Quaternary International 464 (2018) 18–31

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Geo-chronological context of the open-air Acheulian site at Nahal Hesi, northwestern Negev, Israel

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ARTICLE INFO

Article history:
Received 7 February 2017
Received in revised form
29 July 2017
Accepted 8 August 2017
Available online 23 August 2017

ABSTRACT

The open-air site of Nahal Hesi, located on northwestern Negev desert fringe of Israel, is one of the few primary-context late Acheulian localities in the Levant. Late Acheulian sites in the Levant rarely provide faunal assemblages and radiometric ages, leaving large gaps in our knowledge of the Lower Paleolithic palaeoenvironment, ecology, subsistence and chronology. Here we present a new geo-chronological study conducted at the Nahal Hesi site. The major objectives were to describe the geological and archaeological stratigraphy, assign a numerical age to the Acheulian artifact-bearing deposit by TT-OSL and pIR-IR_{290} dating, and reconstruct the local palaeoenvironment during the human occupation at the site.

Geological and microfaunal observations suggest that late Acheulian hominins at Nahal Hesi exploited marshy environments. The limited spatial and vertical extent of the artifact-bearing deposit and the presence of artifacts only in context of marsh-like sediments, highlight the utilization of short-lived water bodies by the hominins. The combined TT-OSL and pIR-IR_{290} methods provide an average age of 430 ± 35 ka for the studied marsh-like deposits.

The study indicates that the Middle Pleistocene in the area of the Nahal Hesi site is characterized by lengthy cycles of deposition and erosion of fine-grained sediments associated with the semi-arid Nahal Shiqma drainage system. Marshy sediments could be the result of full or partial blockage of the Shiqma system, probably by coastal dune ridges, that led to formation of standing water bodies during the Middle Pleistocene.

1. Introduction

The site of Nahal Hesi is located along the desert fringe between the northwestern Negev desert and the southern coastal plain of Israel, on the eastern bank of Nahal Shiqma (Wadi el-Hesi), five meters above the Shiqma riverbed (Fig. 1). The site is situated 500 m east of the archaeological site of Tell el-Hesi (Dahlberg and O'Connell, 1989). It is an open-air Acheulian locality that was excavated by David Gilead in 1971 and 1973. The lithic and faunal assemblages were studied only recently (Yeshurun et al., 2011; Zaidner, 2014). Because most of the documentation was lost, we lack direct data on the depositional context and mode of collection of lithics and faunal remains. Yet, lithic pieces were probably collected quite meticulously during excavation as suggested by the presence of microdebris. The analysis of the lithic assemblage indicates *in situ* knapping activities and complex pattern of exploitation of raw materials. Use of limestone is one of the major features of the lithic industry of Nahal Hesi and it is rare phenomenon in the Levant, occurring only at the Early Pleistocene and

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http://dx.doi.org/10.1016/j.quaint.2017.08.023
1040-6182/

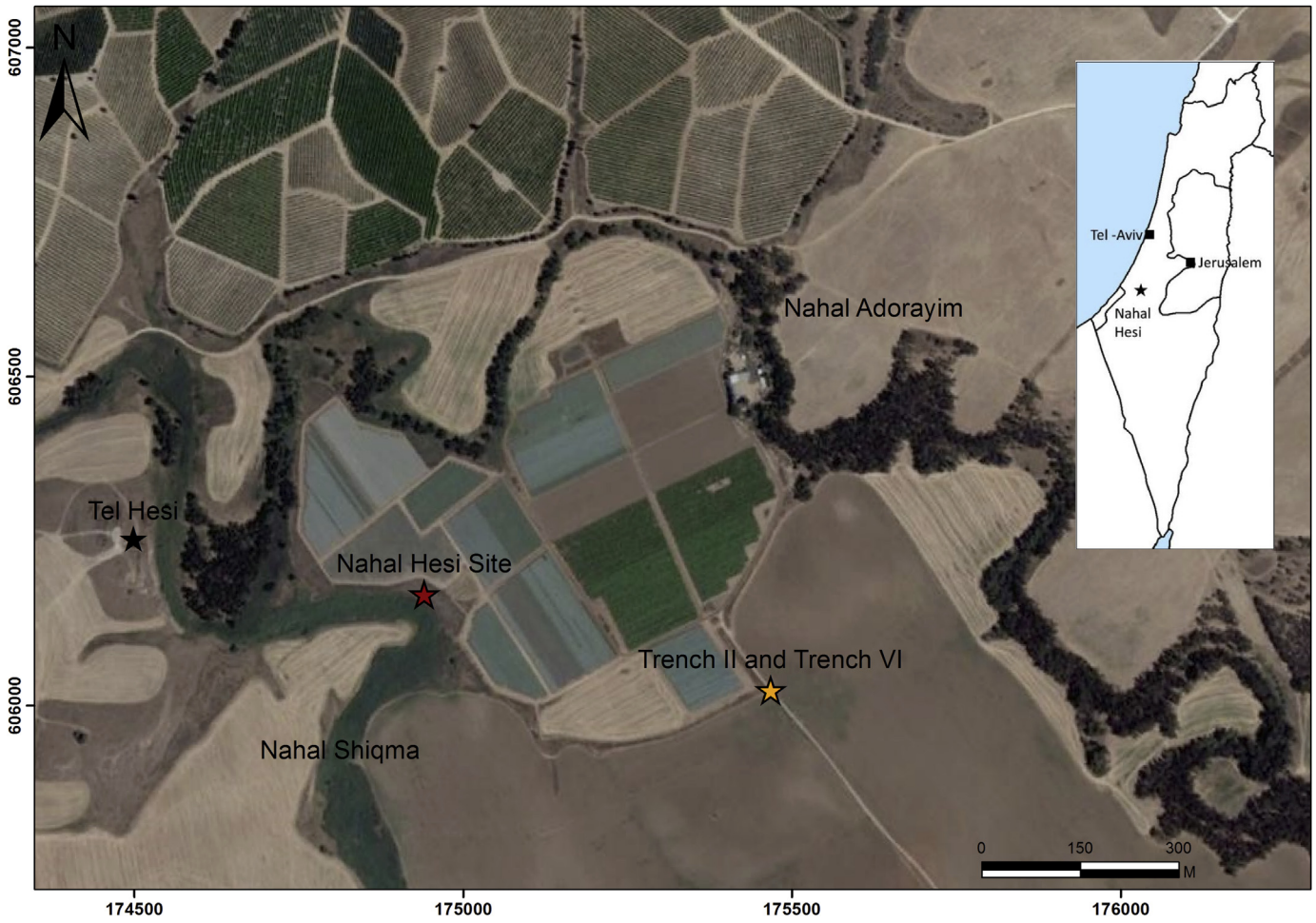

Fig. 1. Location map. Star marks the location of the site in Fig. 2.

the beginning of the Middle Pleistocene sites of 'Ubeidiya (Bar-Yosef and Goren-Inbar, 1993), Gesher Benot Ya'aqov (Goren-Inbar et al., 2000; Belfer-Cohen and Goren-Inbar, 1994) and Latamne (Clark, 1969). In sites that are geographically and chronologically close to Nahal Hesi, limestone artifacts are virtually absent (Zaidner, 2014). The lithic assemblage is exceptionally well-preserved and is composed of 557 artifacts that show well-defined Acheulian characteristics. The assemblage contains handaxes, choppers, cores, flakes and retouched flake-tools. Some of the handaxes, and especially the flake-tools, demonstrate a high degree of refinement, which is typical to the late Acheulian, thereby assigning the site to the Middle Pleistocene (Zaidner, 2014).

The bone assemblage of the site (NSP = 160) is heavily fragmented and composed mainly of teeth (all isolated) and long-bone shaft fragments, with infrequent complete elements. The dominant species is an equid (*Equus* cf. *E. melkiensis*), followed by aurochs (*Bos primigenius*). A small bovid, most probably gazelle (*Gazella* sp.) is also present. *Equus* cf. *E. melkiensis* is known from a number of North African sites, all dated to the Middle Pleistocene. Cutmarked specimens are relatively frequent in Nahal Hesi faunal assemblage (9% of NSP). Both cutmarks representing filleting activities and carcass dismemberment were found, attesting to primary access of hominins to fleshed carcasses (Yeshurun et al., 2011).

The Nahal Hesi faunal assemblage is among the very few Lower Paleolithic faunas in the southern Levant that are dominated by equids and lack cervids, suids, elephants and amphibious animals. These findings indicate an open, relatively uniform environment with patchy water sources and perennial shrubs, much like this region today (Yeshurun et al., 2011).

The studies of the faunal and lithic assemblages from Gilead's excavation suggest that the site of Nahal Hesi is likely to be a Middle Pleistocene Acheulian locality in primary context. Only a few such sites are known in the Southern Levant, and very few of them provided faunal assemblages and radiometric ages, leaving large gaps in our knowledge of the Lower Paleolithic palaeoenvironment, ecology, subsistence and chronology. Middle Pleistocene Acheulian sites are difficult to date as their age range usually falls between the Brunhes-Matuyama palaeomagnetic boundary at 780 ka (e.g. Goren-Inbar et al., 2000; Laukhin et al., 2001) and 200–300 ka for which the OSL signal reaches saturation (Falguères et al., 2011). Thermoluminescence (TL) that is widely used for dating heated flint artifacts from Paleolithic sites, has a longer range, however heated flints suitable for TL dating method occur only in late Middle Pleistocene sites (Mercier et al., 1995, 2013; Valladas et al., 2013). Newly developed luminescence methods such as TT-OSL and pIR-IR_{290} cover the time range of 500–300 ka and are important for filling this gap (Thiel et al., 2011; Arnold et al., 2015).

Given the potential of the Nahal Hesi site to fill some of these gaps, a new field project was recently launched at the site. The major objectives of the new study were to describe the geological and archaeological stratigraphy of the site, to date it by OSL, TT-OSL and pIR-IR_{290} methods in order to assign an absolute age to the Acheulian artifact-bearing layer, and to reconstruct the local palaeoenvironment during the human occupation at the site.