arranged in cascades, allowing effective water exploitation through a system of risers, canals and spillways. The examined terrace profiles show similar stratigraphic sequences of mixed unstratified fine sediments that are composed of small-scale relocated sediments with local origin. The accumulation of these fines is associated with the construction of agricultural terraces, forcing infiltration and storage of the water within the terraces. Two OSL ages of terrace fills indicate that the construction of these terrace systems started as early as 5300 ± 300 a, which fits well to the beginning of the occupation phase of Jawa at around 3.500 calBC, thus making them to the oldest examples of its kind in the Middle East known to date. The results for simulating yields of different crops and under different irrigation scenarios showed that simulated mean grain yields were greater under supplemental irrigation. Thereby, yields usually increase considerably with increasing catchment size and thus (runoff) irrigation. Moreover, there is a significant decrease of crop failures under irrigation. Overall, these agricultural terrace systems seem to have been very efficient and their construction required a good understanding of the local climate, hydrology, geomorphology & pedology.