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The palaeoecological development of the Late Medieval moat - Multiproxy research at Rozprza, Central Poland



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ABSTRACT

The Rozprza stronghold functioned as a seat of a noble family since at least the early 14th century AD in the form of the motte-and-bailey residence. The remains of the residence are situated in the central part of mid-Luciąza River valley, on the river terrace remnant adjoining a strongly expanding floodplain. The situation and state of preservation give a unique opportunity to conduct research that explain the construction process, detailed history of the medieval moat and palaeoenvironmental reconstruction of the valley floor. Radiocarbon and dendrochronological dating and analysis of artefacts confirmed 14th century age of the moat. Organic deposits (gyttja, peat and organic mud) of moat fill allowed for a set of multiproxy analyses based on sediment cores. The research results indicate shallow water with brief episodes of in-wash in the first stage (13th-14th c. AD), followed by a transformation into telmatic habitat in the second phase of the moat development from 16th-17th c. AD. The deposition of overbank alluvium took place within the moat ditch system as late as the 18th and/or 19th c. AD. We studied the development of this moat environment in the context of valley floor changes.

1. Introduction

Palaeoenvironmental studies of moats are not often undertaken as part of archaeological research of military defensive structures in Central European countries (eg. Beneš et al., 2002; Brown and Pluskowski, 2011; Koszałka, 2014). However, the depositional environment of water-filled moats is very similar to that of small lake basins such as ox-bows, and can be examined with the use of multiproxy palaeoecological methods. Our research at the Rozprza stronghold remnants is one of the first detailed studies on the development of

a wet moat environment in the context of natural changes and human impacts in the Late Middle Ages and Modern Times.

Investigations of plant macrofossils were focused on determining the character of local vegetation and its changes during the accumulation of sediments infilling the moat. This small reservoir provides a record of local vegetation changes, which reflects moat functioning from construction to complete infilling by sediment. Pollen analysis, conducted on deposits filling up the moat, allows for the reconstruction of local vegetation evolution and changes in human activity. Cladocera, beetles, Chironomidae and other insects are good palaeoindicators of

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past anthropogenic habitats (Ruiz et al., 2006; Elias, 2015; et al.), shedding a somewhat different light on paleoenvironments. In the case of a moat habitat reconstruction, flooding phases and human influence on aquatic ecosystems, Chironomidae and Cladocera are a key indicators of water level changes (Nevalainen et al., 2011), water inflow (eg. Kittel et al., 2016), water trophic status (eg. Brooks et al., 2001; Luoto, 2011; Kittel et al., 2014) and microhabitat diversity (Armitage et al., 1995). Other aquatic stenotopic insects like beetles and caddisflies, which are less frequently represented in the sediment, give more precise information about presence of certain habitats and adjacent terrestrial environments.

The palaeoenvironmental record of moat fill is very important from the point of view of function and natural evolution of the studied ditch basin, the evolution of the surrounding environment, as well as changes in the Luciąża River valley. This palaeoecological research aimed to support the larger archaeological project investigating the Rozprza stronghold. Our multi-proxy studies were proposed to analyse ecological functioning of the immediate vicinity of the motte, specifically the Luciąża river valley, and the anthropogenic aspects of the landscape evolution. We were particularly interested in the interaction of the economic activity of the Late Medieval communities with the natural environment. We tested whether local river activity (floods, hyporheic flow) was the main factor influencing the moat ecosystem, or whether some human intervention kept the moat in stable condition. We hypothesised that ecological conditions in the moat were poor, driven by strong human impacts. This is why its ecosystem possibly needed to be refreshed by local floods, the inflow of hyporheic waters, or by human activity. We used the moat sediment as an archive of settlers' activity, local agriculture, livestock pasturage, and textile production. All of these activities left evidence in the moat sediment archive.

2. Study area and the study site

The study site (51°18'07" N; 19°40'04" E; 182–183 m a.s.l.) is situated in Central Poland, about 60 km south of Łódź. The remnants of a stronghold in Rozprza are located in the middle reach of the Luciąża River (a 3rd-order river in the Vistula River basin) valley floor. The morphology of the valley, and especially of the valley floor, is crucial for the environmental setting of the settlement's location and moat functioning. The region is part of the Odranian (Saalian) formerly glaciated area and the last ice sheet was present there during the Wartanian Cold Stage of the Odranian Glaciation (Marks, 2011). The area is a part of the "European sand belt" (Zeeberg, 1998) characterized by wide-spread fluvial terraces and also aeolian landforms. Intense transformation of river valleys took place under periglacial conditions during the Weichselian glacial period. Two or three terraces existed in most river valleys of the Łódź region (Turkowska, 1988). Three river terraces were recognised by Wachecka-Kotkowska (2004) in the Luciąża River valley in the Rozprza surroundings: the highest is associated with the Wartanian glacial, followed by the higher and lower Weichselian fluvial terraces. The western morainic upland is formed by tills, while the eastern one by glacial sands and gravels (Wachecka-Kotkowska, 2004).

The stronghold's remnants are situated in the central part of the Luciąża River valley (Fig. 1), on the Plenivistulian residual terrace which adjoins a floodplain that likely formed in the Late Vistulian and the Holocene. The valley floor is strongly expanded in the stronghold area (Kittel et al., 2015). According to Wachecka-Kotkowska (2004), the morphology of the valley floor was obliterated by the deposition of modern overbank alluvium. However, this landscape reconstruction has not been confirmed by detailed examination of the surficial geology (Kittel et al., 2015, 2018).

Contemporary climatic conditions in the area are highly variable because of the influence of oceanic and continental air masses. The average annual temperature ranges from 8.6 to 8.9 °C for the neighbouring areas and average annual precipitation varies from 537 to

626 mm per year (<http://www.tutiempo.net>; date of last access: 11th Dec. 2017). The mean temperature of the warmest month (July) is 18 °C and mean temperature of the coldest month (January) is –3.3 °C for the Lodz region (Kłysik, 2001). Average annual precipitation from 1951 to 1989 was 601 mm for the surroundings of Rozprza (Kłysik, 1993).

The potential natural vegetation of the Luciąża River valley within 5 km of the studied site at Rozprza would be mostly lime-oak-hornbeam forests representing the Tilio-Carpinetum association and to lesser extent the Potentillo albae-Quercetum typicum. In smaller areas, located east and south of Rozprza, Vaccinio uliginosi-Pinetum, Leucobryopinetum and Quercu-Pinetum would occur. Terrains near the water courses would be overgrown by lowland ash-alder forests and alder of Fraxino-Alnetum and Carici elongatae-Alnetum associations (Matuszkiewicz, 2008).

According to written sources from the 11th to the 13th c. AD, Rozprza was one of the most important medieval strongholds in Central Poland, next to Łęczyca, Sieradz and Spycimierz (Kamińska, 1953; Kajzer, 2007; Sikora, 2007). It is mentioned for the first time in the "Mogilno Falsification" (1065 AD), then in the "Gniezno Bull" (1136 AD), as a one of the most important princely castles paying tribute to the Mogilno Monastery and the Archbishopric of Gniezno. In the 13th c. it was a seat of castellanus a ducal official, but in the next century it is mentioned as private property of the Nagodzice-Jelitzycy noble family (Zajączkowski, 1961).

The stronghold was first described by Kamińska (1953) as a motte type of earth-work. After the first archaeological excavation undertaken by Chmielowska (1982), this motte phase was dated to the 13th - 14th c. AD. A noble family private residence was built on the site of an older early medieval ring-fort. New research proved that the stronghold functioned as a seat of a noble family in the 14th and 15th c. in the form of motte-and-bailey timber castle (Kittel et al., 2018).

The motte was a pan-European type of fortified residence with artificial mound, in either conical, circular, oval or rectangular shape, usually surrounded by an outer moat and protected by more-or-less complicated systems of additional fortifications, and sometimes with one or more baileys the fortified courtyards. A timber or in later period masonry tower was situated on the mound top, and either formed part of the residential manor building or just a part of a defensive system. Motte features appeared at the turn of 10th and 11th centuries in Northern France and western Germany, in the 11th c. in Flanders and the Netherlands as well as in England (eg. Müller-Wille, 1966; Kenyon, 1990; Higham and Barker, 2004; Aarts, 2007). In Western Europe, motte castles were gradually turned into masonry features or abandoned in 13th – 14th c. In the same period they become a popular type of defensive residence in Southern Scandinavia, eastern German countries, the Czech lands (Durdík, 1996), Hungary (Dénes, 2004) and in Poland (Kamińska, 1968; Kajzer, 1993; et al.). Structures analogous to motte type castles even occurred in Western Ukraine (Volyn) (Panyshko, 2014). In 13th c. mottes replaced older timber-earth ring-work castles as ducal residences of minor importance (Kajzer, 1993). Between the 13th and 15th c., timber castles of motte type became the dominant model of knightly residence, especially in the Polish Lowlands.

3. Materials and methods

3.1. Field work and sampling strategy

In recent years, non-destructive research on the stronghold's remnants in Rozprza included detailed geological mapping, large scale aerial photography, and geochemical and geophysical testing. These studies, combined with detailed topographical mapping, uncovered traces of the moat system (Kittel et al., 2015; Sikora et al., 2015). Relicts of the moat system are still clearly visible in the terrain relief, which is currently covered by meadows and fallow fields. A geological survey was carried out in the stronghold's surroundings, in order to

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