



# Lapidary technology revealed by functional analysis of carnelian beads from the early Neolithic site of Nahal Hemar Cave, southern Levant



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## ABSTRACT

Use-wear analysis applied to two carnelian beads from Nahal Hemar Cave, southern Israel, and dated to the Middle Pre-Pottery Neolithic B period, revealed a manufacturing procedure that corresponds to genuine lapidary technologies of contemporary traditional societies. Based on ethnographic observations combined with experiments in working carnelian, wear patterns were interpreted to be produced by a multi-stage manufacturing sequence that includes abrasion against varying abrasion surfaces, drilling probably with a splinter drill equipped into a rod and finally, tumbling. These beads are one of the earliest examples of carnelian beads and thus represent a lapidary technology with roots from over 9000 years ago.

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## 1. Introduction

Stone beads in the Levant began appearing at the end of the Epipaleolithic period, in Late Natufian sites, about 12,000 (cal) BP. Although still outnumbered by beads of biological origin (shell and bone) that prevailed during earlier periods, the appearance of stone beads in the Neolithic period is related to a new mode of existence with the emergence of agricultural societies and the development of major technological innovations (Bar-Yosef Mayer and Porat, 2008; Bar-Yosef Mayer, 2013; Hauptman, 2004; Wright and Garrard, 2003; Wright et al., 2008). In the Neolithic period stone beads became unique goods, and the skills and sophistication of making them are manifested in their distinctive shapes and materials.

Stone beads research provides information on various aspects of human developments during the Neolithic period of the Levant. Some examples include the reconstruction of exchange networks by the application of provenance analyses (e.g., Balzi, 1994; Hauptman, 2004; Sozzi et al., 1991), investigation of cognitive and symbolic aspects (Andrews, 1994; Bar-Yosef Mayer and Porat, 2008;

Wright, 2007; Wright and Garrard, 2003), reconstruction of manufacturing techniques (Altinbilek et al., 2001; Berna, 1995; Calley and Grace, 1988; Chevalier et al. 1982; Coşkun, 2008; Fabiano et al., 2001; Gorelick and Gwinnett, 1990; Gurova et al., 2013; Roux, 2000; Unger-Hamilton et al., 1989; van Gijn, 2006; Vianello, 1986; Wright et al., 2008; Yang et al., 2009), and as chronological markers (Bar-Yosef Mayer, 2013).

Technological research of stone beads is based on historic records, ethnographic observations, experimental approach, and microscopic observations. Here we apply the functional approach of use-wear analysis to stone beads as a method to reconstruct the entire manufacture procedures of two carnelian beads found at the site of Nahal Hemar Cave (NHC), southern Israel. This method is typically used in the research of lithic tools to reconstruct actions and worked materials. Its application to the study of carnelian beads is used to reconstruct manufacturing techniques and chaîne opératoire for some of the earliest carnelian beads discovered thus far dated to the Middle Pre-Pottery Neolithic B (MPPNB) of the Levant.

### 1.1. The site and the beads

NHC is located on the right bank of Nahal Hemar, about 210 masl, about 11 km south of the town of Arad on the southern

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limit of the Judean Desert (Fig. 1). The cave is a small chamber with a narrow entrance dated to the MPPNB (9900–9500 cal BP), based on calibrated dates from NHC (O. Bar-Yosef, pers. comm.). The cave was reconstructed as a site that was occasionally used as a storage or cache facility, particularly for revered objects of ritual significance, which contained various organic remains as well as modeled skulls, stone masks, remains of an anthropoid statue, bone figurines, and a complete sickle (Bar-Yosef and Alon, 1988).

The NHC stone bead collection comprises 32 beads of various shapes made of several minerals. In addition there were beads made of shell, wood and plaster, all of which were briefly discussed in the preliminary report (Bar-Yosef and Alon, 1988: 19–20). A recent study determined the minerals and they were included in a broad typological study of Neolithic stone beads (Bar-Yosef Mayer,

2013). We studied the only two carnelian beads from this assemblage due to their exceptional shape and material (Fig. 2). Considering that they represent one of few examples of the earliest carnelian beads, we focused on the evaluation of the antiquity of carnelian bead manufacturing technique and by the application of use-wear analysis we aimed at reconstructing the manufacturing process.

### 1.2. The application of use-wear analysis to stone beads research

The use of microscopy for studying beads goes back to the days of Horace Beck in the 1920's (Westlake, 1976). Decades later, Goriclick and Gwinnett, who were inspired by functional analysis conducted by Semenov (1965), applied extensive high resolution

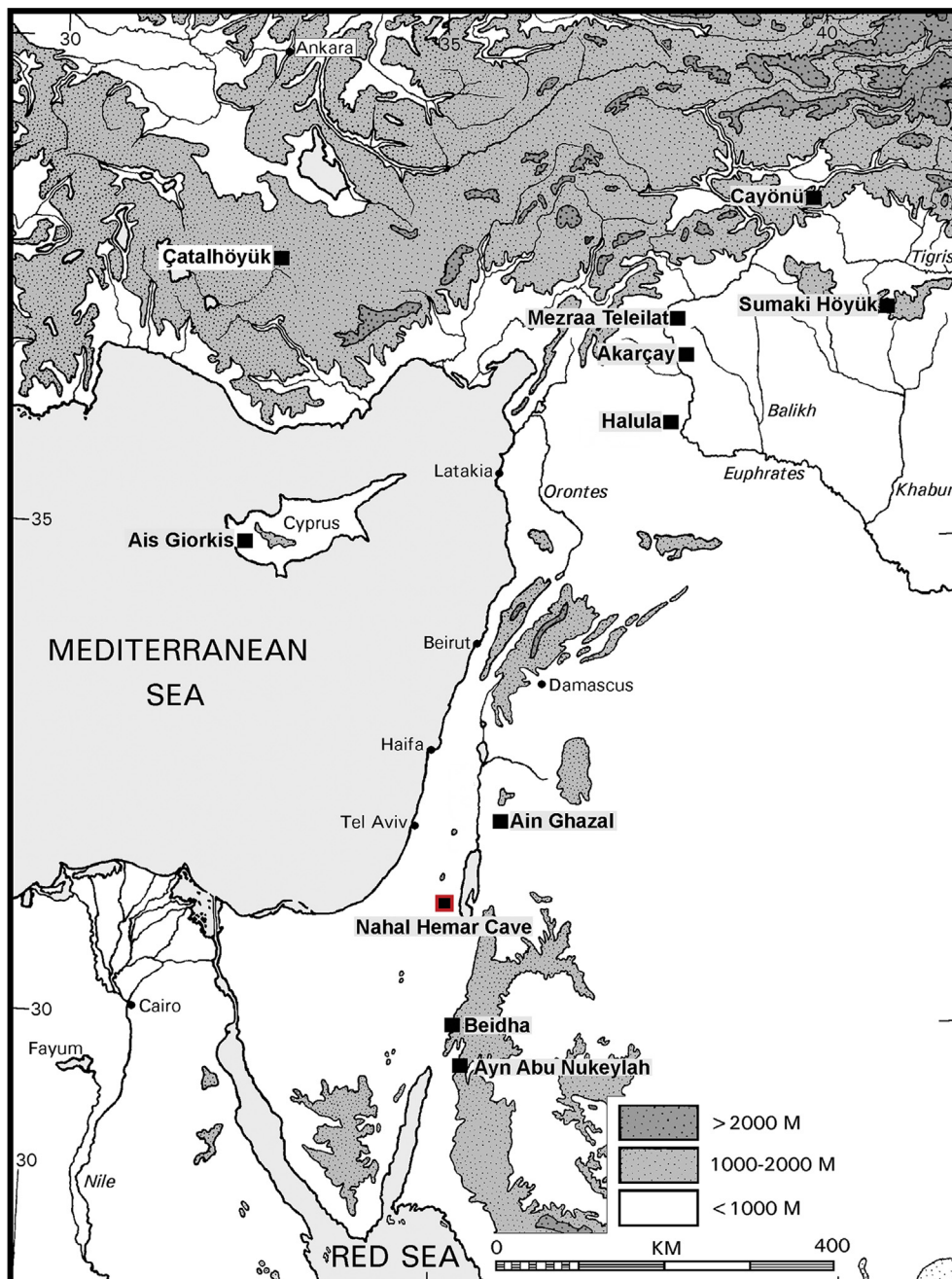


Fig. 1. Map showing the location of the Nahal Hemar Cave and PPNB sites mentioned in the text.

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