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Non-invasive research on medieval strongholds in Silesia. Case studies from Borucin (Silesian province) and Chrzelice (Opole province)

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A non-invasive research project on selected Silesian medieval strongholds commenced in 2013. Its primary objectives were the identification of the sites and an assessment of their current condition. To achieve this goal, data and methods typical of landscape archaeology (Aston 1985: 13–20; Rippon 2004; Chapman 2009: 27–35), such as old analysis of cartographic records, aerial photography, satellite imagery and airborne laser scanning, were used. To a large extent, the research relied on archival data collected for various purposes by different institutions. Fieldwork

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involving surface surveys and geophysical prospection (using a Bartington Grad601-2 gradient magnetometer; data collected in zigzag mode, reading resolution 0.125 m x 1 m: data processing DW Consulting TerraSurveyor 3.0.22.1 software) was also conducted successively.

The project postulated the development of a universal, swift, affordable and effective research methodology, which could be employed in heritage management practice, facilitating the recognition of site extent and degree of preservation.

Since evaluation of the proposed research scenario was a project priority, the selection of study sites followed no special criteria; on the contrary, the diversity of the research sample was seen as an asset. The selected strongholds differ in terms of function, form, size and chronology, implying different models of spatial organization and construction solutions. The research targeted poorly investigated and heavily destroyed sites, where the relief was obliterated almost completely owing to the intensity of agricultural practices.

BORUCIN (SILESIAN PROVINCE, KRZANOWICE COMMUNE), SITE 2

The stronghold is located between the villages of Borucin, Bojanowo and Bieńkowice in the Cyna (Psina) valley, which is over 1 km wide in this area. Nearly the whole width of the marshy valley is cut by palaeochannels; their complex system is clearly visible in LiDAR data (Fig. 1a, b, d). The vast terraces were meliorated in the 19th century and are currently used as arable fields. One of the old channels, used perhaps as a mill race, cuts through the eastern and southern parts of the site, damaging a section of the fortifications.

The maidan was rectangular in plan with rounded corners. It was surrounded by an inner moat, a rampart and an outer moat, circular in shape and measuring approximately 120 m in diameter. An active bend of the watercourse was probably adapted as the southern and western segments of the moat (Fig. 1b–d). The stronghold is dated to the 13th–14th century AD (Hellmich 1930; Fock 1942).

The magnetic prospection covered an area of 2.5 ha limited on the south and west by a modern channel (Fig. 1c, d). The most interesting anomalies were recorded within the central mound area. Two distinct clusters of high-value readings and dipole anomalies were detected in its north-western part, indicating the existence of buried foundations, cobblestones or rubble (Fig. 1d:A). Both clusters have regularly rectangular shapes, the sides roughly 12–15 m long, oriented according to the maidan outline. In the central part of the mound, a square-like contour was also identified (Fig. 1d:B), supposedly pointing to the presence of building foundations (tower?). Linear anomalies identified along the maidan mound (Fig. 1d:C) may be evidence of a strengthening of its edges (e.g., with a retaining wall).

The rampart and moats surrounding the maidan were quite poorly visible in the magnetic map s. The only distinct anomalies were detected in the northern part of the rampart perimeter (Fig. 1d:D). It seems possible that the construction of this segment may have been intentionally strengthened with larger amounts of magnetic susceptible materials or was burnt, which would also result in enhanced magnetic readings.

No anthropogenic features were identified in the partly investigated surrounding area; however, numerous natural structures were recorded (e.g., linear, meandering anomalies tracing the old river network).

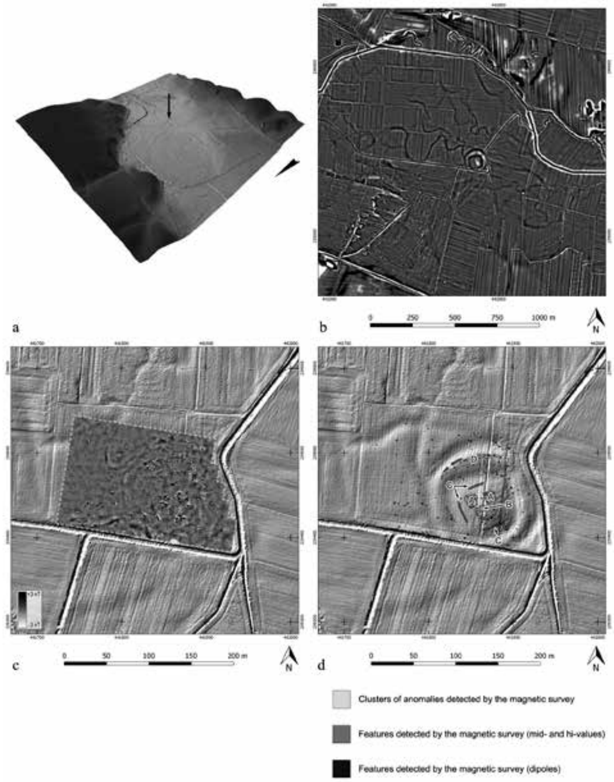


Fig. 1. Borucin (Silesian Province), a - 3D-view of the Cyna (Psina) valley based on ALS data, b - Local Relief Model visualization of the Cyna (Psina) valley, c - results of the magnetic survey, d - interpretation of the magnetic survey results

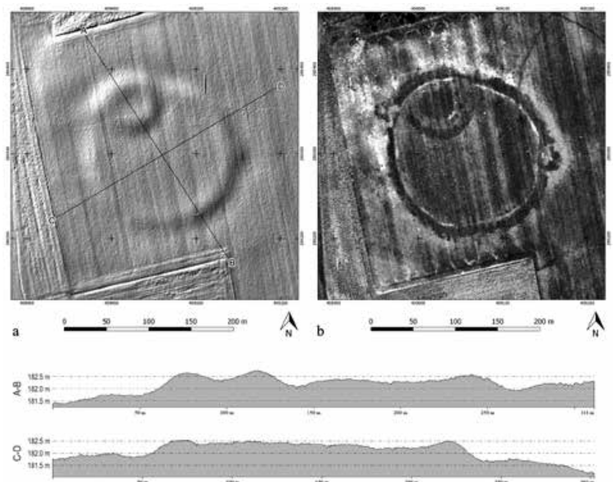
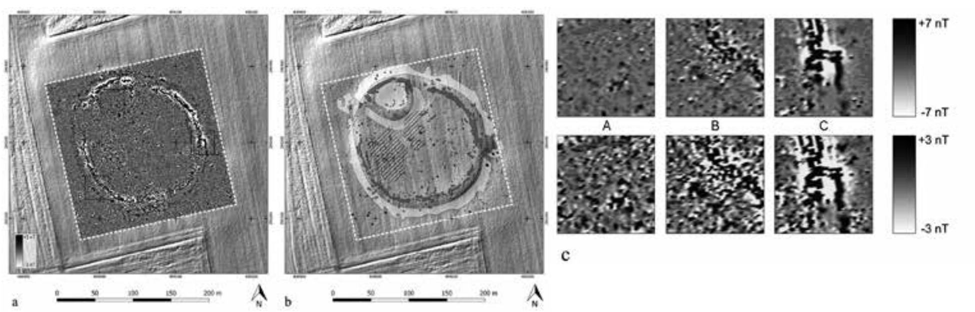


Fig. 2. Chrzelice (Opole Province), a - hillshaded model, b - aerial photograph, c - cross sections of the site



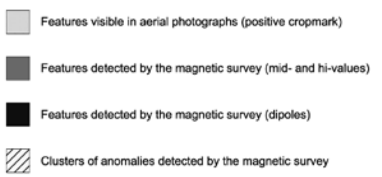


Fig. 3. Chrzelice (Opole Province), a - results of the magnetic survey, b - interpretation of the magnetic survey results, c - results of the magnetic survey (details)

CHRZELICE (OPOLE PROVINCE, BIAŁA COMMUNE), SITE 1

The stronghold is located between the villages of Chrzelice and Pogórze, about 400 m west of a nameless watercourse. Its position in the landscape — on a slight elevation in a wide meltwater valley — is quite typical of early medieval sites of this type. The feature has a ringed form with two segments: a stronghold and an adjacent *suburbium*. The smaller, acropolis segment located in the north-western part of the site was semicircular in plan. A modest, somewhat depressed maidan was surrounded by a rampart and a moat. The diameter of the outer perimeter of these earthworks measured roughly 90 m. Immediately adjacent to its south-eastern part was the *suburbium*, surrounded by a fortification with a semicircular outline and approximately 220 m in diameter. The stronghold is broadly dated to the Tribal and early State periods (8th–11th AD) (Hellmich 1930: 47; Bagniewski 1967: 26; Kaźmierczyk, *et al.* 1977: 359–399; Macewicz 1997; 2000; Gorgolewski and Tomczak 1996: 28–29; Mackiewicz and Myślecki 2014).

At present the site has been heavily destroyed by intensive agriculture and the earthworks are not visible in the field. The differences in elevation between the bottom of the moat and the top of the ramparts do not exceed 50–70 cm as a rule (Fig. 2a, c). The form of the feature is best readable in visualizations of airborne laser scanning data and in aerial photographs (Fig. 2a, b).

The magnetic prospection covered an area of 4.51 ha. A number of anomalies revealing the construction details of the fortification and providing certain information regarding the spatial arrangement of the feature were recorded (Fig. 3a).

The presence of linear anomalies aligned with the ramparts (Fig. 3a, b) indicates the use of construction materials of high magnetic susceptibility (e.g. stone). It is worth noting that stone was used as building material only in the outer (perimeter) part of the fortifications. The segment of the acropolis rampart which was an inner partition was an earthen or a timber-and-earth structure.

Two entrance gates interrupted the course of the earthworks in the eastern and south-western parts of the *suburbium*. They were symmetrically placed in relation to an axis running through the centre of the acropolis and suburbium. The south-western gate belongs to the tunnel type (Fig. 3a:B, 3c:B); it was slightly trapezoidal and narrowing towards the interior of the feature. The eastern entrance extended bay-like outside the perimeter of the rampart, perhaps including a tower (Fig. 3a:C, 3c:C). At present, the ramparts in its vicinity are characterized by the highest elevation in relation to the surrounding terrain, suggesting that they used to be higher and more massive in that part.

The geophysical prospection only vaguely indicated the presence of a moat, the results characterized by a 'magnetic cleanness'. The outline of the feature was revealed based on vegetation marks seen in aerial photographs and LiDAR visualizations. This stresses the necessity of combining different research methods during similar non-invasive studies.

Clusters of small anomalies strewn across large surfaces were detected in the suburb, for example in its south-eastern part (Fig. 3a, b). Their character may indicate the presence of a utility zone associated with activities that left behind significant amounts of material of high magnetic susceptibility. The extent of this zone also corresponds to a concentration of pottery on the surface of the site. Small-scale excavations conducted in 1996 demonstrated the involvement of the *suburbium* residents in metallurgical production (Macewicz 2000: 102). It seems probable that the abovementioned anomalies are related to these activities and the elevated magnetic readings were caused by significant amounts of burnt clay and slag present in the soil.

The geophysical prospection did not clearly indicate the presence of residential, farm or economic structures. Large, rectangular anomalies characteristic of sunken buildings were not detected. However, it seems possible that the constellations of parallel and perpendicular linear readings represent the relics of foundation trenches of aboveground buildings or accompanying structures (Fig. 3a:A, 3c:A).

SUMMARY

By combining spatial data with the results of geophysical prospection it was possible to create a complex picture of the studied sites. New information regarding their extent, form, building materials and spatial organization was acquired.

The proposed procedure turned out to be very cost-effective and efficient, and the methodology quite universal, making it a perfect tool in heritage management practice. It enabled both an assessment of the present condition of the site and the identification of possible hazards, allowing adequate measures to be taken in terms of monument protection.

Geophysical prospection was the main component of the fieldwork. In both presented cases, it was expected that the magnetic method would deliver the most comprehensive results. More information can surely be obtained by integrating additional non-invasive prospection techniques into the procedure. This will also bring a better understanding of the detected magnetic anomalies.

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