



Contents lists available at ScienceDirect

Quaternary International

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

Sandy deposition in a small dry valley in the periglacial zone of the Last Glacial Maximum: A case study from the Józefów site, SE Poland

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ARTICLE INFO

Article history:

Available online xxx

Keywords:

Dry valley

Periglacial processes

Last Glacial Maximum

Climate change

Fluvial and aeolian environment

ABSTRACT

In this paper, we report the results of the research on the fluvio-aeolian deposit succession in the Józefów site in the region of Roztocze Tomaszowskie (SE Poland). Based on the lithofacial and textural analyses, as well as TL and IR-OLS dating, three lithofacial units have been documented, including their age. They are as follows: 1) a fluvial (lower) unit deposited in the Pleniglacial in the channel of a sandbed braided river under permafrost conditions; 2) a fluvio-aeolian (middle) unit which originated due to alternating aeolian and fluvial deposition and redeposition within a floodplain and/or a zone of abandoned channels at the end of the Pleniglacial and the beginning of the Late Glacial when permafrost was gradually degrading and the climate humidity was decreasing. The top part of the fluvio-aeolian deposits has been reworked by pedogenic processes leading to the development of a soil, which indicates a break in the sediment deposition; 3) an aeolian (upper) unit accumulated due to the development of the sandy aeolian forms (moving dunes) at the end of the Late Glacial and the beginning of the Holocene.

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1. Introduction

The period since the Late Pleniglacial until the Early Holocene was characterised by very dynamic changes in the climatic conditions. These changes are most clearly recorded in the ice cores collected in Greenland and marine sediments from the North Atlantic (Andersen et al., 2006; Svensson et al., 2006), as well as terrestrial laminated and organic sediments (Goslar et al., 1989, 1999; Litt et al., 2001; Ralska-Jasiewiczowa et al., 2003). The climate changes were expressed by the evolution of the depositional environments, both in the marginal zone of the Scandinavian Ice Sheet (SIS) and in its more distant foreland – in the extraglacial zone (Bohncke et al., 1995; Van Huissteden and Kasse,

2001; Rinterknecht et al., 2006; Kolstrup, 2007; Renssen et al., 2007). These changes are very well recorded in loess deposits (Jersak et al., 1992; Jary, 2009) but they are also found in fluvial deposits and dune sands (Nowaczyk, 1986; Bohncke et al., 1995; Huijzer and Isarin, 1997; Huijzer and Vandenberghe, 1998; Kasse et al., 1998; Krzyszkowski et al., 1999; Mol et al., 2000; Van Huissteden and Kasse, 2001; Schokker and Koster, 2004; Zieliński et al., 2011, in press). Such deposits occur mostly in large river valleys and provide an excellent possibility of reconstructing changes in the depositional conditions in the periglacial zone of the Last Glaciation in the so-called European Sand Belt (Koster, 1988; Zeeberg, 1998). The sedimentary successions occurring in small valleys of the erosion-denudation origin are much more rarely described (Manikowska, 1992; Woronko et al., 2013). However, such small valleys are very important for the characterisation of the periglacial zone. Due to their location between uplands and river valleys they were transit zones for the material denuded in upland areas, and – in specific cases – for the material transported by wind in the opposite direction, i.e. to the

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<http://dx.doi.org/10.1016/j.quaint.2015.08.089>

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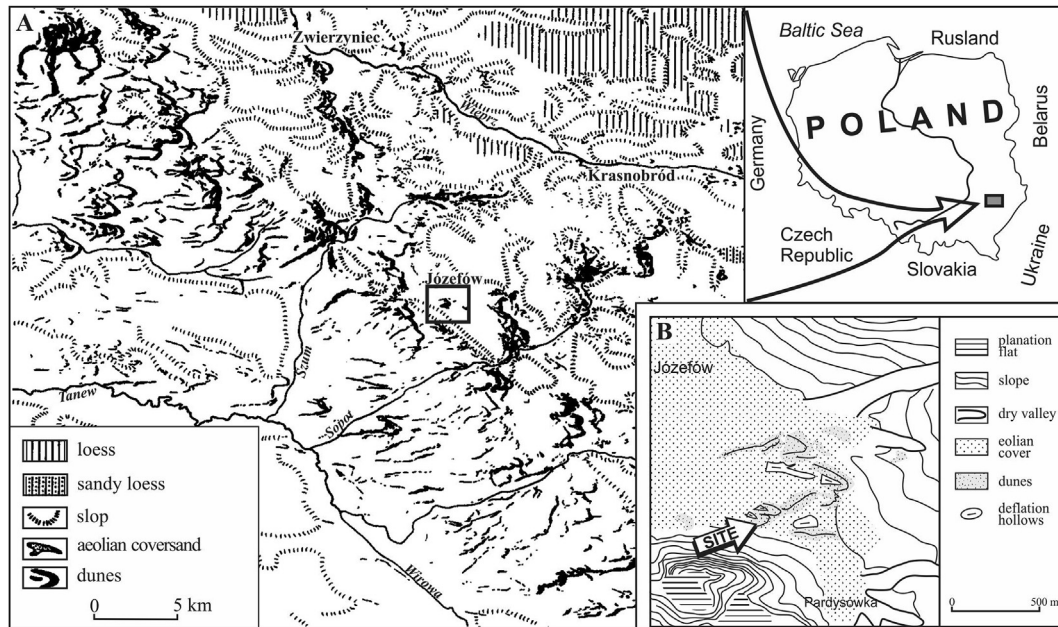


Fig. 1. Location of the study site in relation to: A – dune distribution in the region of Roztocze Tomaszowskie according to Buraczyński (1993); B – geomorphological situation of the site vicinity.

uplands (Henkiel, 1993). Because of their small catchments and small groundwater supplies, such systems may have responded much more quickly and clearly to climate fluctuations than large river systems (Blum and Tornquist, 2000; Huisink, 2000; Mol et al., 2000; Vandenberghe, 2001, 2003; Briant et al., 2004). That is why it is possible to find the correlations between aeolian and fluvial processes there. This fact has induced researchers to undertake investigations in small valleys developed in the periglacial zone of the Last Glaciation, which contain a fluvio-aeolian sedimentary succession. The aim of this paper is to reconstruct the evolution of the depositional environments and determine its duration in a small fluvial system (a dry valley at present) in the

Józefów site in comparison to the climatic changes occurring since the Late Pleniglacial to the Early Holocene.

2. Study area

The site is located within the mouth section of an erosional valley leading to a basin-shaped depression in the zone of the southern scarp of the Roztocze Tomaszowskie elevation (SW Poland, Central Europe), SE of Józefów (Fig. 1). It is a small bowl-shaped dry valley 1.8 km long and 150–300 m wide. Two smaller bowl-shaped side valleys open into it in the north. To the east of the site, the catchment is about 3.75 km² and relative heights

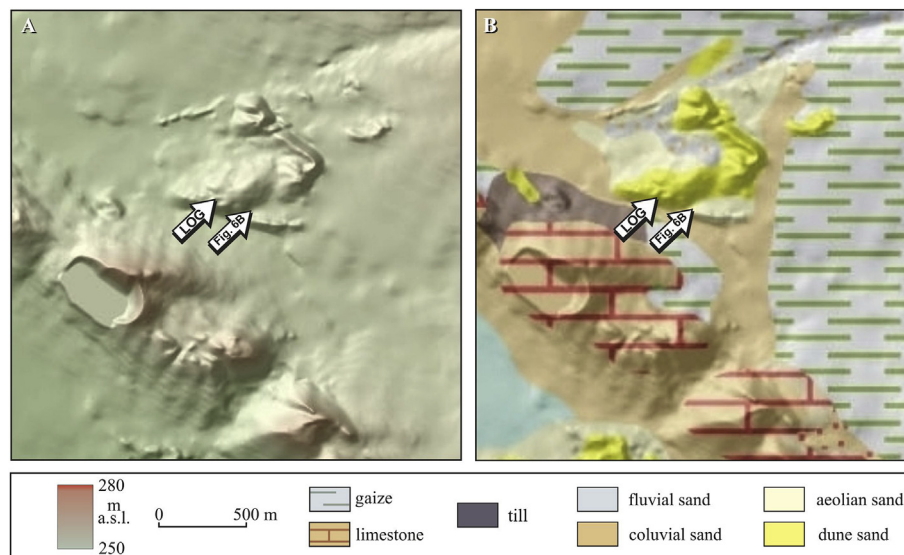


Fig. 2. Location of the research site (circle) against the background of: A, DEM; B, surface sediments and DEM.

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