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Uncovering a Bronze Age landscape. A case study from Krotoszyn Forest (Poland)

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Several research projects have been carried out since 2007 in the area of Krotoszyn Oak Forest (*Dąbrowy Krotoszyńskie*) in the south of the Wielkopolska region (Kneisel *et al*. 2010; Jaeger, Pospieszny 2011a; 2011b; Czebreszuk *et al*. 2013; Jaeger *et al*. 2014). Their primary goal was to identify cultural landscape relics from the Bronze Age, preserved by 150-year-old oak forests, growing on Pleistocene and moraine sediments and covering an area of about 40 km^2, protected today as a "Natura 2000" reserve. Such forested zones survived radical landscape transformations caused by rapid industry and farming developments starting from the 19th century. Today they are the only places where one has a chance to encounter prehistoric and early historic archaeological monuments in well-preserved form. The forests near the town of Krotoszyn are well known to prehistorians because of the outstanding discoveries made in 1923 and 1924 (to a smaller extent also in 1965, unpublished) at the barrow cemetery in Smoszew site 1 (Kostrzewski 1924), dated to the Middle Bronze Age (approx. 1550–1300 BC).

A search of the archival data at the start of the project brought extensive information produced by surveys and excavations carried out from the 1960s. Next, a large fragment of the forest complex (62.29 km^2) called the Krotoszyn Forest was scanned using ALS/LiDAR technology, with density of 4 points/1 m^2 and Full-Waveform Mode. The captured cloud of points was processed in SAGA GIS 2.0.7 software. Several functions were used to detect archaeological monuments, including analyses of lighting (Analytical hillshading) and terrain geomorphometry (Slope, Slope height and Normalized height). As a result 176 monuments were registered; these were subjected later to archaeological verification in the field and documentation. All in all, 124 barrows hypothetically dating to the Bronze Age were identified, as well as less numerous features from other prehistoric and historic periods, like early medieval strongholds and modern military installations (Fig. 1: A). The diameters of the burial mounds varied from 15 m to 20 m. A photographic and descriptive documentation was prepared for each barrow. The data was integrated in a relational database.

In selected parts of the forest, a geophysical prospection was carried out, followed by coring and small-scale excavations (partly destroyed barrow 15 at the cemetery in Smoszew site 1; Fig. 1: B) to collect further information about the burial mounds and their environs. The surveys were made using a fluxgate gradiometer (Bartington Grad601-1), data was collected in

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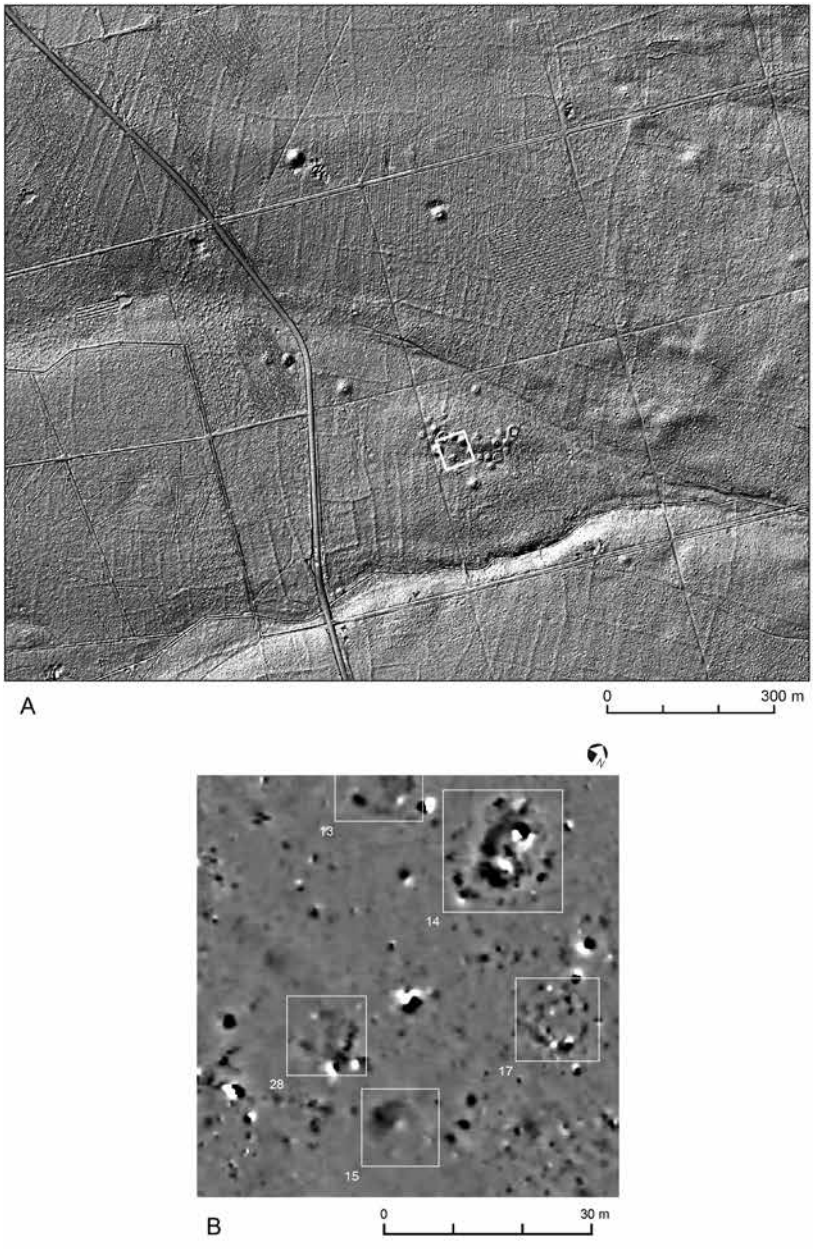

Fig. 1. A – fragment of an ALS-derived DTM of Krotoszyn Forest (shaded map relief); scattered as well as clustered barrows are clearly visible; B – fragment of a geophysical image of the cemetery at Smoszew site 1 (dynamics -10/+10 nT); numbers indicated of prospected barrows (white boxes)

parallel mode with a sampling interval of 0.25 m along transects spaced 0.5 m. Data processing was performed using Geoplot 3 and Surfer 8 software.

The results of fieldwork investigations revealed that the mounds covered complex stone structures, consisting of an outer ring or rings (usually 9 m to 21 m in diameter) and a central core raised above a rectangular grave chamber, placed at the prehistoric ground level. Excavations indicated that the main source of magnetism were the erratic boulders and pebbles of high magnetic susceptibility. They contrasted strongly with the mounds built of sands and clays. All graves unearthed since the 1920s were poorly furnished with small bronze objects (daggers, pins, spirals) and ceramic vessels (pots, vases, bowls). The latter, often fragmented, could cause small magnetic anomalies, together with numerous lumps of charcoal found in various parts of the barrows. The geophysical survey covered also the spaces between the tumuli. Surprisingly, almost all magnetic anomalies detected were caused by shallow lithology, including buried erratic boulders (confirmed by excavations and drillings), and large archaeological features of increased magnetic susceptibility seem to be absent. Numerous magnetic dipoles represented metal trash, like steel food cans, left by previous excavators.

The application of ALS/LiDAR and geophysical survey, combined with excavations, coring and revision of old excavations and surveys reports, brought comprehensive and detailed information about the remains of the Bronze Age landscape, especially the barrows. Accordingly, it was possible: 1) to identify the number of prehistoric and historic monuments, including burial mounds, 2) to recognise the state of preservation and internal structure of the latter and 3) to confirm a reoccurrence of structures typical of Middle Bronze Age monuments, as well as 4) to explore their variability and 5) to calculate the original size of the barrows based on the diameter of the stone rings. The latter is of particular importance considering the erosion and devastation that has transformed the mounds over the centuries. In other words, any attempts at characterising and interpreting the dimension of barrows, e.g., in temporal or socio-ideological terms, had been unjustified before the application of geophysical methods. It should be emphasized that drilling and small-scale but thorough excavation of carefully selected barrows, together with a reevaluation of archival information, enabled a realistic interpretation of the results of the non-invasive part of the research.

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