

# The significance of geomorphological and soil formation research for understanding the unfinished Roman ramp at Masada



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## ABSTRACT

New multidisciplinary research based on geomorphological investigation and soil survey conducted at the slopes of Masada fort enabled us to reevaluate and question the dramatic events that took place there, in 73/74 CE, according to the 1st century CE Jewish historian, Flavius Josephus. The fort, built on a high elevated and isolated rocky block facing the Dead Sea in Israel, is now on the UNESCO list of World Heritage sites. Here, according to Josephus, a group of Jewish rebels occupying Masada chose to kill each other and die as free people rather than go into captivity. This act took place after the rebels realized that the Roman army, laying a complex assault ramp against the fort of Masada, were breaching its walls. The archaeological finds unearthed at Masada, revealing the daily life of the Jewish rebels and the well-preserved remains of the Roman siege apparatus, seem at face value to complement Josephus' description.

However, our new geomorphological and soil examination of the assault ramp and the natural terrain in its vicinity enable us to clearly separate between the man-made construction and the natural slope environments, and draw a clear boundary between the two. In addition, we conclude that since their formation, they were not subjected to later modification by processes such as natural erosion, slope sliding, or anthropogenic interruptions. As the Roman assault ramp was found to be an uncompleted structure, we conclude that the final scenario of the siege could not have happened as Josephus described it. This meticulous new research confirms our earlier hypothesis that the assault ramp was never completed and therefore could not have been operational. Such a conclusion challenges the common understanding of how the Roman siege of Masada ended.

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## 1. Introduction

This article is dedicated to the memory of Professor Dan Yaalon, a beloved teacher and a colleague, who was a pioneer in the field of desert pedology. Since the early 1950s Dan dedicated his research to the study of arid soils in Israel, the Sinai Peninsula and other arid zones around the world. He was also very interested in the interaction between soils, natural environment and man (see e.g. Yaalon, 2000). The present research comprises a new multidisciplinary research involving soil survey, geomorphological investigation and human activity conducted at the slopes of the famous Masada fort, located at the desert zone of the Dead Sea region, Israel. The results of the soil survey and the study of arid soils in the vicinity of the Roman assault ramp, integrated with data from the fields of archeology, architecture and civil engineering, enable us to re-evaluate and challenge the common understanding of the history of the site, with an emphasis on its end.

### 1.1. The Masada fort within the Judean desert context

The Masada fort is located at the eastern edge of the Judean desert facing the Dead Sea tectonic depression along the Dead Sea fault zone (Garfunkel, 1981, 2001) (Fig. 1). The Judean desert is a local desert, developed on the down-wind slope of the longitudinal, N–S oriented Judean mountain ridge, ranging in elevation between 800 and 1000 m. This mountain ridge blocks the westerly winds carrying the winter precipitation to the eastern Mediterranean, creating a shortage of precipitation along its eastern slope. This process is the driving force behind the formation of the desert, forming an elongated strip between the Judean Hills in the west and the Dead Sea Lake in the east.

The fort of Masada was built on an isolated horst located on the extreme eastern edge of the Judean desert, circa 500 m above the Dead Sea Lake (Fig. 2A). The fort is surrounded by steep slopes covered by mature colluvial section interfingering with colluvial-alluvial sections that developed on top of abandoned stream terraces. To the east, toward the Dead Sea coastal plain, the lower slopes of Masada block merge with the lacustrine section of the late Pleistocene Lake Lisan (Begin et al., 1974; Fig. 2B). Desert soils, composed of local lithoclasts and fine

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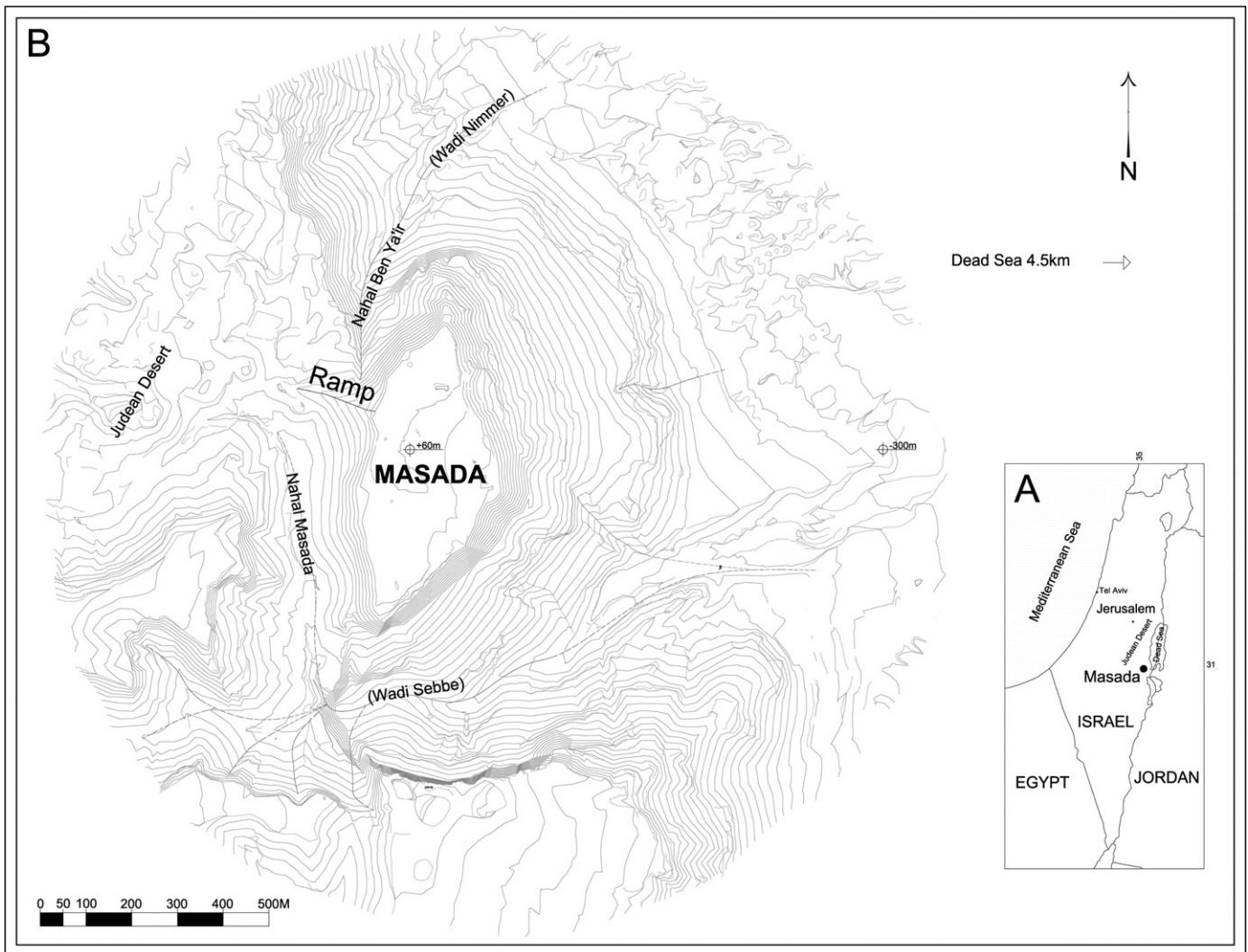


Fig. 1. Location map of Masada site.

grained aeolian dust (Yaalon and Ganor, 1973; Yaalon, 1981; Dan et al., 1981), were poorly developed on top of the alluvial sediments and the colluvial slopes.

The archaeological site of Masada is on the UNESCO list of World Heritage sites. According to the Jewish historian of the 1st century CE, Flavius Josephus, a group of Jewish rebels, identified by Josephus as Sicarii, besieged on the fort of Masada by the Roman army, chose to kill each other and die as free people rather than go into captivity and slavery (JW Bk. 7. 205–406). The archaeological finds unearthed at Masada, revealing the daily life of the Jewish rebels and the well-preserved remains of the Roman siege camps and assault apparatus, seem at face value to complement Josephus' description of the events that took place there (see Ben-Tor, 2009, for an extended summary of the history of Masada and the archaeological finds). According to Josephus's account, Flavius Silva, the Roman commander, ordered the construction of an assault ramp on top of the white natural rock projection jutting out from the cliff of Masada. Since the ramp was neither high nor stable enough, to support siege machines that would enable the breach of the wall of Masada, a massive podium made of perfectly fitted stones was added on top of the ramp. The Romans began their direct attack after an ironclad wooden tower was placed on the latter construction.

The geologist Gill (1993, 2001), following General Lammerer (in Schulten et al., 1933, pp.167–171), questioned part of Josephus' account. He convincingly showed, contrary to what laymen and scholars alike comprehended while reading Josephus' description, that the Roman

ramp was natural to a large extent, and only its upper part was man-made. In addition, Gill concluded that the Romans did not build a massive stone platform atop the ramp. Independently of Gill's study, Goldfus and Arubas (2002, p. 209) came to similar conclusions following their excavations of the assault ramp in the summer of 1995. However, Arubas and Goldfus (2008, 2010) went further, to assert that the construction of the siege ramp was never completed and therefore it was never operational. Unfortunately, this latter conclusion is either overlooked or worse dismissed (Davies, 2011; Magness, 2012). A lone voice supporting the conclusions of Arubas and Goldfus (2008, 2010) can be found in the recently published book by Mason (2016, pp. 558–75).

In general, the story of Masada has been naively accepted and presented in popular presentations and in the official publications of and at Masada. Clearly, Josephus' description of the final acts of the "encounter" between the rebels whereby the Roman ramp was used to breach the walls of Masada, was accepted to a large extent by amateurs and scholars alike (e.g. Roth, 1995; Campbell, 2006, pp. 176–178; Ben-Tor, 2009, p. 292; Gill, 2001, pp. 29–31).

Our present multidisciplinary study aimed to entirely re-examine the validity of Josephus' description by using geomorphological and soil survey methods. We examined the natural slopes and soils developed around the Masada block and in the vicinity of the Roman ramp, and managed to clearly differentiate between the natural, lower part and the man-made upper part. This allowed us to reconstruct with little

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