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Lateglacial to Late Holocene landscape history derived from floodplain sediments in context to prehistoric settlement sites of the southern foreland of the Harz Mountains, Germany

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ABSTRACT

The Harz Mountains are Germany's northernmost low mountain range. The southern foreland is characterised by a fragmentary distribution of loess and loess-like deposits. During prehistoric times this region was sparsely populated, in contrast to the adjoining southern floodplain of the Helme River, which has been a favoured settlement area since the Neolithic period. This study focusses on the onset of human impact on the landscape and aims to reconstruct the landscape development of this peripheral prehistoric settlement area under a long term perspective (Lateglacial to Late Holocene). The study is based on the sedimentological analysis of six sediment profiles from the floodplain of two small valleys. The chronology of the sedimentological records is provided by 24 new AMS radiocarbon ages that range from 21.7 ka BP to 0.1 ka BP. Three major changes in the depositional environment are observed in the sediment records representing the landscape evolution: a) During the Lateglacial, periglacial conditions prevailed and deposition and reworking of loess occurred on the slopes, while in the floodplains periglacial cover beds and alternating partly gravelly layers of silts and clays were deposited. b) From Preboreal to Atlantic periods a marked rise in the groundwater table led to authigenic precipitation of carbonates in the floodplains under ameliorated climatic conditions. During this phase the valleys were progressively filled by intercalated organogenic and calcareous sediments. c) Human influence on the landscape is reflected in colluvial and alluvial deposits indicating the occurrence of human-induced soil erosion and is dated prior to the beginning of the Bronze Age (here corresponding to Subboreal period). During the period of the Little Ice Age gully incision occurred, probably as a result of an intensified land use in upslope areas and of high-magnitude precipitation events during this period.

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1. Introduction

Landscapes are subject to perpetual changes driven by various exogenous and endogenous processes (Kalis et al., 2003; Zolitschka et al., 2003). With the beginning of the Neolithic period, human impact becomes an additional driving factor, leading to a system of complex interactions between humans and the environment. Distinguishing between changes mainly related to natural factors and changes induced by human impact is often challenging (Kalis et al.,

2003; Jalut et al., 2009; Kittel, 2014). Since early Neolithic settlers preferred central European loess areas, for instance the so-called Börde regions in north central Germany (Haase et al., 2007), human environmental interactions in these landscapes are well investigated (Bork, 1983; Bode et al., 2003; Lubos et al., 2011, 2013; Dreibrodt et al., 2013). In contrast studies on the southern foreland of the Harz Mountains are scarce, or focus exclusively on Holocene vegetation development under the consideration of human impact (Voigt et al., 2008). The southern foreland of the Harz Mountains is characterized by a fragmentary distribution of loess and loess derivatives (Haase et al., 2007), which made the area less favourable for early Neolithic settlers. Additionally, the altogether hilly study area is situated in the transition zone between the Lower Bunter Sandstone and the Zechstein where the relief is steeper in

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comparison to the southerly adjoining alluvial plains of the Helme – Zorge river system (Fig. 1A and C) (Wagenbreth and Steiner, 1989). These dis-favourable conditions are reflected in the distribution of prehistoric settlement sites, which cluster in the fertile and flat floodplains of the River Zorge and River Helme (Fig. 1A). These alluvial plains formed the southern boundary of the Harz Mountains' southern foreland and have been regarded as a preferred settlement area since the Neolithic period (Starling, 1983; Meyer, 2013), among other reasons due to their fertile soils.

In contrast the low mountain foreland itself was only sparsely populated in prehistoric times (Fig. 1A). Based on sedimentological records of floodplain sediments of two tributaries of the River Zorge, this paper aims to reconstruct the landscape development of the area since the Last Glacial Maximum, with a focus on possible human-induced landscape changes over approximately the past 4000 years. We aim to answer the following questions: (i) Which processes were the driving factors of the landscape development before the study area was settled? (ii) When did human impact on

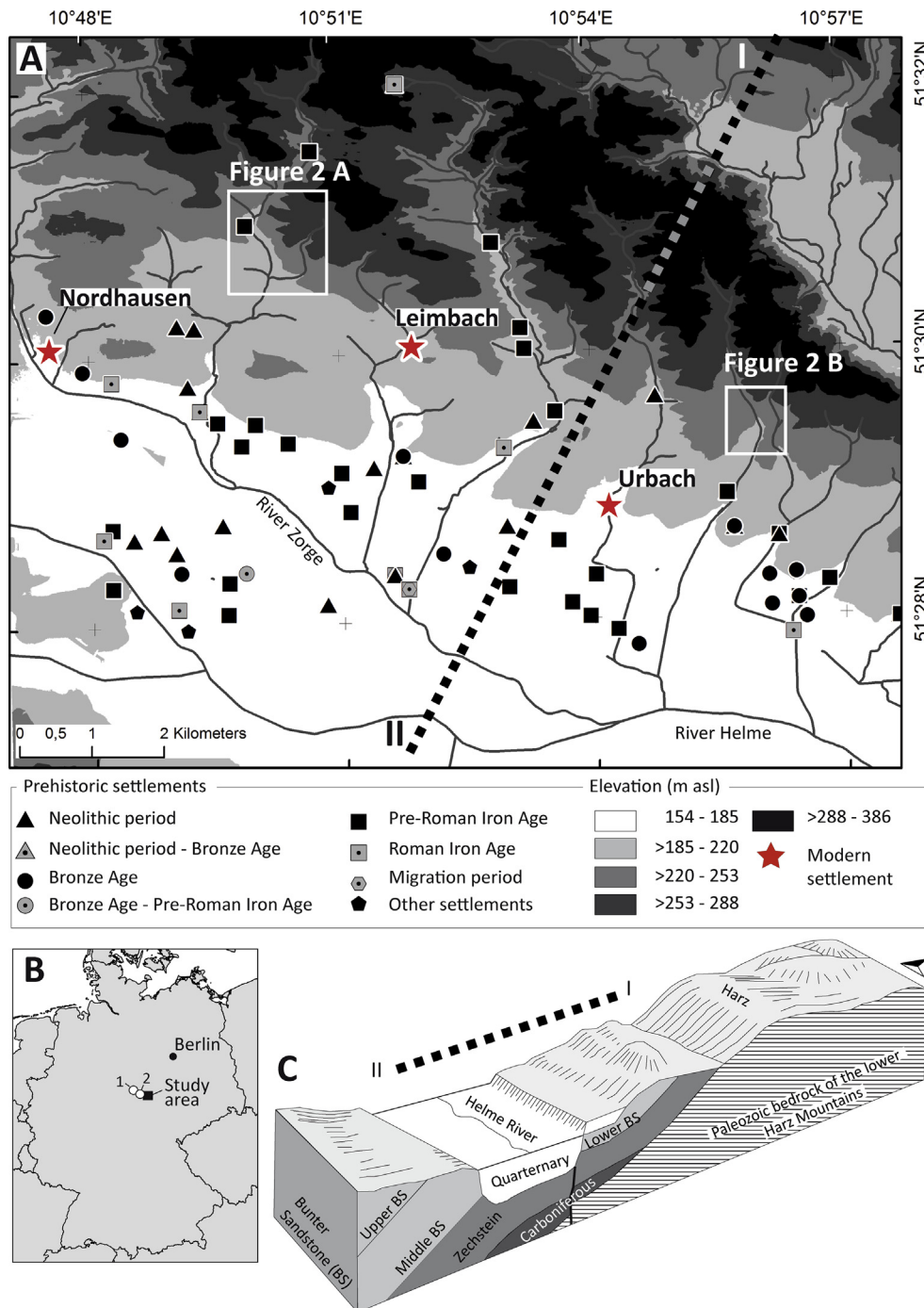


Fig. 1. A. Prehistoric settlement sites in the study area. The foreland of the Harz Mountains is represented by grey colors in the legend of the digital elevation model. The floodplain of the Rivers Helme and Zorge are shown in white color (data base of prehistoric sites: Wetzel, 2012. Digital Elevation Model: DGM5, Thüringisches Landesamt für Vermessung und Geoinformation). B. Location of the study area in Germany (1. Lake Jues, 2. Moosloch (sinkhole)). C. Geological transect of the study area (modified after Wagenbreth and Steiner, 1989).

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