ARCHAEOLOGICAL FIELDWORK IN ESTONIA

2008

ARHEOLOOGILISED VÄLITÖÖD EESTIS

EDITORS / TOIMETAJAD:
ESTER ORAS, ERKI RUSSOW

MUINSUSKAITSEAMET
TALLINN 2009

FLUXGATE GRADIOMETRY SURVEY IN THE RUINS OF KARKSI CASTLE AND PALAEOENVIRONMENTAL ANALYSIS IN ITS HINTERLANDS

HEIKI VALK
heiki.valk@ut.ee

Tartu Ülikool
(University of Tartu)
Lossi 3, 51003 Tartu, Estonia

ALEXANDER PLUSKOWSKI
a.g.pluskowski@reading.ac.uk

University of Reading
Department of Archaeology
Whiteknights, Reading RG6 6AB UK

DAVID THORNLEY
d.m.thornley@reading.ac.uk

ALEXANDER BROWN
a.d.brown@reading.ac.uk

CHANTEL SUMMERFIELD
chantel_summerfield@hotmail.com

Department of Archeology
and Anthropology
University Bristol
43 Woodland Road, BS81UU. UK

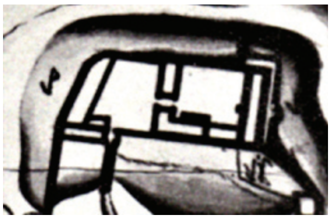

Fig. 1. 17th century plan of Karksi Castle.
Jn 1. Karksi linnuse 17. sajandi plaan.
(Tuulse 1942, fig. 168.)

The castle of Karksi which belonged to the Livonian branch of the Teutonic Order is poorly reflected in the written sources. Its architecture has been briefly discussed by architecture historians Armin Tuulse (1942, 244–246) and Kaur Alttoa (1995, 74–76). Tuulse has suggested that the stone castle was built instead of the former timber castle only after 1297, when the latter was burnt by the Lithuanians. The *Fögte* of Karksi (Karkus) are mentioned from 1248 until the Late Middle Ages. The castle was probably in use for the last time in the Polish-Swedish war of 1600–1629. The ruins have been mostly destroyed and only a few sections of the walls remain exposed above ground. A survey of its general plan is depicted on a 17th century plan (Fig. 1).

Archaeological investigations in the Karksi castle have been limited. In 1939 Tuulse conducted trial excavations in the main castle, discovering the remains of a well-preserved log house and timber constructions *ca.* 1.5 m below the medieval cobblestone pavement (Tuulse 1942, 244, footnote 42). However, no more data is available about these excavations. Small-scale rescue work was carried out in the outer bailey – south-west of the church tower in 1994 (Valk 1995) and when laying electricity cables in the northern and eastern part of the yard in 2007 (Valk & Malve 2008). ^{14}C-dates gained from the bottom layers of the outer bailey in the course of the work (*ibid.*, 122) refer to the last quarter of the 13th or to the 14th century.

Fig. 2. The Bartington gradiometer being used in the ruins of Karksi castle.
Jn 2. Bartingtoni gradiomeetri kasutamine Karksi linnuse varemetes.
Photo / Foto: Alexander Pluskowsky

Karksi castle was chosen for one of the research objects in the project 'The Ecology of Crusades', launched by Reading University (UK). Within this framework, as a pilot project, a geophysical survey of the castle was undertaken in August 2008 using a Bartington Grad 601-2 dual fluxgate gradiometer (Fig. 2).[1] The aim of the project was to gather data about the concentration areas of debris, to detect the buried perimeter walls, internal buildings and open spaces and to find 'magnetically quiet' areas that may be suitable to site an archaeological excavation.

Fluxgate gradiometry is a technique that records small magnetic anomalies associated with both natural and man made features beneath the ground surface. The depth of investigation for the Bartington gradiometer is generally considered to be up to 1.5 meters, but it is not possible to give an exact depth of burial from the strength of magnetic response. Features such as pits, ditches, kilns and materials such as ceramics and metals all have magnetic fields of different strengths which create distortions in the earth's magnetic field. The magnitude of these distortions can be measured using the gradiometer.

The data collected during the field work has been processed to produce magnetic contrast maps, which mainly highlight the position of the buried granite boulders. The castle is mainly constructed of granite, a weakly magnetic material that contains a small amount of magnetite,

[1] http://www.bartington.com/;
http://www.britishmuseum.org/research/research_projects/amara_west_research_project.aspx.

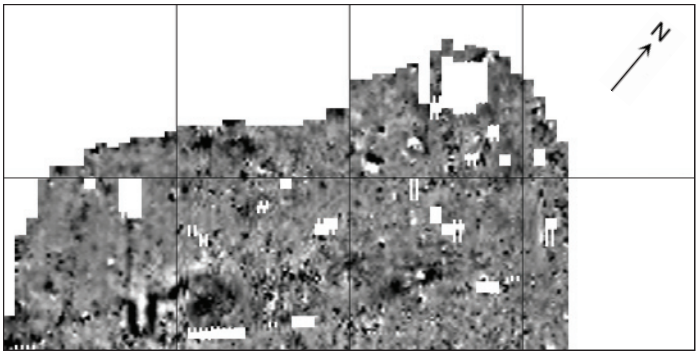

Fig. 3. Gradiometry greyscale map of Karksi castle at ±50nT. White spots designate areas that were impossible to measure.
Jn 3. Karksi linnuse gradiomeetriline mustvalge plaan (±50nT). Valged laigud markeerivad alasid, mida polnud võimalik mõõdistada.
Drawing / Joonis: David Thornley

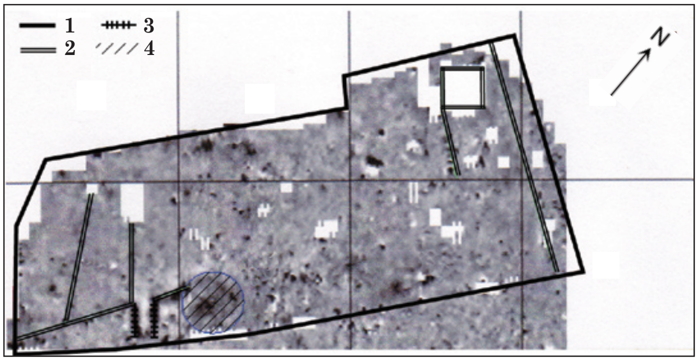

Fig. 4. Interpretation of the gradiometry greyscale map of the Karksi castle (±70nT).
1 – outlines of exterior
2 – interior walls
3 – main entrance
4 – circular region of high magnetic response north-east of the main entrance.
Jn 4. Karksi linnuse mustvalge gradiomeetrilise plaani (±70nT) tõlgendus.
1 – välismüürid
2 – sisemüürid
3 – väravaehitus
4 – kõrge magneetilise peegeldusega ala peaväravast kirdes.
Drawing / Joonis: David Thornley

a magnetic iron oxide. The magnetic signature of this material is considerably higher than the surrounding land.

The area surveyed included most of the castle and a smaller region on the slope that goes down into the moat outside the front walls. Numerous trees, logs and sunken areas within the castle rendered some of the areas inaccessible and the terrain was also extremely undulating in places. Despite restricted access, it was possible to survey approximately 90 % of the castle interior. It was important to carry out part of the survey outside the castle walls with an aim to show the difference between the interior and exterior of the castle. The gradiometry was carried out using a system of 30 m by 30 m grids and partial grids (Fig. 3). The data was collected in zig-zag fashion with traverse intervals of 0.5 m and sample intervals along each traverse being 0.25 m. Data was processed using Geoscan Research 'Geoplot' software.

The granite blocks used in the construction of the castle walls gave a strong magnetic response ranging between ±30 and ±70 nT (nanotesla), the value depending on the depth of the responding object. This was in contrast to the magnetic response from the general surrounding land which shows an average response of ± 5 nT.

The greyscale plot where the darker areas show areas of high magnetic response (Fig. 3), is the most popular plot for geophysical interpretation. It is likely that most of the very dark areas shown are responses to buried granite. In a few areas, the gradiometer passed over exposed granite and the response was between ±70 and ±75 nT. The lower response is most probably due to granite buried deeper beneath the ground surface, with the higher responses indicating more shallow burial. Areas of low magnetic response may likely be places where to site an archaeological excavation. The 'blank' regions within the plots are areas that were inaccessible for reasons described above.

The clearest construction discovered was a U-shaped feature on the line of the pillars in the moat. Evidently, it derives from the gatehouse or gate tower which is not visible above the ground any more. A wall continuing on the line of its inner side could also be clearly distinguished on both sides of the gate construction. A circular nine meter diameter region of high magnetic response, indicating a large concentration of granite boulders was discovered north of the entrance, on the inner side of the castle exterior wall. By using gradiometry also the presence of several other walls could be observed (Fig. 3). The area surveyed in the moat in front of the castle, shows only a few small areas of high magnetic response. These areas may be attributed to individual pieces of granite that have fallen down the slopes.

The results of the gradiometric survey (Fig. 4) fit rather well with the data of the 17th century plan (Fig. 1), providing, however, some extra information. The biggest contradiction lies at the main entrance. Contrasting with the Swedish map, gradiometry depicts the gatehouse (or gate tower?) to be of a more oblong shape, and also not stretching outside the line of the south-eastern wall of the main part. In addition to lines depicted on the Swedish map, gradiometry also shows a wall on the yard behind the gatehouse, on the prolongation of its southern wall. The massive circular heap of stones north of the gateway cannot be explained on the basis of the Swedish plan. It might be the debris of the south-eastern corner of the main castle, maybe of a fallen tower. Using the results of gradiometry and coring, a potential site was also chosen within the castle for possible excavations. Here coring also provided evidence of the preservation of organic remains.

Samples for palaeoenvironmental analysis were taken to determine environmental conditions pertaining before, during and subsequent to the crusades, with a specific focus on the castle hinterland. Samples have been taken from two locations: the first from organic deposits within the outer bailey of the Karksi castle; the second from a large area of peatland at Äriküla, *ca.* 5 km SSE of the castle. Analysis of these samples is ongoing and will be reported in due course. Here only the interim results of the analysis of the sample from Äriküla will be presented.

In Äriküla a sequence of peat to a depth of 2.8 m, underlain by blue-grey clay, was sampled for pollen analysis. Two samples were sent to Waikato (New Zealand) for AMS radiocarbon dating. The first sample (1.02–1.04 m) produced a date of 1039±30 BP[2] (cal. 890–1040 AD), whilst the second sample from the base of the peat (2.76–2.78 m) produced a date of 9744±47 BP[3] (cal. 9300–9130 BC; 95.4% probability). Assuming that there are no hiatuses or erosive breaks in the sequence, the radiocarbon dates suggest the peat accumulated very slowly over the course of *ca.* 11.000 years.

This off-site sequence presents a useful contrast to on-site pollen samples by providing data on vegetation environments within the broader hinterland of the castle, and the potential impacts of human communities on the landscape.

A total of 23 samples have been analysed from Äriküla (sequence K08-1) to a depth of 1.32 m (all depths are measurements from the ground surface). The pollen data suggest that the landscape was heavily wooded (80–90% tree pollen), dominated by *Pinus* (pine), *Betula* (birch), *Picea* (spruce) and *Alnus* (alder). Evidence for human activity is apparent at 1.02 m with the appearance of small quantities of *Secale* (rye) pollen and an increase in *Erica* sp. (heathers), suggesting nearby cultivation and possible heathland. This horizon is radiocarbon dated to 1039±30 BP (cal. 890–1040 AD). Evidence for more sustained human impact is not apparent until *ca.* 0.6 m, with an increase in Poaceae (true grasses), *Secale*, and other herbaceous plant taxa, and a decrease in *Picea*. If the top 1.02 m represents the last *ca.* 1100 years, and one assumes a constant accumulation rate, then 0.6 m would be around *ca.* 1360 AD, contemporary with the medieval, i.e. the crusader period.

Other palaeoenvironmental studies in Estonia covering the last 1000 years demonstrate that the proportion of tree pollen remained high (*ca.* 80%) even during the period of intensive farming, with large-scale cultivation of rye starting in some locations by the end of the Middle Iron Age (e.g. Niinements & Saarse 2007), in other areas from *ca.* 1100 AD (e.g. Veski *et al.* 2005), but being most pronounced from the *ca.* 15th to 18th centuries (Veski *et al.* 2005; Poska & Saarse 2006; Niinemets & Saarse 2006; 2007; Niinemets 2008). Pollen of *Centaurea cyanus*, characteristic of permanent rye fields (Vuorela *et al.* 2001), occur in pollen sequences from southern Estonia from *ca.* 1100 AD (Niinemets & Saarse 2006; 2007), and has been taken to suggest a rotating crop/fallow and slash and burn agricultural system similar to that in use until the 18th–19th centuries (Niinemets & Saarse 2007). *Centaurea cyanus* pollen does not occur in the Äriküla sequence until 0.16 m, although the resolution of the diagram above 0.56 m is poor.

Further pollen analysis and radiocarbon dating is required to determine whether the increase in rye pollen and grasses from around

[2] Wk-24855.
[3] Wk-24856.

60 cm is really contemporary with the castle in Karksi. Quantification of the microscopic charcoal, and identification of pollen taxa such as *Centaurea cyanus*, and other anthropogenic indicator species, may also help to determine whether a system of agriculture involving permanent fields similar to that suggested by Niinemets and Saarse (2007) was in use in the Karksi hinterland during the medieval period.

References

Alttoa, K. 1995. Lõuna-Eesti arhitektuur 15. saj – 16. saj I poolel. Magistritöö. Tartu. *(Manuscript in the library of the University of Tartu.)*

Niinemets, E. 2008. Vegetation and land-use history of the Haanja Heights (SE-Estonia) during the Holocene. *Dissertationes Geologicae Universitatis Tartuensis, 22.* Tartu.

Niinemets, E. & Saarse, L. 2006. Holocene forest dynamics and human impact in south-eastern Estonia. – Vegetation History and Archaeobotany, 16, 1–13.

Niinemets, E. & Saarse, L. 2007. Mid- and Late-Holocene land-use changes inferred from pollen records, in a south-eastern Estonian upland area. – Review of Palaeobotany and Palynology 146, 51–73.

Poska, A. & Saarse, L. 2006. New evidence of possible crop introduction to north-eastern Europe during the Stone Age. – Vegetation History and Archaeobotany, 15, 169–179.

Taavitsainen, J.-P. 2001. Stone Age to recent land-use history at Pegrema, northern Lake Onega, Russian Karelia. – Vegetation History and Archaeobotany, 10, 121–138.

Tuulse, A. 1942. Die Burgen in Estland und Lettland. Õpetatud Eesti Seltsi Toimetused, XXXIII. Dorpat.

Valk, H. 1995. Aruanne arheoloogilistest kaevamistest Karksi ordulinnuse kiriku restaureerimistöödel 11. ja 12. juunil 1994. a. *(Manuscript in TÜ.)*

Valk, H. & Malve, M. 2008. Archaeological supervision work in the outer bailey of Karksi castle. – AVE, 2007, 121–126.

Veski, S., Koppel, K. & Poska, A. 2005. Intergrated palaeoecological and historical data in the service of fine-resolution land use and ecological change assessment during the last 1000 years in Rõuge, southern Estonia. – Journal of Biogeography, 32, 1473–1488.

Vuorela, I., Saarnisto, M., Lempiäinen, T. & Taavitsainen, J.-P. 2001. Stone Age to recent land-use history at Pegrema, northern Lake Onega, Russian Karelia. – Vegetation History and Archaeobotany, 10, 121–138.

http://www.bartington.com. 11.08.2009.

http://www.britishmuseum.org/research/research_projects/amara_west_research_project.aspx. 11.08.2009.

HEIKI VALK, ALEXANDER PLUSKOWSKI, DAVID THORNLEY, ALEXANDER BROWN ja CHANTEL SUMMERFIELD

GRADIOMEETRILISED UURINGUD KARKSI LINNUSEVAREMETES JA PALEOÖKOLOOGILISED UURINGUD LINNUSE TAGAMAADEL

2007. a suvel toimusid koostöös Readingi Ülikooliga (Suurbritannia) prooviuuringud Karksi ordulinnuses ja selle ümbruses. Karksi linnus on valitud ristisõdade ökoloogiat käsitleva rahvusvahelise uurimisprojekti üheks uurimisobjektiks. Ülevaate pealinnuses olnud ehitiste kohta annab 17. sajandil koostatud plaan (jn 1). Varasemad arheoloogilised andmed piirduvad eeslinnuse alal 1994. ja 2007. aastal tehtud päästekaevamistega.

Pealinnuse alal viidi Bartingtoni gradiomeetri abil läbi geomagneetilised uuringud (jn 2) eesmärgiga täpsustada linnuse põhiplaani ning leida rusuvaesemaid kohti proovikaevamiste jaoks. Mõõdistada oli võimalik üle 90% pealinnuse alast. Mõõtmistulemuste mustvalgel kuvandil (jn 3) kajastuvad tumedama tooniga tugevama magneetilise tagasisidega alad, mis viitavad maetud raudkivirusudele või -müüridele; kivideta alad on heledad. Uuringute tulemusena tuvastati üle vallikraavi kulgenud silla otsa juures pealinnuse U-kujuline väravaehitis; sellest põhja pool avastati ligi 9 m läbimõõduga ümar tugeva magneetilise peegeldusega, raudkivirusudele viitav ala ning teistegi mattunud müüriosade peegeldusi (jn 4).

Gradiomeetriliste uuringute tulemused sobivad üldjoontes Karksi linnuse 17. sajandi plaaniga, pakkudes siiski täiendavat informatsiooni. Suurim erinevus ilmnes peavärava piirkonnas. Erinevalt rootsiaegsest plaanist näitab magnetluure väravahoonet (-torni?) piklikumana ning linnuse kagumüürist väljapoole mitte ulatuvana. Ka ilmneb väravaehitise tagusel õuel väravahoone lõunaseina pikendusel veel ühe müüri olemasolu. Ümarale massiivsele rusukogumile väravaehitisest põhja pool ei anna rootsiaegne plaan seletust. Võimalik, et tegemist on pealinnuse kagunurga või seal paiknenud torni varingurusudega. Eeslinnusel valiti magnetluure ja puurimise tulemusena sobiv koht proovikaevandiks; pinnase alaosa on seal niiske ja kõrge orgaanikasisaldusega.

Karksi linnusest 5 km lõuna poolt Äriküla rabast võetud palünoloogiline analüüs näitab, et varasematel metsamaastikel suureneb vahemikus 890–1040 pKr kanarbiku osakaal ja ilmuvad esimesed rukki õietolmuterad. Inimmõju kasvule 1360. aasta paiku viitab kanarbiku ja rohttaimede õietolmu sagenemine ja eriti kuuse õietolmu märgatav vähenemine.