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Analysis of coleopterans from Late Holocene natural spring deposits in south-central Sweden

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A R T I C L E I N F O

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A B S T R A C T

The usage history of a natural spring deposit in associated glacial till was investigated via analysis of coleopteran remains found in peat. This material was recovered during archaeological excavations in a spring outflow in south central Sweden. The geographical region of southern Sweden has been heavily affected by uplift following the terminal glaciation (Weichselian) in Scandinavia, with the study area for this project having risen above sea level about 1200 BC. The spring was found in connection to the northern part of a large settlement and religious area, dating from the Younger Bronze Age and Pre Roman Iron Age (1100–300 BC). However, the area has been used for agricultural land up until the present day. Sampling was conducted for interpretation of the usage history of the site, with the insect fragments showing exceptional preservation as a result of unusual conditions in the sediments. ^{14}C-dating from the lower to upper part of the spring yielded a stratigraphic range of 670–870 to 660–810 AD respectively. A half-circle boulder construction provides clear evidence that the spring was used early in prehistory, probably during the Bronze Age, and potentially excavated at irregular periods. The coleopteran assemblage was dominated by beetles indicative of open landscapes, grazing land, and forested environments. This closely resembles the vegetation setting of today, in which the spring is situated on the border between arable land and mixed deciduous and coniferous forest. A high frequency of carabid beetles suggests that the spring may have functioned as a pitfall trap, and correlated well with the relative inorganic to organic compound composition of the ground conditions. The spring was probably abandoned in the late Iron Age (600–800 AD). Identification of two red-listed threatened species that are not present in the current fauna implies that radical change in the agricultural landscape over the last 1200 years could be negatively affecting diversity dynamics within the local fauna.

1. Introduction

Arranging solutions for adequate water supply for everyday life is one of the most important resource management issues affecting humans. The simplest way to obtain water is by using local natural resources such as small brooks, rivers, and lakes. The most obvious anthropogenic construction for water resources are wells, which have played an important role in providing water for people and may have been the main sources of water, or used to complement other supplies. Another natural resource of water, often neglected in the discussions of management in prehistoric time, are natural springs as available water resources in the landscape.

Wells can act as traps for insects, and the study of insect remains within them can help in understanding their history of use and their changing environmental contexts (Buckland, 1980; Hall et al. 1980; Osborne, 1981; Girling, 1989). Although the number of studies of insect remains in Swedish wells is limited, there are some published investigations (Lemdahl, 1994, 2003; Hellqvist and Lemdahl, 1996; Hellqvist, 1999, 2004, 2007, 2013). There are a large number of studies concerning wells and studies of insect remains from wells and pits from other parts of Europe, particularly from Britain (e.g. Coope and Osborne, 1968; Buckland, 1980; Hall et al. 1980; Kenward et al. 1986; Osborne, 1994).

Natural springs usually create small water filled ponds by groundwater outflow in depressions or pits that also must have functioned as traps for insects, similar to wells. They should frequently have been used by people, as they usually provide available outflowing water throughout the year, although it is often very difficult to establish this usage, since natural springs are normally found outside studied prehistorical settlement areas or lack other obvious connections to them.

A natural spring is defined in hydrology and geology as a concentrated discharge of groundwater appearing at the ground

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surface as a current of flowing water. Seepage areas are separated from natural springs, with slower movement of groundwater to the ground surface. Natural springs may occur in many forms, and the classification is primarily based on factors that cause spring appearance, i.e. geological and hydrological factors, rock structure, discharge, temperature, and variability (Todd, 1959). One common reason for formation of springs is that the groundwater table cuts through the ground surface where there is some change in the terrain, such as a depression, or at the lower part of a hill. Another common reason for the formation of a natural spring in Sweden is that the groundwater appears at the ground surface when flowing through a permeable layer in the soil, such as sand (Fig. 4), overlying a more impermeable layer, such as clay (Knutsson and Morfeldt, 2002).

It is very rare to find excavations and/or investigations during archaeological excavations of natural springs still in their natural setting. There are no published records of archaeological investigations on natural springs in Sweden. In contrast, examples from elsewhere mainly concentrate on the wetland environments created through outflow from natural spring and more as seepage areas (e.g. Ashley, 1996, 2001; Owen et al., 2004; Ashley et al., 2009; Adelsberger and Smith, 2010). Some of these publications describe the environment and climate in and around pools, wetlands created by the spring outflow or changes of lake levels during the last glacial and/or Holocene. These are a reflection of changes in dry/wet conditions, as well as faunal and human activities around the spring and wetlands.

There are also investigations on spring outflow and raised groundwater levels as an effect of pluvial periods during glaciations, changing during the Holocene as the groundwater table fell according to changed climate (Quade and Pratt, 1989; Quade et al., 1995). These investigations differ from the study here in their focus on the Pleistocene, the Pleistocene/Holocene boundary, or the early part of the Holocene. Another difference is the type of spring, in some cases hot or warm springs, and also by the actual size of the area affected by the spring, such as larger areas changed into wetlands due to the groundwater outflow.

Although the number of published archaeological studies of spring deposits is very limited, the number of publications in general on excavated springs where insect remains have been studied is even more limited. One of the rare investigations of insect fossils in spring deposits is presented by Elias (1989) and Elias and Toolin (1990). He presents studies of insect remains in organic sediments from a spring, Lamb Spring, in late-glacial deposits from Denver, Colorado. The insect assemblage was studied in combination with fossil mollusk data, and the site has also since been evaluated archaeologically and through ^{14}C dating. The fauna represents both full glacial and tundra climatic conditions at the site. It also revealed taphonomic reworking, which was partly resolved using ^{14}C dating.

This paper presents the results from macrofossil insect analysis, mainly Coleopteran, of samples from a natural spring deposit in glacially-deposited till, excavated and sampled during archaeological rescue excavations at site locally named Nibble in south-central Sweden (Fig. 1). The spring was found in connection with excavation of the northern part of a larger settlement and religious area (Fig. 2), where most of the cultural activity has been dated to primarily within the archaeological periods Younger Bronze Age and Pre Roman Iron Age (1100–300 BC). However, the area has also been used for agricultural land use until the present day. Samples were collected for Coleoptera analysis to use for interpretation of the usage history, and insect fragments were very well preserved by the extraordinary conditions in the sediments.

2. Site description

The study site of Nibble, excavated during archaeological rescue work in 2007 due to the building of a new highway, is situated west of Enköping in the Mälardalen region in the south-central part of Sweden (Fig. 1). The region was strongly affected by erosion and deposition during the last Scandinavian ice sheet (Weichselian). Sweden has also experienced significant land elevation since the end of the last glaciation, gaining new terrestrial environments by isolation of freshwater lakes from the sea.

The region around Mälardalen valley has been inhabited since land uplift raised the area above sea level. It is very rich in all types of cultural remnants from Neolithic times and onwards, such as remains of settlement areas, rock carvings, and grave mounds. The studied site is primarily situated on the northern part of a small hill,

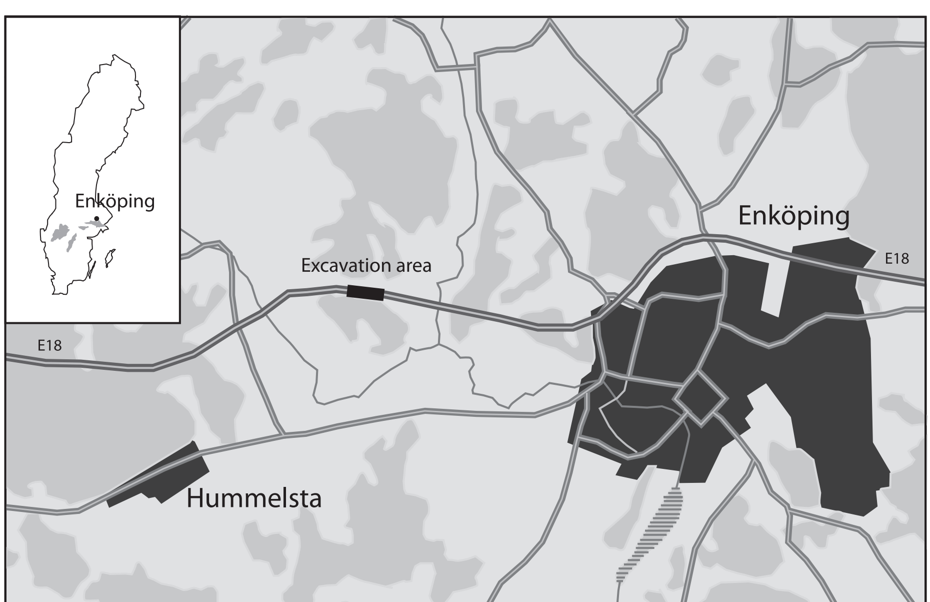

Fig. 1. Map of the studied site Nibble in south-central Sweden.