



RESEARCH NOTES: Quantifying the Past

The transition from Paleolithic hunter-gatherers to sedentary Neolithic farmers was a major turning point in human history. The Neolithic Age (10,000-6,000 BCE) saw the development of agriculture, architecture, permanent villages

and increasingly sophisticated social structures and tools. Two complementary techniques are widely used to date the stages of this process: *stratigraphy*, in which layers of excavated earth are sequenced using their varying physical and chemical characteristics; and *cultural sequencing*, based on the analysis of artifacts, such as the shape or decoration of pottery fragments.

Prof. Avi Gopher and his colleagues have applied quantitative methods to both types of data to cast new light on the cultural and social evolution of Nahal Zehora I and II (NZ-I, II), two Neolithic villages just west of Megiddo. For example, pottery handles, being extra thick and compact, are often well preserved. The investigators collected 800 handles from NZ-II and 300 from NZ-I. The NZ-II strata ranged from the Late Yarmukian Culture (Stratum IV) to the more recent Neolithic Wadi-Raba Culture (Stratum II). Clear trends were found over time. For example, the percentage of splayed loop handles trebles from Stratum IV to Stratum II, while the percentage of unsplayed handles decreases. The percentage of loop handles with circular and convex/flat cross-sections decreases, while the percentage of horizontal-elliptical cross-sections increases. In all cases, NZ-I resembles or further continues the trends of NZ-II/Stratum-II.

Further insight comes from plotting the relative locations of grain seed concentrations, active grinding tools and passive grinding slabs on detailed maps of the NZ-II site. In Yarmukian times, grinding tools and slabs are found surrounding, but not within, extended central areas of high grain concentrations. All are located outdoors in the open, not near architectural structures. In contrast, in Wadi-Raba times, relatively localized concentrations of tools (including mortars, pestles, three grinders and three grinding slabs found close to each other) are found between, but outside of, the architectural structures. Three small grain concentrations were found surrounding the tool-rich area. There are hints of a "production line" approach to grain processing, with grinding all along the line, but with a final pounding confined to the western end.

One could speculate that the Yarmukians processed grain in large, perhaps communal groups in dedicated grain processing areas. Wadi-Raba grain-processors worked near dwellings (presumably their own) in much smaller, localized groups. This could reflect a shift from a more leisurely, village square-oriented lifestyle to a more pressured, private and urban one. The increased incidence of spindle whorls and other economic artifacts also suggests a more labor-intensive economy and social system. Such a system may also have encouraged increased reproduction, further increasing fragmentation into busy family units.

Quantitative changes in the distribution of pottery handle shapes, types and cross-sections can help track cultural changes at archaeological sites.

